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Gandhinagar Institute of Technology was established by Platinum Foundation Trust in December 2006. The Institute is affiliated to Gujarat Technological University and approved by AICTE New Delhi. It is situated near Village “Moti Bhoyan” and 24 km away from Ahmedabad city.

The Trust is registered under Public Trust Act, having Registration No. E-17490 dated 19 June 2006 at Ahmedabad, Gujarat. The members of the trust are involved in the social activities and are also promoting the technical interest of the state and country by contributing to the technical institution development.

The vision of the institute is to develop young engineers with active and creative minds. It stresses total development of the students. The Institute aims to be a leading center for research and engineering study, pursuing knowledge in both fundamental and applied area, and collaborating closely with business and industry in promoting technological innovation and economic development. The institute has team of dynamic and dedicated professors, working hard for overall development of students, so that they get ready for any kind of challenges in their life.

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Our students are innovative and have excellent acceptability to latest trends and technologies of present time. Our students have also participated in various technical activities as well as sports activities and have achieved various prizes at state level. We have two annual publications, a National level research journal 'GIT-Journal of Engineering and Technology (ISSN 2249–6157)' and 'GIT-a Song of Technocrat' (college magazine).

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## Message from the Director



“Somewhere, something incredible is waiting to be known.” - Carl Sagan

GIT was established in 2006 and during a short span of fourteen years; it has accomplished the mission effectively for which it was established. Institute has been constantly achieving the glory of excellence in the field of curricular and co-curricular activities. It gives me immense pleasure that the Special Edition for "International Conference on "Data Science and Intelligent Applications" - (ICDSIA-20)" of our National journal ‘GIT-Journal of Engineering and Technology’ is being published with Twelfth Volume-I, 2020, ISSN 2249 – 6157. Two days International Conference on Data Science and Intelligent Applications (ICDSIA-20) is being organized by Computer Engineering Department of Gandhinagar Institute of Technology (GIT), on 24th-25th January 2020, sponsored by Gujarat Council on Science and Technology (GUJCOST), in association with Gujarat Technological University (GTU), Ahmedabad and Indian Society for Technical Education (ISTE), New Delhi. It presents original, significant and quality research work contributions on the theories and practices on emerging technologies in the areas of Data Science, Intelligent Applications and Communication Technologies. Total 128 research papers were received on Data Science, Intelligent Applications and Communication Technologies from renowned Institutes like IIT's, Bits Pilani, Ramaiah Institute of Technology, Visvesvaraya Technological University, Gujarat Forensic Sciences University, Nirma University, L. D. College of Engineering and many more renown institutes of India. After peer reviewed, 77 research papers were selected. From these, 60 research papers are published by Springer Series: Lecture Notes on Data Engineering and Communications Technologies (LNDECT, volume 52) and 17 research papers are published in the Special Edition of GIT-Journal of Engineering and Technology (JET-2020).

It is a matter of pride that GIT has been awarded as a valuable and outstanding Blood donation camp organizer by Indian Red Cross Society, Ahmedabad District Branch. It received the award from Governor of Gujarat Honorable Shri Acharya Devvrat at Ahmedabad Management Association, Ahmedabad on 10<sup>th</sup> September, 2019. GIT has also received "Eminence award for being the best engineering college" by Honorable Chief Minister Vijay Rupani on 14 December 2019, event supported by Divya Bhaskar. In Smart India Hackathon-2019, GIT got first prize worth Rs 50000 and in Smart City Hackathon - 2020, GIT got first prize worth Rs 30000. Salot Chaitya Jitendra, an MBA student has been awarded Gold Medal at the 9th convocation of Gujarat Technological University. Institute is awarded as the best Engineering College for providing best placement to the students by ASSOCHAM in 2018. Institute was awarded by 94.3 MY FM for “Excellence in Faculty (Engineering & Technology)”. Institute is 3 star Super RESOURCE center for spoken tutorial project of IIT-Bombay funded by MHRD, Govt. of India. Student Team Greenitious as Best Design Award for Effi-Cycle was awarded by SAE LD Collegiate Club. Institute has also hosted GTU Zonal Techfest 2015 and 2018 of Gandhinagar Zone. Team Renosters participated in ATV car design competition “BAJA STUDENT INDIA” held at NIT, Jamshedpur and got 20th position in all over India. Institute won ISHRAE “A-Quest” quiz competition at Zonal Level and appreciated by GTU for creating student innovation and Start-up Ecosystem in campus.

For the thirteen consecutive year an annual technical symposium TechXtreme 2020 was successfully organized by the institute. More than 3000 students of various technical institutions across the Gujarat participated in the Techfest. Annual cultural event Jazba 2019 was organized with participation of more than 1500 students.

When Gandhinagar Institute of technology has been closed, along with other engineering colleges in the State, it was an unforeseen situation for the students and the faculty. The Management, Director and faculties discussed ways and means to work out possible alternatives. The outcome was the decision to migrate to an online model to teach remotely, conduct seminars, assignments and other activities and tremendous output has been got in this pandemic situation.

I am very grateful to our respectable trustees as amidst the nationwide lockdown, no matter how uncertain, strange, challenging and stressful life is in coronavirus pandemic outbreak, the support of our management is unforgettable and appreciated. It gives me immense pride to state that as a result of the collective effort of the faculty, students and staff over the past few years Gandhinagar Institute of Technology today ranks among the top technical institutions of the state. I am hopeful of its acquiring greater heights in the years to come.

Dr H N Shah  
Director & Chief Editor

## About ICDSIA Conference

1st International Conference on Data Science and Intelligent Applications (ICDSIA-2020) is being organized by Gandhinagar Institute of Technology (GIT), sponsored by Gujarat Council on Science and Technology (GUJCOST), Gandhinagar and Platinum Foundation, Ahmedabad, and in association with Gujarat Technological University (GTU), Ahmedabad and Indian Society for Technical Education (ISTE), New Delhi on 24th -25th January 2020. It presents original, significant and quality research work contributions on the theories and practices on emerging technologies in the main areas of Data Science, Intelligent Applications and Communication Technologies. It provides the scope for opportunities to researchers and practitioners from academia and industry. The conference is projected to invite a large number of quality submissions and stimulate the cutting-edge research discussions among many academic pioneering researchers, scientists, industrial engineers, students from all around the world and provide a forum to researchers. It provides a common platform and offers excessive quality content to suit the diverse professional development of science and technologies to Enrich technocrats and academicians by presenting their innovative and constructive ideas and achievements too. The conference is focused on innovative issues at international level by bringing together the experts and participants from different countries. It covers the domain of Data Science, Intelligent Applications and Communication Engineering.

**Message from Conference Secretary: Dr. Rajan Patel / Prof. Archana Singh**

We are happy to note that the department of Computer Engineering has organized the 1st International Conference on Data Science and Intelligent Applications (ICDSIA-20) during 24th-25th January 2020. It presents original, significant and quality research work contributions on the theories and practices on emerging technologies in the main areas of Data Science, Intelligent Applications and Communication Technologies.

Small efforts, it is said, lead to big success. While the proposed conference is by no means a small effort, it is undoubtedly a big milestone in the history of the department of computer engineering and that of GIT. This conference will definitely facilitate knowledge exchange and enriching learning experience for all, which in turn will help them evolve themselves as useful tools in building world-class standards in language learning.

The endeavour of the department of computer science, GIT, Ahmedabad in collaboration with Gujarat Council on Science and Technology (GUJCOST), Gandhinagar, Gujarat Technological University (GTU), Ahmedabad and Indian Society for Technical Education (ISTE), New Delhi is worthy of praise for initiating and sprouting literary, cultural and social zeal and enthusiasm among the teachers and scholars through organising a two day International conference.

We laud the efforts of all the members of GIT to organise an International Conference.

With best wishes..!

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# Literature Review on Abstractive Text Summarization

Gandhi Kush<sup>a\*</sup>, Kalpana Mudaliar<sup>b</sup>

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## Abstract

In this era where the data and information are endless on the internet, magazines, web documents, etc. it is important to get an abstractive text summarization to understand the context on the long documents. Therefore, we have analysed the topic of Abstractive Text Summarization and analysed the methods used up-till now to generate an effective summary from the given data to the system. We analysed and referred to many different techniques used and researched by different researchers in their research publications. If we look at the current summarization techniques used for the abstractive summarization it is sometimes inscrutable to implement it. For a perfect abstractive summary, the model has to first understand the text in the document completely and then implement and try to summarize it in a short possible way. So, there are many Deep Learning and RNN (Recurrent Neural Networks) techniques used to solve this problem and have achieved success to a greater extent.

**Keywords:** Abstractive Text Summarization, Neural-sequence-to-sequence model, Deep learning, text summarization, Feed-Forward network, Approaches for abstractive text summarization, ROUGE, Recurrent Neural Network.

## 1. Introduction

### 1.1 What is Text Summarization?

When we think of summarization, we just get to do with making something shorter, but people generally forget the main element is that summarization is to make text shorter, but my maintaining the meaning of the text or document with all the information representing in just few words.

Generally, there are two types of text summarization:

- Extractive Text Summarization
- Abstractive Text Summarization

### 1.2 Extractive text Summarization

Extractive text Summarization is formed by just summarizing the important or relevant sentences from the text. Here some important sentences are not summarized and might mislead the summary reader.

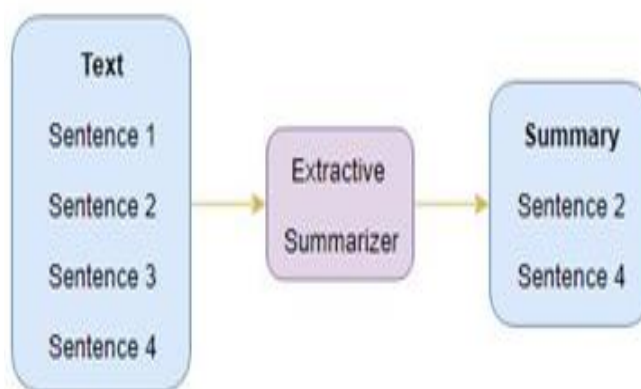


Fig. 1. Extractive text Summarization [6]

### 1.3 Abstractive text Summarization

This approach might seem to be somewhat more interesting. Abstractive text Summarization generates new phrases, by using the words that cannot be sometimes found in the original text. Abstractive text summarization is much harder to implement than the extractive summarization. It is more complex and more ambiguous in terms of generalization, and sometimes paraphrasing the long sentences.

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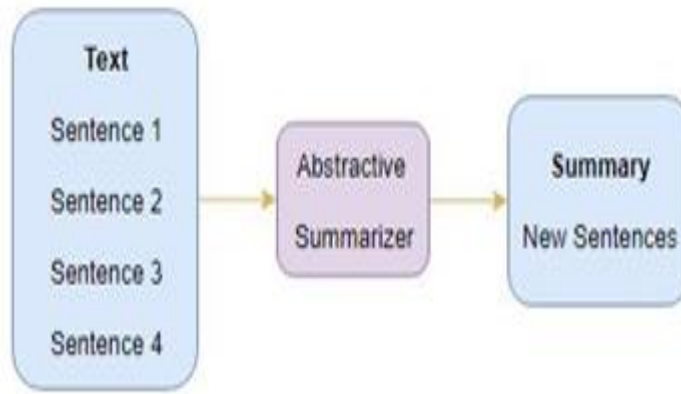


Fig. 2. Abstractive text Summarization [6]

## 2. Deep Learning's role in Text Summarization

Deep-learning is basically a part of Artificial Intelligence that works in a similarity to a human brain. Deep Learning approaches are quite promising and would be helpful in the near future to solve the abstractive text summarization issues in the near future. Neural-sequence-to-sequence model along with deep learning approaches showed a remarkable achievement in field of text summarization.

## 3. Problems with Text Summarization

The main issues we can focus on are [4]:

- Sentences selected are sometimes longer, so unnecessary parts of the text or sentence for summary gets included and consumes space.
- If summary size is not long as per the requirement, the important information scattered in various statements cannot be captured using extractive summarization.
- Information overlapping or clashing may not be represented accurately.

## 4. Proposed Solutions to achieve Abstractive Text Summarization

At First, as per the research by [1] Neural Sequence to Sequence attention models have shown promising results in Abstractive Text Summarization. But according to them, still there are many issues with many uprising problems. Summaries obtained are usually absurd, rather they have explored many techniques to overcome these issues.

They explored the reinforcement learning based training procedures using intra-Attention that significantly improves the model's performance. They also analysed the problems that plagued the area in detail, and possible ways to improve those areas were analysed deeply. And they proposed a novel architecture to solve the issues and problems in long summary generation areas which were difficult to be captured with currently ongoing used models. With their deep learning approaches, they succeeded to a great extent and finally concluded that Deep Learning approach are quite promising and would be helpful in the near future to solve the abstractive text summarization issues in the near future.

But there are problems with the metrics and lack of datasets availability which are proving as a big challenge to scalability and generalization process of multi- sentence summarization. Datasets Used: DUC-2004 and Gigaword [1]

They finally concluded that Deep Learning approach are quite promising and would be helpful in the near future to solve the abstractive text summarization issues in the near future. But there are problems with the metrics and lack of datasets availability which are proving as a big challenge to scalability and generalization process of multi- sentence summarization. [1]

Looking forward for second approach according to [2] again according to them as we discussed further the Abstractive Text Summarization has always been made feasible with the Neural Sequence to Sequence models. In continue with this, they have also represented the flaws of this model as: models are responsible to regenerate true features imprecisely, so as they inclined reiterate themselves. Furthermore, for coming out of these issues they proposed a novel architecture that increased the importance of the standard sequence-to-sequence attentional model in two orthogonal ways.

Initially, they utilized the hybrid pointer-generator network which could imitate words from the original text via *pointing*, which gives a perfect regeneration of data, and it also holds a retaining ability to generate novel words through the *generator*.

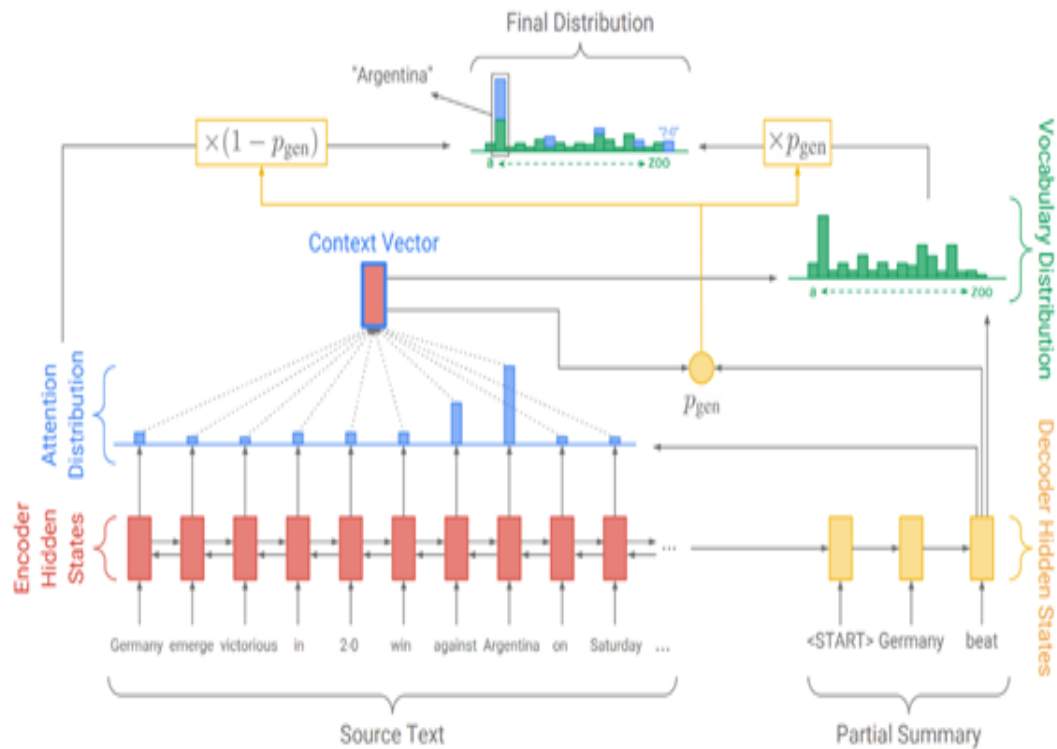


Fig. 3. Pointer Generator model [2]

Furthermore, they utilized coverage to point on what has been already summarized, which prevents the restating issues. With their model they performed an experiment on CNN/ Daily Mail summarization task, outperforming the current abstractive state-of-the-art by at least 2 ROUGE points, but sometimes attaining higher levels of abstraction still remains an open research question. [2]

Moreover, another great proven usage of Sequence-to-Sequence model was demonstrated by Tian Shi et al. [5] according to them neural sequence-to-sequence model has gained a great popularity in the last few years. Many interesting techniques have been developed for sequence-to-sequence models to improve and make them capable of handling further challenges in the field of summarization. Generally according to them, majority of the techniques varies among these three categories: network structure, parameter inference and decoding/generation. Sometimes while training a model efficiency proves to be a great concern. In their paper publication, they presented a detailed literature as well as technical survey on various sequence-to-sequence models for abstractive text summarization. Many of their models were primarily used and proposed for modelling of the language and task generation, such as machine translation, and were applied later to abstractive text summarization.

During their survey, an open source library was developed, named as Neural Abstractive Text Summarizer (NATS) toolkit, for abstractive text summarization. A wide range of examinations were performed on the highly used CNN/Daily Mail dataset to evaluate its effects of various different neural network components. At-last, they compared and confirmed two models implemented in NATS on two newly contributed datasets, such as, Newsroom and Bytecup. This proved them to be very effective in their work. They, concluded that this application was quite successful for sequence-to-sequence models, neural abstractive text summarization has been a prominent research area and has gained a lot of demand from both industry as well as academia.

Now, moving forward to see something different, is the use of Feed-Forward network by Lu Yang [3], This research is focused to meet the problems of abstractive text summarization by using feed-forward neural network with attention-based encoder. Attentive recurrent neural network and recurrent neural network encoder-decoder was also analysed by them to check its power and effect. These discussed models were mainly developed for solving tasks, such as summarization of newspaper publication and translation of machine context. They made assessment on model's advantages using ROUGE and results of visual inspection by modifying and furthering these models to the issue of product review summarization. In the end, they discovered the outcomes to be favourable. The one of the datasets, they used was Amazon reviews from Stanford Network Analysis Project (SNAP). That raw dataset included 34,686,770 reviews ranging all kinds of products form books to toys and music and each contained information of the user, product names, grading and ratings, review's and summarization. They concluded by comparing different tables and their summaries and elicited that attention-based encoder proved to be quite effective way and they proved that feed-forward neural network can be very effective and useful for product review summarization tasks. According to their outcomes it was a very conventional model by them, based on highly intense level description rather than just a general detail. And finally, model was able to achieve the required generalization over the entire datasets.

To summarize, and display the experimental results we have presented it in a more crystalize way by using tabular representation.

Table 1. Experimental results acquired using different models for Abstractive text Summarization

References	Highlights	Model Used	Datasets	Outcomes
Singhal, S. et al. [1]	Reinforcement learning based training procedures using intra-Attention.	Neural Sequence to Sequence Model	DUC-2004 and Gigaword	Deep-learning approaches will prove beneficial in the coming future.
See Abigail et al. [2]	Improved more on Neural Sequence to Sequence models	The Hybrid Pointer-Generator Network	CNN/ Daily Mail	Outperformed the current abstractive state-of-the-art by at least 2 ROUGE points but concluded that obtaining higher level of abstraction will still be a question till certain extent.
Lu, Yang [3]	Focused to meet the problems of abstractive text summarization by using feed-forward neural network with attention-based encoder	Feed-Forward Neural Network with Attention-Based Encoder	Amazon reviews from Stanford Network Analysis Project (SNAP)	They proved that feed-forward neural network can be very effective and useful for product review summarization tasks
Tian Shi et al. [5]	Developed an open source library Neural Abstractive Text Summarizer (NATS) toolkit	Neural Sequence to Sequence Model	CNN/Daily Mail, Newsroom and Bytecup	They concluded that this application was quite successful for sequence-to-sequence models

## 5. Conclusion

The main motive for us was to study the past important information related to abstractive text summarization as well as understand the current trends in it. We have focused here mainly on the techniques used and developed by different researches in their abstractive text summarization models, if we look on to the current trend we feel that abstractive text summarization has gone to a new level and many different techniques are invented that helps and guides to its best in evaluating the summary of a given text. Abstractive Text Summarization is a very motivating field for research and it has a wide usage and applications also. Still this area is an open ground for research, and hope it could be developed with more optimism in the near future. We saw that pointer-generator model was quite effective and we would try to use further this model with a better essence of deep learning approach so long text and documents can be summarized in a more optimized way

## References

1. Singhal, S., Bhattacharya, A.: Abstractive Text Summarisation, Department of Computer Science IIT Kanpur.
2. Liu, P.J. Christopher, D. M. Get to the Point: Summarization with Pointer-Generator Network.
3. Lu Yang: Abstractive Summarization for Amazon Reviews, Stanford University.
4. Saiyed, S., Priti S.S.: Literature Review on Extractive Text Summarization Approaches, International Journal of Computer Applications (0975 – 8887) vol. 156 – No 12, Sardar Patel University, Vallabh Vidhyanagar, Gujarat, India, December (2016).
5. Tian Shi, Yaser, K., Naren, R., Reddy, C.K.: Neural Abstractive Text Summarization with Sequence-to-Sequence Models, Senior Member, IEEE, arXiv: 1812.02303v2 [cs.CL] 7 Dec (2018).
6. Analytics Vidhya, Extractive and Abstractive Text Summarization Figures, <https://www.analyticsvidhya.com/blog/2019/06/comprehensive-guide-text-summarization-using-deep-learning-python/>

# Clustering with LEACH in Wireless Sensor Network

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## Abstract

This paper studies LEACH protocol, and puts forward energy- LEACH and multihop-LEACH protocols. Energy-LEACH protocol improves the choice method of the cluster head, makes some nodes which have more residual energy as cluster heads in next round. Multihop-LEACH protocol improves communication mode from single hop to multi-hop between cluster head and sink. Simulation results show that energy-LEACH and multihop-LEACH protocols have better performance than LEACH protocols.

**Keywords:** WSN, LEACH, Energy efficiency, clustering, routing protocol.

## 1. Introduction

WSN is a spatially distributed network of various sensor nodes to track environmental and physical conditions like temperature, pressure, humidity. Here we can use low latency and energy efficiency concept to manage the time delay and energy. Low latency is a computer network that is optimized to process a very high volume of data messages with minimal delay. WSNs are used in various specific applications in fields as diverse as the military, medicine, ecological monitoring and smart home. When there are more than one sensors available than each node in sensor network is typically allocate with a radio transceiver and many other wireless communication devices.

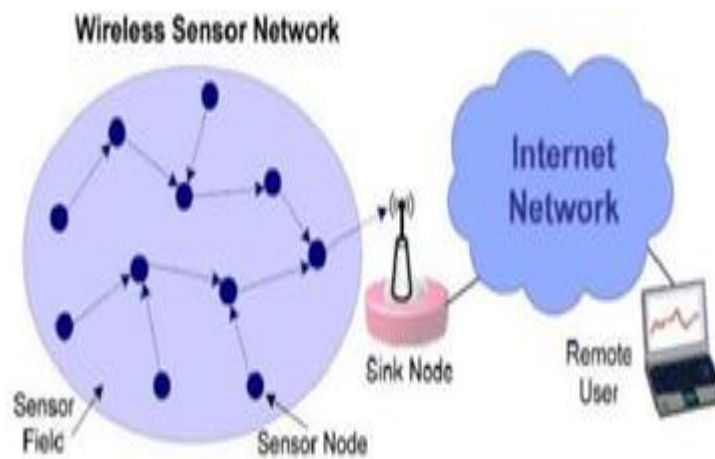


Fig. 1. Wireless Sensor Network

## 2. Energy efficiency

Energy efficiency simply means using less energy to perform the same task – that is, eliminating energy waste.

**Energy efficiency brings a variety of benefits:** Reduction greenhouse gas emissions, reducing demand for energy imports and lowering our costs on a household and economy-wide level. Energy efficiency is an analytical factor in designing WSNs where a sensor node is small with limited power resources. The following figure represents the Energy –LEACH Protocol. In this paper, we analyze WSNs and their Low Latency and Energy efficiency in various techniques. Low latency maintains and more energy-consuming algorithms. Energy conservation for WSNs is a basic objective that needs to be addressed at all layers of the networking protocol.

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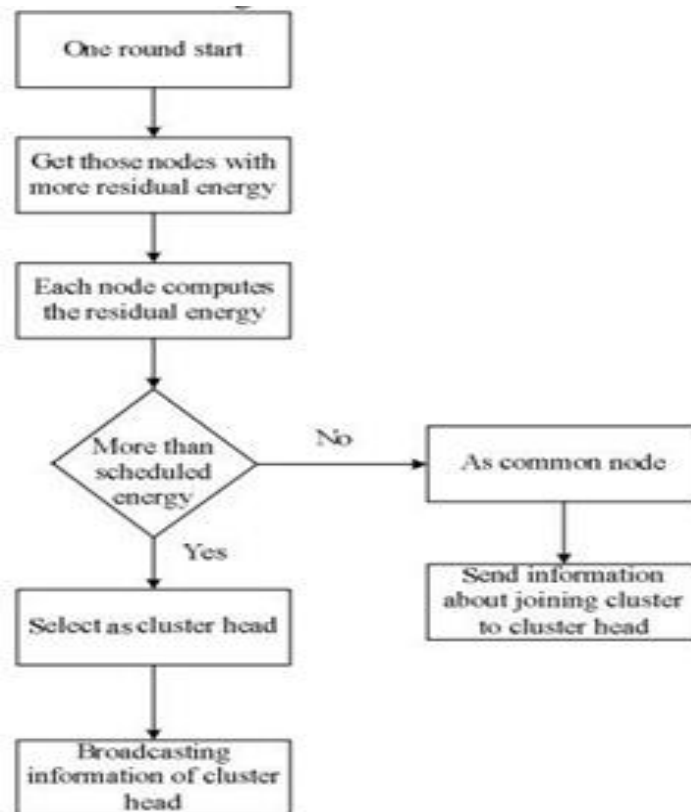


Fig. 2. Wireless Sensor Network

### 3. Latency

In traditional WSN, the data dissemination latency by using probabilistic broadcast is  $O(1/r)$ . However, the nodes would sleep or wake up periodically. A relay node must on hold for the wake up of its neighbors, and, after that, it can perform the transmission. Here we can use low latency and energy efficiency concepts to manage the time delay and energy. Low latency is a computer network that is optimized to process a very high volume of data messages with minimal delay. LEACH (Lower Energy Adaptive Clustering Hierarchy) protocol is a standard routing protocol.

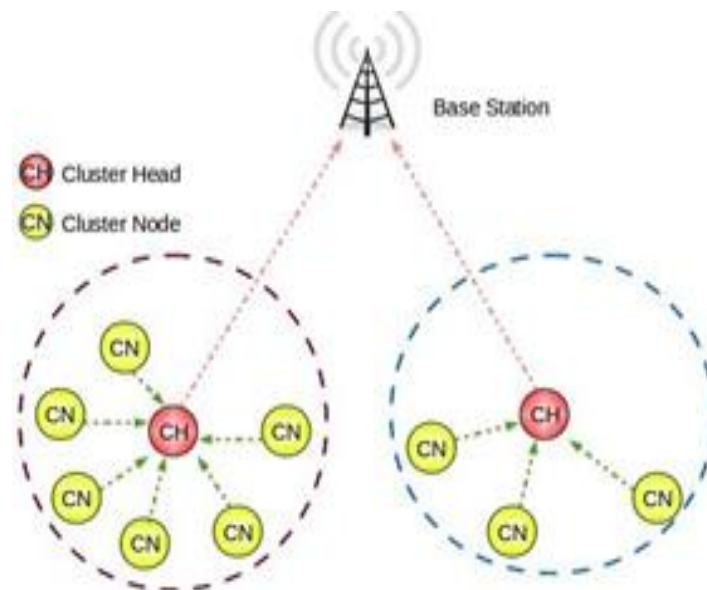


Fig. 3. LEACH Protocol

This presentation of Paper introduces LEACH protocols in detail. LEACH protocol's main techniques of the protocol include algorithms for distributing cluster forming, adaptive cluster forming, and cluster header position changing. The adaptive cluster build and cluster header position changing algorithms provide to distribute the energy recreation fairly among all nodes and continue the lifetime of the all system in the end. LEACH protocol provides a conception of the round. LEACH protocol runs with

many rounds. The following flow chart represents the Performances of LEACH protocol, energy-LEACH protocol, and multihop LEACH protocol are simulated and compared in this section.

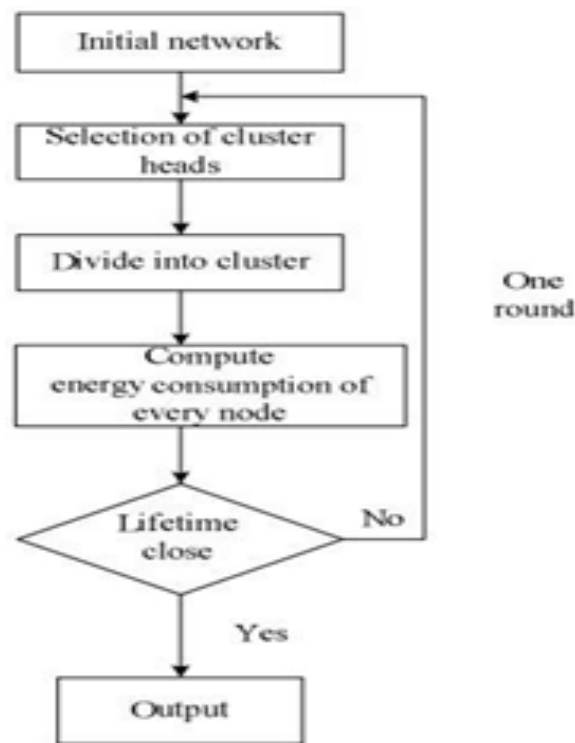


Fig. 4. Flow chart of LEACH Protocol

## 4. Simulations and analysis

### 4.1 Performance matrixes

The network lifetime of WSN is very important due to restricting energy. Here, two matrixes are given to show the state of network energy consumption. 1. The residual energy of all node; 2. Time of network death for a different number of nodes. In our simulation, matrix (1) shows all residual energy of 100 nodes, and matrix (2) is the time when 262 the whole network is finally dead under the condition of a given number of the node.

### 4.2 Simulation parameters setting

1. Sensor nodes contain two kinds of nodes: sink nodes (no energy restriction) and common nodes (with energy restriction); 2. Nodes are randomly distributed in an area within 80m×80m, and the efficient distance among nodes is 15m; 3. Suppose that every node knows its position, channels between sensor nodes are ideal, sending energy consumption is the same as receiving energy consumption, energy consumption in each round is 0.05J and initial energy of each node is 10J; 4. Energy utilization between cluster head and sink is 59 times of the energy consumption among common nodes; 5. Probability of being cluster head equals 0.04; 6. Each node sends data in every 0.5s, and sends data in every time interval at a random time by a TDMA slotted MAC (Medium Access Control) protocol; 7. Network with the same number of nodes still may have different performances due to network structure. In our simulation, the network topology is randomly built each time, and simulation results are moderate for 3 different network topologies.

### 4.3 Simulation results

Fig. 5 shows the performance of residual energy of LEACH protocol, our energy- LEACH protocol and multiple-leach protocol. Multiple-LEACH protocol has more residual energy than LEACH and energy-LEACH protocols. Energy-LEACH protocol has the same residual energy as LEACH protocol in the beginning, but Energy-LEACH protocol gradually has more residual energy than LEACH protocol after a certain period of time (120s for our simulation). Fig. 6 shows the performance of network death time for different number of nodes. Multihop- LEACH protocol survives longer than both energy-LEACH protocol and LEACH protocol, and Energy-LEACH protocol longer than LEACH protocol. The results show that our two modified protocols prolong the network lifetime as compared with the commonly used LEACH protocol.



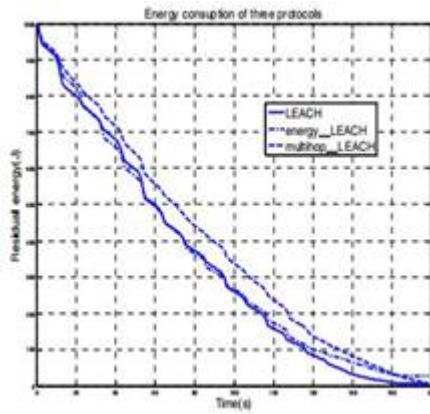


Fig. 5. Residual energy of three protocols different with 100 node.

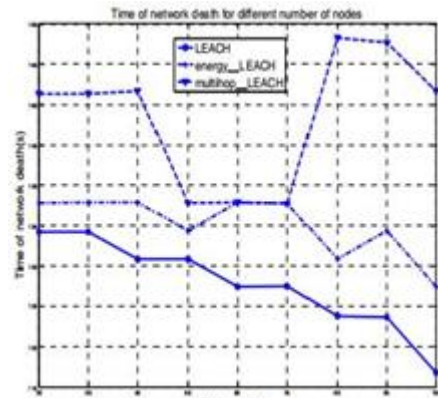


Fig. 6. Time of network death in three protocols.

## 5. Conclusion

Two modified LEACH protocols: energy-LEACH protocol and multihop-LEACH protocol are presented in this paper. Energy-LEACH protocol considers residual energy in the phase of cluster head selection. Multihop-LEACH protocol adopts multi-hop communication between cluster and sink. Simulation results show that energy-LEACH and multihop LEACH protocols have better performance than LEACH protocol.

## References

1. Fan Xiangning, Song Yulin, "Improvement on LEACH Protocol of Wireless Sensor Network", 2007 International Conference on Sensor Technologies and Applications
2. Sun Limin, Li Jianzhong, Chen Yu, Wireless Sensor Networks, Tsinghua publishing company, Beijing, 2005.
3. I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, "A Survey on Sensor Networks", IEEE Communications Magazine, 2002, 40(8), pp.102- 114
4. G. J. Pottie, W. J. Kaiser, "Embedding the Internet: Wireless Intergrated Network Sensors", Communications of the ACM, 2000, 43(5), pp.51- 58.
5. D. Estrin, "Tutorial Wireless Sensor Networks Part IV: Sensor Network Protocols", MobiCom, 2002.
6. W. Heinzelman, A. Chandrakasan, and H. Balakrishnan, "Energy- efficient Communication Protocol for Wireless Sensor Networks", Proceeding of the Hawaii International Conference on System Sciences, Hawaii, January 2000.
7. Wang Wei, "Study on Low Energy Grade Routing Protocols of Wireless Sensor Networks", Dissertation, Hang Zhou, Zhe Jiang University, 2006.
8. Mo Xiaoyan, "Study and Design on Cluster Routing Protocols of Wireless Sensor Networks", Dissertation, Hang Zhou, Zhe Jiang university, 2006.



# An Effective Encryption Algorithm for Cloud Data Security in Cloud Architecture – A Survey

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## Abstract

Cloud Computing is the latest and maximum required topic in studies in IT industry in recent times. With the improvement of cloud computing, Data protection becomes more and more vital in cloud computing. This paper analyses the security troubles and techniques that are in advance utilized in cloud safety. Cloud computing offers the way to share allotted assets and offerings that belong to special organizations or sites. Since it shares dispensed sources thru community within the open environment consequently it makes protection problems. This paper proposes a data protection model which offers authentication to its customers and additionally the data is tremendously secured through encryption and decryption strategies.

**Keywords:** Cloud computing, Cloud storage, Data Security model, Encryption, Decryption.

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## 1. Introduction

Cloud computing is the most recent innovation that utilizes web, focal administrations for the association of information and applications, which the client can get to. In distributed computing, singular clients and different agents can utilize the application without the need to introduce in their PC. They can get to the records utilizing web. Basically, distributed computing is the conveyance of processing administrations, servers, stockpiling, databases, organizing, programming, examination, knowledge, and increasingly over the Internet ("the cloud") to offer quicker advancement, adaptable assets and economies to scale. You need to pay for cloud administrations you use, which assist us with bringing down our working costs, run our foundation all the more productively and scale as your business needs change. In distributed computing, the client's information is put away inside the distributed storage, which is kept up by outsider CSP (Cloud Service Provider). Now-a-days; for the most part received cloud administrations are offered and kept up by enormous IT organizations like Google and Amazon. SO, we can say that the 3 main components of cloud computing model are: -

1. CSP (Cloud Service Provider) — the third party which manages all the cloud services i.e., infrastructure, platform, and the software's offered to cloud users along with its technical team. They are responsible for providing safe and uninterrupted services to the cloud users.
2. Client owner – An individual or any small organization who want to store their data files on the cloud storage services.
3. User— an entity who has enrolled with the data owner and access owners cloud data after confirm authentication from CSP.

## 2. Top benefits of cloud computing

1. Cost—it decreases the expense of clients as it doesn't require any establishment.
2. Speed – The speed of distributed computing is high because of accessibility of web and system
3. Global scale—the cloud administrations can enormously scale flexibility. It conveys the perfect measure of cloud administrations.
4. Productivity—Cloud stockpiling expels the utilization of on location server farms.
5. Performance—Cloud administrations deal with greatest server farm organizes which are regularly redesigned.
6. Security—there are different safety efforts and along these lines distributed storage information can without much of a stretch be verified utilizing different encryption strategies.

## 3. Types of Cloud Computing

1. Public cloud—the cloud service which can be accessed by anyone and resides outside an organization is called public cloud. The third party is responsible for hosting the files. Example: Amazon Elastic Compute Cloud (EC2), Google App Engine, Windows Azure Services Platform.
2. Private cloud—the cloud services which are accessed through a network and resides inside an organization is called private cloud.

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3. Hybrid cloud—Combination of both public and private cloud is hybrid cloud.

#### 4. Types of cloud services

1. IAAS (Infrastructure-as-a-service) - It is the most basic category of cloud computing services.
2. SAAS (Software-as-a-service) - Software-as-a-service is a method that delivers software application over internet, on-demand any typically subscription basis.
3. PAAS (Platform-as-a-service) - Platform as a service refers to cloud computing services that supply an on-demand environment for developing, testing, delivering and managing software applications. PaaS is designed to make it easier for developers to quickly create web or mobile apps, without worrying about setting up or managing the underlying infrastructure of servers, storage, network and databases needed for development.

Cloud carport – in light of the fact that the call for distributed computing will expand, the clients' in-wrinkle the call for of cloud carport period. Or on the other hand distributed storage can likewise be depicted as the information which is spared online inside the cloud. Cloud carport is likewise called utility carport – a term trouble to separation principally dependent on real usage and administration shipping. Cloud carport is a distributed computing model wherein records is saved money on remote servers got to from the web, or "cloud." it is kept up, worked and constrained by utilizing a distributed storage supplier guarantor on capacity servers which can be based on virtualization systems. Actualities assurance in cloud—moving to the cloud age, realities security transforms into a prime obligation. You not have controlled in your put away insights your realities should are living wherever inside the worldwide depending at the cloud network we use. Clients are upset from the heaviness of measurements stockpiling and upkeep. At the point when clients input their records as a rule of enormous length on the cloud, the measurements honesty security is stressing. Approving open assessment for cloud records carport security is fundamental. Data security and private are the primary stresses in distributed storage. Clients raise the worry in their realities whether it can be gotten to by utilizing unapproved individual because of the reality there are assortments of different clients sharing the indistinguishable assets over the cloud. Assurance run of the mill wraps extraordinarily three highlights: privacy, trustworthiness and accessibility. Those capacities are the highest investigation in planning a security measure to guarantee greatest wellbeing.

#### 5. The main security risks of cloud computing are

- Compliance violations
- Identity theft
- Malware infections and data breaches
- Diminished customer trust and potential revenue loss

What's bit in encryption and how can it work Encryption is the procedure which translates mystery data into useless data i.e.it changes over plain content into encrypted structure which can't be comprehended by some other individual. With SSL affirmation it produces a key. The key enables the opportune individuals to have the option to decode the data. It is significant and valuable when you are securing individual installment data or other classified data.

At the point when you are working with every little snippet of data is called bit. A piece is littlest piece of data. Bit is spoken to as number. Number of bit is equivalent to the quantity of characters. 40 bit encryption isn't solid. 128 bit and 256 bit are more grounded than 40 bit.

#### 6. Literature Survey/ Related Work

We have encountered distinctive research papers to recognize security issues in distributed registering. A segment of the wellbeing endeavors and troubles faced as of not long ago and their answers are depicted in these assessment papers portrayed underneath. Srijita Basu [1] has recognized security challenges and game plans as an audit. The security challenges were on data order, virtualization protection, data uprightness, virtualization dependability, data openness, virtualization availability. This paper covers the fundamental security get away from provisos similarly as security requirements of a present Cloud System. Bhupesh Kumar Dewangan [2] along with his partners ,reviews the present model of data duplication in conveyed registering .Some of the circulated stockpiling techniques like piece figuring, dispersed hash table and bloom channel has added to stack altering the board in appropriated processing structures. They recognized a couple of perils related with circulated registering. Vikas Goyal and Chanker Kant [3] proposed a mutt count which uses encryption as a basic security system. Encoding is the methodology for adjustment of plain substance data in a mixed structure called figure message that can be deciphered and read by the real individual having a genuine disentangling key. The proposed mutt computation incorporates unmistakable coding strategies, for instance, AES (symmetric cryptography framework), SHA-1 (hashing system), and ECC (elliptic curve cryptography) for the characterized fragile data. Sunil Kumar, Jayant Shekhar and Jatinder Paul Singh [4] proposed a data security and encryption system to give assurance and security to our dynamic cloud data. They proposed a framework that uses a matched tree in that each center point holds a letters all together, number and exceptional character and every association has a parallel worth 0 and 1. B.Muthulakshmi and M.Venkatesulu [5] in their paper proposed an arrangement that relies upon allocating the plain substance

into different data parts, making various figure compositions for each part and each figure works set aside in different focal points of disseminated stockpiling. (Data security procedure subject to dividing data/information, prime numbers and a secret key.) Manoj Tyagi, Manish Manoria [6] have referenced a multifaceted check which is applied to confirm the client's certifications before information getting to. Encryption at client side guarantees the uprightness as well as classification of information. Here they have utilized MCS (Modified Cuckoo Search), PSEC (Provably Secure Elliptic Curve) encryption and AES (Advanced Encryption Standard) is utilized for asset booking, client side encryption, and cloud side encryption individually for accomplishing respectability, secrecy and furthermore proficient calculation capacity. Yu Wei and Yongsheng Zhang [7] in their paper investigated the security assurance of huge information distributed computing information, which is of incredible hugeness for advancing the foundation of a total information security framework, and can likewise be additionally advanced the valuable of distributed computing. Manoj Tyagi, Manish Manoria [6] have referenced a multifaceted affirmation which is applied to check the customer's confirmations going before data finding a workable pace. Encryption at customer side ensures the decency just as security of data. Here they have used MCS (Modified Cuckoo Search), PSEC (Provably Secure Elliptic Curve) encryption and AES (Advanced Encryption Standard) is used for resource arranging, customer side encryption, and cloud side encryption individual-partner for achieving decency, protection and moreover compelling estimation limit. Yu Wei and Yongsheng Zhang [7] in their paper separated the security affirmation of colossal data appropriated processing data, which is of extraordinary centrality for propelling the establishment of a complete data security structure, and can in like manner be moreover best in class the accommodating of dispersed figuring. Yu Wei and Yongsheng Zhang [8] in this paper proposes four security techniques and plans for the security and hardware improvement of grounds arrange server farm under the haze condition, along these lines improving the security of grounds organize server farm in the cloud condition.

## 7. Conclusion

As depicted above, tremendous amounts of customers are grasping cloud organizations because of its radiant workplaces. Maybe the best discussion to the wide gathering of these organizations is client protection and decency concerns. We have encountered adequate of research papers and the various frameworks used to ensure security in cloud. In this paper, we have organized a 'cloud security model' which offers approval to its clients with the objective that their data could be thoroughly secure. Here, the two particular frameworks are used for encryption and a stand-out methodology for disentangling. As soon as possible, this model could be used to recognize security and moreover the movements could be made to make it further progressively secure. A couple of various thoughts can be joined and various strategies can be incorporated this model to impel it high for cloud data amassing.

## References

1. Srijita Basu, Arjun Bardhan, Koyal Gupta, Payel Saha, Mahasweta Pal, Manjima Bose, Kaushik Basu, Saunak Chaudhury, Pritika Sarkar: Cloud Computing Security Challenges & Solutions-A Survey, Department of Computer Science & Engineering, IEM Institute of Engg. & Management Kolkata, India, IEEE (2018).
2. Bhupesh Kumar Dewangan, Amit Agarwal, Venkatadri, Ashutosh Pasricha: Credential and Security Issues of Cloud Service Models, Department of Computer Science & Engineering, Chhatrapati Shivaji Institute of Technology, Durg, India, International Conference on Next Generation Computing Technologies (NGCT-2016).
3. Vikas Goyal and Chander Kant: An Effective Hybrid Encryption Algorithm for Ensuring Cloud Data Security, NIT, Kurukshetra, India, © Springer Nature Singapore Pvt Ltd. (2018).
4. Sunil Kumar, Jayant Shekhar and Jatinder Paul Singh: Data Security and Encryption Technique for Cloud Storage, Swami Vivekanand Subharti University, Meerut, Uttar Pradesh, India, © Springer Nature Singapore Pte Ltd. (2018).
5. B. Muthulakshmi (B) and M. Venkatesulu: Cloud Data Security Based on Data Partitions and Multiple Encryptions, Kalasalingam University, Anand Nagar, Krishnankoil 626126, Tamil Nadu, India, © Springer International Publishing AG (2017).
6. Manoj Tyagi, Manish Manoria, and Bharat Mishra: Effective Data Storage Security with Efficient Computing in Cloud, Mahatma Gandhi Chitrakoot Gramodya Vishwavidyalaya, Chitrakoot, India, © Springer Nature Singapore Pvt Ltd. (2019).
7. Yu Wei and Yongsheng Zhang: Cloud Computing Data Security Protection Strategy, 1 School of Information Science and Engineering, Shandong Normal University, Jinan 250358, China, © Springer Nature Switzerland AG (2018).
8. Syed Rizvi, Jungwoo Ryoo, John Kissell, William Aiken, Yuhong Liu: A security evaluation framework for cloud security auditing, 1 Department of Information Sciences and Technology, Pennsylvania State University, Altoona, PA, USA, © Springer Science + Business Media New York (2017).

# A Survey on Representation Based Methods for Human Action Recognition from Video

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## Abstract

Recognition of Human actions is an important task in the area of computer vision. And it is broadly used in many applications such as surveillance, patient monitoring, human performance analysis, content-based image/video retrieval, and systems that involve human-human interactions or human-object interactions, etc. Although wide employed in these many application areas, accurate and efficient human action recognition remains a difficult task within the field of computer vision. The need for such systems is increasing day by day, with the increase in the number of surveillance cameras deployed in public places requiring automated systems that can identify human activities and request human attention only when necessary.

In this paper we present and provide a review of human action recognition methods and a brief overview of recent approaches in human action recognition research.

**Keywords:** surveillance, action recognition. Computer vision, patient monitoring

## 1. Introduction

In recent years, the problem of human action recognition has acquired the attention of researchers from industry, academia, security agencies, consumer agencies and the general populace due to its wide span of applications in different areas. Human action recognition has its applicability in areas such as intelligent video surveillance and home monitoring, intelligent human-machine interfaces, video storage and retrieval and identity recognition. It is also a challenging problem in the field of computer vision and machine learning. Currently, there are several major problems in human action recognition that remain unresolved.

Feature representation is the key to good human action recognition. Feature representation and selection is a classic problem in computer vision and machine learning. The feature representation of human action in the video not only describes the appearance of the human (s) in the image space, but also extract changes in appearance and pose. The feature representation problem is extended from two-dimensional space to three-dimensional space-time. In recent years, a number of action representation methods have been proposed, including local and global features based on temporal and spatial changes, trajectory features based on interest point tracking, motion changes based on depth information, and action features based on human pose changes. With the successful application of deep learning to image classification and object detection, many researchers have also applied deep learning to human action recognition. This enables action features to be automatically learned from video data.

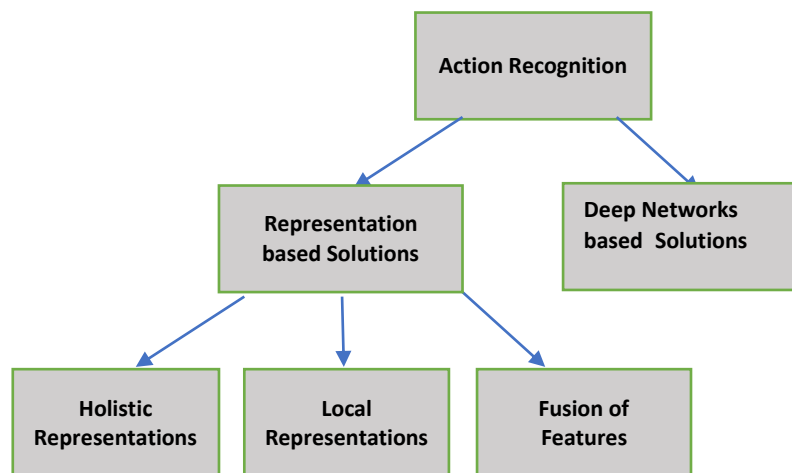


Fig. 1. Classification for human action recognition methods

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In this work, we summarize human action recognition methods based on handcrafted feature and fusion of various features which are applicable to different types of data.

### 1.1 Challenges of the Domain

Challenges faces while recognizing human actions from videos are as below:

- Same action may vary person to person which leads to intraclass variation and distinct actions may fall in to same action class i.e. interclass similarity.
- Most real-world videos have complex and dynamic backgrounds. Occlusions, viewpoint changes and illumination variance make it difficult to recognize activities in such complex conditions.
- In real world videos there are more than one person and/or objects interacting with each other. It is a challenging task to detect and track multiple subjects in vide synchronously or recognize the whole human group activities. E.g. on football ground the activity is “playing football” instead of “running.”
- The low quality and long-distance videos increase the difficulty of human action recognition system.

## 2. Feature Representation Methods for Human Action Recognition

### 2.1 Handcrafted Action Features

Handcrafted features record spatio-temporal changes in videos representing action and capture the human actions. Handcrafted methods include spatiotemporal volume-based action representation methods, space time interest point -based methods, action representation methods based on the trajectory of skeleton joints, and action representation based on human image sequences. These features are mainly used in classic machine learning methods such as Boost, support vector machines, and probability map models to recognize action.

Holistic method of action recognition is based on the extraction of a global representation of human body structure, shape and movements. A. Bobick and J. Davis[3] introduced the concept of Motion Energy Image (MEI) and Motion History Image (MHI), where MEI template describes where the motion happens and the MHI template shows how the motion image is moving considering higher intensities as more recent movements. Yilmaz and Shah[5] proposed to recognize actions based on the differential properties of the Space-Time Volume (STV), which is constructed by stacking the object contours along the time axis. Kholgade and Natasha[6] introduced shape context descriptor computed on silhouette points to identify human actions Background subtraction is performed for each video frame.

The holistic approaches [3] [5] [4] are too rigid to identify possible adaptations of actions (e.g., view point, appearance, occlusions). When the camera is fixed, these methods can use background subtraction techniques to retrieve shape information such as human silhouettes and shapes. However, in the case of complex scenes and camera movements, it is difficult to obtain an accurate silhouette and shape, and in cases where the human body is occluded, an accurate human appearance cannot be identified. Also they are not able to capture fine details within the silhouette, such as a clap man with both hands in front of his body.

Local representation method of action recognition is based on the extraction of local features. STIP-based methods, which are broadly used for action recognition, extract the key region of movement change from a video to represent action. The “interest points” in STIP are referred to as points with a significant local variation of image intensities. An interest point detector [12] is an algorithm that chooses points from an image based on some criterion. Harris3D detector detects corners, Cuboid detector extract cuboids, dense sampling extracts video blocks at regular positions. According to [12] dense sampling is currently popular and outperforms all tested interest point detectors.

Local representations for action recognition follow the below pipeline: interest point detection → local descriptor extraction → aggregation of local descriptors

Laptev [8] extends the notion of interest points into the spatiotemporal domain and used 3D-Harris detector to identify points with large spatial variations and non-constant motions. Liu et al. [11] suggested to extract local static features from a sequence of poses of a person in still images along with motion features and then Pruned irrelevant features. Matikainen et al. [13] proposed a variation of state of the art STIP methods by introducing the concept of trajecton which is obtained by tracking interest points over the video to produce features.

Techniques based on spatiotemporal features have been very popular among researchers. The main advantage of such methods is that they do not require pre-processing steps such as background subtraction or human detection. Local features provide scale and rotation invariance. They are stable under illumination changes and are more robust to occlusion than other methods. However, the spatiotemporal feature points are easily affected by changes in camera view. In the case of background motion and camera motion, local spatio temporal features generate many background feature points, and the motion estimation of the object suffer from large errors.

Trajectories are also used as features which trace the path of interest points or the joints in the human skeleton. Jiang et al.[14] adopted global and local reference points to characterize motion information. Temporal tracking of Local frame patches is

performed and then features are calculated on these patch trajectories. Kliper-Gross et al. [15] used the concept of motion interchange pattern which first computes flow and then at a separate stage analyze the motion.

## 2.2 Fusion of Features

The fusion of different features and descriptors aims to enhance the action recognition performance. There are two general approaches [22]:

1. Early Fusion: Merge the obtained video features and then feed this higher dimensional feature set to a single classifier.
2. Late Fusion: Single classifiers are trained using the individual feature sets and then scores of classifiers are fused to make the final decision.

Kliper-Gross, Orit, et al. [23], used three video descriptors, Histogram of Oriented Gradient (HOG), Histogram of Optical Flow (HOF), and a composition of these two referred to as HNF, are used. Dimensionality is reduced two times, first by Principal Component Analysis (PCA) and then by One Shot Similarity (OSS). Linear SVM is used to classify actions. Hasan, Mahmudul, et al. [24], segmented continuous video using a motion segmentation algorithm. For each motion segment spatiotemporal features such as STIP, higher level features such as Action Bank (AB), and global features such as Gist3D are collected. An ensemble of linear Support Vector Machine (SVM) classifiers is used as the prior model to recognize actions. Can, Ethem F., and R. Manmatha [25], formulated action recognition as a ranking problem and focus on binary ranking models rather than multiclass models. The combination of histogram of oriented gradients (HOG) and histogram of optical flow (HOF) is used for action recognition. Two decision functions; rank-pooling and score-pooling are provided for ranking models. S. Nazir et al. [32], obtained feature representation for a video by extracting space time interest points using 3DHarris and describing the extracted STIPs using 3D SIFT. A visual word codebook is formed by quantizing the obtained features using k-means clustering and each video is represented as a set of spatio temporal visual words from a visual words codebook. The occurrence of every word is counted to form a histogram of visual words. Multi-class learning model is applied using Support Vector Machines (SVM). Patel, Chirag I., et al.[21], have proposed six different fusion models based on early fusion schemes, late fusion schemes, and inter- mediate fusion schemes where different features like HOG , DWT, Displacement of object centroid, Velocity of an object, Local Binary Pattern are calculated and different fusion techniques (as mentioned above) are applied on different combinations of features.

Representation based AR methods in general follow three steps:

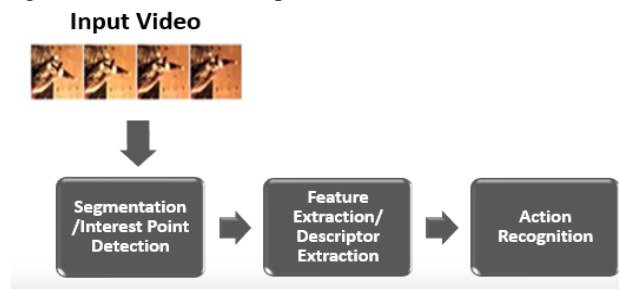


Fig. 2. General steps involved in representation-based methods

Table 1. Accuracies of Handcrafted Action Features on different datasets

Paper	Method	Dataset	Accuracy
A. Bobick and J. Davis, 2001	Motion Energy Image (MEI) and Motion History Image (MHI)	Aerobics Data	66.66%
Yilmaz, Alper, and Mubarak Shah, 2005	the Space-Time Volume (STV)	-	No accuracy data presented
Kholgade Natasha, and Andreas Savakis, 2009	Shape context descriptor	Weizmann dataset	97.9%
Laptev, Ivan, 2005	Spatiotemporal interest points	-	No accuracy data presented
Liu, Jingen, Jiebo Luo, and Mubarak Shah, 2009	Motion and static spatiotemporal features	KTH, YouTube Dataset and personal videos	71.2%
Matikainen, Pyry, Martial Hebert, and Rahul Sukthankar, 2009	Trajectons	Hollywood Actions, YouTube Dataset	31.2%
Kliper-Gross, Orit, et al., 2012	Motion interchange patterns (MIP)	ASLAN, HMDB51, UCF50, KTH	71.92%, 29.17%, 68.51%, 93%

### 3. Recent Trends in Machine Learning for Human Activity Recognition

#### 3.1 Transfer Learning

Transfer learning [31] can be defined as the ability to extend what has been learned in one context to new contexts. It lets one transfer knowledge from one domain to another assuming that there exists some relationship between the source and target. Using transfer learning a reduced amount of data points are required to train the model in target domain because of using information from the previously trained model.

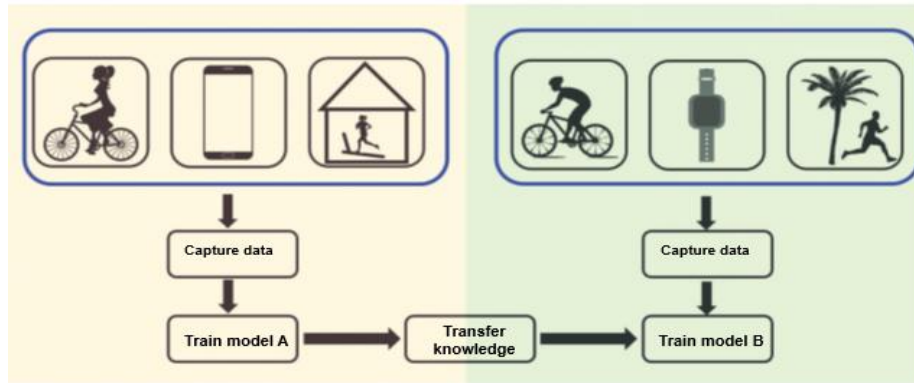


Fig. 3. Transfer Learning [31]

#### 3.2. Deep Learning

The Hand-crafted Feature extraction is tedious and the computer's success rate depends entirely upon the programmer's ability to accurately define a feature set. In deep learning, the features are learned from the raw data hierarchically by itself without supervision. Deep Network based solutions generalize well on large datasets.

### 4. Conclusion

From review and study of different methods on different datasets using only single feature gave good results over simple and static background datasets (e.g. KTH and Weizmann datasets) but lack with realistic video datasets. The recent methods use fusion of multiple features i.e. early fusion (taking care of displacement, velocity, direction, shape etc) to obtain greater performance levels in complex background datasets (e.g. Hollywood, HMDB51 etc.). While working with large datasets, compact image descriptor property is useful as it occupies less space. Recent machine learning trends such as late fusion, one-to-one classifier, transfer learning and deep learning are used to increase accuracy of the recognition task.

### References

1. Kong, Yu, and Yun Fu. "Human Action Recognition and Prediction: A Survey." arXiv preprint arXiv:1806.11230 (2018).
2. S. Herath, M. Harandi, and F. Porikli, "Going deeper into action recognition: A survey," Image and Vision Computing, 2017.
3. A. Bobick and J. Davis, "The recognition of human movement using temporal templates," IEEE Trans Pattern Analysis and Machine Intelligence, vol. 23, no. 3, pp. 257–267, 2001.
4. Poppe, Ronald. "A survey on vision-based human action recognition." Image and vision computing 28.6 (2010): 976-990.
5. Yilmaz, Alper, and Mubarak Shah. "Actions sketch: A novel action representation." Computer Vision and Pattern Recognition, 2005.CVPR 2005. IEEE Computer Society Conference on. Vol. 1. IEEE, 2005.
6. Kholgade, Natasha, and Andreas Savakis. "Human activity recognition using the 4d spatiotemporal shape context descriptor." International Symposium on Visual Computing. Springer, Berlin, Heidelberg, 2009.
7. Belongie, Serge, Jitendra Malik, and Jan Puzicha. "Shape context: A new descriptor for shape matching and object recognition." Advances in neural information processing systems. 2001.
8. Laptev, Ivan. "On space-time interest points." International journal of computer vision 64.2-3 (2005): 107-123.
9. Harris, Chris, and Mike Stephens. "A combined corner and edge detector." Alvey vision conference. Vol. 15. No. 50. 1988
10. Willems, Geert, Tinne Tuytelaars, and Luc Van Gool. "An efficient dense and scale-invariant spatio-temporal interest point detector." European conference on computer vision. Springer, Berlin, Heidelberg, 2008.
11. Liu, Jingen, Jiebo Luo, and Mubarak Shah. "Recognizing realistic actions from videos "in the wild"." Computer vision and pattern recognition, 2009. CVPR 2009. IEEE conference on. IEEE, 2009.
12. Wang, Heng, et al. "Evaluation of local spatio-temporal features for action recognition." BMVC 2009-British Machine Vision Conference. BMVA Press, 2009.

13. Matikainen, Pyry, Martial Hebert, and Rahul Sukthankar. "Trajectons: Action recognition through the motion analysis of tracked features." *Computer Vision Workshops (ICCV Workshops)*, 2009 IEEE 12th International Conference on. IEEE, 2009.
14. Jiang, Yu-Gang, et al. "Trajectory-based modeling of human actions with motion reference points." *European Conference on Computer Vision*. Springer, Berlin, Heidelberg, 2012.
15. Kliper-Gross, Orit, et al. "Motion interchange patterns for action recognition in unconstrained videos." *European Conference on Computer Vision*. Springer, Berlin, Heidelberg, 2012.
16. Mabrouk, Amira Ben, and Ezzeddine Zagrouba. "Abnormal behavior recognition for intelligent video surveillance systems: A review." *Expert Systems with Applications* 91 (2018): 480-491.
17. Polana, Ramprasad, and Randal Nelson. "Low level recognition of human motion (or how to get your man without finding his body parts)." *Motion of Non-Rigid and Articulated Objects*, 1994., *Proceedings of the 1994 IEEE Workshop on*. IEEE, 1994.
18. Zhang, Hong-Bo, et al. "A Comprehensive Survey of Vision-Based Human Action Recognition Methods." *Sensors* 19.5 (2019): 1005.
19. Ye, Mao, et al. "A survey on human motion analysis from depth data." *Time-of-flight and depth imaging. sensors, algorithms, and applications*. Springer, Berlin, Heidelberg, 2013. 149-187.
20. Singh, Tej, and Dinesh Kumar Vishwakarma. "Human Activity Recognition in Video Benchmarks: A Survey." *Advances in Signal Processing and Communication*. Springer, Singapore, 2019. 247-259.
21. Patel, Chirag I., et al. "Human action recognition using fusion of features for unconstrained video sequences." *Computers & Electrical Engineering* 70 (2018): 284-301.
22. Mohammadi Nejad, Eman. "Simple and Complex Human Action Recognition in Constrained and Unconstrained Videos." (2018).
23. Kliper-Gross, Orit, Tal Hassner, and Lior Wolf. "One shot similarity metric learning for action recognition." *International Workshop on Similarity-Based Pattern Recognition*. Springer, Berlin, Heidelberg, 2011.
24. Hasan, Mahmudul, and Amit K. Roy-Chowdhury. "Incremental activity modeling and recognition in streaming videos." *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. 2014.
25. Can, Ethem F., and R. Manmatha. "Formulating action recognition as a ranking problem." *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition Workshops*. 2013.
26. Maia, Helena Almeida, et al. "A video tensor self-descriptor based on variable size block matching." *Journal of Mobile Multimedia* 11.1&2 (2015): 090-102.
27. Kulbacki, Marek, et al. "Intelligent Video Monitoring System with the Functionality of Online Recognition of People's Behavior and Interactions Between People." *Asian Conference on Intelligent Information and Database Systems*. Springer, Cham, 2018.
28. González, Luis, Sergio A. Velastin, and Gonzalo Acuna. "Silhouette-based human action recognition with a multi-class support vector machine." (2018): 14-5.
29. Chaquet, Jose M., Enrique J. Carmona, and Antonio Fernández-Caballero. "A survey of video datasets for human action and activity recognition." *Computer Vision and Image Understanding* 117.6 (2013): 633-659.
30. Kholgade, Natasha, and Andreas Savakis. "Human activity recognition in video using two methods for matching shape contexts of silhouettes." *Intelligent Computing: Theory and Applications VI*. Vol. 6961. International Society for Optics and Photonics, 2008.
31. Ramasamy Ramamurthy, Sreenivasan, and Nirmalya Roy. "Recent trends in machine learning for human activity recognition—A survey." *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery* 8.4 (2018): e1254.
32. Nazir, Saima, Muhammad Haroon Yousaf, and Sergio A. Velastin. "Evaluating a bag-of-visual features approach using spatio-temporal features for action recognition." *Computers & Electrical Engineering* 72 (2018): 660-669.
33. Liu, An-An, et al. "Benchmarking a multimodal and multiview and interactive dataset for human action recognition." *IEEE Transactions on cybernetics* 47.7 (2016): 1781-1794.
34. UIUC1 dataset "<http://vision.cs.uiuc.edu/projects/activity/>"
35. T. Bouwmans, F. El Baf, B. Vachon, "Background Modeling using Mixture of Gaussians for Foreground Detection - A Survey", *Recent Patents on Computer Science* 1, 3 (2008) 219-237



# Energy Efficient and Fast Data Transmission Techniques for Wireless Sensor Networks

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## Abstract

In this Paper we analyze WSNs and show that it's possible to achieve better performances in terms of energy consumption and latency. Event aggregation in WSNs is a process of combining several low-level events into a high-level event to eliminate redundant information to be transmitted and thus save energy. Existing works on event aggregation consider either latency constraint or aggregation function, but not both. This paper studies the problem of aggregating multiple high-level events in WSNs with different latency constraints and aggregation functions. We propose relation matrix to define aggregation function, which describes the similarity among limited number of primitive events rather than the growing number of high-level events. Based on it, we propose an event aggregation algorithm jointly considering the two issues for single high-level event. This algorithm supports partial aggregation which is more general than fully aggregation. Through selection the optimal base events, the work is extended to multiple high-level events and consider the practical reliable constraint. The simulation results show that our algorithm outperforms existing approaches and saves significant amount of energy (up to 35% in our system).

**Keywords:** Wireless Sensor Networks, WSN, Data Aggregation, Energy efficiency, Event Aggregation, Latency.

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## 1. Wireless Sensor Networks

Wireless Sensor Network (WSN) has developed in recent years. WSN because of its edibility in arrangement as well as the less effort demanded for maintenance, have exhibited promising applications in many fields like military, healthcare, environmental applications, etc. WSN comprises of large number of tiny sensor nodes. Because of their small size and use of wireless medium for communication these nodes can be deployed in the phenomenon or close to it. These sensor nodes because of its size have some limitations. They have limited computation power, memory, communication capabilities and energy. WSNs have been extensively studied with the objective of energy efficiency whereas throughput, bandwidth utilization, fairness and latency were considered as the secondary objectives. One of the most prominent operations of WSN is converge casting. Converge cast, namely the collection of data from a set of sensors toward a common sink over a tree-based routing topology, is a fundamental operation in wire- less sensor networks (WSN). Two types of data collection: (i) aggregated converge cast where packets are aggregated at each hop (ii) raw data converge cast where packets are individually relayed toward the sink. Aggregated converge cast is applicable when a strong spatial correlation exists in the data, or the goal is to collect summarized information such as the maximum sensor reading. Raw data converge cast, on the other hand, is applicable within each sensor reading, is equally important, or the correlation is minimal. Aggregated converge cast also results in energy conservation and one of the most popular techniques used. In this it reduces the number of packets to be transmitted from source to sink which saves the energy of transmitting each pack- et individually. This process does increase the latency of communication. The collection of data formal set of sensors toward a common sink over a tree based routing topology, called as converge cast, is a fundamental operation in wireless sensor networks (WSNs).it is essential to provide a guarantee on the delivery time as well as increase the rate of such data collection in many applications. For instance, the applications in which the actuators and the controllers need to receive data from all sensors within a specific deadline, failure of which might lead to unpredictable and catastrophic events. This falls under the category of one-shot data collection. On the other hand, applications such as permafrost monitoring require periodic and fast data delivery over long periods of time, which falls under the category of continuous data collection. However, since various sensor nodes often detect common phenomena, there is likely to be some redundancy in the data that the source nodes communicate to a sink. In-network filtering and processing techniques like data aggregation can help to conserve the scarce energy re- sources. In this paper we study the energy savings and the traffic reduction at the expense of latency that can be obtained by introducing data aggregation in the described scenario.

## 2. Event Aggregation

Early works in WSNs are mainly about data processing and the latest ones begin to discuss event processing. Event processing is a natural extension of data processing in WSNs, which encapsulates collected data in events. Correspondingly, while data aggregation generates the summary of raw data, event aggregation deduces high-level events from low-level events.

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Event aggregation is an effective approach to reduce data amount in WSN communication.

In existing works, some analyze the impact of aggregation functions on aggregation structure, where aggregation function describes the correlations among different events. Others consider latency constraints to meet time sensitive requirements. An aggregation with both of the factors is more general but has not been considered yet. The difficulty partly arises from the aggregation function which is usually assumed as fully aggregation function which means two low-level events with one unit data amount can merge into a composite event with one unit data amount, or more general function which takes low-level events as input and composite event as output. It is not clear how to combine aggregation function with latency constraint. More importantly, hardly any existing works have been conducted for multiple high-level events. Considering a WSN based intelligent traffic system, many events are required by different users for different purposes. Some users may have interests in the average speed of vehicles, while some others may want to know the speed of individual vehicles. The events have different correlations among low-level events hence have different aggregation functions. Moreover, the latency requirements also may be different. Existing approaches have not investigated the diversity of requirements in event aggregation. [3] In this paper, we investigate the aggregation problem of multiple high-level events with different latency constraints and aggregation functions in WSNs. We propose relation matrix as a simple approach to define aggregation function, which use the similarity among limited number of primitive events rather than growing number of high-level events. After that we design algorithm named DBEA to build the aggregation tree for single high-level event considering both the two issues.

### 3. Delay Bounded Event Aggregation Algorithm

We propose Delay Bounded Event Aggregation algorithm (DBEA) to build the aggregation tree considering both latency constraint and aggregation function. Different from fully aggregation, DBEA supports partial aggregation. During the tree building, if a source node joins in the tree, the distance increased is not the distance between this node and the tree, but the distance between this node and the sink node.

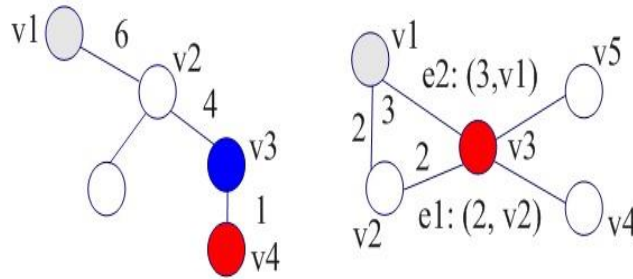


Fig. 1. Design rationale of delay bounded event aggregation algorithm

For example, in Figure 2.1, aggregation tree  $T$  already includes  $v1$ ,  $v2$  and  $v3$ ; the distance between  $v4$  and  $T$  is 1, which is exactly the increased distance in fully aggregation since when a packet traverses from  $v4$  to  $v3$ , it merges into the packet of  $v3$  hence not increase the cost from  $v3$ . This is not the case in partial aggregation, the packet traversing to  $v3$  may aggregate into a packet with data amount more than 1 (e.g. 1.5), then it has additional cost from  $v3$  to the sink node (e.g.  $(1.5 + 1)(6 + 4) = 5$ ). We also introduce the concept of possible distance because different events may have conflicting optimal parent candidates. As in Figure 3.1,  $v1$ ,  $v2$  and  $v3$  are already in  $T$ ; When event  $e1$  transmits to  $v3$ , the optimal distance is 2 subject to the parent of  $v2$ , while for event  $e2$ , the optimal distance is 3 subject to the parent of  $v2$ . In the aggregation tree,  $v3$  have only one parent. This is so called possible and need adjustment when a source node joins in the tree. The details are shown in Algorithm 1. We randomly create networks with minimum latency 4 and aggregation function  $N0$  (norm of  $A2$  is 0, norm=0 for short), then issue a set of events with increasing latency constraints from 0 to 25.

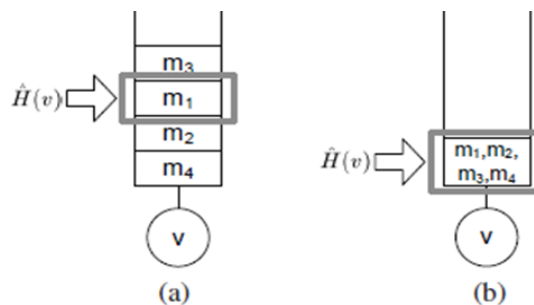


Fig. 2. Messages in the queue of node  $v$  with and without aggregation. Without aggregation, when node  $v$  is scheduled, the message  $m1$  will be forwarded. With aggregation, all messages are aggregated into a single packet and will be forwarded simultaneously. (a) Without in-network aggregation. (b) With in-network aggregation.

#### 4. Impact of Aggregation

In this section, we study the effectiveness of in-network aggregation in terms of the total delay. Given a tree network of  $n$  nodes including the sink, we consider a scenario in which each sensor node generates a message, and all  $(n - 1)$  messages are equally important. Specifically, all weights are set to 1. We show that without aggregation, the optimal delay is lower bounded by  $O(n^2)$ , while it is upper bounded by  $O(n \log n)$  with aggregation. Therefore, the gain is quite substantial  $O(n/\log n)$ .

##### 4.1 PERFORMANCE WITHOUT AGGREGATION

Without in-network aggregation, the delay is lower bounded by when  $d = O(\log n)$ . Proof: Since messages cannot be aggregated, each packet has to include only one message. Then, at the root, the sink can receive at most one packet during each time slot under the node-exclusive interference model. Since it takes at least  $(n - 1)$  time slots to receive all  $(n - 1)$  messages.

$$\sum_{m \in \hat{V}} D_m \geq O(n^2)$$

##### 4.2 PERFORMANCE WITH AGGREGATION

In-network aggregation can significantly reduce the delays by integrating multiple messages into a single packet. Since the reduction in the number of transmissions implies less interference, messages can be forwarded faster. We assume that messages can be aggregated into a single packet with no cost if they are located in the same node. Proposition 2: With in-network aggregation, the delay is upper bounded by

$$\sum_{m \in \hat{V}} D_m \leq O(n \log n)$$

#### 5. Simulation Results

In our simulation, 200 nodes are put into a  $10 \times 10$  (m<sup>2</sup>) spaces. Any nodes within communication radius  $r_c$  can communicate with each other. We use the energy consumption as the performance metric. Assuming the packet with data amount  $I$  and transmission distance  $d$ , the transmission cost is  $I(\beta\gamma + E)$  when  $d < r_c$ , where  $\gamma$  denotes energy consumption per bit on the transmitter and receiver circuit [3]. The parameters are set that  $\gamma = 2$ ,  $\beta = 100$  (pJ/bit/m<sup>2</sup>),  $E = 40$  (nJ/bit). The number of hops is used to describe the latency. We randomly create networks with minimum latency 4 and aggregation function N0 (norm of A2 is 0, norm=0 for the word “data” is plural, not singular. The subscript for short, then issue a set of events with increasing latency constraints from 0 to 25.

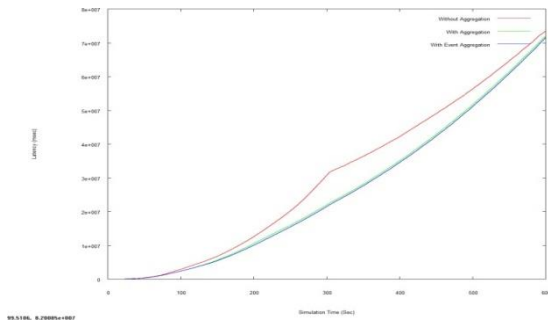


Fig. 3. Delay bounded event aggregation

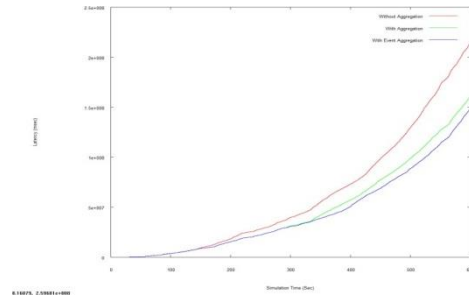


Fig. 4. Aggregation with different event number

#### 6. Conclusion

In this paper, we studied the event aggregation problem considering both aggregation function and latency constraints in multiple high-level events. We proposed solutions to this problem including a simple approach to describe aggregation function, the DBEA algorithm considering both latency constraint and aggregation function for single high-level event, and the optimal base events selection algorithm for aggregating multiple high-level events given a reliable constraint. The simulation results show that significant energy (up to 35% in our system) can be saved by using our algorithm.

**References**

1. Mr Bhabani Prasad, Mrs. Chitrakala, "A Fast Convergecast Method for Tree-Based Wireless sensor Networks," Electronics Research Laboratory Memorandum Number M98/2, 2016.
2. Claudio Barone, Fabrizio Ciarlo, Sebastiano Testa "Energy Efficiency and Latency Optimization through Data Aggregation in Wireless Sensor Networks," in Proc. IEEE MEMS Workshop, Nagoya Jan. 2009, pp. 350355.
3. K.-W. Fan, S. Liu, "Structure-free Data Aggregation in Sensor Networks," journal IEEE Transactions on Mobile Computing, vol. 6 Issue 8. August 2007.
4. Weiping Zhu, Jiannong Cao, Yi Xu, "Event Aggregation with Different Latency Constraints and Aggregation Functions in Wireless Sensor Networks" IEEE ICC 2011.
5. H. Luo, Y. Liu and S. K. Das, Routing Correlated Data with Fusion Cost in Wireless Sensor Networks, IEEE Trans. on Mobile Computing, vol. 5, no.11, pp. 1620-1632, 2006.
6. Changhee Joo, Jin-Ghoo Choi, and Ness B. Shroff, "Delay Performance of Scheduling with Data Aggregation in Wireless Sensor Networks" IEEE INFOCOM 2010.
7. L. Becchetti, P. Korteweg, A. Marchetti-Spaccamela, M. Skutella, L. Stougie, and A. Vitaletti, Latency Constrained Aggregation in Sensor Networks, in the 14th conference on Annual European Symposium, 2006.
8. Athanassios Boulis, "Castalia A simulator for Wireless Sensor Networks and Body Area Networks" Ver 3.1, 3.2 NICTA December 2010.
9. Amitabha Ghosh, Ozlem Durmaz Incel, V.S. Anil Kumar, and Bhaskar Krishnamachari, "Algorithms for Fast Aggregated Convergecast in Sensor Networks" University of Southern California 2007.

# Survey of Feature-based Bot Detection Methodologies

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## Abstract

Social media platform like twitter contains bot accounts that mimic human behavior and try to mislead, manipulate, exploit or influence social media discourse with rumors, malware, and misinformation. To guard against such a security breach, we need to separate bots from humans. Various bot detection methodologies are available to detect bots from social media that can be derived within four subsections: dataset, analyzed features, model/classifier, and performance measures. Here a review of various methodologies that are based on a feature-based approach is given.

**Keywords:** Sybil account, social bot, bot, feature-based approach.

## 1. Introduction

Bot (Social bot) also known as Sybil account is a software program that is programmed to perform specific tasks regularly. There are mainly two types of bots [1]. The first category of social bots includes bots that are created with the purpose of help. This category includes bots that automatically aggregate content from various web sources. For example Automatic responder to customer's inquiry adopted by customer care of brand/companies. Although this type of bots created to provide useful information, they sometimes spread unverified information or rumors unintentionally. The second category of social bots includes bots that are created with the purpose of harm. This type of bots can mislead, manipulate, exploit or influence social media discourse with rumors, malware, and misinformation that can cause several levels of damage to society. For example, Bot can influence election result by artificially inflate support for a political candidate, this could endanger democracy.

Bots can influence the result of the election, as was observed during the U.S. midterm elections, social bots were activated to support some candidates and slander their opponents [2]. Malicious activity of bots include disseminating of misleading information, as observed in case of Cynk, an automatic trading algorithms picked up fake conversation created by bot and started trading heavily in the company's stocks. This resulted in a 200- fold increase in market value of company. [3]. Bots attempt to reach more people by using negative sentiment as a technique and causing potential damage to the brand [7]. Bots can steal personal information and subsequently use it for spamming and fishing activities. These and many other activities of social bots have several endanger impacts on social discourse.

## 2. Background

Approaches to detect bots can be categorized into main four classes: graph-based, crowdsourcing, feature-based and hybrid [1]. A graph-based approach for discriminating bots from humans is based on the structure of a social network. Crowdsourcing approach is based on human intelligence. The feature-based approach is based on the identification of highly revealing features and a hybrid approach is a combination of multiple approaches. In this paper, we focus on studying methodologies that are based on feature-based approaches. There are thousands of features for discriminating bots from humans can be classified into mainly 6 classes [1] represented in Table 1.

Table 1. Classes of Features Employed by Feature-Based System for Discriminating Bots from Humans

Class	Description	Features
Network	Capture various dimensions of information diffusion patterns	In and out degree centrality, Number of known bots followed by user, etc.
Users	Twitter meta-data related to an account	Number of posts/ tweets/ re- tweets/ followers, Profile photo, Profile URL, etc.
Friends	Relative to friends of account	Moments and median of the distribution their number of followers and post.
Timing	Temporal pattern of tweet and re- tweet	Variance in tweet sentiment overtime, Average number of tweets per day. etc.
Content	Related with the message of a tweet	Number of words in a tweet, Number of URLs, hashtags, etc.
Sentiment	Determines how poster feels about the topic of associated tweet	Happiness, dominance, and emotion scores, etc.

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### 3. Analysis of Various Feature-based Methodologies

#### 3.1 Random Forest Twitter Bot Classifier [4]

James Schnebly et al. in [4] elaborates basic account features and other ratio features derived from basic account features. Random forest classifier used for bot detection as it is not prone to over fitting.

Two dataset used in experiment. First dataset contains 3202 bot accounts and 445 genuine accounts from the dataset [10] while second dataset contains 3457 bot accounts and 1946 genuine accounts from the dataset [11].

The approach for detecting bots begins with data collection in which two dataset imported into a MySQL, each database contained two tables namely tweet and users. Driven by data collection, now feature selection and feature creation performed. In feature selection, 7 features related to account information selected namely length of bio, followers, age of account, following, number of tweets, number of likes, and follower ratio. In feature creation, 5 features namely like\_age\_ratio, tweet\_age\_ratio, hashtag\_tweet\_ratio, URL/pics\_tweet\_ratio, re- ply\_tweet\_ratio created using various SQL operation. After having all features CSV file has been created for prepared database to serve it as input to classifier. Driven by creation of CSV file, bot detection is performed using random forest classifier made up of 20 decision trees. Three different model of random forest used for experiment. First model used first dataset for training as well as testing, Second model combined first and second dataset for training and testing, and third model used first dataset for training and second for testing.

#### 3.2 Identifying Twitter Bots Using a Convolution Neural Network Notebook for PAN at CLEF 2019 [5]

Michael Farber et al. [5] proposed the bot detection system that identifies whether a user is human or bot from twitter feed. They experiment with various embedding methods and convolution neural network architectures.

Training and validation data set of the CLEF 2019 Bots and Gender Profiling Task used for bot detection. Dataset provided by CLEF is a balanced dataset.

The approach for detecting bots begins with data pre-processing by merging all tweets into a single block of text called “article”. The article pre-processed by performing the text cleaning, text to sequence and sequence padding respectively. Having pre-processed tweets, now CNN used consists of two one-dimensional convolutional neural networks layers, followed by MaxPooling layers, with a dense neural networks layer processing the output of the second CNN layer, and a final output layer that uses the sigmoid activation function to return a binary output (namely, the classification into human or bot).

Two different variants of CNN used for bot detection. In the first variation, 1-dimensional MaxPooling of size 2 used after each layer of a convolutional layer. In the second variation, 1-dimensional MaxPooling of size 4 used after each layer of a convolutional layer.

#### 3.3 A Big Data Approach to Examining Social Bots on Twitter [6]

Xia Liu [6] determines how social bots distort brand information and identify features that make social bots viral in the context of big data of user-generated content.

The data of 24 companies collected using a java based web crawling tool from twitter API. The data pre- processed by removing stop word. The rest of the text is tokenized and tagged using the Stanford CoreNLP tool. Driven by data collection and data pre-processing, data visualization is performed using word cloud and Latent Dirichlet allocation (LDA) to identify the most frequent word used. Driven by data visualization, sentiment analysis performed using maximum entropy on each of tweets and data integration respectively. After having pre-processed data, to answer the first research question: Do social bots distort brand information on social media? Two sample t-test performed to compare bot-created tweets and human-created tweets in four aspects: positive sentiment, negative sentiment or neutral sentiment and virality. A fixed-effect model has been used to identify features that make social bots viral.

#### 3.4 Contrast Pattern-based Classification for Bot Detection on Twitter [7]

Octavio Loyola-gonzález et al. in [7] elaborates an understandable model for bot detection on social media platform more likely for twitter that provide an explanation for each decision and help expert to take legal action against an account that perform suspicious activity or display offensive behaviour. The proposed model can be used for bot detection on twitter regardless of whether tweets are written in either Spanish or English.

Four different datasets used in for experiment: first database containing all features proposed in [10], second database containing all features proposed in [10] and their proposed features, third dataset Containing subset of the original features proposed in [10] and their proposed features, and forth dataset containing only their pro- posed features.

The approach for detecting bots begins with building feature model, 59 features derived for building feature model among it 5 features related to sentiment, 31 features related to the frequency of last 200 tweets and additional 8 features related to date and time of tweet and twitter account. After having a feature model, contrast pattern mining performed using k number of diverse

decision trees. As duplicate contrast patten and redundant items reduce the complexity of classification, contrast pattern filtering performed by removing redundant contrast patterns, specific contrast pattern and redundant items. Having filtered contrast pattern, PBC4cip contrast- pattern classifier is used for bot detection.

### 3.5 Deep Neural Network for Bot Detection [8]

Sneha Kudugunta et al. [8] Proposed a bot detection mechanism based on fewer features to detect bot at tweet level as well as at account level. The main objective here is to develop a bot detection mechanism that can detect bot from a single tweet.

The dataset used in their work is a mixture of the groups' genuine accounts, social spambots #1, social spam- bots #2, and social spambots #3 presented in [10]

For account level classification, 10 features related to account information of user used and for bot detection synthetic minority oversampling technique (SMOTE) with enhancement via (1) Edited Nearest Neighbours (ENN) and (2) Tomek Links used.

For tweet level classification, they make use of 7 features related to a tweet and metadata of a tweet. At tweet level classification two approaches are defined. In the first approach, bot detection is performed using tweet only, in which the first tweet content pre-processed, and it becomes input to pre-trained Glove embedding. The sequence of vector from Glove embedding becomes input to Long Short Term Memory (LSTM). The output of LSTM becomes input to two ReLU (rectified linear unit) to give output. In the second approach, bot detection is performed using tweet content and metadata that comes with tweet content, in which contextual LSTM used as LSTM can only process sequential data. It works similar to the previous one the difference is only that auxiliary input is given to the output layer of LSTM which means result in output vector is combined with auxiliary input (metadata of tweet).

### 3.6 BotOrNot: A System to Evaluate Social Bots [9]

Clayton A. Davis et al. [9] proposed a publically available bot detection system that makes use of more than 1000 features to detect bot.

BotOrNot API takes a twitter screen as specified by the client. A recent history of specified user collected and sent it to the BotOrNot server. Bot likely score calculated by BotOrNot server and sent the result to the client in JSON format.

The dataset used in training contained 16k legitimate account and 15k bot account along with more than 5.6 million tweets, collected through Twitter search API. BotOrNot makes use of more than 1000 features can be grouped into mainly six class namely network, user, friends, temporal, content, sentiment which are extracted from interaction pattern and content. Extracted features are employed to train seven different random forest classifiers, one for each subclass of features and one for calculating the overall score.

## 4. Conclusion

The dynamics of how users communicate on social media make it a fascinating area of both social and security- related studies. We can summarize the bot detection approach within four subsections: dataset, features, classifier/model, and Performance measure. There are some limitations in reviewed methodologies that point to future direction in this field. Such as, in [4] sentiment analysis could be performed for increasing accuracy. In [5] using balanced test data across all tests, it is assumed that unknown data is balanced. This means the tests conducted in this study do not indicate a general direction for distributions in all situations generating correct output. In [6] it is difficult to handle to opposite sentiment at sentence level in automatic sentiment analysis. In [7] there is no specification about the value of k during the contrast-pattern mining phase. In [8] it is difficult to train and optimized LSTM. In [9] it is a time-consuming process as generating more than 1000 features from interaction pat- terns and content. The finding reveals that accuracy and computational cost of bot detection is highly depended on selected features as weak selection of features lead to high computational cost, high dimensionality in data, over-fitting, and decay in performance of predictor. As a result, for better bot classification good feature selection is required.

## References

1. Ferrara, E., Varol, O., Davis, C., Menczer, F., & Flammini, A. (2016). The rise of social bots. *Communications of the ACM*, 59(7), 96-104.
2. Ratkiewicz, J., Conover, M. D., Meiss, M., Gonçalves, B., Flammini, A., & Menczer, F. M. (2011, July). Detecting and tracking political abuse in social media. In *Fifth international AAAI conference on weblogs and socialmedia*.
3. Fiegeman, S. (2014). The curious case of Cynk, an abandoned tech company now worth \$5Billion.
4. Schnebly, J., & Sengupta, S. (2019, January). Random Forest Twitter Bot Classifier. In *2019 IEEE 9th Annual Computing and Communication Workshop and Conference (CCWC)* (pp. 0506-0512). IEEE.
5. Färber, M., Qurdina, A., & Ahmedi, L. (2019). Identifying Twitter Bots Using a Convolutional Neural Network.
6. Liu, X. (2019). A big data approach to examining social bots on Twitter. *Journal of Services Marketing*.
7. Loyola-González, O., Monroy, R., Rodríguez, J., López-Cuevas, A., & Mata-Sánchez, J. I. (2019). Contrast Pattern- Based

- Classification for Bot Detection on Twitter. *IEEE Access*, 7, 45800-45817.
8. Kudugunta, S., & Ferrara, E. (2018). Deep neural networks for bot detection. *Information Sciences*, 467,312-322.
  9. Davis, C. A., Varol, O., Ferrara, E., Flammini, A., & Menczer, F. (2016, April). Botornot: A system to evaluate social bots. In *Proceedings of the 25th International Conference Companion on World Wide Web* (pp. 273-274). International World Wide Web Conferences Steering Committee.
  10. Cresci, S., Di Pietro, R., Petrocchi, M., Spognardi, A., & Tesconi, M. (2017, April). The paradigm-shift of social spam- bots: Evidence, theories, and tools for the arms race. In *Proceedings of the 26th international conference on World Wide Web companion* (pp. 963-972). International World Wide Web Conferences Steering Committee.
  11. Cresci, S., Di Pietro, R., Petrocchi, M., Spognardi, A., & Tesconi, M. (2015). Fame for sale: Efficient detection of fake Twitter followers. *Decision Support Systems*, 80, 56-71.



# Execution of SPARQL Query on Distributed Database

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## Abstract

A web of linked data elements easily processed by the machine is referred as Semantic Web as referred as the extensible version of World Wide Web. In this paper a job search ontology is presented through which a user can search a job matching all the requirements. Protege, Java and SPARQL queries are used for enabling the requirements of an Employee and a job seeker. Single queries are executed in the job search ontology and then multiple ontologies are combined in the same URL and SPARQL queries are executed on different databases enabling best search output.

**Keywords:** SPARQL, JobOntology, Semantic Web, Distributed database.

## 1. Introduction

With the development in the field of computing, machine learning, AI, the Semantic web technologies have also started gaining popularity. The Semantic Web focuses on the meaning of the word to be searched i.e. Semantics while matching the context area of interaction on web [1]. Advancement in AI has led to emphasis on Ontology where domains are defined. Semantic Web and trends in AI includes standards like Resource Description Format (RDF) and Web Ontology Language (OWL). These standards searches for the data and users query based on the semantics which enables more precise access of data requested.

## 2. Ontology

Ontology is defined as a formal specification of shared concepts. It is the building block of Semantic Web. It has a common language representing various symbols and expressions conveying very specific meanings. Based on the semantics many classes and symbols are created. According to Fensel [2] (2001, p.VI), an ontology is “a community mediated and accepted description of the kinds of entities that are in a domain of discourse and how they are related”. In this paper multiple Job Search Ontologies are used on which SPARQL queries are executed enabling the best match between the job seeker search and Employers requirement for the specific designation and company.

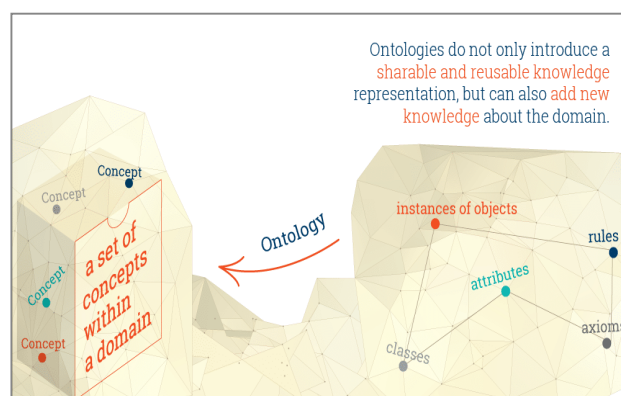


Fig. 1. Ontology concept [16]

## 3. Semantic Web

Semantic web is known as the extension of the World Wide Web, representing data as metadata in a web page, to enable information and content sharing of a web page along with its author information between the web pages. Semantic web provides the users with necessary structure to link one set of information to another set of information on the World Wide Web. As they are used to specify common modeling representations of data from heterogeneous/distributed systems and databases, ontologies enable interoperability, cross-database search and smooth knowledge management.

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Semantic web is created with an intension that computers understand the data available on web pages in context with their meanings. Semantic framework allows the content to be created in Owl, CML and RDF languages which are machine readable. It enables automatic linking of information on one page with the information on another page. Data is searched on the basis of its underlying meaning. Resource Description Framework (RDF) is used for the meta data exchange across web. RDF supports the merging of data for different schemas.

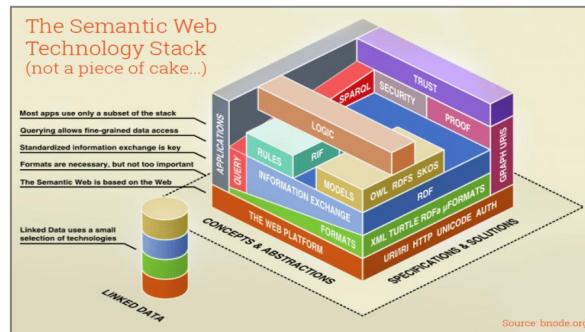


Fig. 2. Semantic Web Technology Stack<sup>[17]</sup>

#### 4. Protégé

Protege is an Ontology editor and also considered as a framework for building intelligent systems. An Ontology can be referred as a taxonomy containing different vocabularies for a particular domain.

Protégé allows users to

- Create new ontologies and save it in RDF or OWL.
- Update, import and save the existing ontologies written in Ontology Web Language or in Resource Definition Framework.
- Define classes and populate them with concrete instances.
- Ontologies can be visualized in graphical form, showing the functional relationship between classes.
- Based on instance properties they can be easily classified.

Protégé editor is used to create the different ontologies namely job search, testing and testing1.

#### 5. Ontology Structure

A Job Search Ontology structure is defined to enable the requirements of a Job seeker and employer to match. Classes are defined and associated with data properties. Object properties are defined and linked correspondingly with the source class and object class. Establishing this linkage shall enable the formation of the Job search ontology through which précised job search could be enabled. The class, associated data properties and represented below.

Table 1. Object Properties

Sr. No.	Object Property	Source Class	Object Class
1	isPosting	Company	JobOffer
2	IsRecruiting	Company	JobSeeker
3	isLocatedIn	Company	City
4	isSearching	JobSeeker	JobOffer
5	isLivingIn	JobSeeker	City
6	isHaving	JobSeeker	Skill
7	isHaving	JobSeeker	Qualification
8	isHaving	JobSeeker	WorkExperience
9	isExpecting	JobSeeker	Salary
10	isRequiring	JobOffer	WorkExperience
11	isRequiring	JobOffer	Qualification
12	isRequiring	JobOffer	Skill
13	isRequiring	Skill	Domain
14	isPostedBy	JobOffer	Company
15	isOffering	JobOffer	Salary
16	isRelatedTo	JobOffer	Domain
17	isLocatedIn	City	State
18	isSituating	Company	City

Table 2. Job Search Ontology Classes and Data Property Association

Sr. No	Class Name	Data Property			
1	Company	CompanyName	CompanyCode	CompanyAddress	CompanyEmail
		CompanyYearOfEstablishment	CompanyWebSite	CompanyContactNo	
2	JobSeeker	JSeekerName	JSeekerId	JSeekerAddress	JSeekerEmail
		JSeekerContactNo	JSeekerCity	SeekerState	JSeekerWorkExperience
		JSeekerQualification			
3	JobOffer	JobId	JobTitle		
4	Skill	TypeOfSkill			
5	Domain	NameOfDomain	DomainId		
6	City	CityName			
7	State	StateName			

### 5.1 Job Search Ontology Structure

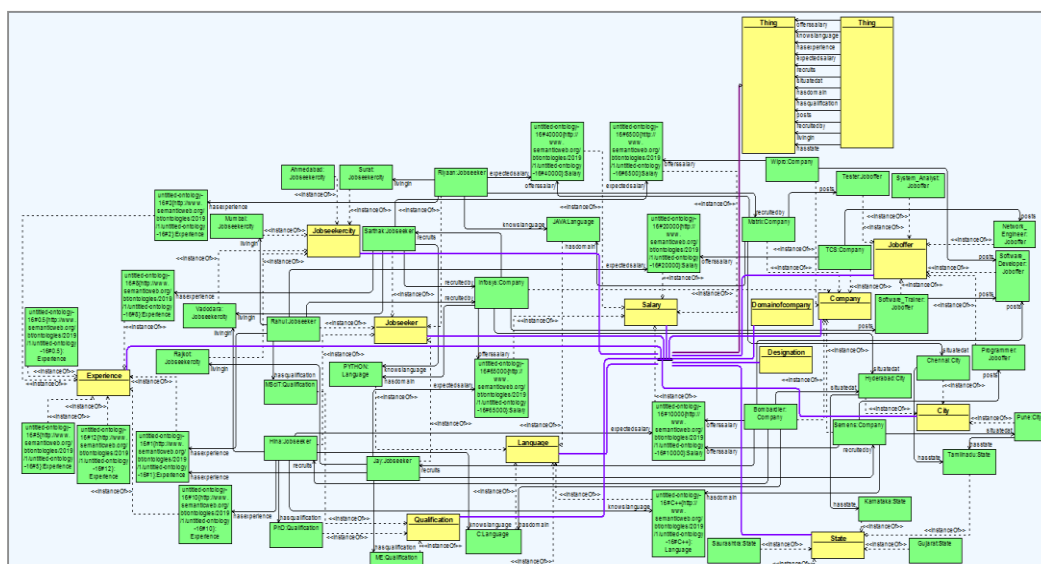


Fig. 3. Job Ontology Structure representation in OWLGrEd

### 5.2 Ontology Design in Protege

In Job search Ontology various classes are created. For enabling sharing of information relationships are defined between several classes. The list of classes and the relationship established between them are mentioned. For example the company class is related with the Job offer class establishing 2 different relationships. Company posts the job offer and the company recruits the job seeker. The list of classes and the relationship established between different classes are mentioned below.

Table 1. Class and Relationship

Class	Relationship		
Company	Company_isPosting_JobOffer	Company_isRecruiting_JobSeeker	
JobOffer	JobSeeker_isSearching_JobOffer		
JobSeeker	JobSeeker_isHaving_Skill		
Skill	Skill_isRequiring_Domain	JobOffer_isRequiring_Skill	JobSeeker_isHaving_Skill
Domain	JobOffer_isRelatedTo_Domain	Domain_IsRequiringSkill	
City	Company_isSituatingIn_City	JobSeeker_isLivingIn_City	
State	City_isLocatedIn_State		
Salary	JobSeeker_isExpecting_Salary	JobOffer_isOffering_Salary	

### 5.3 Job search Ontology design in Protege

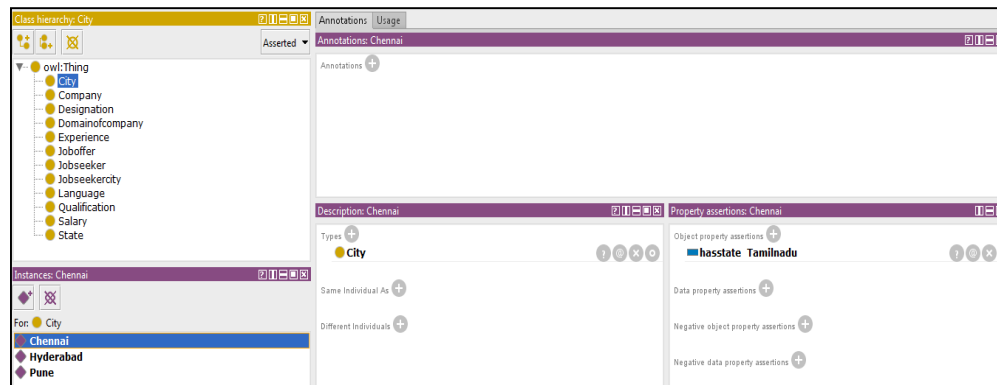


Fig. 4. Job Ontology design in Protege

## 6. SPARQL Query

SPARQL is a query language and a data access protocol for the Semantic Web. SPARQL is defined in terms of the W3C's RDF data model and will work for any data source which can be mapped into RDF.

SPARQL queries consist of a set of triples where the subject, predicate and object can consist of variables<sup>[6]</sup>. The main logic behind is to map the SPARQL Query with the existing RDF triples and find solutions to the variables. The query will then be executed in a native RDF or and Relational database to RDF. These databases have SPARQL endpoints which accept queries and return results through HTTP in an XML format.

### 6.1 Defining Query on Job Ontology

Below given queries were created and executed.

- Find all company name with its city name

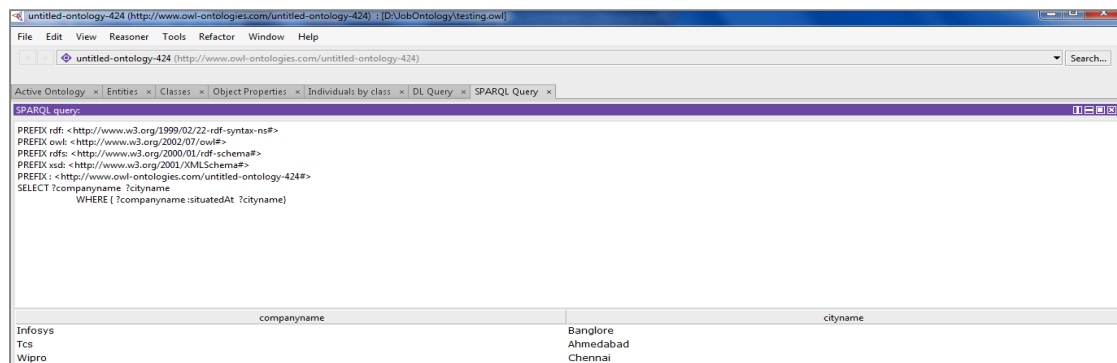


Fig. 5. Query to display company names of different cities

- Find all company name with its domain name

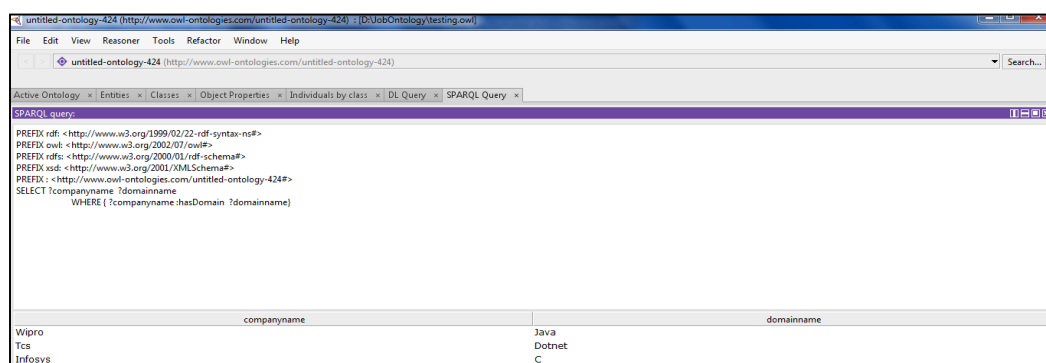


Fig. 6. Query to display company names with its domain names

- Find all jobseekers name

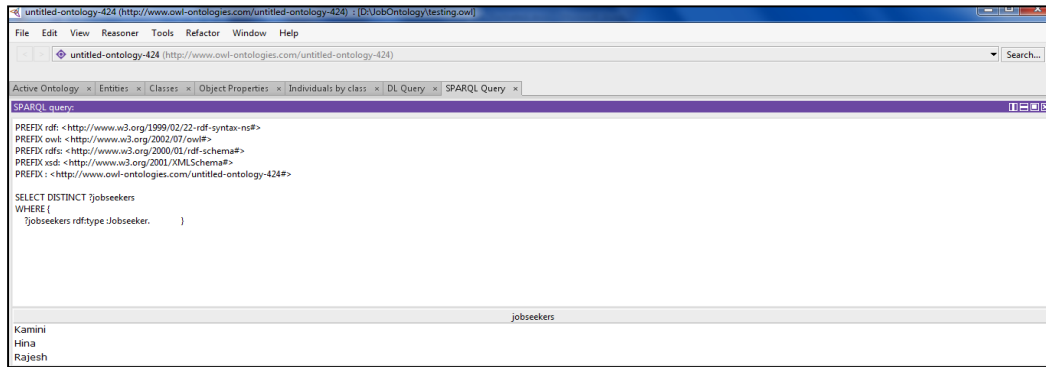


Fig. 7. Query to display all job seekers looking for job

## 6.2 Limitations of Centralized Ontologies

Centralised database structure enables

- Executing SPARQL queries on a single ontology and fetching data from specific single ontology only.
- Same query will be required to be executed on different ontologies wasting retrieval and execution time and human efforts and shall retrieve data from a single location giving specific result only..
- A query for job search when executed on a company's website shall return the specific job opening details from that company only. Whereas in distributed environment, the same query gives more precised job opportunities matching the user requirements from different companies job posted.
- Enabling decentralization shall fetch the data from multiple ontologies by executing a single query and optimising the search.

## 7. Combining Multiple Ontology

In Semantic Web combining multiple ontologies is possible. Standardization of data, relying on a common vocabulary and defined relationship is necessary for applying a hybrid approach of Ontology. Different Ontologies following the same structure can be combined together and a single query can be executed on it. Technical integration between the different SPARQL databases with different content relating to the domain terminologies and classification is required. The benefit of executing a common query on multiple combined Ontology can define the reusability of existing ontologies and giving new combined results. It servers the purpose of Centralization of data where data is stored at a common location and multiple queries from different Web browsers when fired shall get access and executed to these centralized data store and yield to the best results. A common Data base repository concept is getting evolved here. Decentralized data store is no longer an issue. This has been clearly observed with the current World Wide Web scenarios where different search engines when executes the queries yields multiple results matching the words of the query fired. It does not go with the semantic specific search.

### 7.1 Benefits of Combining Ontologies

- 1) Re-usability and decentralizationof data
- 2) Executing hybrid query by combining multiple SPARQL databases together.
- 3) Meaning specific and context specific results.

- Ontology Name: Testing.owl

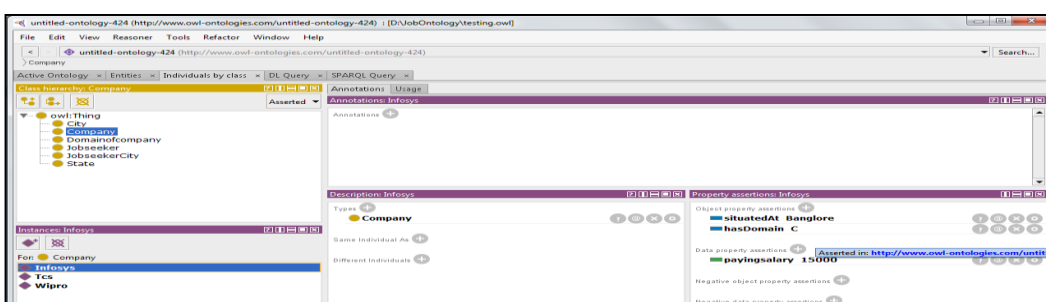


Fig. 8. Testing.owl ontology

- Ontology Name: JobOntology.owl

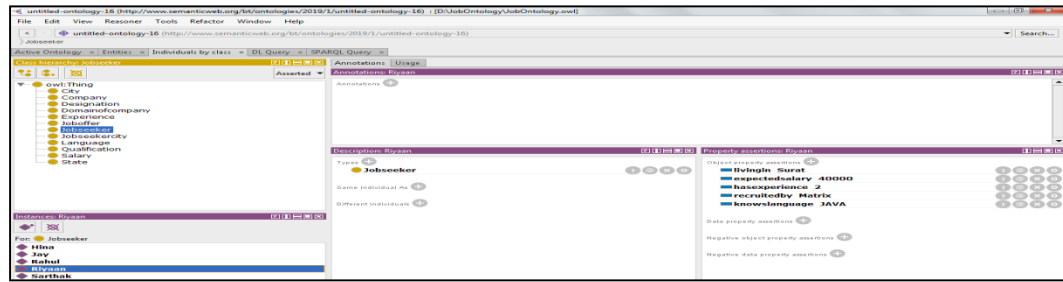


Fig. 9. Job design ontology

- Importing Testing.owl and JobOntology.owl together in a single OWL file.

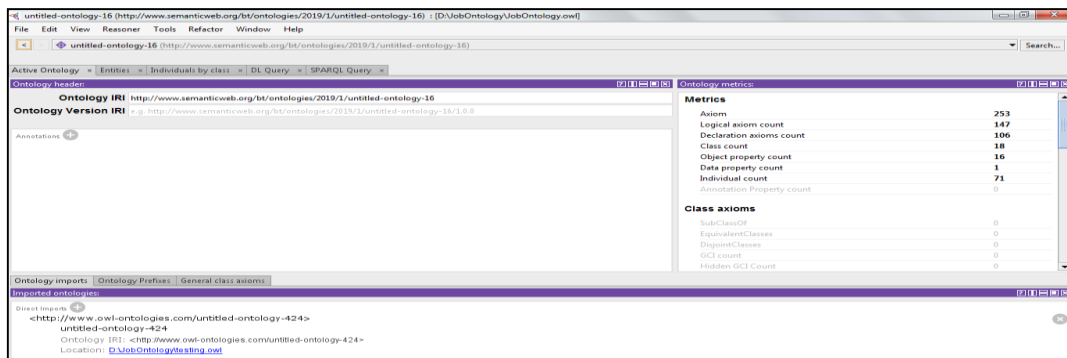


Fig. 10. Importing Ontologies

- The imported Ontologies looks in class view as

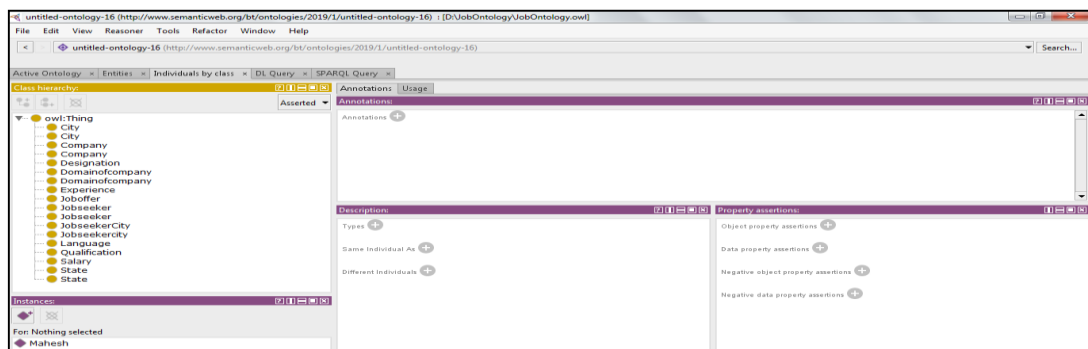


Fig. 11. Class View of Combined Ontologies

- Object Properties of combined ontologies are shown

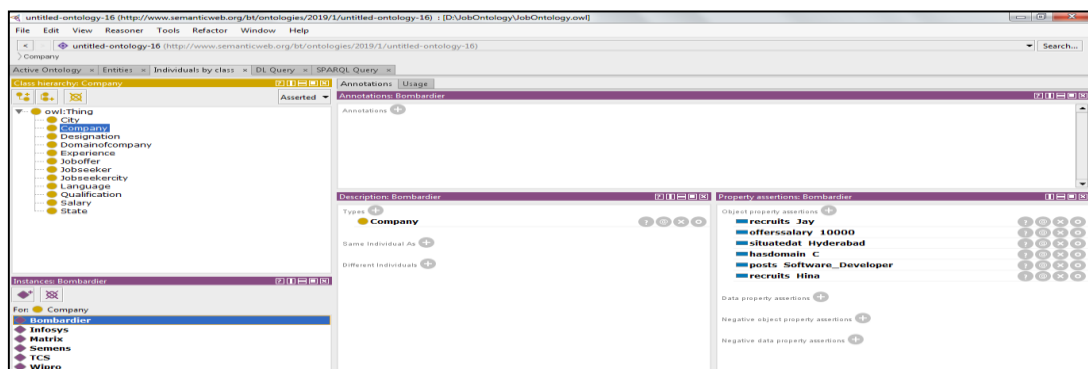


Fig. 12. Combined ontologies

- Object Properties of Combined Ontologies

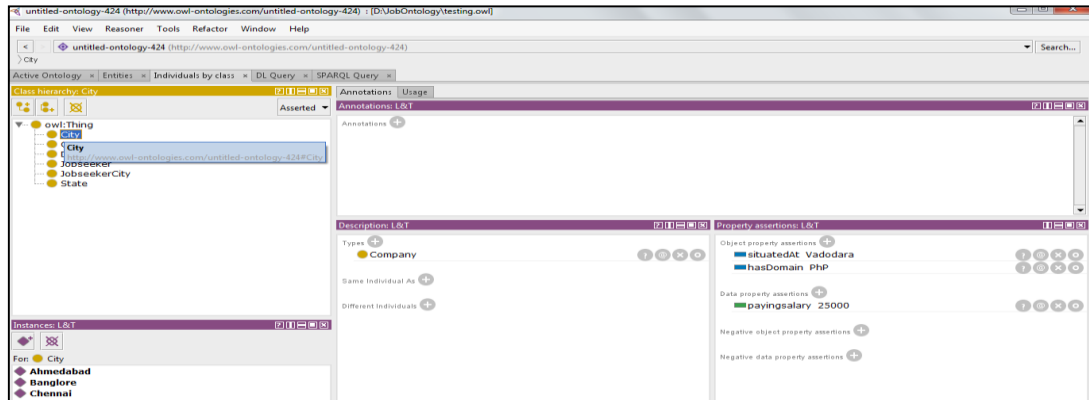


Fig. 13. testing.owl Ontology Structuretesting1.owl

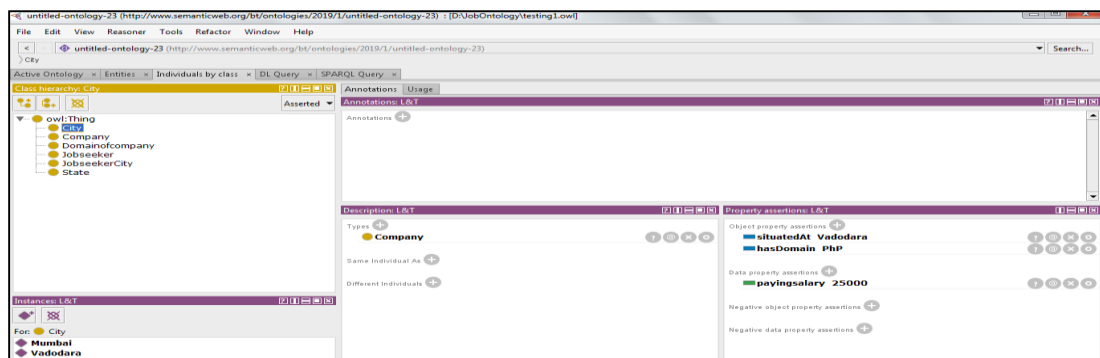


Fig. 14. testing1.owl Ontology Structure

- Combined Query executed on 2 imported Ontologies

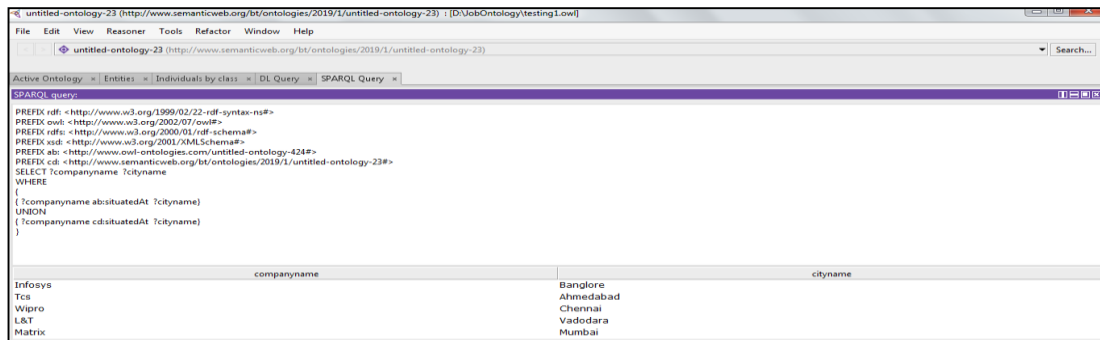


Fig.15. Query Execution on Combined Ontology

## 8. Limitations

Standardization of Ontology design and relationship set between different entities is necessary in order to opt for a hybrid Ontology approach. This means, direct utilization of semantic web data used as a basis for context based information retrieval is an important issue to be addressed. To have all Semantic web data following the same structure is mandatory for each domain of information.

## 9. Conclusion

The Semantic Web is referred as an extension of the current web in which information is given well-defined meaning. In this research, I have developed a “Job Search” ontology specifying the different Specialisation Area, City, Job, Language and Platform information. The users query shall be executed with the Java interface through Jena Framework and required output shall be generated. A single query is executed in a de-centralised database (importing multiple ontologies). Re-usability of existing ontologies following the same structure is observed. My future work shall correspond to selling my ontology interface to different



domains of Job search like Naukri.com, Monster.com and others. Getting multiple job requisition from different domain shall now correspond to analyzing the results generated through single query execution.

## References

1. [https://www.researchgate.net/publication/259145288\\_Web\\_to\\_Semantic\\_Web\\_and\\_Role\\_of\\_Ontology\\_in\\_its\\_Development](https://www.researchgate.net/publication/259145288_Web_to_Semantic_Web_and_Role_of_Ontology_in_its_Development),
2. Fensel, D. (2001), *Ontologies – A Silver Bullet for Knowledge Management and Electronic Commerce*, Springer, Berlin.
3. Stuckenschmidt, H. and Harmelen, F. van (2005), *Information Sharing on the Semantic Web*, Springer, Berlin
4. Ladwig, G., Tran, T.: *Linked Data Query Processing Strategies*. In: Patel-Schneider, P.F., Pan, Y., Hitzler, P., Mika, P., Zhang, L., Pan, J.Z., Horrocks, I., Glimm, B. (eds.) *ISWC 2010, Part I. LNCS*, vol. 6496, pp. 453–469. Springer, Heidelberg (2010)
5. Reddy, BR Kuldeep, and P. Sreenivasa Kumar. "Optimizing SPARQL queries over the Web of Linked Data." *Proceedings of the VLDB Workshop on Semantic Data Management, SemData*. 2010.
6. Drashty R. Dadhaniya, Ashwin Makwana. A survey paper on different SPARQL query optimization techniques. In, *A Multidisciplinary Journal of Scientific Research & Education*, 2(8), 2016.
7. Tanvi Chawla, Girdhari Singh, Emmanuel S. Pilli. A Shortest Path Approach to SPARQL Chain Query Optimisation. In, 978-1-5090-6367-3/17/\$31.00 ©2017 IEEE 2017.
8. Sisay Chala, Scott Harrison, Madjid Fathi. Knowledge Extraction from Online Vacancies for Effective Job Matching. In: 2017 IEEE 30th Canadian Conference on Electrical and Computer Engineering (CCECE)
9. S. Chala and M. Fathi, "Job seeker to vacancy matching using social network analysis," in *Industrial Electronics Society (IES), 18th Annual International Conference on Industrial Technology*, IEEE, 2017.
10. S. Chala, F. Ansari, and M. Fathi, "A framework for enriching job vacancies and job descriptions through bidirectional matching," in *12th International Conference on Web Information Systems and Technologies*, SCITEPRESS Digital Library (Science and Technology Publications, Lda), vol. 2, 2016, pp. 219–226.
11. E. Prud'hommeaux and A. Seaborne, "Sparql query language for rdf," W3C, Recommendation, 2008. [Online]. Available: <http://www.w3.org/TR/rdf-sparql-query>
12. Sheng-Wei Huang<sup>1</sup>, Chia-Ho Yu<sup>1</sup>, Ce-Kuen Shieh<sup>1</sup>, Ming-Fong Tsai<sup>2</sup>, "Efficient and Scalable SPARQL Query Processing with Transformed Table": *IEEE Wireless Communications and Networking Conference (WCNC) - Workshop - Next Generation WiFi Technology*, 2015
13. Vijay Rana, Gurdev Singh, "MBSOM: An Agent Based Semantic Ontology Matching Technique": *1st International Conference on Futuristic trend in Computational Analysis and Knowledge Management (ABLAZE-2015)*
14. Micha'el Guedj, "Levelized Taxonomy Approach for The Job Seeking/Recruitment Problem": *IEEE International Conference on Computational Science and Engineering, IEEE International Conference on Embedded*, 2016
15. P. R. Agarwal, "Semantic Web in Comparison to Web 2.0," *2012 Third International Conference on Intelligent Systems Modelling and Simulation*, Kota Kinabalu, 2012, pp. 558-563. doi: 10.1109/ISMS.2012.49
16. <https://www.ontotext.com/knowledgehub/fundamentals/what-are-ontologies/>
17. <https://www.xml.com/pub/a/2005/11/16/introducing-sparql-querying-semantic-web-tutorial.html>



# Security Based Blockchain Approaches for Verification of Smart Contracts

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## Abstract

A smart contract is an agreement between two or more parties, which is executed by the computer code. The code does the execution without giving either party the ability to back out, so it ensures the trust less execution. The smart contract is one of the most important features in blockchain applications. Specifically, in this paper, we introduce a secure data trading ecosystem and present a new blockchain-based data trading ecosystem (hereafter referred to as SDTE). This paper not only presents the proposed Access Control system in general, but also its application to the innovative reference scenario where the resources to be protected are themselves smart contracts.

**Keywords:** Smart contract, Blockchain, Intel SGX, Data trading, Ethereum

## 1. Introduction

The capability to handle and process large amount of data efficiently is critical, as such data (and their analysis) can inform decision making in both public and private sectors and result in communal benefits such as increased productivity and reduced bureaucracy. To facilitate the exchange of datasets, data trading platforms, also known as data exchange, have proliferated in recent years. Such platforms act as the bridge. A solution for resource owners is to deploy and run their own Access Control systems on their premises. In this case, resource owners have the responsibility to choose and deploy proper Access Control systems for their resources. However, this solution causes resource owners a burden due to the configuration, deployment and management of the system. Furthermore, resource owners should bear a relevant cost, both in terms of hardware (the servers/VMs which host the Access Control system), software (the Access Control system product could require to pay a periodical fee), and man power (the time spent by the administrators for the Access Control system management). The current work presents a novel solution for the accurate detection of intruders in a controlled area by a fleet of UAVs even when a minority of these have been physically hijacked. The proposed solution takes advantage of narrowing to this specific domain, by being based on the secure sharing of the UAVs that directly observed an intruder, which is a specific information in the context of surveillance. Prior research has already developed various approaches to create and protect secure logs from intruders. A key aspect of these works is integrity preservation of evidence using write-only or access-protected storage. Recently developed blockchain technology provides a novel way to achieve these goals. Blockchain systems are highly redundant data stores with the purpose of maintaining an append-only log of transactions. Since data is shared with other independent organizations based on distributed consensus, it is tamper resistant.

## 2. Related Work

Here the work which is done on the blockchain is in the blockchain, each distributed node uses the Merkle Tree structure to record the transactions that have occurred and encapsulates the transaction data into a block. These enormous transaction data constitutes the block body, while the other block information, such as the Merkle Root Hash, Time, and Nonce constitutes the block header. Blocks are connected in Time order by storing the hash value (calculated by SHA256) of the parent block. In the existing data trading ecosystem, a buyer generally obtains the entire dataset from the seller. However, rather than having access to a complete dataset, the buyer may only need the findings from the data analysis to inform data driven decision-making. For example, instead of having access to the seller's entire sales data for the quarter, the buyer may only need an aggregate of certain statistics for the quarter's sales data. Therefore, if the data trading ecosystem can provide such findings directly, then there is no need for the seller to transmit the entire dataset to the buyer. [4] An Access Control system (ACS) is in charge to protect the resources of an application scenario by checking the access requests performed by the subjects of that scenario in a given access context. In other words, the ACS decides whether these subjects have the rights to perform the accesses they request in the current access context or those accesses must be denied.

## 3. A Synoptic Overview

To have a picture of the state-of-art of the security verification of block chain smart contracts, we make an in-depth survey. First, we make an effective survey towards the research about security verification of smart contracts. The correct execution of smart contracts requires a secure and reliable environment.

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In this section, we introduce the impact of environment security on smart contracts from two aspects: block chain security and secure data source. The block chain security provides a secure execution environment. The secure data source provides the credible data to ensure the secure execution. Below we discuss these two aspects in detail. A smart contract is a computing protocol intended to digitally facilitate, verify, or enforce the negotiation or performance of a contract. Smart contracts allow one to achieve nonrepudiation in the execution of transactions without involving a third-party

In Ethereum, a smart contract contains a contract account, a 160-bit address, runtime byte code and some related transactions. To deploy a contract, the developer writes and compiles the contract code into byte code. Then, the developer uses externally owned accounts (EOAS) to build a transaction (tx) with the contract byte code prior to broadcasting it after signing with his/her private key. The overall objective of a secure logging system is maintaining availability and integrity of log files. We use four of these phases to guide system design in the following chapter. In secure logging, verification occurs during dispute resolution, since tampered log records may also contain valuable information about system compromise.

#### 4. Design Principles

SDTE (Secure Data Trading Ecosystem) is designed around the three key security features, and we will explain the core design. Resisting data theft from nodes. SDTE contains three key data types, namely: the intermediate data generated during the process of running smart contract, the source data and the final data analysis results. Prior to executing the data analysis contract, raw data from the seller needs to be sent to the buyer-selected trusted node. In order to protect the raw data, the seller's data needs to be encrypted before transferring to the trusted node and then decrypt in the SGX security environment of the trusted node. In this way, the raw data cannot be leaked before being processed by the smart contract. After the analysis results is available from SGX, the trusted nodes will send the (encrypted) results to the buyer (to prevent the leakage of the results). In other words, the analysis result will not be leaked to a third-party prior to the buyer obtaining the results. Since the seller keeps the key for decrypting the raw data and the buyer keeps the key for encrypting the analysis results, a secure key transmission process is necessary for the node to get the related keys into the SGX environment. Therefore, we need to establish a secure channel through SGX remote attestation to transfer the respective keys. In this way, the seller's and buyer's keys can be directly passed into the enclave and stored outside the enclave using the SGX SEAL method. After getting the related keys, the encrypted data sent by the seller is decrypted thus, we rely on the secure encryption and SGX to ensure the security of the critical data. Non-repudiation and fraud prevention. Although critical data is protected, malicious buyers may refuse to pay the seller and the nodes. For example, the malicious nodes may falsify the results and collude with other selected nodes to obtain the buyer's reward. A malicious seller may also attempt to receive additional rewards by sending additional irrelevant data to the smart contracts. In order to ensure that seller, buyer and trusted node can honestly full their obligations, we introduce a data trading manager contract (DTMC) as a guardian. DTMC is a traditional Ethereum smart contract, which will honestly record incoming information. Before executing the data analysis contract, the buyer should deploy the contract written by himself/herself on the SDTP. Before the seller sends data to the data analysis contract, (s) he will query DTMC and check whether the offer price is satisfied. If the buyer changes the reward to the seller, then the seller will be notified by the DTMC. In the same way, the nodes will also send a transaction to the DTMC to check whether the reward to be received has changed before executing the smart contract.

#### 5. Verification of Smart Contracts

In addition to security assurance the correctness of the smart contracts deserves more attentions. Since there is no uniform programming specification for smart contracts and the limitations of the programming language, a variety of contract vulnerabilities have emerged, giving attackers opportunities to take advantage of them. So, in this section, we discuss how to write reliable smart contract from the following two aspects, which include programming correctness and formal verification. The essence of a smart contract is the computer code that can be executed automatically on the computer, so programming smart contract correctly is an important research direction. After summarizing the papers in recent years, we find that there are four ways of programming, including setting standards, developing new contract language, semantic analysis, and software engineering tools, which ensure the correctness of the contract.

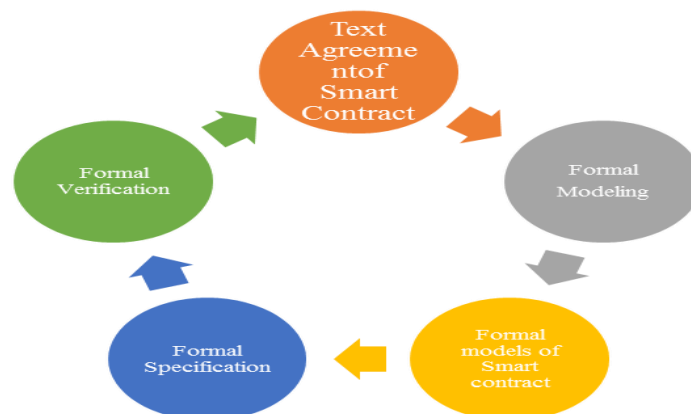


Fig. 1. Formal Verification of Smart Contracts

Formal methods provide a powerful technology for the correctness verification of smart contracts. At present, the use of formal methods to verify smart contracts has been widely recognized, and significant results have been achieved in practice. To solve the demands for high assurance contracts, the Ethereum community has turned to formal methods as well. Besides, using formal methods to validate smart contracts can provide a rigorous mathematical model for the verification of smart contracts. The formal verification of smart contracts tends to be a great potential for development in the future. Then, implementing formal specification and formal verification on above established contract, which is an iterative process. Through multiple behavioral modelling and attribute modelling of smart contracts, we can validate whether the attributes meet the contract requirement or not. In our survey, we divide the formal verification method of smart contracts into two categories. One is program-based verification and the other one is behavior-based verification. Program-based verification treats smart contracts as codes, it translates the contract codes into formal languages and then identifies vulnerabilities in contracts. Behavior-based verification takes into account issues that may be encountered during the execution of smart contracts, such as improper operations and maliciously attacks. By constructing a formal model, it finds out the weak position of the contract, which is a way to dynamically analyze smart contracts. Below we discuss these two aspects in detail.

## 6. Program Based Formal Verification

The essence of a smart contract is the program that is executed on the blockchain. Verifying the correctness of the program is a key part of ensuring the safety and reliability of smart contracts. There are both successful practical cases and theoretical studies on program-based verification of smart contracts. At the 3rd Global Blockchain Summit in 2017, a blockchain formal verification team of the University of Electronic Science and Technology presented the VaaS (Verification as service) as an EOS formal verification platform. The principle of VaaS platform is to translate programs written in the Solidity scripting language into the Coq code, thus establishing a standard formal model for smart contracts, and then verify the correctness of the smart contract by verifying the correctness of the language. The complete F\* language for any smart contract had not yet been implemented because of huge work. Moreover, for the same contract, it was so hard to verify whether the F\* language translated by Solidity language consistent with the decompiled binary code. Hirai proposed a formal verification method based on Ethereum Bytecode. In the process of translating one language into another, there may be cases where the meaning expressed in the translated language not be consistent with that before translation. So he proposed using the Isabelle/HOL to verify the binary Ethereum code. To illustrate his method, first, he obtained the binary instructions of a small contract called “deed”.

## 7. Conclusion

As one of the most important features in blockchain systems, smart contracts have attracted much attentions but also have exposed many problems. The major contributions of our survey include three aspects. This is the techniques of the Blockchain works. Blockchain is the trending topic in the technology world. Here blockchain is used for the security purpose. In our opinion the main advantage obtained is auditability. In fact, delegating the Access Control policies management and evaluation (through smart contracts) to the blockchain hands over such tasks to a decentralized, transparent, and immutable system. This means that resource owners cannot fraudulently deny access to subjects without leaving an auditable trace of the misbehavior.

## References

1. N. Szabo. The Idea of Smart Contracts. Accessed: May.18, 2019. [Online]. Available:<http://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/idea.html>
2. D. Vujičić, D. Jagodić, and S. Ranđić, “Blockchain technology, bitcoin, and Ethereum: A brief overview,” in Proc. 17th Int. Symp. INFOTEHJAHORINA (INFOTEH), Mar. 2018, pp. 21–23.
3. V. Buterin. Ethereum: A Next-Generation Smart Contract and Decentralized Application Platform. Accessed: May. 18, 2019. [Online]. Available: <https://github.com/ethereum/wiki/wiki/White-Paper>
4. K. Finley. Ethereum: A Next-Generation Smart Contract and Decentralized Application Platform. Accessed: May. 18, 2019. [Online]. Available: <https://www.wired.com/2016/06/50-million-hack-just-showed-daohuman/>
5. S. Nakamoto. Bitcoin: A Peer-to-Peer Electronic Cash System. Accessed: May. 18, 2019. [Online]. Available: <https://bitcoin.org/bitcoin.pdf>
6. E. Dumbill, “Data markets compared-a look at data market offerings from four providers.” <http://radar.oreilly.com/2012/03/data-markets-survey.html>, 2012.
7. F. Liang, W. Yu, D. An, Q. Yang, X. Fu, and W. Zhao, “A survey on big data market: Pricing, trading and protection,” IEEE Access, vol. 6, no. 1, pp. 15132–15154, 2018.
8. C. Zuo, J. Shao, J. K. Liu, G. Wei, and Y. Ling, “Fine-grained two factor protection mechanism for data sharing in cloud storage,” IEEE Trans. Information Forensics and Security, vol. 13, pp. 186–196, 2018.
9. M. Felici, T. Koulouris, and S. Pearson, “Accountability for data governance in cloud ecosystems,” in Proceedings of the 2013 IEEE 5th International Conference on Cloud Computing Technology and Science (CloudCom). Los Alamitos, CA, USA: IEEE Computer Society, 2013, pp. 327–332.
10. T. Jung, X. Li, W. Huang, J. Qian, L. Chen, J. Han, J. Hou, and C. Su, “Accounttrade: Accountable protocols for big data trading against dishonest consumers,” in Proceedings of the IEEE INFOCOM 2017 - IEEE Conference on Computer Communications (INFOCOM). Piscataway, NJ, USA: IEEE, 2017, pp. 1–9.
11. K. Liang, W. Susilo, and J. K. Liu, “Privacy-preserving ciphertext multisharing control for big data storage,” IEEE Trans. Information Forensics and Security, vol. 10, pp. 1578–1589, 2015

# Image Mapping

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## Abstract

Shopping is an activity in which a customer browses the available goods or services presented by one or more retailers with the potential intent to purchase a suitable selection of them. And this selection requires much time from the user. And also in online shopping, the user cannot check the actual quality of fabric and colour. Moreover, the customer sometimes is not able to find what he/she is looking for. To find the solution of this problem, we are going to develop an application which is an AI-powered technology that uses your smartphone's camera and deep machine learning to not only detect an object or an image but also understands what it detects and maps it to the location of the availability of the given image or object. The previous systems were for obtaining online results whereas our system gives the physical location of place wherever the user can get it. It makes the shopping process easier for the user and also less time-consuming. Moreover, the user can go to physical areas and personally check the materials and the quality of the product. The main purpose of this project is not only to bring automation in retail sectors but also develop a technology for consumer using which they can easily find their desired inventory with the least amount of time.

*Keywords:* Artificial Intelligence, Deep Learning, Digital Shopping, Image Mapping.

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## 1. Introduction

This is an independent stand-alone system. It will be placed on the shopkeeper's PC throughout the company and for the user, they can download it through their respective OS's app store. It allows user to perform efficient shopping and find their desirable apparels and have its physical location. Due to minimal requirements from all three sides: Admin, User, Shopkeeper, the project is attainable. Users will just require a smartphone, and also this application being unpaid for users, they are more likely to use this. This technique is related to image detection in general, and to methods and systems which map an input image with the given image by applying a pre-trained CNN on the input image. [1]

## 2. Literature Review

A research of the popular object detection and classification of objects based on computer vision includes a description of (1) existing object detection methods associated with colour or shape. (2) Important methods developed to tackle the object classification problem [4], and (3) Comparison of performances of these techniques.

## 3. Problem Statement

- 1) The previous systems were for obtaining online results whereas our system gives the physical location of place wherever the user can get it. It makes the shopping process easier for the user and also less time-consuming.
- 2) And also there were product quality problems in the system. That is the user was not able to check the real-time quality of the product he is buying.
- 3) That leads to another problem of return and refund.
- 4) Moreover, the unsuccessful money transfers and the loss of money in the process was also an issue.

## 4. Related Work

Presently, there are many computer-based visual image processing techniques. Detecting an object and classifying area of a given image and using pixel labelling are two examples of techniques which are used for computer-based image processing. However, with recent advancements in the field of deep learning, an object detection technique and a pixel labelling technique which uses a CNN are considered as potential independent methods for object detection and image area classification [2]. The present innovation makes use of principles of iterative transformational separation and signature mapping, in which articles in pictures, when subjected to special variations, will show radically distinct responses based on the physical, characteristics of the object or its depiction (such as images), integrated with machine learning capabilities [3].

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Fig. 1. Flow Diagram

This project can use artificial intelligence and deep learning technologies to detect the object and map the image. Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks typically require human intelligence. AI is an interdisciplinary science with more than one approaches, but advancements in machine learning and deep learning are making a paradigm shift in virtually every sector of the technological industry. Deep Learning is a subset of machine learning related to algorithms created by the structure and function of the human brain called artificial neural networks. Object detection, irrespective of whether performed via deep learning or any other computer vision techniques is made on image classification and it tries to identify or detect exactly where in the image each that article is appearing. Most probable use of another technique: CNN. As soon as the user scans and upload the picture of desired apparel on this web-application, the object detection will be performed the algorithm will determine what object is it, next up the image processing will analyse what are its characteristics and features. Then the system will look for similar or most closely looking apparel from the existing database using the image mapping. Here the existing database of image and other kinds of data is given by the seller of the product. The system then will retrieve the resultant outcome with other details on which users decision might rely on like the address of the seller or the price, sizes and availability of the product. The retrieved data will be of specific geographical range.

## 5. Tools and Techniques

The Libraries and Frameworks used are as detailed below:-

**5.1 Python as language:** Python is easy to understand and work with and also to integrate.

**5.2 OpenCV:** OpenCV-Python is a library provided by Python language aimed to solve computer vision problems. OpenCV provides support of an extensive range of programming languages such as C++, Python, Java, etc., and is obtainable on different platforms including Windows, Linux, OS X, Android, and iOS. Interfaces for high-speed Graphical Processing operations. OpenCV-Python is the Python API which is used for OpenCV, merging the best qualities of the OpenCV C++ API.

**5.3 Pycharm:** PyCharm is an IDE. It cross-platform editor developed by JetBrains. Pycharm gives all the tools one needs for efficient Python development.

**5.4 CNN:** A convolutional neural network is a collection of deep neural networks, most often used to predict visual imagery. They are also called shift invariant or space invariant artificial neural networks (SIANN) which might be used for object detection.

**5.5 Flask as a framework:** Flask is one of the frameworks of python.

## 6. Conclusion

In this paper, we stated the deep Learning concept which has recently emerged as a promising paradigm and with reference to artificial intelligence, the expected outcome of the application would be able to provide the exact location of user's desirable apparel. So that user can go to the location to buy his stuff and that the application will be able to map to similar or exact clothing as given in the image which the main purpose of the application. We expect the proper working of the deep learning algorithm which could map the apparel. This concept intends to bring automation in the retail sector which still lacks technology. It can be further expanded to not only the local retail shops but also the mega malls so that people can find their desired product within no time. We hope our work will propose further research in this area.

## References

1. Michael Chertok and Alexander LORBERT, "Image representation from convolutional neural networks", July 7, 2016
2. Thomas E. Ramsay, Eugene B. Ramsay, Gerard Felteau, Victor F. Kriporotov and Oleksandr Andrushchenko, "System and method for the detection, characterization, visualization and classification of objects in image data"
3. Xiaoheng JIANG, "Object detection with the neural network"
4. R. Davis, "Magic Paper: Sketch-Understanding Research"
5. OpenCV, [https://docs.opencv.org/master/d0/de3/tutorial\\_py\\_intro.html](https://docs.opencv.org/master/d0/de3/tutorial_py_intro.html)
6. Convolutional Neural Network, [https://en.wikipedia.org/wiki/Convolutional\\_neural\\_network](https://en.wikipedia.org/wiki/Convolutional_neural_network)
7. Python, <https://www.python.org/>

# Synthesizing Photograph via Voice Commands using Generative Adversarial Networks (GANs)

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## Abstract

Interior designers often get troubled with imagining the designs. Generative Adversarial Networks (GANs) can help designers put their thoughts on computer screen in real-time by giving voice commands. GANs are one of the trending research topics in the field of artificial intelligence. Speech recognition is an important aspect of AI in present days and GANs have the ability to generate new data based on its learning from gaussian curve. Synthesizing photo-realistic images is a challenging task. In this paper, an approach of synthesizing photo-realistic images from voice commands is shown. Two GAN models are used in order to generate a healthy-looking image based on the voice commands are given. Google voice API is used in order to achieve voice-to-text conversion. Converted text being the input for first GAN and it will generate a low-resolution image with primitive shape conditioned with the text given. The image generated from first GAN will work as input for the second GAN along with the same text used earlier. Second GAN will refine the image and put more details in the image along with converting the image to a larger resolution. Dataset used for this purpose is created on own from scratch, It consists of sofa set images for interior designing.

**Keywords:** Generative adversarial networks, gan, image synthesis, voice to text conversion.

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## 1. Introduction

Interior designers make interior spaces functional, safe, and beautiful by determining space requirements and selecting decorative items, such as colors, lighting, and materials. Interior designers generally face many problems while imagining designs. What if there is a model that can help put the imagination into a picture in real time. This project is aiming to generate images based on the descriptions given.

Imagine designers just needs to give voice descriptions and the model generates an image based on that. It is a difficult task, however, can be achieved using a Machine Learning's technique called Generative Adversarial Networks (GANs).

GANs are proven to be most useful when it comes to generate new data. Apart from interior designing, GANs have wide variety of applications such as photo editing, generation of realistic looking photos based on text descriptions. Giving a text description and generating image is good, However, I have taken this approach a little further. Instead of giving text descriptions user just needs to give voice commands which further will be converted to text and then converted into equivalent images. Although, generating photo-realistic image is a challenging task. Crucial part for this task is volume of dataset images and texts associated with it. We humans can easily imagine things as we already have a clear picture of the description. For example, if I say imagine one green and one red apple, we can easily imaging a picture as we are aware of how apples looks and what are colour red and green. However, building this intelligence in a machine is difficult task. Images along with the associated texts needs to be mapped in multi model dimensions. Model needs to learn meaning of each word from the given text and map it to an image separately. Likewise, in real-time scenario there can be a number of descriptions for a single image. Hence, in order to work efficiently machine needs to be trained properly with wide range of data. In addition, creating dataset of own is a challenging task as this approach requires plethora number of images to get trained. Oxford-102 flower dataset has been referred in order to create our own dataset.

## 2. Related Work

H. Zhang et al [1] has suggested an approach for text-to-image synthesis with multistage GANs. They have used oxford102 flower dataset in order to train the model. Oxford102 flower dataset has 102 types of different flowers. Each type of flower has 80 to 81 images approximately. Additionally, each flower image is associated with a text file containing captions, in other words, descriptions of that particular image. Each image has 10 captions available. Hence, it represents how a single image can be described in 10 different ways. While training the model all these images along with their respective caption files are given as input. Model learns and tries to understand meaning of each word from the captions and relate it to an image provided. Ultimately, model learns the distribution for this joint representation of text and image. After training is completed and model has reached on a certain accuracy level which is checked manually, two stages of GANs are introduced. Stage-I GAN will generate a primitive shape from the given input text. Generated image from Stage-I generator is low resolution image that is further passed on to Stage-II generator as input along with the text input. Stage-II GAN will refine the given image by traversing over text repetitively. This way Stage-II GAN can cover missed out details in input text by Stage-IGAN.

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H. Zhang et al [2] has suggested the similar approach with a minor modification that can be considered as incremental version of [1]. An addition of series of generator and discriminator in Stage-II GAN architecture. Benefits of this approach has been seen in terms of stability in training and results accuracy.

According to C. Ledig et al [4] it is the first framework capable of inferring photo-realistic natural images for 4 up scaling factors. To achieve this, they have proposed a perceptual loss function which consists of an adversarial loss and a content loss. The adversarial loss pushes the solution to the natural image manifold using a discriminator network that is trained to differentiate between the super-resolved images and original photo-realistic images.

### 3. Basic Understanding of Generative Adversarial Networks

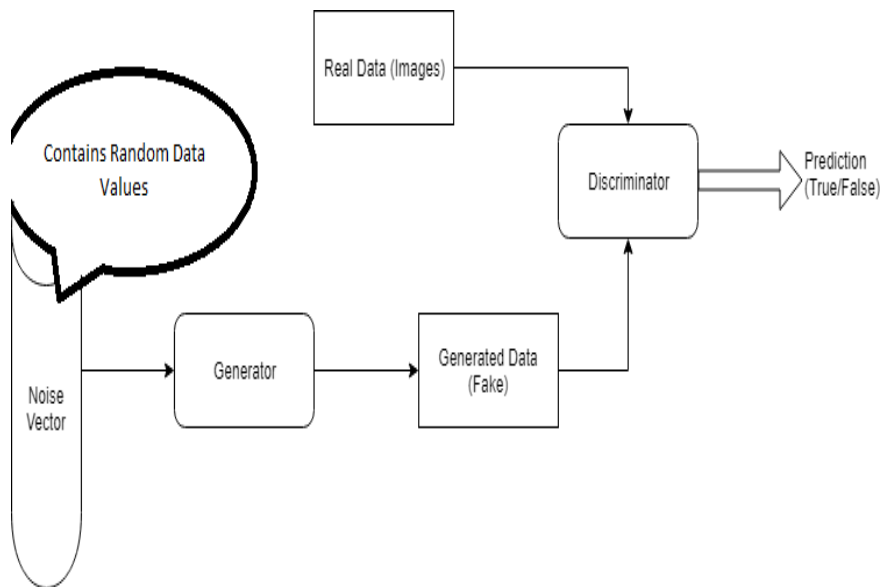


Fig. 1. How GAN Works

Fig. 1 shows the basic procedure of GAN's working. Initially, generator and discriminator needs to be trained. However, question may arise which one should be trained first. Answer to that question would be discriminator needs to be trained first before generator. Reason being that discriminator's job is to predict the possibility of generated image to be real of fake and based on that feedback generator is be trained. Hence, discriminator should be trained before generator. Discriminator is trained with real image dataset along with the text captions

### 4. Dataset Information

Here are some information about oxford-102 dataset. The dataset consists of total 8189 images of different types of flowers.

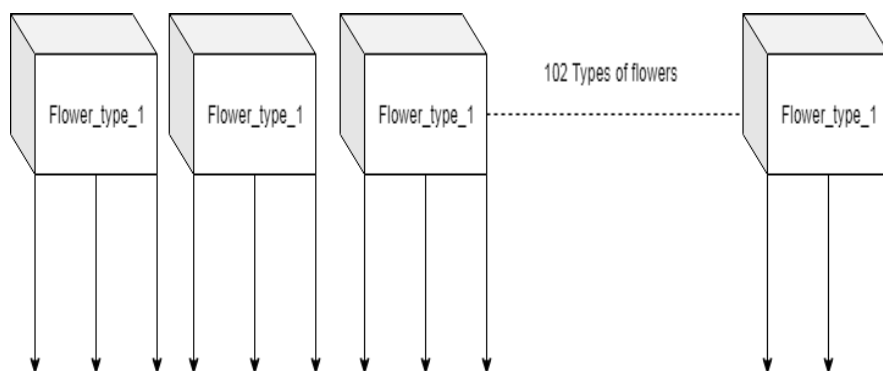


Fig. 2. Flower Types

Fig. 2 depicts that oxford-102 dataset for flowers consist of 102 types of different flowers. Each type of flower has approx. 80-81 images of flowers of its type.



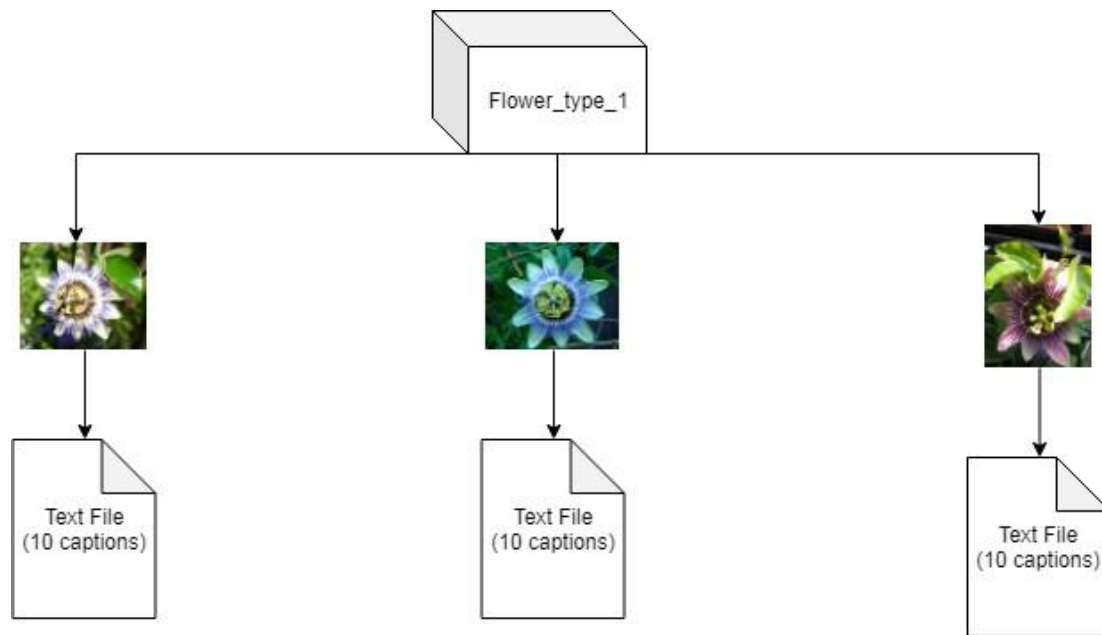


Fig. 3. Dataset Structure

Fig. 3 shows that in each category of flowers there is ample amount of images available of its kind. Furthermore, for each image there is a text file associated with it that consist of 10 caption of each image. Hence, a single image is described in 10 different ways. Benefit of this is it easier for model to learn from it about each and every image individually.

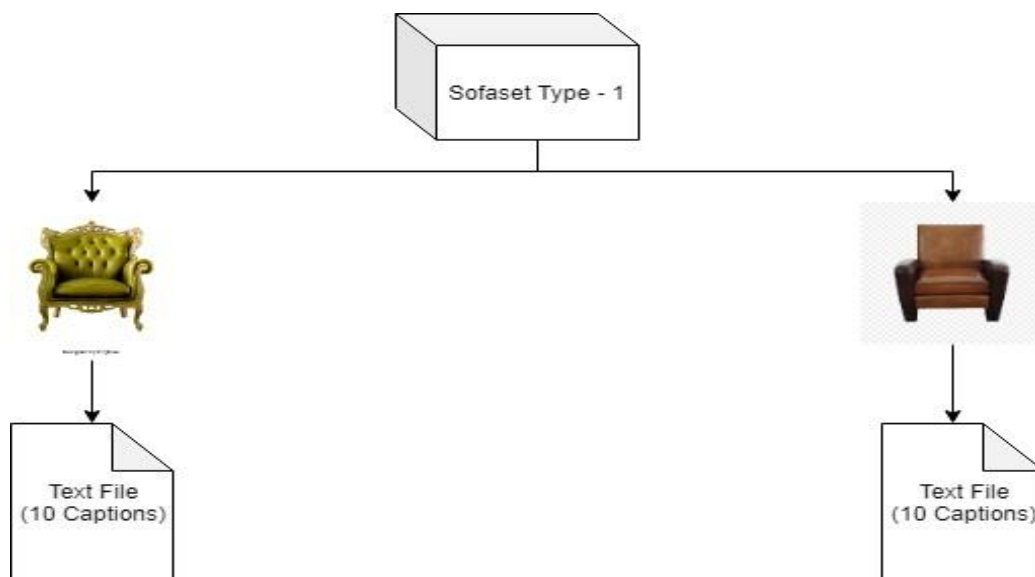


Fig. 4. Sofa set Dataset Structure

With the similar structure I have created my dataset for furniture. At current point, focus is only on sofa sets. There are images of different types of sofa sets, in each type there are 40-45 images. Each image has an associated text file which consists of 10 different description of the particular image. This approach can be widened by gathering images of paintings, televisions, ceiling fans, air conditioners. Gathering all of the mentioned images and prepare a dataset is a challenging task but once done applications of this project can be proved very essential. Fig. 4 depicts the structure of furniture dataset on which this project is based.

## 5. Chosen approach

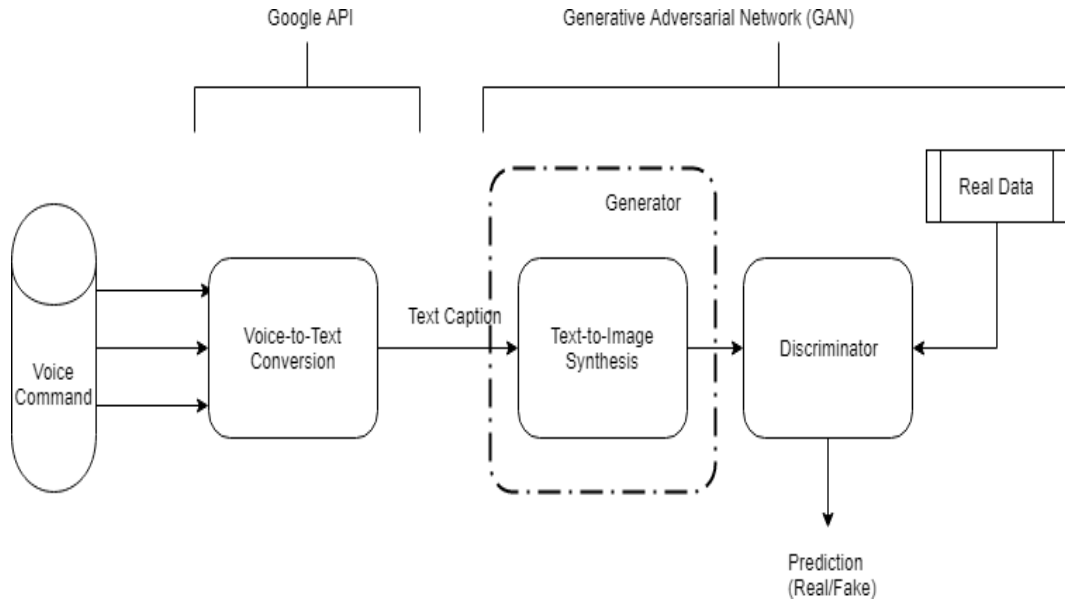


Fig. 5. Flowchart

Fig. 5 gives an overall idea about how this approach is going to work. Generator and discriminator are trained based on the images and texts provided. However, this much number of captions per image is still less if we are looking forward to train a generative adversarial network. Hence, text augmentation needs to be used in order to make the text captions cover wide variety of images. Which we will discuss in the upcoming chapters. For now, let us understand the basic flow of the process. Process initiates with user's voice command. There are a number of APIs available to convert voice commands to text. However, for this approach of converting voice to text captions I have used google API. After the voice is converted to text caption, It is given as input generator. Based on the learning generator will try and understand meaning of each word in caption and try and generate an image based on it, which will be our output.

Understanding more about the process in depth, there are two generative adversarial networks used in this process. Both the networks needs to be trained together. Purpose of level-I GAN is to generate a low resolution image and purpose of level-II GAN is to take output of level-I GAN's image as input and generate a high resolution image. Level-I GAN's low resolution image lack of details as generator might miss understanding some details in text captions. Hence, Level-II GAN convolves over the text caption and try to fill more details into low resolution image and using up sampling it generates high resolution image.

### 5.1 Conditioning Augmentation of Text

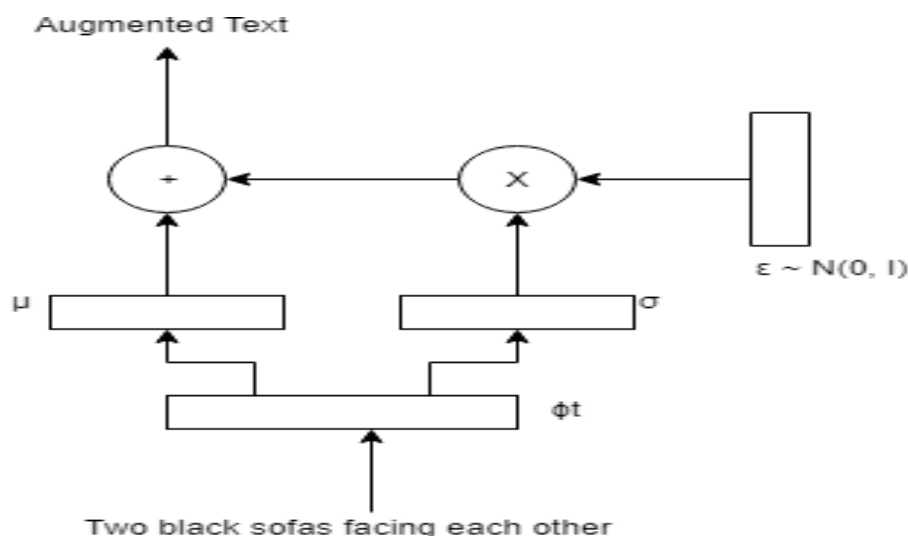


Fig. 6. Conditioning Augmentation

Fig. 6 depicts the process of how conditioning augmentation is performed. The conditioning text description is first encoded by an encoder, yielding a text embedding  $\phi_t$ . Non-linear transformation is done on text embedding to produce conditioning latent variables. Usually these latent variables are very high dimensional. However, lack of amount of data is an issue here. Hence, conditioning augmentation comes into picture. We randomly sample latent variables from an independent Gaussian distribution  $N(\mu(\phi_t), \Sigma(\phi_t))$ , where the mean  $\mu(\phi_t)$  and diagonal co- variance matrix  $\Sigma(\phi_t)$  are functions of the text embedding  $\phi_t$ .

## 6. Conclusion

Generative Adversarial Networks has variety of applications. Dataset preparation is an important aspect of this project which needs to satisfy the needs of model to be trained to a specific extent. What measures are there to be taken care of are mentioned in this paper along with the implementation approach. Scope of this project is way too wide, this model is trained with images of sofa sets and related captions only. If we train it with various data sets of images with appropriate captions, it would make the process of visualization easy in real time. Although, that would be a very challenging task to achieve as ample amount of images will be required. However, once achieved it can be proven as a boon to interior designers and graphic designers.

## References

1. H. Zhang, T. Xu, H. Li, S. Zhang, X. Huang, X. Wang and D. Metaxas, "StackGAN: Text to Photo-realistic Image Synthesis with Stacked Generative Adversarial Networks"2017.
2. H. Zhang, T. Xu, H. Li, S. Zhang, X. Huang, X. Wang and D. Metaxas, "StackGAN++: Text to Photo-realistic Image Synthesis with Stacked Generative Adversarial Networks"2018.
3. A. Creswell, T. White, V. Dumoulin, K. Arulkumaran, and B. Sengupta, "Generative adversarial networks an overview,"2018.
4. C. Ledig, L. Theis, F. Huszar, J. Caballero, A. Cunningham, A. Acosta, A. Aitken, A. Tejani, J. Totz, Z. Wang, and W. Shi, "Photo-realistic single image super-resolution using a generative adversarial network,"2017.
5. C. Valentini-Botinhao and J. Yamagishi, "Speech Enhancement of Noisy and Reverberant Speech for Text-to-Speech"2018.
6. A. Schmidt, "Cloud-Based AI for Pervasive Applications"2016.
7. G. Bordel, M. Penagarikano, L. Javier Rodríguez-Fuentes, A. Álvarez and Amparo Varona, "Probabilistic Kernels for Improved Text-to-Speech Alignment in Long Audio Tracks"2016.

# An Innovative Approach on Multi-Objective Tasks Scheduling Using Amalgamation of Cuckoo and Harmony Search

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## Abstract

Undertaking planning is an essential for enhancement of execution and the board of assets in the distributed computing. Ordinarily there are not many parameters which are generally crucial for improvement of the Task Scheduling in Cloud Computing like Execution Time (Make span), response time, Cost, Scalability, Trust, Reliability, Resources Utilization, Energy Consumption, and Fairness and so on. Here we've proposed the Multi-target work which blends cost, Makespan and asset designation. In order to understand this undertaking planning must be sorted out and streamlined. There are many work and papers are composed and distributed about a proportionate. During this present paper's degree amalgamation of Cuckoo Search and Harmony Search Algorithms is finished in order to enhance the assignment booking. This paper exhibits the CHSA Algorithm to perform powerful and natural work planning. Ultimately, utilizing open cloud as a test system tests are being performed and examination with. According to the outcome from the test system our proposed CHSA calculation acquire ideal expense and make range in addition to ideal asset usage contrasted with existing methods.

**Keywords** – Cloud Computing System, Task Scheduling, Multi-Objective, Cuckoo Search, Harmony Search, HS/ CSA algorithm, Resource Utilization, Make span

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## 1. Introduction

Cloud computing is a result of blending the conventional PC in with arrange innovations, for example disseminated web figuring, equal calculation, utility registering, organize capacity advances, virtualization, load balance, high accessibility, et al. [1]. Particular from conventional system server stages, cloud computing offers an on-request administration model, accessible, helpful, on-request, getting to a configurable figuring asset pool, total with organize, server, memory, application programming, administrations, et al. With little administration or a little communication with the specialist organizations fulfilled, of these assets are regularly offered with incredible productivity. Upheld the administration provisioning at various levels, three cloud administration models are proposed [2, 3], to be specific Infrastructure-as-a-Service, Platform-as-a Service, and Software-as-a-Service.

Right now, market of organizations and associations, distributed computing gives virtual assets that are versatile. It depicts virtualized assets, programming, stages, applications, calculations and capacity to be versatile and given to clients in a split second on installment for not as much as what they use [6]. Disseminated processing highlights a couple of troubles (e.g., security, execution, asset organization, unwavering quality, at that point forward.) [4]. Errand planning on Cloud handling implies dispensing the customers' assignment on the open advantages for strengthen execution of undertaking, and increment asset usage [5]. Errand booking on Cloud preparing implies distributing the customers' undertaking on the available advantages for strengthen execution of assignment, and increment asset usage [5].

An effective task scheduling mechanism is that the key think about distributed computing environments that influences customer satisfaction. However, mapping tasks during a workflow application to resources is complex because the mapping must consider not only the processing capacity of the resources and their communication rates but also user-defined QoS rules. Therefore, the task scheduling problem has always been a core aspect of distributed computing environments, and it's become a search hotspot. [7] The advancement of present-day booking calculations has been immovably related to divulgences inside the zone of AI that are commonly used of late to require care of this kind of issue [8]. As dispersed registering conditions found a good pace a top to bottom number of buyers and assignments, showing a booking calculation which will capably spread the advantages and tasks changes into a key point for research. Present day look at vocations changed probabilistic strategies, for example, genetic figuring, voracious computation, the Ant Colony (ACO) estimation and thusly the Particle Swarm Optimization count (PSO) [9].

In cloud computing, assortment of errands found a workable pace on various virtual machines in order to constrict make length and increment framework use [10]. Subsequently, task planning assumes a key job to upgrade adaptability and dependability of frameworks in cloud [5]. Be that as it may, the undertaking booking has a top to bottom streamlining issue and NP Completeness issue; it gives a genuine commitment to improve solid and extensible powerful frameworks [11]. Thus, the greater part of the assignment booking calculations used in distributed computing are rule based [12] in light of the fact that they're anything but difficult to actualize.

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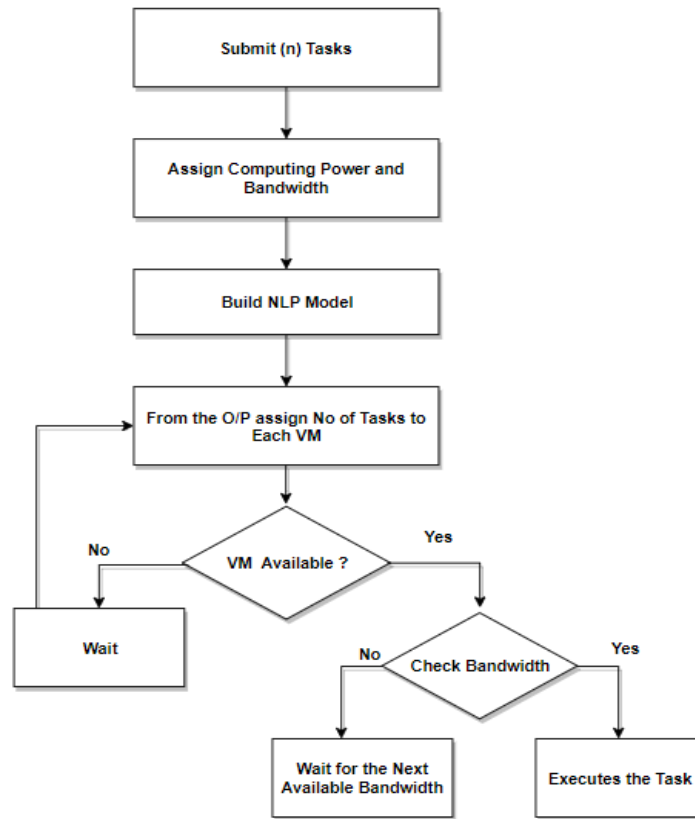


Fig. 1. Task Scheduling – Introduction

Rule based calculations perform ineffectively when it includes complex assignment booking issues [13]. Additionally, the asset booking and distribution aren't just connected with nature of administration (QoS), yet can likewise influence the benefits of the cloud specialist organization legitimately. At the present, asset planning has become the ongoing issue inside the field of distributed computing, and a progression of asset booking calculations are displayed by the understudies. From this the response to the related issue is Traditional distributed computing calculations.

In this paper, we proposed multi-objective task scheduling employing us proposed multi-target task booking utilizing a hybridization of cuckoo search and congruity search calculation. The multi-target work used right now to cost, makespan and asset use. Calendar of the errand is predicated on the destinations getting satisfied.

- We propose an advanced methodology booking calculation (cross breed) with lower execution time and to upgrade the expense and for better asset usage in task planning.
- An Innovative methodology named CHSA is applied for task planning, which has the benefits of instantly associate and immediately see. With the goal that this planning strategy can get an ideal arrangement than cuckoo search calculation and congruity search calculation exclusively can.

## 2. Related Works

Cloud computing is a neighborhood of research which has attracted much attention, but only a couple of among those that do that work use rigorous analytical approaches thus far addressing the performance issues. When evaluating the service delay performance, a key requirement in SLA for Internet-Data Center (IDC) operations, most existing works adopt queuing models or other stochastic models, and use the expected service delay because the metric. Here we reviewed few research papers associated with job scheduling.

Zhu et al. [14] have developed a scheduling in cloud computing. Therein Paper, Creators structured count rules of the offering esteems in both forward and in reverse declaration offering stages. Besides, they created free and intermittent assignments in mists utilizing an operator based powerful planning calculation named ANGEL. This technique was tending to the issues of schedulable, need, versatility, ongoing in virtualized cloud condition. But this technique wasn't thinking about the correspondence and dispatching times and it can't improve the asset usage rate. In addition, the first testing part in Clouds is work process booking, i.e., the matter of fulfilling the QoS of the client likewise as keeping the estimation of work process execution at negligible. To beat the issues, Alkhanak et al. [15] have clarified a value mindful work process planning for distributed computing. The cost-mindful

huge challenges of work process planning (WFS) in distributed computing are organized in sight of Quality of Service (QoS) execution, structure usefulness and system plan, which in the end result during a scientific classification set.

Shubhashree S. R et.al [16] proposed that proposed multi-task scheduling algorithm that upgrades the information community execution without harming SLA. The proposed calculation is as showed up underneath in Figure 8 and Figure 9, that use non-commanding calculation for appreciating the multi-objective (task size, QoS esteem). After a firm time, interim, the rundown will be refreshed progressively. This calculation will give the improved throughput in correlation with the overarching calculation.

Atul Vikas Lakraa et.al [17] state that the issue is to tie set of errands got by the intermediary to the got rundown of VMs, all together that execution time of remaining task at hand is diminished to negligible advanced time. Single target planning calculations have some issue. for example, in need task booking, high need assignments consistently get opportunity to execute, on account of this low need task need to anticipate an all-inclusive time. Here and there low need task gets a chance to execute at the same time, on the off chance that high need undertakings continue coming, at that point low need task is pre-empted and CPU is dispensed to high need task which brings about increment in execution time of an errand additionally in light of the fact that it diminishes the throughput of the framework. Correspondingly, in First Come First Serve (FCFS) and Shortest Job First (SJF), task booking calculations face issue in most dire outcome imaginable. These calculations perform better inside the best case yet in most pessimistic scenario they decrease the presentation to bring down levels. In this way, a productive booking calculation is required to offer improved execution in those cases. By utilizing a legitimate booking calculation, the usage in agent improves the datacenter's presentation without disregarding administration level understandings. Assignment accommodation and subsequently the VMs requesting impacts the makespan of the entire remaining task at hand.

A.I.Awad et.al[18] state that the proficient assignment of errands accessible to virtual machine at client level is predicated on various parameters like dependability, time, cost and freight adjusting of virtual machine. The proposed numerical model of Multi-Objective Load Balancing Mutation Particle Swarm Optimization (MLBMPSO) is utilized to plan and dispense undertakings to asset. Dependability will be accomplished in framework by getting task inability to reschedule and assign with gave asset bolstered virtual machine load.

From the writing overview, we see all the works are efficient for planning. In any case, each work has some restriction like most extreme cost, time, less QoS parameters and unpredictability. Additionally, most work uses the main target work for planning. The main target capacities aren't compelling for all the planning strategies. To beat the challenges, present inside the previously mentioned works, during this paper, we build up a multi objective based errand planning utilizing amalgamation of cuckoo and Harmony calculations.

### 3. Preliminary

In this section, we explain the basics of the Harmony and Cuckoo Search. Then, we explain the proposed multi objective task scheduling

#### 3.1 Harmony Search

By simplifying the natural musical improvement processes, Geem et al. in 2001 put forward HS [20] that is a relatively new meta heuristic search technique [21]. The basics of Harmony Search algorithm include the following operators: the harmony memory (HM) [see Eq. (1)], the harmony memory size, the harmony memory consideration rate, the pitch adjustment rate and the pitch adjustment bandwidth.

$$HM = \left[ \begin{array}{cccc|c} x_1^1 & x_2^1 & \dots & x_D^1 & fitness(x^1) \\ x_1^2 & x_2^2 & \dots & x_D^2 & fitness(x^2) \\ \vdots & \vdots & \dots & \vdots & \vdots \\ x_1^{HMS} & x_2^{HMS} & \dots & x_D^{HMS} & fitness(x^{HMS}) \end{array} \right] \quad (1)$$

In Harmony Search, we have total 3 component: usage of harmony memory, adjustment of pitch and process of randomization. In these optimization process, the value of each decision variable in Harmony Memory shall be determined by any of the three rules. Once the harmony updates, newly generated one has better fitness value, it will be used to replace the worst one in Harmony Memory. This process stops when the satisfactory solution is found. It is same as the selection of the optimal fit individuals in Genetic Algorithms, the first part is significant in the whole HS process. This will make sure that the best harmonies can't be changed and make the memory always stay the best status. I.e. Harmony Memory Considering Rate belongs to [0, 1] has to be

carefully adjusted with the aim of using effective memory utilization. If it nears 1 (too high), almost all the harmonies in HM can be fully exploited, but the HS algorithm cannot search globally well, leading to potentially wrong solutions. In contrast, if it is very small (even 0), HS only takes use of few best harmonies, which may result in finding the best solutions slowly. Herein, generally, HMCR = 0.7–0.95.

For the second part, though the pitch can be slightly adjusted in the linear or nonlinear form theoretically, a linear adjustment is chosen in most cases. The pitch is updated as follows:

$$x_{\text{new}} = x_{\text{old}} + \text{bw}(2\delta - 1) \quad (2)$$

Where  $\delta$  is a random number in  $[0, 1]$ , bw is the band width.  $x_{\text{old}}$  and  $x_{\text{new}}$  are the old and new pitch, respectively.

Pitch change has the closeness with the variety administrator in dynamic calculations. Additionally, the PAR is likewise balanced with the point of executing HS in the most ideal manner. In the event that PAR approaches 1, the congruity in HM will influence even toward the finish of HS procedure, and HS is accordingly difficult to meet to the best arrangements. Conversely, in the event that it is excessively low, at that point little change will be made for harmonies in HM and HS may unite rashly. Henceforth, we have utilized PAR = 0.1–0.5 for most cases.

The last part is basically an irregular procedure with the point of including concordance decent variety. The arbitrary procedure causes the HS to investigate the entire inquiry space well and this has a higher likelihood of finding the last ideal arrangements. Because of its great execution, HS has been applied to manage different advancement issues including direct radio wire exhibits, train neural system, stream shop booking, unwavering quality issue, financial burden dispatch, and others [19].

Simple Steps are [22] Step 1: Harmony Initialization, Step 2: Considering harmony memory, Step 3: Adjusting the pitch, Step 4: Randomization, Step 5: Harmony Selection.

### 3.2 Cuckoo Search

Cuckoo search calculation is a swarm-knowledge based calculation. This calculation is set up on the characteristic conduct of cuckoos. Right now, egg in a home shows the competitor arrangement. All in all, each cuckoo can lay only a solitary egg into a home fit as a fiddle though each home can have various eggs speaking to a lot of arrangement. The primary goal of CS is to make new arrangements that will supplant the most noticeably terrible arrangements in the present home populace. For use of the cuckoo brood personal conduct standard for improvement issues, Yang and Deb [23] admired the brood parasitic conduct of certain cuckoos and the accompanying three principals have been advanced:

1. In cuckoo populace, each cuckoo place one egg in an arbitrarily chosen home;
2. The excellent homes won't be influenced, and this ensures the cuckoo populace that incorporates the better arrangements, not deteriorating than before in any event;
3. The home number is unaltered, and the egg laid by a cuckoo is found by the host flying creature with a likelihood  $\text{dad} \in [0, 1]$ .

In the least difficult structure, each home is reacting to an egg. In like manner, the Cuckoo Search technique is effectively reached out to manage multi-target advancement issues in which each home incorporates more than one eggs/arrangements. Here, we consider that each home has just an egg. In this manner, in his audit study, we don't recognize the distinction among the home, egg, and arrangement.

In Harmony Search method, the discovery rate is considered as a switching parameter that is used to balance the random walk globally and locally. The local one can be given as

$$x_i^{t+1} = x_i^t + \beta s \otimes H(p_a - \varepsilon) \otimes (x_j^t - x_k^t) \quad (3)$$

Where  $x_j^t$  and  $x_k^t$  are two different randomly selected solutions,  $H(u)$  is a Heaviside function,  $\varepsilon$  is a random number, and  $s$  is the step size. While, the global one is performed using Lévy flights.

$$x_i^{t+1} = x_i^t + \beta L(s, \lambda),$$

$$L(s, \lambda) = \frac{\lambda \Gamma(\lambda) \sin(\pi \lambda / 2)}{\pi} \frac{1}{s^{1+\lambda}}, \quad (s, s_0 > 0) \quad (4)$$

Here  $\beta > 0$  is the step size scaling factor related to the scales of the problem of interest.

### 3.3 Proposed Approach Harmony Search Cuckoo Search Algorithm (HS/CS)

So as to acknowledge better exactness, proposed strategy consolidates the improvement capacities of Harmony Search and Cuckoo Search. Moreover, it's wont to improve the abuse ability of the proposed strategy so on not being caught into neighborhood optima. The proposed half and half strategy for cuckoo search and congruity search has been proposed and

investigated by numerous examinations, for example ideal structure of water dispersion frameworks, malignant growth arrangement, backpack issues, worldwide numerical streamlining, and so on.

The cuckoo search might be a notable enhancement which calculation plays out the neighborhood search all the more productively and there's just a single parameter beside the populace size. Yet, this calculation has some impediment. In CS, the arrangements are refreshed inside the pursuit space towards ceaseless esteemed positions and moreover it's set aside most extreme effort to search out the ideal arrangement. So also, the significant shortcoming of the HS calculation is that its execution depends on upon the parameter setting and static parameter characteristics aren't useful for modifying escalation and enhancement. By hybridized these two streamlining calculations, it'll defeat the deficiencies of the individual execution of the HS and CS and it's the advantages of sufficiently perceiving and rapidly focusing, with the objective that this masterminding technique can get a thought or deficient strategy during a base computational time.

#### 4. Task Scheduling Using Proposed HSCS Algorithm

As Discussed in above areas related with CS and HS calculation, during this segment we'll give more knowledge on the proposed calculation and application in Task Scheduling all in all, the quality CS calculation investigates the hunt space well and highlights a quick speed of finding the overall ideal worth, yet it abuses arrangements inadequately because of sporadically huge advances or moves. On the contrary hand, standard concordance search is well equipped for misusing arrangements via cautiously tuning HMCR (amicability memory thought rate) and PAR (pitch modification rate). Here we've acquainted with upgrades in cross breed calculation.

Table 1. Pseudo Code of Proposed Hybrid Method

<p>Input:</p> <p>Set Generation Counter <math>c = 1</math>;</p> <p>Initialize the Population <math>P</math>;</p> <p>Set parameters for HS Algorithm</p> <p>Set Parameters for CS Algorithm</p> <p>Output:</p> <p>An Optimized and Scheduled task</p> <p>Start</p> <p>Determine the Fitness “<math>F</math>” for each individual</p> <p>Repeat</p> <p>While (<math>c &lt; \text{Max Generation}</math>) or (stop criterion)</p> <p>{</p> <p>Sort the Population as per fitness</p> <p>Store the BEST individuals</p> <p>For (var <math>a</math>: NP All Individuals) // CS</p> <p>{</p> <p>Get Cuckoo randomly and replace its solution by Levy Flights</p> <p><math>V = \text{Upper Ceiling of } (NP * \text{rand})</math></p> <p>For all (<math>b = 1: D</math>) // Mutation</p> <p>{</p> <p>Compare current cuckoo's HMCR and PAR Values with random distribution Variable and find the segregate based on the new fitness values</p> <p>}</p> <p>Evaluate fitness for new offspring generation</p> <p>Choose best among them.</p> <p>Replace WORST with the BEST</p> <p>Sort based on latest population data</p> <p>Pass current best to next generation</p> <p>}</p> <p><math>c = c + 1</math> // Next Generation Counter</p> <p>}</p> <p>end while</p> <p>Stop</p>
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First Improvement is said to Pitch modification activity of HS and other improvement is expansion of elitism conspire. Further improvement will be inside the present Hybrid Algorithm will be related with randomization work related with populace assorted variety and pitch alteration. The numerical advances which can resemble Solution Encoding, Fitness Calculation, Update upheld cuckoo search calculation, Update bolstered concordance search calculation, Hybridization, Termination criteria. Pseudo Code for proposed arrangement and work process (Fig. 2.) is as beneath.



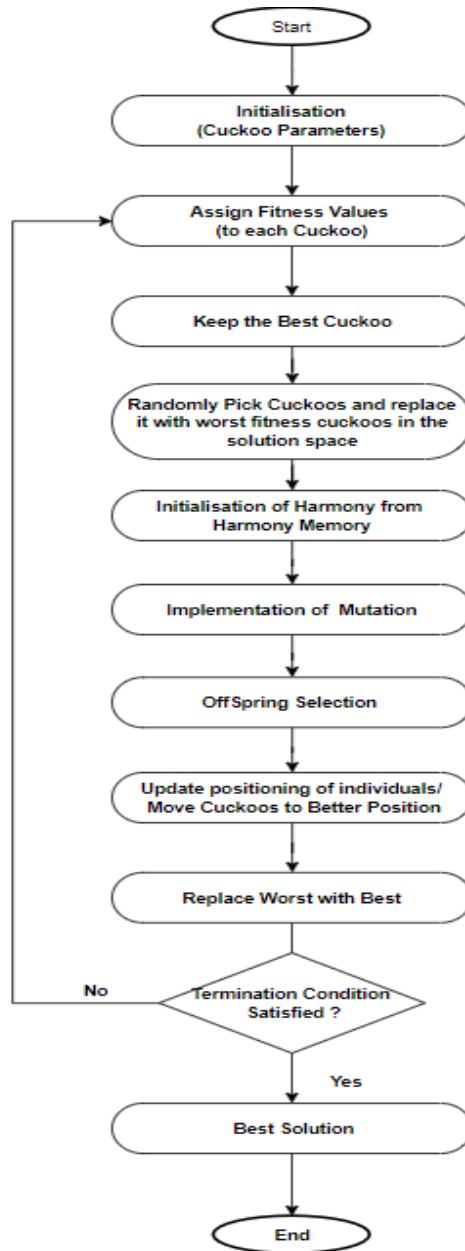


Fig. 2. Proposed Architecture

## 5. Conclusion

In this paper, a multi-objective task scheduling method was proposed bolstered the mixture approach of Harmony and Cuckoo Search Algorithms. The multi-target streamlining approach is utilized to improve the booking execution contrasted with single target work. Here multi-target work like makespan, cost and asset use were taken for better execution. Yield of the proposed arrangement will give adjusts and best set from the whole populace. The normal outcomes should show our proposed multi target task planning is best than different methodologies. Further here we'd prefer to explore a proportionate on open cloud condition with n number of VMs and n number of errands and contrast the analysis results and the normal outcome. We are finding a workable pace against all the quality benchmark testing capacity. Additionally, we'll take a shot at limiting the impact of the control parameters.

## References

1. Vaquero, L., Rodero-Merino, L., Caceres, J., et al.: A break in the clouds: towards a cloud definition. ACM SIGCOMM Comput. Commun. Rev. 39(1), 50–55 (2009)
2. Zhou, M., Zhang, R., Zeng, D., et al.: Services in the cloud computing era: a survey. In: Proceeding of the Fourth International Universal Communication Symposium (FIUCS2010), pp. 40–46 (2010)

3. Buyya, R., Yeo, C., Venugopal, S.: Market-oriented cloud computing: vision, hype, and reality for delivering it services as computing utilities. In: Proceeding of the 10th IEEE International Conference on High Performance Computing and Communications (HPCC2008), pp. 5–13 (2008)
4. Etro, F. (2010). Introducing cloud computing. In London Conference on Cloud Computing for the Public Sector (pp. 01–20)
5. Singh, R. M., Paul, S., & Kumar, A. (2014). Task scheduling in cloud computing: Review. *International Journal of Computer Science and Information Technologies*, 5(6), 7940–7944.
6. Shikha Chaudhary, SarojHiranwal, C. P. Gupta,” Review on Multiobjective Task Scheduling in Cloud Computing using Nature Inspired Algorithms”, *International Journal of Emerging Research in Management &Technology*, ISSN: 2278-9359 (Volume-6, Issue-8)
7. Naqin Zhou1, FuFang Li, Kefu Xu, Deyu Qi (2018). Concurrent workflow budget- and deadline-constrained scheduling in heterogeneous distributed environments, 22: 7705. <https://doi.org/10.1007/s00500-018-3229-3>
8. Sfrent, A., & Pop, F. (2015). Asymptotic scheduling for many task computing in big data platforms. *Information Sciences*, 319, 71–91. 12.
9. Zhong, Z., Chen, K., Zhai, X., & Zhou, S. (2016). Virtual machine-based task scheduling algorithm in a cloud computing environment. *Tsinghua Science and Technology*, 21(6), 660–667.
10. Abdullahi, M., &Ngadi, M. A. (2016). Symbiotic organism search optimization-based task scheduling in cloud computing environment. *Future Generation Computer Systems*, 56, 640–650.
11. Awan, M., & Shah, M. A. (2015). A survey on task scheduling algorithms in cloud computing environment. *International Journal of Computer and Information Technology*, 4(2), 441–448.
12. Ming, G., & Li, H. (2012). An improved algorithm based on max-min for cloud task scheduling. *Journal of Recent Advances*, 125, 217–223.
13. Tsai, C. W. (2014). A hyper-heuristic scheduling algorithm for cloud. *IEEE Transactions on Cloud Computing*, 2, 236–250.
14. Zhu, X., Chen, C., Yang, L. T., & Xiang, Y. (2015). ANGEL: Agent-based scheduling for real-time tasks in virtualized clouds. *IEEE Transactions on Computers*, 64(12), 3389–3403.
15. Alkhanak, E. N., Lee, S. P., & Khan, S. U. R. (2015). Cost-aware challenges for workflow scheduling approaches in cloud computing environments: Taxonomy and opportunities. *Future Generation Computer Systems*, 50, 3–21
16. Sourabh Budhiraja, Dr. Dheerendra Singh, “An Efficient Approach for Task Scheduling Based on Multi-Objective Genetic Algorithm in Cloud Computing Environment”, *JCSC VOLUME 5 • NUMBER 2 JULY-SEPT 2014 PP. 110- 115 ISSN-0973-7391*.
17. Atul Vikas Lakraa, Dharmendra Kumar Yadav,” Multi-Objective Tasks Scheduling Algorithm for Cloud Computing Throughput Optimization”, *International Conference on Intelligent Computing, Communication & Convergence, Procedia Computer Science* 48 (2015) 107 – 113
18. A.I.Awad, N.A.El-Hefnawy and H.M.Abdel\_kader,” Dynamic Multi-objective task scheduling in Cloud Computing based on Modified particle swarm optimization”, *Advances in Computer Science: an International Journal*, Vol. 4, Issue 5, No.17 , September 2015
19. Wang G, Guo L, Duan H, Wang H, Liu L, Shao M (2013c) Hybridizing harmony search with biogeography-based optimization for global numerical optimization. *J ComputTheorNanosci* 10(10):2318– 2328. doi:10.1166/jctn.2013.3207
20. Geem ZW, Kim JH, Loganathan GV (2001) A new heuristic optimization algorithm: harmony search. *Simulation* 76(2):60–68. doi:10.1177/003754970107600201
21. Yang XS (2010a) A new metaheuristic bat-inspired algorithm. In: *Nature inspired cooperative strategies for optimization (NICSO 2010)*, studies in computational intelligence, vol 284. Springer, pp 65–74. doi:10.1007/978-3-642-12538-6\_6
22. K. Pradeep1, T. Prem Jacob (2018), A Hybrid Approach for Task Scheduling Using the Cuckoo and Harmony Search in Cloud Computing Environment, *Wireless Pers Commun* (2018) 101:2287–2311 <https://doi.org/10.1007/s11277-018-5816-0>
23. Yang XS, Deb S (2009) Cuckoo search via Lévy flights. In: *Proceedings of world congress on nature and biologically inspired computing (NaBIC 2009)*, Coimbatore, India, December 2009. IEEE Publications, USA, pp 210–214

# A Novel Approach on Implementing Accident Alerts and emergency management mechanism using IOV and VANETS

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## Abstract

The absence of instantaneous medical services on road accidents is the major cause for the loss of life. In situations like these, an automatic accident detection and emergency management mechanism can help to save the loss of life. In this paper, a prototype is designed for an automatic accident alerts and emergency management mechanism using Vehicular Adhoc Network (VANET) and Internet of Vehicles (IoV). This prototype is designed to be able to detect severity of the accident and its emergency level with the help of sensors which are deployed in the vehicle. In the emergency cases, the message is sent to a hospital via the control room executive, where our central server finds out the location of the mishap and nearest medical service provider. In order to clear the path on the way to accident's location, the chip on the ambulance generates SOS alerts which will be received by every vehicle on the road which has the chip installed, so that the vehicles will clear the way for ambulance in advance.

*Keywords:* Accident alert, IoV, VANET, Emergency management.

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## 1. Introduction

The accident alert and emergency management are well studied areas, where numerous researchers found and implemented various procedures to figure out the event of accident. Mostly the use of mechanical sensors to detect accidents, and smartphone-based applications to communicate with the sensors and with the medical centers using mobile data networks as a medium of communication were found to be implemented. As per our readings, most of the implementations and solutions were reliable, but they were extremely dependent on some specific tools. Few of the solutions proposed in literature are discussed below.

## 2. Literature Review

Various research work which has been conducted in the area of road safety and vehicle to vehicle communication and has been analyzed by us thoroughly. The studied work has been mentioned below.

According to [1], their project objective was to provide medical services on the location of impact as soon as possible. They chose IoT for the communication of small devices which were inside the vehicle to get rid of wired connections between the installed sensors and Vehicular Ad-Hoc Networks for the communication in between the vehicles, RSU (road side units) and medical service providers.

According to [2] the process of Authentication of vehicles in Vehicle to vehicle communication includes two vehicles taking pictures of each other. The pictures were shared mutually. The first vehicle (Vehicle A) determines the relative location of the second vehicle (vehicle B). If the agreement is successful, then both vehicles authenticate each other, with the methods such as Diffie-Hellman key exchange. Identifying both vehicles in the pictures may include recognition of the license plates of both vehicles in the pictures. Both vehicles may exchange license plate numbers before snapping the pictures.

According to [3], they proposed a system and a method to communicate a message to a vehicle as shown in the figures in their paper. "These features and pros of the present disclosure may be appreciated from a review of the following detailed description of the present disclosure", along with the figures in which similar reference numbers refer to similar parts throughout."

According to [4] their invention relates to a procedure for collecting data in a vehicle which is requesting from other vehicles in a network that interconnects the communication devices of various vehicles together.

According to [5] their work is done in the area of providing a solution to the problems which includes fast brake action and head on collisions. In order to overcome this problem, "according to some embodiment of the invention, the PUBCH slots in each frame may be used and they should be classified according to the types of messages."

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## Proposed Work and Algorithm

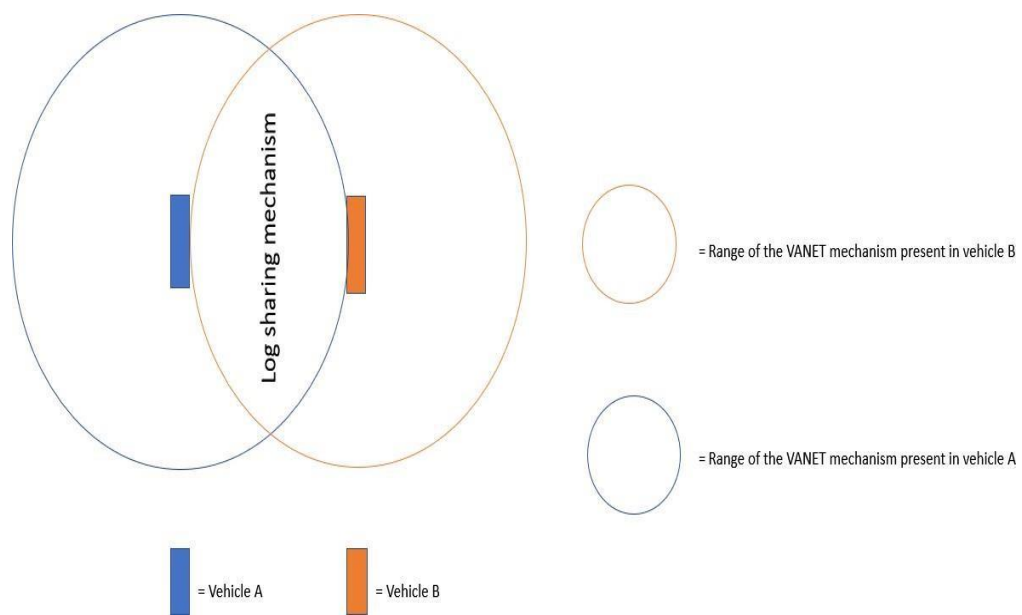


Fig. 1. Level 0 DFD (Data Flow Diagram)

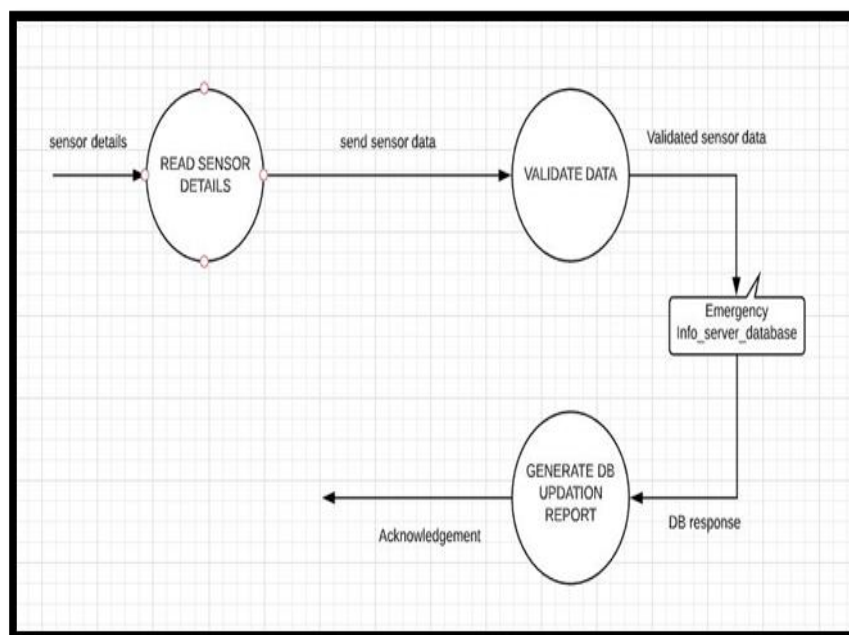


Fig. 2. Level 1 DFD (Data Flow Diagram)

There are essentially two major scenarios in which we have done our work and enhanced the existing accident alerts and emergency management mechanisms with the help of a novel approach towards the management of the accident information. The first scenario is a situation where there is a severe traffic congestion due to an accident. The traditional systems are not capable of

immediately coming for a rescue and due to the lack of system advancement, there are millions of deaths per year in which a person is alive at the time of the impact but eventually dies because of the lack of medication and emergency services.

Therefore, our proposed work provides a mechanism to overcome this. This project requires a chip in every vehicle which is capable of detecting accidents and providing SOS alerts to all the nearby emergency services with the help of multiple sensors and mobile networking equipment. The chip is also capable of creating and managing vehicular Ad-Hoc networks. Now coming back to the scenario, the ambulance could not essentially reach in time due to the traffic with traditional systems but with this chip built in all the vehicles on the road, Vehicles will communicate with each other in the case of medical emergency as the ambulance will send a path clearance signal ahead of reaching that particular accident location to all the neighboring vehicles around that ambulance. Therefore, the neighboring vehicles will forward that signal further to their neighbors and eventually the path will be already cleared before the ambulance reaches the accident location. Therefore, the chances of saving lives of the people involved in the accident can be vastly increased.

Accidents can be detected via various impact sensors and the built in gyroscope in the chip. If the gyroscope values are more than a particular threshold then the vehicle is said to be in an accidental state. The other scenario involves a situation in which a vehicle enters an area with no network coverage and meets with an accident. In traditional mechanisms the alerts will not be received by the emergency service providers.

Therefore, our proposed work provides a mechanism to overcome this situation too. It does so by locally communicating and sharing the gyroscope and location information to the vehicles which are passing near by the accident zone. These vehicles will eventually get to a point where there is network coverage and at that very moment the local logs would be uploaded to the server and the person sitting in the control room will get an alert of the accidental vehicle and will send emergency services to the location. The algorithm in accidental scenarios is described below:

Step 1: The OBU (on board unit) will collect the data from the sensors present on the vehicle and share the data via vehicle to other vehicles that are passing by. Therefore, if a vehicle is in accidental state, the data received by the other vehicle will be uploaded to the servers as soon as the non-accidental vehicle regains its network connectivity.

Step 2: Now that the accidental data is successfully uploaded to the server for monitoring, the control room official will immediately send help to the particular accidental location

Step 3: All the shared data logs will be deleted after a fixed amount of time and after checking upon all the necessary parameters for ensuring the safety and integrity of human life.

### 3. Conclusion

In this paper, we proposed a prototyping methodology of enhancing road safety via communication between vehicles. As this is a very deep area of research and the implementation is not too feasible according to traditional concepts of VANETS and IoV, we have tried to make it feasible and implement it on a user level for better implementation and enhanced lifesaving mechanisms. Our future work includes working upon increasing the fault tolerance and developing this prototype on a more practical basis so that the exact details of the hardware used can be shown and our main focus of future work will be on developing this prototype in the most effective and efficient way possible.

### References

1. Khaliq, Kishwer Abdul, Amir Qayyum, and Jürgen Pannek. "Prototype of automatic accident detection and management in vehicular environment using VANET and IoT." 2017 11th International Conference on Software, Knowledge, Information Management and Applications (SKIMA). IEEE, 2017.
2. Kim, Yu Seung, Jun Han, and Patrick Tague. "Inter-vehicle authentication using visual contextual information." U.S. Patent No. 9,842,263. 12 Dec. 2017.
3. Gupta, Manish, et al. "System and method for communicating a message to a vehicle." U.S. Patent Application No. 14/938,052
4. Murat Caliskan. "Method for collecting data in a requestor vehicle from other vehicles in a network." E.P. Patent Application No. 07015866.2
5. Feng, Xianjun, et al. "Fast access in V2V communication services by dynamic resources allocation." U.S. Patent No. 9,736,847. 15 Aug. 2017.

# An Optimal Resource Utilization in Cloud Computing by Efficient Scheduling of Incoming Tasks Using Clumping of Tasks

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## Abstract

At a recent time, cloud computing is the new archetype of utility of information communication technology (ICT). The cloud users are always having an importance of high performance for cloud computing service. And it must satisfy service level agreement (SLA). In cloud computing, there are high-level of scope in improvisation in scheduling algorithms, which must reduce the response time and increases the computing of resource utilization. This dynamic clumping strategy considers the processing capacity, memory size and service type requirement of each task to realize the optimization for cloud computing environment. It also improvises computation/communication ratio and utilization of available resources by dynamic clumping of the user tasks before resource allocation. That increases or improvises the better resource utilization. The experimental results will be conducted in a simulation cloud computing environment by generator services and tasks request for cloud. The results will show that improvisation and also gives comparator between our strategies and improve activity based dynamic clumping algorithm.

**Keywords:** Cloud Computing System, Scheduling task, Service Level Agreement (SLA), Grid model, Cloud Information Service (CIS), Clumping of Tasks (COT)

## 1. Introduction

Cloud computing is new archetype of utility computing after cluster and grid computing. From the Google trend, it can be observed that the last five years, Cloud computing more interesting than other archetypes. the National Institute of Standards and Technology (NIST) has been defined of cloud computing is a type of parallel and distributed system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resource(s) based on service-level agreements established through negotiation between the service provider and consumer [1], so the basic characteristics of cloud computing are parallel, distribution, virtualization and dynamic resource. The cloud computing has three delivery services available to cloud consumer, they are Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) such as social Networks, application deployment, compute and storage [2].

Figure 1 depicts hierarchical view for cloud computing [3]. Data Centers is the foundation of cloud computing which provides the hardware the clouds run on. Data centers are usually built in le leisure area with cheaper energy rate and lower probability of natural disasters [3]. Top of data centers layer, IaaS layer virtualizes computing power, storage and network connectivity of the datacenters, and offers it as provisioned services to consumers. Users can scale up and down these computing resources on demand dynamically [3]

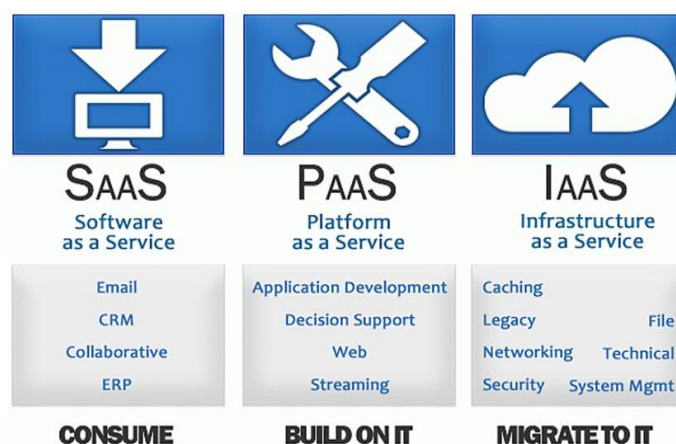


Fig. 1. Separate Services of Cloud Computing

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PaaS, often referred as cloud ware, provides a development platform with a set of services to assist application design, development, testing, deployment, monitoring, hosting on the cloud. It usually requires no software download or installation, and supports geographically distributed teams to work on projects collaboratively [3]. In SaaS, Software is presented to the end users as services on demand, usually in a browser. It saves the users from the troubles of software deployment and maintenance. The software is often shared by multiple tenants, automatically updated from the clouds, and no additional license needs to be purchased. Features can be requested on demand, and are rolled out more frequently [3].

The SLA is a contract negotiated and agreed between a customer and a service provider [3]. A service-level agreement (SLA) is a contract between a service provider and its internal or external customers that documents what services the provider will furnish and defines the service standards the provider is compelled to meet. This is SLAs can cover terms regarding the quality of service for performance system so cloud consumers need SLAs to specify the technical performance requirements fulfilled by a cloud provider such as processing capacity for compute resource. In this case, the provider may specify its requirements on capability, flexibility and functionality in SLA in order to provide essential requirements SLA for cloud consumers [3].

In this work, a scheduling of task classification tasks based on service type. Then, it is using task clumping strategy. The scheduler retrieves information of the processing capability and memory size for computing resource. Then, the scheduler selects the appropriate computing resource target to clumps based on processing capability and memory size for resource in order to attain the reduce for response time of task execution. Thus, improves computation/communication ratio and utilization of available resources.

The CloudSim toolkit has been used to test the task clumping and scheduling in a simulation cloud computing environment. The toolkit, a java-based discrete-event cloud computing simulation package, supported both system and behavior modeling of cloud computing system components such as data center and virtual machines (VMs). Mapping of task to resource and resource management are also supported [5].

This paper is organized shows as follows: Section 2 discusses the related work, section 3 shows the architecture of task-clumping schedule, section 4 represents the algorithm of task-clumping schedule, section 5 present experimental result and section 6 gives conclusion and future work.

## 2. Related work

In this section, some delinquent research works on task clumping and scheduling in distributed computing system and cloud computing environment have been surveyed. Clumping- Based job scheduling model in grid computing [6], clump jobs according to MIPS, memory size and bandwidth of the resource. This model reduces the processing time of jobs, utilize grid resources sufficiently, network delay to schedule and execute jobs on the grid due to this study presented and evaluation an extension from computational-communication to computational- communication-memory based clumping job scheduling strategy, but the algorithm doesn't parallel schedule resource. Scheduling framework for bandwidth-aware job clumping-based scheduling in grid computing [7], clump jobs according to MIPS and bandwidth of resource. This model reduces processing time of jobs compare to a non-bandwidth-aware job clumping scheduling framework. Dynamic job clumping-based scheduling for deploying application [8] clump jobs according to MIPS of resource only. This model reduces processing time, communication time of jobs and cost. In the same way, improve activity-based cost algorithm for cloud computing [9]. Before clump tasks scheduling, tasks are sorted according to their priority and they are place in three different list based on three levels of priority. They are high, medium and low priority. This model according MIPS of resource only when the scheduler is clumped task. This algorithm improved the computation-communication ratio. It also is minimization of make-span and cost compare to activity-based cost algorithm.

Moreover, this study focuses and evaluates dynamic clumping-based task scheduling where classification task based on service type before there are clumped. The propose model minimization of processing time in cloud computing. This model is according to MIPS and memory size of computing resource, and MI and file size of tasks.

## 3. Architecture of task-clumping schedule

Figure 2 presents an overview Architecture of task-clumping schedule model which identifies the major blocks of model. There is task schedule, computational server, storage server, task clump and selection resource, information collection, cloud information services, dispatcher, resource.

In architecture of task-clumping schedule model are using basic of grid model and task scheduling. The scheduler accept task for request user with SLA parameter such as service type, size of file and scheduler is classification task user 's request based on service type. The services types are two majors in cloud computing, there are storage service and computational service. The storage server accepts tasks for storage service where storage server provided data storage and it don't require mapping of services where storage of data doesn't need map resource with task request. The computational server accepts tasks for computational services where provides mapping between tasks and computing resource-based SLA parameters. Begin the schedule task clumping

by grid model which contain of five basic blocks are task clumping and selection resource, information collection, cloud information service (CIS), dispatcher and resource [7].

The task clump and selection resource functions are accepting tasks and clump it to list and selection appropriate of computing resource by dispatcher based on information collection where it collected information for resource available from cloud information services. The cloud information services (CIS) is service in cloud computing which provides information about all the registration computing resource. It collects computing resource information such as operating system (windows, Linux), management policy (time share, space share), resource index and processing capability (Million Instructions per Second). In addition, it also provides information to user on the availability of the resources. Information collector collects information from cloud information service. It collects available of the computing resource and get characteristic resource such as processing capability (MIPS) and memory size to each available of resource through cloud information service. The task clump and selection resource used for information collector to gather necessary information resource to perform task selection via required for information such as MIPS, memory size. The dispatcher functions as sender where sends clumped task their appropriate resource based on the schedule model during the mapping of tasks with computing resource and it gathers the results of the processed tasks from the resource. The resource functions execute of clump tasks and send to result for user.

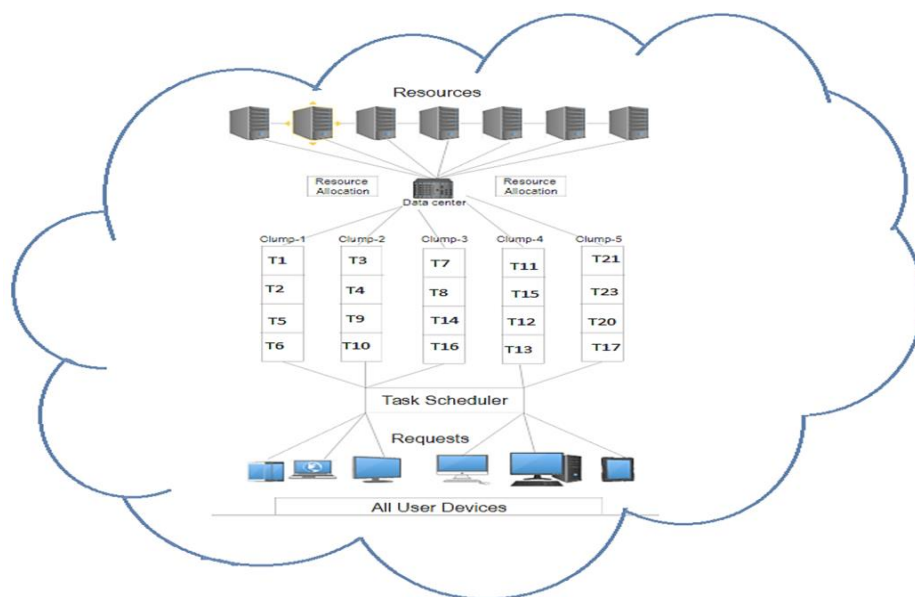


Fig. 2. Architecture of task-clumping schedule model

Figure 3 presents an overview of block diagram scheduling and clumping task model, which identifies five basic blocks of this model. There is user request task, task scheduling, task clumping, schedule and execute.

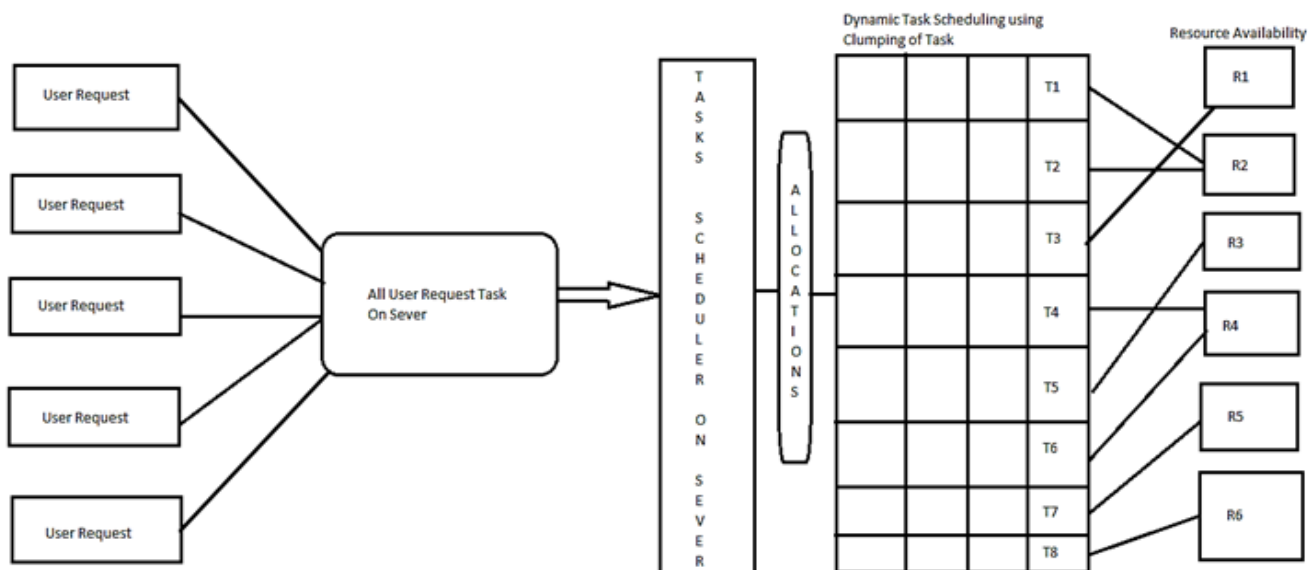


Fig. 3. Block diagram of task schedule and clump model



The user request task with SLA parameter sends to task scheduling. The outputs task schedule are submit task for required user or not and classification them then send to task clumping since clumped for tasks and mapping with computing resource based on schedule of clump task then execute task and return result for user.

#### 4. The algorithm of task-clumping schedule

The algorithm is divided into two parts; there are task schedule and task clumping. The task schedule algorithm is classification of task depended on service type of task. The second part algorithm is clumping of task and mapping with computing resource.

##### 4.1 Task Scheduling

The scheduler submits number of tasks for required of user with SLA parameters. There are service type and file size of tasks. Then tasks are sort based on file size each task ascending order Then classification of tasks based on service type where ask what is service type? If service type is storage service then storage data and send message to user “the task storage in system”. But the service type of tasks is computational service send them to computing resource.

1. Input: request user for tasks with SLA term
2. Task\_list(ID,MI,FS) {
3. Sort tasklist based on min FS
4. For (each tasks for user){
5. Get service\_type
6. If (service\_type is computation) then
7. Insert taski into tasklist
8. Else
9. Insert taski into storage device
10. }
11. Send tasklist to task\_clumping Algorithm
12. }

##### 4.2 Task-Clumping Strategy

Task-clumping strategy is depended on processor capability expressed in the amount of million instructions per second (MIPS) and memory size of the available computing resource the size of clumped task depended on the processing length expressed in million instructions (MI). So, the following conditions must be satisfied:

$$\text{Taskclump\_MI} \leq \text{Resource\_MI} \dots\dots\dots (\text{Eq.1})$$

$$\text{Resource\_MI} = \text{Resource\_MIPS} * \text{GS}$$

$$\text{Taskclump\_FS} \leq \text{Resource\_MS} \dots\dots\dots (\text{Eq. 2})$$

Where task\_clump\_MI: Million instruction is task’s required computational power, resource MIPS: million instruction per second is processing capability of resource, GS: granularity size is used to measure total number of tasks that can be complete within a specific time. It always defined by user, Reource\_MI: MI of resource is multiply granularity size with MIPS of resource, task clump MS: the total memory size of clump tasks, Resource\_MS is the storage memory available at resource. The condition one required computational power (taskclump\_MI) of clumped task is less than or equal processing capability of resource. The second condition total memory size of clump task is less than or equal memory size of computing resource. These conditions are basic factor in task clumping strategy. If there are not execute this strategy repeated until find appropriate available resources.

Terms used in the algorithm

MI: Million instruction requirements of a user task.

FS: file size requirements of a user task.

MIPS: million instructions per second of resource

SM: Storage memory of resource

GS: granularity size (time in second) for task clumping.

1. Input: TaskList (IDj,MI,FS) and ResourceList(IDi,MIPS, SM)
2. Task\_clumping {
3. Set file size of Task\_clumpi (Fs(Task\_clumpi))equal zero;
4. Set MI ofTask\_clump equal zero;
5. Get Gs specified by user;
6. Set index for ResourceList is i from 0 to ResoueceList-1;
7. Sort ResourceList based on min MIPS
8. Get MIPS of Resourcei ;
9. Get memory size of Resourcei;

```

10.  $MI(Resource_i) = MIPS(Resource_i) * GS;$ 
11. For( $j=0; j \leq TaskList; j++$ ) {
12.  $MI(Task\_clump) = MI(Task\_clump) + MI(Tasklistj);$ 
13.  $Fs(Task\_clump) = Fs(Task\_clump) + FS(Tasklistj);$ 
14. If ( $MI(Task\_clump) \leq MI(Resource_i) \ \&\& \ Fs(Task\_clump) \leq SM(Resource_i)$ )
15. Send Taskj to resourcei
16. Else {
17.  $I++;$ 
18. Set file size of Task_clumpi equal zero;
19. Get MIPS of Resourcei+1 ;
20. Get memory size of Resourcei+1;
21.  $MI(Resource_{i+1}) = MIPS(Resource_{i+1}) * GS;$ 
22.  $MI(Task\_clump) = MI(Task\_clump) + MI(Tasklistj+1);$ 
23.  $Fs(Task\_clump) = Fs(Task\_clump) + FS(Tasklistj+1);$ 
24. If ( $MI(Task\_clump) \leq MI(Resource_{i+1}) \ \&\& \ Fs(Task\_clump) \leq SM(Resource_{i+1})$ ) {
25. Send Taskj to resource i+1 } } }
```

CloudSim3.0 has been used to create the simulation cloud computing environment. The inputs to simulations are number of tasks, average MI of task 100, average file size of task 300MB (megabyte) and five second of granularity time. The algorithm simulated with six resources has been created to verify task clumping and scheduling, where each resource has different characteristics such as MIPS and memory size. In this simulation, the MIPS and memory size of resource in table 1.

Table 1. Characteristics of Resource

Resources	MIPS	Storage Memory (GB)
R1	1500	16
R2	1800	16
R3	1200	16
R4	900	16
R5	1600	16

## 5. Conclusion

This paper discusses dynamic task-clumping schedule algorithm in cloud computing environment. Cloud computing at many places required to be performed well optimized task scheduling. This will help in better resource utilization and optimistic solution in task scheduling. In this paper we are trying to achieve Dynamic Task Clumping over the server using task scheduler. The algorithm will be implemented in extended version of paper using cloudsim version 3.0 and we be shown the experimental results.

## References

1. R. Buyya, C. S. Yeo, S. Venugopal, J. Broberg, and I. Brandic, "Cloud Computing and Emerging IT Platforms: Vision, Hype, and Reality for Delivering Computing as the 5th Utility, Future Generation Computer Systems", Elsevier Science, Amsterdam, The Netherlands, 2009 (pp. 599-616).
2. Fang Liu, Jin Tong, Jian Mao, Robert Bohn, John Messina, Lee Badger and Dawn Leaf, "NIST Cloud Computing Reference Architecture" Special Publication 500-292 September 2011.
3. Wei-Tek Tsai\*, Xin Sun, Janaka Balasooriya, "Service-Oriented Cloud Computing Architecture". 2010 Seventh International Conference on Information Technology, IEEE.
4. Kaiqi Xiong, Harry Perros, "Service Performance and Analysis in Cloud Computing", 2009 IEEE.
5. R.N. Calheiros, R. Ranjan, A. Beloglazov, C.A.F. De Rose, R. Buyya, Cloudsim: a toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms, Software: Practice and Experience 41 (1) (2011) 23–50.
6. V.Soni, R.Sharma & M.Mishra, "Grouping-Based Job Scheduling Model In Grid Computing ", World Academy of Science, Engineering and Technology Publishing, Vol. 4(1),issue 5 , 2010, pp: 781-784.
7. Ng Wai Keat, Ang Tan Fong, "Scheduling Framework for Bandwidth-Aware Job Grouping-Based Scheduling In Grid Computing", Malaysian Journal of Computer Science, Vol. 19, No. 2, pp. 117-126, 2006.
8. N. Muthuvelu, Junyan Liu, N.L.Soe, S.venugopal, A.Sulistio, and R.Buyya, "A dynamic job grouping-based scheduling for deploying applications with fine-grained tasks on global grids," in Proc of Australasian workshop on grid computing, vol. 4, pp. 41–48, 2005.
9. Mrs.S.Selvarani, Dr.G.Sudha Sadhasivam, "Improved Cost-Based Algorithm For Task Scheduling In Cloud Computing" IEEE, 2010.
10. <https://medium.com/lattice-research/iot-considerations-server-side-iaas-paas-saas-1f55afc03185>

# A Web Application to Explore and learn Blockchain Technology

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## Abstract

The paper introduces a web application named BC Tutor which is developed in ASP.NET (C#) for exploring and learning the concepts of Block chain. Blockchain technology is widely known and is being used in some applications. Blockchain is being explored by researchers and other stakeholders who are trying to implement a working application in the field of Banking, Healthcare, Finance, Agriculture, IoT etc. Blockchain technology is not easily understood by beginners. With this web application introduced beginners can experiment with the Blockchain technology and understand it easily. They can generate keys, wallets and do the transaction. By doing this they can see the low level details of block chain like encryption keys which are generated with the help of cryptographic key generation algorithms and hashes. They can add blocks while doing transactions. After finally completing the transaction they can even see the entire chain. This web application is intended for beginners who would like to explore Blockchain technology and for students and instructors in academic institutions.

**Keywords:** Blockchain, web application, explore blockchain.

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## 1. Introduction

Blockchain technology has been an interest for many people in industry and also attracted many researchers and various stakeholders to do the research in this technology. There are many benefits associated with Blockchain Technology. Some of the benefits are: improved security, privacy, protection of data against attacks [1]. Industry has started adopting the Blockchain technology due to a variety of applications [2]. Blockchain technology can be implemented in variety of domains such as finance, agriculture, Banking, Healthcare etc. Blockchain technology for beginners make a steep learning curve. There are many well-known applications of blockchain, some of them are: Bitcoin, Ethereum, etc. Applications such as Ethereum and Hyperledger Fabric are readily available. But these don't provide the low details of the Blockchain Technology. In order to know the low-level details of the Blockchain Technology and to know how the Blockchain works, the BC Tutor Application becomes a perfect fit.

The author's main contribution is to develop a web application named BC Tutor that can be used in classroom environment by students and instructors. However, the work of the web application is still in progress because the development is not yet completed.

The paper is organized into the following sections: Section II contains the General Information about Blockchain Technology. Section III describes the details on how to design and develop Web Application. Section IV describes the conclusions and future work.

## 2. General Information about Blockchain

### 2.1 What is Blockchain?

Blockchain is the technological foundation of Ethereum. The definition given by NIST [4] states that “a distributed digital ledger of cryptographically signed transactions that are grouped into blocks. Each block is cryptographically linked to the previous one after validation and undergoing a consensus decision. As new blocks are added, older blocks become more difficult to modify. New blocks are replicated across all copies of the ledger within the network, and any conflicts are resolved automatically using established rules”.

Blockchain is a special data structure of chained blocks. Privacy of data is maintained by encrypting the data with the help of cryptographic algorithms which are stored in the blocks. To prevent data loss and enhance the data security replicated copies are used along with the distributed storage.

### 2.2 Application of Blockchain

Blockchains can be applied almost in each and every domain of every industry. With blockchain we can achieve feasible solutions

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for various problems pertaining to industries like Finance, Healthcare, IoT, Banking, Agriculture etc. Blockchain is a promising technology which provides feasible solutions to the industry.

### *2.3 Working of Blockchain*

In computer Linked list is a data structure to which the Blockchain Technology resembles to. In Linked List there are “chained nodes” but in Blockchain there are “chained blocks”. In Blockchain technology “node” has a different meaning. The blocks in a Blockchain are not chained based on basis of block addresses. The blocks are chained on cryptographic hashes which are derived from the data in the blocks. Each and every block in Blockchain contains hash of the previous block to form a chain. If an attacker tries to change the data in published blocks then hash will also be changed. Due to this it will cause to change the hash of every block. This mechanism is very useful for detection of unwanted modification of published blocks.

In a blockchain there can be many nodes. So many or all nodes in a blockchain may keep a copy of blockchain. Every node in a blockchain can initiate a transaction. A transaction can be referred to as a record of data transfer activity which can be identified by hash.

To add a new block to blockchain a candidate block is prepared by mining node by using unspent transaction and other information to build a block. The required information can be hash of the previous block. The candidate block is then propagated to other participating mining nodes which will validate and solve a challenging puzzle if a consensus model named Power of Work is adopted.

A mining node gets the right to publish the next new block and receive a reward if it is the first node to find a nonce value which solves the puzzle. Other mining nodes will validate the block and add the new block to their copies of the blockchain.

However, in a working blockchain, many mining nodes are trying to solve the puzzle and they may find a suitable nonce value at almost the same time. This is called a conflict. There are strategies in Blockchain that can help resolve such conflicts.

In Blockchain, there is another element called wallet. A wallet is a piece of software that stores participants’ addresses (private and public keys) and fund balances. Wallets are used to initiate transactions too.

### *2.4 History of Blockchain*

In 1991, two research scientists named Stuart Haber and W. Scott Stornetta ideated the Blockchain Technology. They then introduced the computationally practical solution in which digital documents can be time stamped, so that they cannot be tampered with. This system used cryptographically secured chain of blocks.

Later in 1992 Merkle trees were incorporated in the design of Blockchain Technology. After incorporation of Merkle trees, the Blockchain Technology was made so efficient that it allowed several documents to be collected in one block. The technology left unused and this patent was lapsed in 2004, just four years prior to the inception of Bitcoin, one of the most successful applications of Blockchain Technology as we know today.

In 2004, a computer scientist and cryptographic activist Harold Thomas Finney introduced a system called as RPoW, Reusable Proof of Work. Later in 2008 Bitcoin was introduced by a person or group using the pseudonym Satoshi Nakamoto.

In 2013, Vitalik Buterin, a programmer and a co-founder of the Bitcoin Magazine stated that Bitcoin needed a scripting language for building decentralized applications. Failing to gain agreement in the community, Vitalik started the development of a new blockchain-based distributed computing platform, Ethereum that featured a scripting functionality, called smart contracts.

By 2027, it is expected that World Economic Forum expects the Global Gross Domestic Product (GDP) from Blockchain Technology would stand at 10%.

## **3. The Web Application BC Tutor**

Blockchain is not simple to understand for young students and beginners who are wanting to explore this technology. The web application will provide a visual to the students and beginners regarding the Blockchain technology.

For course instructors of blockchain they might have felt that it is not easy to explain the concepts of blockchain to students as well. A web application that is easily accessible everywhere and is tangible for students and instructors to “play with”. This web application will surely help them in learning.

### 3.1 Design of Web Application

The structure of web application is denoted as in Fig 1. The application consists of “Home” module, “Wallet” module, “Transactions” module. These modules allow the students to create, verify, and validate different components of blockchain.

### 3.2 The Home Module

This module is designed to give basic instruction on how to operate this web application. It contains the basic steps on how to create wallet and also on how to build a blockchain. (Refer to Fig. 1)

### 3.3 The Wallet Module

Wallets are used to send and receive transactions in this application. In this module you can create wallets and also view wallets. Add wallet allows user to create wallet (Refer to Fig. 2). View wallet allows user to view the wallets created (Refer to Fig. 3).

### 3.4 The Transaction Module

This is the most important module which does the most important work. In this module you can create Genesis Block (Refer to Fig. 4) and add the blocks (Refer to Fig. 5) to the transaction. After completing the transaction, you can view the entire transaction in JSON format (Refer to Fig. 6).

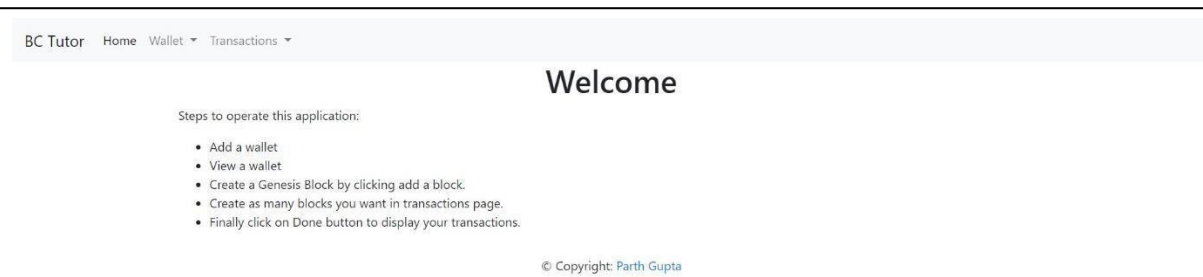


Fig. 1. The Home Module

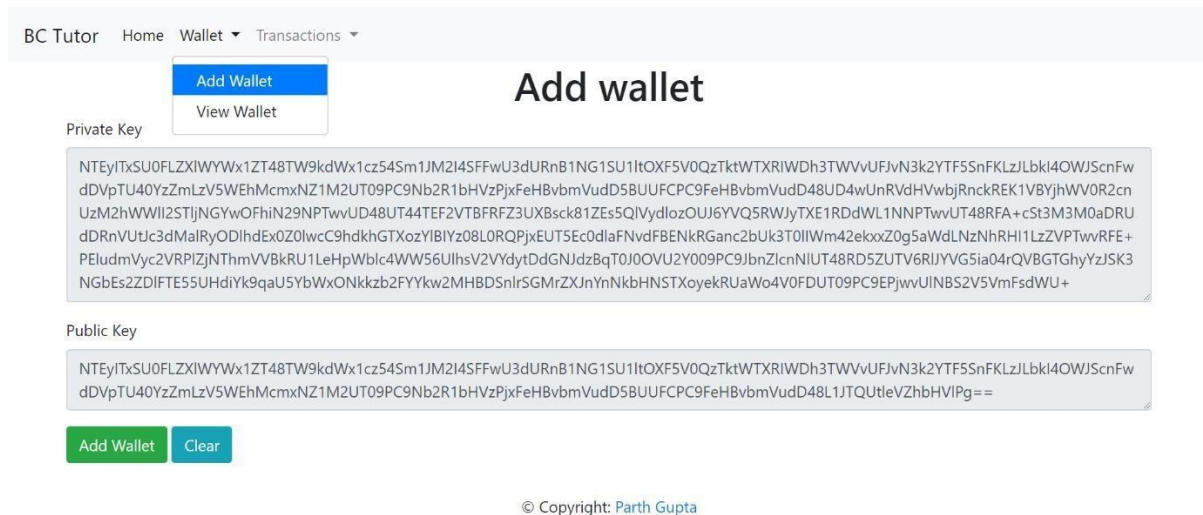


Fig. 2. The Wallet Module\_ Add Wallet

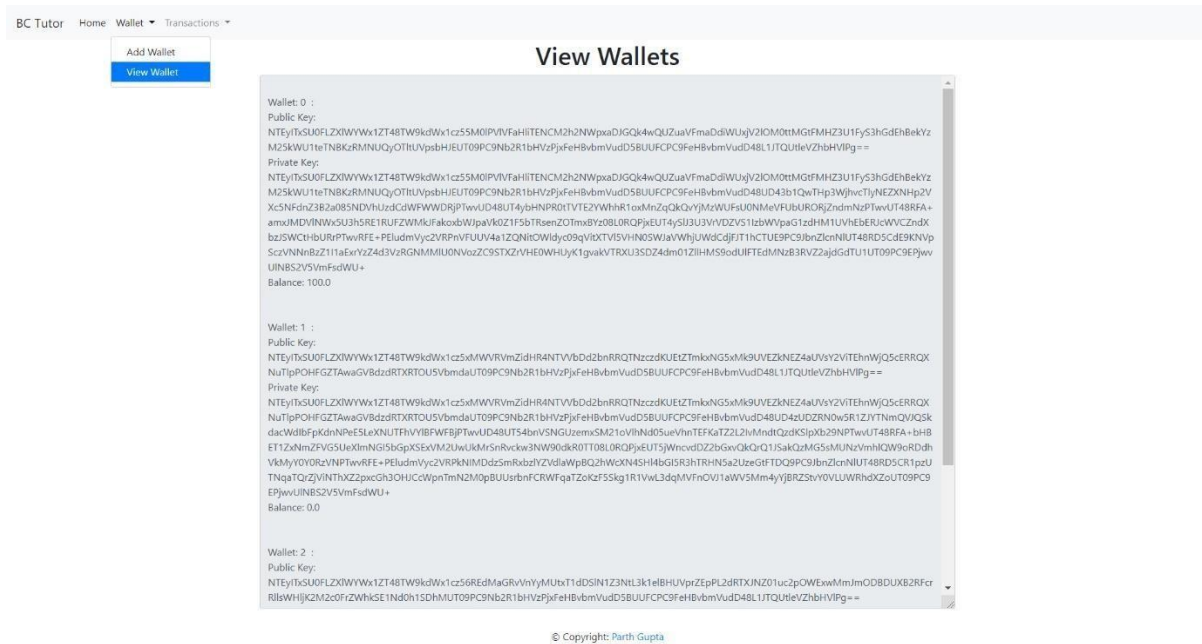


Fig. 3. The Wallet Module – View Wallet

#### 4. Conclusion

The paper introduces a web application named BC Tutor that can be used by academic institutions specifically by students and course instructors as well as beginners who want to explore Blockchain Technology. The application provides low level details of blockchain. Future work would be the development of Network Module in which students can add nodes and work with different nodes in the network.

#### References

1. S. T. Aras and V. Kulkarni, "Blockchain and Its Applications – A Detailed Survey", International Journal of Computer Applications, vol.180, no.3, pp.29-35, December 2017.
2. Henry He, "Building A Blockchain In .NET Core - Basic Blockchain", <https://coincentral.com/blockchainsat-university/>. Last Accessed on 2019/11/10.
3. X. Liu, "Trends in Building Hardware and Software for Smart Things in Internet of Things", CYBER 2017 – The Second International Conference on Cyber-Technologies and Cyber-Systems, pp.65-69, November 12- 16, 2017.
4. D. Yaga, P. Mell, N. Roby, and K. Scarfone, "Blockchain Technology Overview", Draft NISTIR 8202, NIST, January 2018.
5. M. Conoscenti, A. Vetro, J. C. D. Martin, "Blockchain for the Internet of Things: a Systematic Literature Review", 2016 IEEE/ACS 13th International Conference of Computer Systems and Applications (AICCSA), 29 Nov.-2 Dec. 2016.
5. K. Christidis, and M. Devetsikiotis, "Blockchains and Smart Contracts for the Internet of Things", IEEE Access, vol.4, pp.2292-2302, June 2016.
6. W. Cai et al, Decentralized Applications: The Blockchain-Empowered Software System, IEEE Access, vol.8, pp.2169-3536, 2018

# Analysis of Visual Question Answering Algorithms with attention model

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## Abstract

Visual question answering (VQA) uses image processing algorithms to process the image and natural language processing methods to understand the question and answer it. VQA is helpful to a visually impaired person, can be used for the security surveillance system and online chatbots that learn from the web. It uses NLP methods to learn the semantic of question and to derive the textual features. Computer vision techniques are used for generating image representation in such a way that they can identify the objects about which question is asked. The Attention model tries to mimic the human behavior of giving attention to a different region of an image according to our understanding of its context. This paper critically examines and reviews methods of VQA algorithm such as generation of semantics of text, identification of objects and answer classification techniques that use the co-attention approach.

*Keywords:* attention model, co-attention network, fusion features, image features, textual features.

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## 1. Introduction

Visual question answering system can help in humanizing human-computer interactions in the artificial intelligence field in such a way that it becomes similar to human conversations. It is a multi-disciplinary research problem and requires concurrent processing of textual features from a question and visual features from the image. It uses NLP to understand the input question and answer it. It is significantly different from the normal NLP problem as it requires analysis and reasoning of text over the content of the image. Object recognition techniques help in identifying the content of the image. To make the process simpler one can derive which areas of an image are important to answer the given question by providing those parts of the question to the image processing module. So that it gives attention to only essential regions of an image and process them only. In VQA system text analysis and image analysis are mutually dependent on each other. As a human, we can easily identify objects, their position and surrounding in an image, understand the question and its relation to image and can use the knowledge and common sense to answer it. When we want a computer system to perform the same tasks systematic approach and algorithms are required. The process of the VQA system contains three modules, (i) Question features extraction (ii) Image feature extraction (iii) Answering Module. Various deep learning techniques are used to implement these modules. For processing and extraction of text features recurrent neural network (RNN) is used. For processing and extraction of image features convolution neural network (CNN) is used. To predict the correct answer various classification methods are used.

## 2. Basic Concept

Earlier basic baseline models were used to answer the question about the image. Those models answer the question by giving the most frequent answers. Some models even answer the question by randomly picking the answer and then checking its accuracy with various loss functions. Later on, some sophisticated models with a linear classifier or multilayer perceptron were used. Vector representation of the combination of textual and image features are given as input to the multilayer perceptron. Various methods were used to combine these features like simple concatenation, sum pooling, average pooling or product of features, etc. Most of the previous works deal with two models. First model Simple multilayer perceptron (MLP) [1] used a neural network classifier with two hidden layers. Image features combined with textual features were given as input. To derive the output tanh activation function is used. For textual features representation, a bag-of-words method was used. For image features, the output of the last layer of ResNet (visual geometry group) was used. Second model long short-term memory (LSTM) [2] used one-hot encoding for question features and for, image features are derived just like MLP but features are transformed into a linear vector of 1024 dimension to match it with the question feature vector. The basic problem with using global features is that it generates obscure input space for the model. It is important to attend the most relevant region of the input space to get clarity about its target area that should be looked upon to generate the answer. An issue with these models is that they include global image features in processing and generation of the answer. Contrary to that attention model only focuses on local features of the image which are derived using the textual attention model.

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### 3. Related Work

In VQA other than the baseline model, there are various algorithms available for different models. There are various methods to retrieve features of image and text, to represent those features and fuse them. In the Bayesian model, one method uses semantic segmentation to identify objects and their position. Another algorithm uses answer type with question feature to predict the probability of image features. In Multimodal compact bilinear (MCB) pooling, the fusion matrix is created using the outer-product of low dimension feature matrix. There is one more technique that uses Hadamard product and linear mapping to fuse the features called multi-modal low-rank bilinear pooling (MLB). In VQA all questions are not unassuming. Certain questions required more than one step to understand and answer. These sub-tasks can be processed separately. The Neural Module Network (NMN) uses special question parser to find out such sub-tasks and process them individually and combine later. In VQA some questions can't be answered just by deriving image features. First, comprehend the question in depth, which required some external knowledge about the context of the question. There are models available that prove such an external knowledge base in the system. Dynamic Parameter Prediction Model makes sure that image features are completely related to the question dynamically-generated question parameters are added into the CNN which are generated using a recurrent neural network. This mechanism provides implicit attention to image features so that input image features are related to question only. Another method Multimodal residual network derives visual and textual features using residual mapping. Embedding of question and visual features are fused using different techniques. The Attention model contains vectors that assign weights to the regions of image and words of a sentence. A similar approach is used for the sentence where a specific word can increase the probability of occurrence of another word. There are many mechanisms available to implement attention like, dot-product, scale dot-product, content-base and location base. Broadly attention mechanism can be divided into three categories, Self-attention – Try to find a relation between input sequences by relating words at a different position in input sequence in each trial. Global-attention – Attend entire input sequence. Local Attention – Attend parts of the input sequence. Such several VQA models are described in the following section.

### 4. Analysis of Various VQA Algorithms that use Attention Model

#### 4.1 Beyond Bilinear: Generalized Multimodal Factorized High-Order Pooling for Visual Question Answering [3]

In this paper, two models are given, first Baseline Model extracts the features of the image using a residual neural network with 152 layers. Image is represented using the 2048 dimension features generated by the output of pool5. Questions are first tokenized into words and then one-hot encoding is performed and one hot vector containing features is derived. These vectors are given as input in long short term memory (LSTM) recurrent neural network with 1024 hidden layers. The Output feature of the last word from the LSTM network is used to represent the question. Multimodal features that are extracted from image and text are fused using MFB or MFH and output feature  $z$  is generated. For answer prediction they take  $N$  most frequent answers as  $N$  classes and fed  $z$  into  $N$ -way classifier. Second Coattention Model uses similar approach to derive image and text features and then output features of questions are given into question attention module which generates attentive question representation. This output is given to image attention module and using MFH, fusion of image features and text features are generated. In both image and question attention module convolutional layers of  $1 \times 1$  and ReLU layers are given. Its output is given to softmax normalization layers to predict the attention weight for each input feature. The attentive feature is obtained by the weighted sum of the input features. Question attention module is learning in a self-attentive manner using the question feature to make question explicable without image.

It uses the MFB model to provide a fusion of textual and image features. It uses a generalized MFH approach to cascade multiple MFB to find complex correlations to represent an accurate distinction between different question-image pairs. In Multimodal Factorized Bilinear Pooling (MFB) if we consider visual feature  $x \in R^m$  for image and textual feature  $y \in R^n$  for question then simplest multimodal bilinear model is  $Z_i = x^T W_i y$  where  $W_i \in R^{m \times n}$  is projection matrix and  $Z_i$  is the output of the bilinear model. Two lower-level projection matrices are created using matrix factorization. To reduce dimensionality and generate output feature sum pooling is applied on  $U$  and  $V$  vector. Multimodal factorized high-order pooling (MFH) model derives its output feature  $Z$  by concatenating output features of multiple MFB blocks which are derived by performing expansion and squeezing as shown above.  $Z = MFHp = [z_1, z_2, \dots, z_p]$   $P < 4$  ( $P$  is the number of MFB blocks). In model image and question is given as input and feature extraction on both is performed and then features of both are integrated using MFB and MFH. Each derived answer is considered as one class of answer and multiclass classification is performed to predict the correct answer. In ANSWER CORRELATION MODELING each answer is assigned a weight and presented with their probability distribution. KLD (Kullback-Leibler divergence) loss function is applied to it, to measure the dissimilarity among two probability distributions.

#### 4.2 Bottom-Up and Top-Down Attention for Image Captioning and Visual Question Answering [4]

This model determines the image regions and generates feature vectors using bottom-up approach and for weighting each feature and image captioning top-down approach is used. Bottom-up attention model uses faster R-CNN algorithm that detects objects in two stages. The first stage is the Region Proposal Network (RPN) finds out the regions that possibly contains the object. To find out the non-object based segmentation it considers image features such as color similarity, textual similarity, region size, and region filling, then it merges together such smaller regions to generate larger areas and finds out which of these anchors are



foreground and background and using training dataset label objects. There are the different sizes of regions available that are reduced to the same size using ROI Pooling. To train model initiated faster R-CNN with ResNet and embed ground truth objects with mean pool convolution features is used. Captioning Model uses top-down attention mechanism where LSTM levels are defined; the first layer is top-down visual attention layer and second is language model. The output of bottom-up attention model is taken as features  $V$  and input vector for each attention LSTM step is the previous output of language LSTM step and mean pool features vector. In Language LSTM just like attention input is the previous output of attention LSTM and image feature. Its VQA Model encodes each question as to the hidden state  $q$  of a gated recurrent unit and represents it using word embedding. The joint representation of image and question is provided. Learning is done using Self-critical sequence training (SCST) algorithm.

#### 4.3 Co-Attention Network with Question Type for Visual Question Answering [5]

The objective of model is to add question type into the co-attention mechanism to decrease the number of possible answer and make process of selecting answer relatively fast. The main three modules of model are input representation module, co-attention module and question type module. In Input Representation image embedding and question embedding is implemented. In Image Embedding objects in image are derived using a bottom-up approach and faster R-CNN algorithm. In Question Embedding question is tokenized into words and one hot features vector is generated. It is given as input in Bi-LSTM, iteration expresses question at each hidden layer. In Co-attention module there are two sub-modules. In Textual attention based on self-attention, it generates 2-D matrix that represents sentence embedding of a question and contains all or most of the part of the question. Each input vector in self-attention mechanism with weights for all the words. Output of this module is sentence with highlighted. In Question guided visual attention question representation  $M$  is converted into  $m'$  by applying mean function. Question representation  $m'$  and image vector  $V$  is projected in the same dimension and multiplication wise fusion is applied. Using linear layer and softmax normalized attention to the weight of each image object is generated, which is given in a single vector. In Question Type module many question types like color, time, counting, location, reason, sport, judgment etc. are used. One hot encoding of these question type is embedded with multimodal feature fusion and given to classifier for answer generation. In Prediction and Learning phase set of candidate answers are given into multi-layer perceptron to predict the correct answer, the sigmoid activation function is used to predict the score of each answer.

#### 4.4 Cross-Modal Multistep Fusion Network with Co-Attention for Visual Question Answering [6]

AIM is to use cross modal multistep fusion in place of simple multi modal fusion. In Co-attention module sentence-guided word attention and question-guided visual attention is used. Answer prediction uses KLD loss function (Kullback-Leibler Divergence). For Sentence-guided word attention context of the question is taken into consideration for deciding importance of individual words. Attention score of each word is transformed into expectation of word. Expectation  $P_i = \text{softmax}(\text{conv}(\text{mlb}(w_i, s)))$ .  $W_i$  is sentence feature derived from last hidden layer of LSTM and word features derived in each time state of LSTM.  $\text{mlb}()$  is multimodal low rank bilinear pooling and  $\text{conv}()$  is convolution learning operation that consist of  $1 \times 1$  of convolution layers and ReLu layers. Output here is  $\bar{W}$  word attention. In Question-guided visual attention

$$\bar{X} = \sum_{i=1}^M \text{Softmax}(\text{conv}(\text{mlb}(x_i, \bar{W}))) \bullet x_i$$

Where  $X$  is the image feature extracted by deep residual network. In CROSS-MODAL MULTISTEP FUSION NETWORK output from image and word attention is fed as input into CMF network then at each layer three outputs are generated. Out of them two attention features are given for next CMF unit and fusion feature provides multistep fusion using sum pooling to get the final feature for answer prediction. This fusion feature is generated by hadamard product between two models and then output is standardized by power normalization and L2 normalization. For Answer Prediction Kullback-Leibler Divergence (KLD) loss using label distribution learning with a fixed answer distribution is used.

#### 4.5 Object-Difference Attention A Simple Relational Attention for Visual Question Answering [7]

Aim is to develop a VQA system where attention mechanism gives different attention to different objects of an image. For Data Embedding faster R-CNN is used to encode image features using bottom-up attention and GRU is used for encoding text features. In Object Difference Attention Comparison between two objects in image is guided by the question using softmax activation function. In Decision Making ODA model is called multiple time with the learning parameter to obtain more information about the attention region. Image and question features are fused to get candidate answers and sigmoid activation function is applied to get the predicted score of each candidate answer. The model is trained using KLD loss function.

#### 4.6 Visual Question Answering using Explicit Visual Attention [8]

The aim is to use pictorial superiority theory in image attention model of the VQA system. Previous triplet based classification model has implicit attention mechanism for image attention which sometimes could not find important object regions effectively. Explicit Attention Model bridges the semantic gap between the textual and image representation. Feature map from the question representation is generated by applying the convolution neural network. Feature map with the word embedding of the question is

given into multilayer perceptron with hidden layers to generate image representation that has image attention regions. To train this attention model ground truth bounding boxes assigned to feature map using nearest neighbour interpolation are used. There are two modules in VQA model, feature embedding layer and multiple choice layers. In Feature Embedding Layer representations from question and image is extracted. Attention vector is derived using explicit attention model. And embedding vectors are generated to encode the question and answer, but unlike previous models here for textual visual tasks separate model is used. For question features  $Q_f$  and for answer features  $A_f$  notations are used. For Multiple Choice Layer triplet of question-image-answer is given as input in MLP layer to predict whether the triplet is correct or not and it will give scalar values as an output that indicates the correctness of given triplet. Extracted feature vectors are not injected directly instead of similarity and distance between representations of image, question and answer is calculated and that is fed into the classifier. So vector that fed into classifier is  $[Q_f; A_f; Q_f \odot A_f; \|Q_f - A_f\|; I_m; I_m \odot Z]$   $\odot$  is Hadamard product,  $I_m$  is attention representation vector derived from attention model.  $Z$  is the output of the transformation layer that generates common representation for the concatenated vector of question and answer. This is computed as,  $T_{qa} = [Q_f; A_f] \in \mathbb{R}^{2D_w}$ ,  $Z^{(n)} = \sigma(t_{qa}W_{qa}^{(n)} + b_{qa}^{(n)}) \in \mathbb{R}^{D_d}$ ,  $W_{qa}^{(n)}$  and  $b_{qa}^{(n)}$  are parameters of transformation layer.  $\sigma(\cdot)$  is sigmoid activation function. To computing this vector MLP with 8096 hidden units with rectifier activation function is used and for the final layer sigmoid activation function is used. Binary logistic loss function is used for optimization.

## 5. Conclusion

This paper presents an analytical assessment of feature representation and fusion practices used in Visual question answering. Examination of mutual methodologies for merging convolutional and recurrent neural networks to fuse images and questions to a conjoint feature space is performed. Various popular attention models are analyzed against the requirements of VQA. There are some limitations of these algorithms which points to future directions in this field. Like in [3] if the numbers of MFB blocks are more than 4 to 5 then what will happen. In [4] if a select small number of objects from the given feature map in the last convolution layer and what if sum pooling or max pooling is used instead of mean pooling. In [5] one more question type named 'absurd' can be added which tells whether the question is answerable or not also add the knowledge of question type at the time when applying attention algorithm to an image. In [6] what if complex fusion method is combined with multiple fusion networks. In [7] can use linguistic reasoning for ODA model. In [8] what to do with a question that does not contains ground truth boxes. Use the hybrid implicit – explicit model and techniques like bag-of-features can be used for textual representation. Knowledge base can be added to this model in such a way that it does not over train the model and does not answer questions about objects not present in image. These future works can help improve the VQA system and benefits the artificial intelligence field in general.

## References

1. Aishwarya Agrawal, Jiasen Lu, Stanislaw Antol, Margaret Mitchell, C. Lawrence Zitnick, Dhruv Batra, Devi Parikh. VQA: Visual Question Answering. International Conference on Computer Vision (ICCV) 2015
2. M. Malinowski, M. Rohrbach, and M. Fritz. Ask Your Neurons: A Neural-based Approach to Answering Questions about Images. In Proc. IEEE Int. Conf. Comp. Vis., 2015
3. Zhou Yu, Jun Yu, Chenchao Xiang, Jianping Fan, and Dacheng Tao. Beyond Bilinear: Generalized Multimodal Factorized High-Order Pooling for Visual Question Answering. IEEE TRANSACTIONS ON NEURAL NETWORKS AND LEARNING SYSTEMS. 09 April 2018
4. Peter Anderson, Xiaodong He, Chris Buehler, Damien Teney, Mark Johnson, Stephen Gould, Lei Zhang. Bottom-Up and Top-Down Attention for Image Captioning and Visual Question Answering. 2018 IEEE/CVF Conference on Computer Vision and Pattern Recognition
5. Chao Yang, Mengqi Jiang, Bin Jiang, Weixin Zhou, KEQIN Li. Co-Attention Network with Question Type for Visual Question Answering. IEEE Access (Volume: 7). 28 March 2019
6. Mingrui Lao, Yanming Guo, Hui Wang, Xin Zhang. Cross-Modal Multistep Fusion Network with Co-Attention for Visual Question Answering. IEEE Access (Volume: 6). 07 June 2018
7. Chenfei Wu, Jinlai Liu, Xiaojie Wang, Xuan Dong. Object-Difference Attention A Simple Relational Attention for Visual Question Answering. Proceedings of the 26th ACM international conference on Multimedia
8. Vasileios Lioutas, Nikolaos Passalis, ANASTASIOS Tefas. Visual Question Answering using Explicit Visual Attention. 2018 IEEE International Symposium on Circuits and Systems (ISCAS)

# Fake News Detection: A survey Of Detection Methods, Data Set and Open Challenges

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## Abstract

Spreading counterfeit news might be a social improvement that is unavoidable at the social degree among human creatures, and employing online life-like Facebook and Twitter. Counterfeit data that we will, in general, have a side interest in is one among various sorts of trickery in internet-based life, in any case, it's many fundamental ones since it is formed with the unscrupulous objective to mislead people. Accordingly, this trouble is on the purpose of worry because of this improvement has as of late as an aftereffect of the route that of social discussion to alter the course of society and people and their perspectives, for example, all through insurgency in a couple of Arab counterfeit data is one among the variables Trump victories inside the presidential political decision. To collect a sound data discussion environment, it's fundamental to stifle counterfeit news and to limit the conveyance of phony data, therefore, it's important to follow the inventory of audits.

*Keywords:* Countrrtfeit · Fake News · Detection

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## 1. Introduction

In current years, with the occasion of the most recent media, rivalry in the news exchange is warming up. To pull in perusers, various media start to shape a couple of obvious phony news, counterfeit news continues appearing, which has made the issue our way of life. Imagine news in a few fields is rising unendingly, which joins an undesirable affect society. Why commitment this disadvantage is certifiably not a clear difficulty to do: as Chen et al. [1] distinguished that programmed identification of false news is anything but a direct drawback to find a workable pace of since inside the time of 2015 a news story normally conveys photos and films contrasted with the total message that is clear to counterfeit. Besides, with internet-based life on the expansion, counterfeit data stories region devices truly congenial and have over the top effect issues. Before we will in general start with new arrangements, it's important to overview the nation of the work of art systems for learning capacities. In the rest of this paper, we will in general spread different parts of the examination drawback of phony data location. In area 2 we portray the various sorts of media utilized in news Section 3, we depict shifted exercises of phony data. Next, Section 4, we present a top-level perspective on existing fake data recognition strategies. Following that, in Section 5, we talk about the records set accessible for artificial news recognition. Inside the following Section 6, we show a couple of open requesting circumstances for future research. Segment 7, we finish the paper employing an open examination of the advanced systems and its disadvantages of artificial data location.

## 2. Types of media in news

**Print media:** The media forms rectangular degree newspapers, magazines, journals, newsletters, and exceptional written material. These all rectangular measures placed together referred to as the published media. The medium is answerable for additional news than specific information sources [2].

**Broadcast media:** Broadcast Media square measure news reports broadcast thru radio and TV. The newscast is massively crucial within U. S. as a result of additional Americans get their news from TV declares than from the other supply.

**Internet:** Internet is an international medium for exchanging records through a chain of interconnected computers. It's far a fast developing medium for news and advertising. It provides high belongings and adaptability.

Types of Fake News:

There are varying suppositions once it includes trademark kinds of artificial news. Be that as it may, when it incorporates assessing content material on-line there are changed types of imagining or misleading news. Kinds of phony news are as given [3].

**Clickbait:** Those are declarations that can be intentionally intended to achieve other site traffic and lift site business income. Misleading content reports use commercial features to draw introduction and push navigate to the website page of the distributor, unremarkably the inconvenience of the real world or precision.

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**Propaganda:** Stories which can be created to intentionally lie to audiences, promote a biased point of view or specific political cause or agenda.

**Satire/Parody:** Bunches of sites and internet-based life accounts post counterfeit data stories for delight and satire. For instance; The Onion, port Whispers, The Daily Mash, and so on.

**Sloppy Journalism:** Some of the time newshounds or columnists should post a story with temperamental information or on religion the entirety of the data which may deceive crowds. For instance, over the span of the U.S. Races, style merchandiser Urban Outfitters found Associate in Nursing day Guide, the manual contained misleading statements telling the electorate that they required a 'voter enrollment card'. This could be currently not required by methods for any realm in the U.S. For casting a ballot.

**Misleading Headings:** Stories that aren't absolutely sham can be deformed abuse misleading or showcasing master highlights. These sorts of news will spread out quickly by means of online systems administration media regions any place absolutely highlights and little bits of the full article have appeared on swarm news channels.

**Biased/Slanted News:** Various individuals place units pulled in to news or memories that make certain their own special feelings or tendencies and phony information will exploit these inclinations. Web-based systems administration news sources will, in general, reveal information and articles that they surmise we're going to like to maintain our chases.

### 3. Fake News Detection Techniques

#### 3.1 Fake News Identification on Twitter with Hybrid CNN and RNN Models [4]

The method of this work is twofold. First is the robotized recognizable proof of abilities inside a Twitter post without earlier comprehension of the issue territory or point of talking the use of a crossbreed profound picking up information on the model of LSTM and CNN models. Second is the self-control and kind of artificial news posts on Twitter the utilization of both content and pictures. The utilization of profound acing styles permits mechanized trademark extraction, the conditions among the words in counterfeit messages might be distinguished routinely without explicitly characterizing them inside the network. They executed an 82 percent precision by and large execution beating the country of the work of art at the PHEME Data set.

#### 3.2 Automatically Identifying Fake News in Popular Twitter Threads [5]

This present paper's focal examinations inquiry is whether they could mechanically characterize well known Twitter stories as either exact or incorrect. Given the shortage of measurements on certified and bogus recollections, be that as it may, they settle this class issue by moving validity models taught on CREDBANK and PHEME to this phony news location task in the Buzz Feed insights set. To build up a model for characterizing well known Twitter strings as precise or erroneous, first, formalize 4 procedures: displaying exactness forecast, adjusting the 3 insights units, picking which abilities to utilize, and assessing the subsequent models. This current works of art's principal trouble exist in the auxiliary varieties among CREDBANK and PHEME, which could affect the model exchange.

#### 3.3 FaNDeR: Fake News Detection Model Using Media Reliability [6]

They present a phony data location variant, FaNDeR which can effectively arrange the degree of reality for the news in the inquiry noting gadget dependent on the changed CNN profound acing form. The form mirrors the unwavering quality of various media through preparing with the enter insights set which remember the honesty of each mode for expansion to that of the suggestion. The form has higher precision over the measurable technique by method for mirroring the inclination of truth degree for every medium through the preparation of the measurements set accumulated up until now. The proposed model-dependent on a profound considering rendition can be utilized viably not best for identifying fake news anyway moreover for assessing the unwavering quality of different media.

#### 3.4 Weakly Supervised Learning for Fake News Detection on Twitter [7]

They model the issue as a - polish class issue. Their methodology is taught on a huge scale, loud data units, utilizing various frameworks picking up information on calculations. Those strategies envision the portrayal of a tweet as a vector of highlights. In this manner, they utilize unmistakable methods of removing abilities from a tweet. They remember 5 unique gatherings of capacities: client degree capacities, tweet-organize capacities, content capacities, subject abilities, and estimation capacities. For the individual, they first gather all abilities that the Twitter API immediately returns for a client, e.g., the wide assortment of devotees. They achieved an F1 score of 0.77 when least difficult thinking about a tweet in that capacity, and up to 0.9 while likewise which incorporates data about the client account.

### 3.5 Automatic Online Fake News Detection Combining Content and Social Signals [8]

They use a blend of procedures content-based technique and a social-basically based system Combining the social-in a general sense based strategy (that utilizations, as the handiest stockpile of measurements, the ID of the clients who socially connected with a data thing) with a substance based absolutely technique (that dissects the real content of the data thing). They acquired a location precision of 81.7 rates the content corpus for the teache was in Italian and the vast majority of the clients communicating with the posts had been likewise from an indistinguishable nation.

### 3.6 Automatic deception detection: Methods for finding fake news [9]

In this paper, the creator, generally, bases on arranging the information subject to finding the degree of exactness or precision in the news. The perception of developments followed by counterfeit information recognizable proof. Fuse dominantly two classes for appraisal etymological sign procedure (with the gadget getting progressively familiar with) and organize evaluation method. The two strategies get machines getting progressively familiar with techniques for guidance classifiers to fit the examination. A mix of semantic sign and contraption learning on sorting out mainly based on social estimations. Focus on composed data units including artistic substance.

### 3.7 FAMOUS: Fake News Detection Model based on Unified Key Sentence Information [10]

They have offered a sentence organizing model for bogus information revelation which can precisely sentence planning by technique for using key sentence recuperation based totally at the BiMPPM adjustment. This model consolidates 5 layers: In the noteworthy thing sentence recuperation layer, the adjustment removes a lot of key sentences to the request from the thing with the guide of rotting question and article sentences into express contraptions and a while later checking the methodology repeat of articulation units being alluded to in each sentence of the article. Two-express vectors, question articulations, and key sentence set word vectors are picked up by executing word introducing for every articulation unit and LSTM structure in the state depiction layer. By then, from the one's vectors, request significant embedding and a key sentence intelligent embedding vectors are resolved through BiLSTM separately inside the setting portrayal layer. Organizing the depiction layer produces planning vectors: question organizing and key sentence set planning vectors exclusively by methods for full organizing and careful organizing exercises, and by then makes for amassed organizing vector through interfacing the planning vectors from BiLSTM models. Finally, the assurance layer settles on a flat out last decision by the usage of amassed planning vectors through - layered feed-ahead neural frameworks and softmax work. They have exhibited that their model improves the precision appeared differently in relation to the past BilvIPM adjustment for all levels, thus updating the general typical precision from sixty-four to sixty-nine.

### 3.8 Deep Learning Algorithms for Detecting Fake News in Online Text [11]

Work clarified in the going with strides as follows: First step: Preparing the LIAR dataset in four levels: The chief level is separating each sentence to oversee freely. The consequent level is ousting stop words and that perceived the purposeless words for each declaration like (the, an, an, etc.). The third level is stemming which each word returns to its infinitive. Second step: Output of stemming will be the commitment to word embedding which expected a critical activity in significant learning subject to fraud assessment that consolidates addressing every single word in each Sentence by dimensional vector and get the association between two words not simply syntactic yet furthermore proportional to (see' and 'watch' are very surprising in syntactic, yet their essentialness is genuinely related). Another bit of leeway in that the computation distinguishes the words that show up commonly together (like 'wear' and 'articles of clothing') and it shows their relationship and a while later this is proficient to envision the accompanying word. Third step: Results of word embedding level will be the commitment to the RNN models (vanilla, GRU) and LSTMs system. Fourth step: the yield of stage four will Getting convincing results choosing whether the bit of news is straightforward or precarious.

### 3.9 Tracing Fake-News Footprints: Characterizing Social Media Messages by How They Propagate [12]

The creator bases on the class of web-based life content material for online life mining and artistic substance characterization gives especially joining substance with hashtags and words. Through this paper, the writer affirmation on showing the multiplication of messages in a relational association. Here the creator proposes a strategy called TRACEMINER to reason the introduction of online life customers in casual network structure and to make an LSTM-RNN model to address the course of messages. Using of knowledge digger framework, give extreme characterization precision and is better for unraveling a real overall dataset than standard systems. In the Trace digger methodology, they may acknowledge various messages as data and class as yield. This philosophy couldn't care less for the standard procedure as they immediately base on exhibiting the records and making desires. They give streamlining methodologies to infer excavators to ensure precision and consider the introduction of the certified overall relational association information.

#### 4. Fake news Data Set

Coming up next are standard records-units which may be utilized for artificial data discovery:

BuzzFeedNews [13]: BuzzFeedNews can be a blend of title related partners with an authentic story or a flow that is viewed as phony news. These encounters set is beneficial for looking structures, regardless, transmission content material isn't a touch of this estimation set, subsequently, the definite examination isn't ordinarily possible on printed content most clear realities set.

LIAR [14]: LIAR can be a benchmarking gadget made by techniques for Santa Barbara masters from the University of an American Country. Likewise, this plan of records is phonetic in a general sense based educational assortment that consolidates the least troublesome substance bits of knowledge and has similar blocks as the substances set of BuzzFeedNews.

PHHEME [15]: Tattle tweets assembled and clarified at periods the news inclusion use occurrence of the endeavor. It passes on Twitter exchanges that the area unit began with the guide of talk tweets. Furthermore, it's semantic basically dependent on the informational index. It contains thirty-three discussions (297 in English and 33 Germany).

CREDBANK [16]: The clearest bits of knowledge set have contained web-based life information and enables customers to play out an evaluation on Twitter realities. These bits of knowledge set signs additionally, signs off on all of the classes other than the visual records. It leaves behind having transmission information, in any case, it, regardless, settles on it a persuading decision for experts United Nations affiliation additionally is centered on fake news acknowledgment by means of electronic systems administration media.

#### 5. Open Research Challenges

We figure that the subsequent is the huge thing evaluation challenges that may manual destiny assessment on bogus news disclosure:

Multi-modular Data-set: As alluded to inside the past segment none of the information units gives an entire multi-particular course of action of bogus news. This divulges a hazard for researchers to make a multi-secluded informational index that covers all the fake news substances varieties.

Multi-modular Method: The number of strategies is planned to phony news exploitation etymological technique, and it's viable in a few cases, nonetheless, visual introduction plays a colossal capacity in people's fundamental intellectual framework in fake data content. This requires check of no longer genuinely language, however pictures, sound, inserted content material (for example implanted video, tweet, Facebook post) and connections (for example hyperlinks to totally uncommon URLs).

Source Verification: The wellspring of the article has now not been depleted anticipated present ways, this incorporates another false data identification method that will complete conveying check and considers the convey in looking at artificial data declarations.

Root Finding: Develop a method for the basis-finding of the faux information and attempt to stop fake news to propagate further.

#### 6. Conclusion

From the above inspect, its miles inferred that there are no basic strategies accessible for false news identification on the entirety of the accessible records sets and one The normal data set is furthermore now not accessible that is artistic creations for all systems. There is no technique accessible for finding the base of the false news. This investigates likewise recommends that each strategy is done to the little records set so it gives exorbitant exactness.

#### References

1. Y. Chen, N. J. Conroy, and V. L. Rubin, "News in an online world: The need for an automatic crap detector," Proceedings of the Association for Information Science and Technology, vol. 52, no. 1, pp. 1–4, 2015.
2. SparksNotestheMedia, <https://www.sparknotes.com/us-government-and-politics/american-government/the-media/section1/>. Last accessed 26 Dec 2019
3. WEBWISE what is fake news.
4. Oluwaseun Ajao, Deepyan Bhowmik, Shahrzad Zargari. "Fake News Identification on Twitter with Hybrid CNN and RNN Models", International Conference on Social Media Society, Copenhagen, Denmark (SMSociety) by ACM 2018.
5. Cody Buntain, Jennifer Golbeck, "Automatically Identifying Fake News in Popular Twitter Threads", IEEE International Conference on Smart Cloud 2017.

# Survey on Prediction of Cyber Intrusion with Time Series Analysis

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## Abstract

Cyber intrusion on systems and infrastructure are becoming increasingly sophisticated. It is evident that it is no longer effective to deal with Cyber intrusion after they occur or even detect it at the time of intrusion. A new approach is needed based on the prediction of potential attacks along with time series analysis. The scope includes analyzing the methods and the practical usability of approaches to make the timely prediction of Cyber intrusion especially when they can be predicted as soon as possible with nonlinear and continuous data. The accuracy measures of all approaches clearly specify the need to predict the intrusion on computers or web. With this approach, an organization can be aware of its weakness, and can better prepare for proactive attack defense or reactive responses.

**Keywords:** Data Analysis, Prediction, Forecasting, ARIMA Model, RNN, LSTM, BRNN- LSTM, Cyber Intrusion, Security, Time series..

## 1. Introduction

According to Cisco, Cyber intrusion is a type of malicious attack which can also be referred to as malware. It will encrypt the data of the users and will ask them to pay a certain amount of money. Many of the attackers usually ask the ransom money in the form of Bitcoins. After the payment of the requested amount of money, the attackers generally send the decryption key for the encrypted victim's data.

If we look at the facts presented by many of the known providers, we find that the damage done by Cyber-attacks on the systems or organizations were expected to rise by \$8 million in the year of 2018. According to the recent facts of the city of Baltimore, it was built with a massive Cyber-attack of \$18 million loss. The same kind of Cyber-attack happened in New York city in 2019 that was responsible for bringing many services offline. The availability of services is required for the security guidelines to follow by the organization.

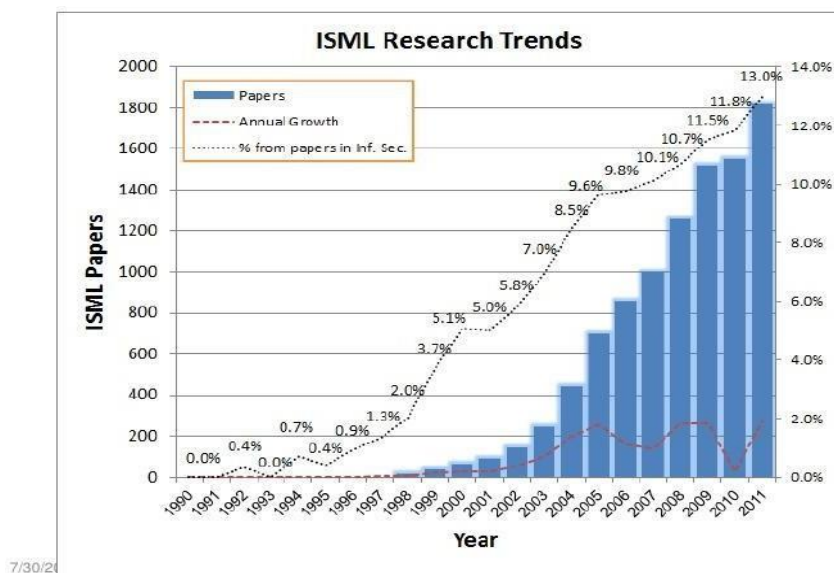


Fig. 1. ISML Research Trends [5]

According to the above ISML Research trends, as the time goes by, the number of researches is increasing in the areas of analytics with cyber security.

Time series analysis refers to the gathering of large amounts of data over certain intervals of time with the idea of analyzing the trends, cycles, patterns and seasonality from the data to predict future events.

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Unlike normal statistical analysis, time series analysis requires measurement of the data at certain periods of time. Trends refer to the continuous increase or decrease in data over a certain period. A trend can be over a year, month, week or day. A cycle is referred to as growth then decline and then again growth in the datasets. A cycle is always repeated after certain time intervals. Patterns are the repetitive occurrences of certain situations occurring over a time period. Patterns are usually identified from the data and then used to predict future events. A seasonal variance refers to specific time period over years or months.

## 2. Background

Earlier contributions of the papers included a novel bi-directional recurrent neural network with long-short term memory or BRNN- LSTM in short to predict the cyber-attacks with time series data and to get the statistical reports of it. This framework allowed to use any number of LSTM layers on BRNN structure and show how the algorithms can be used to achieve the highest accuracy. Another paper used to predict the malware based on a dataset using some machine learning techniques. They used to investigate the correlations among the features and then identify which factors greatly influence the type of attack and helpful to predict them. Advanced malware Detection and prediction are the challenging tasks in this paper. The third paper refers to the use of machine learning algorithms that utilizes social media big data analytics and statistical approaches in order to predict cyber-attacks. The predictor identified the attacks by using the vulnerabilities in software based on social media conversations while prediction was measured on the basis of data of Twitter. They utilized the techniques of Artificial Neural Network (ANN) and using confusion matrix, derived the predictions of social media data.

## 3. Related Work

The given work includes the analysis of different algorithms which were already used to predict the different types of cyber-attacks.

There are multiple methods and algorithms available to predict the cyber-attacks along with the time series analysis of them.

### ARIMA Model [1]

The first model that we are going to consider here is the Autoregressive Integrated Moving Average or ARIMA (p,d,q), which is perhaps the most well-known model in time series analysis[1]. The ARIMA Model is one of the statistical methods for prediction of time series analysis data. The ARIMA model is described as

$$\phi(B)(1-B)^d Y_t = \theta(B) \epsilon_t \quad (1)$$

Where B is the backshift operator, and  $\phi(B)$  and  $\theta(B)$  are respectively the AR and MA characteristic polynomials evaluated at B. An ARIMA model is characterized by 3 terms: p, d, q where,

- **p**: The number of lag observations included in the model, also called the lag order.
- **d**: The number of times that the raw observations are differenced, also called the degree of differencing.
- **q**: The size of the moving average window, also called the order of moving average.

Table 1. Accuracy of ARIMA Model. [1]

Dataset	MSE	MAD	PMAD	MAPE
<b>ARIMA</b>				
I.	40054811	503895	0.1352803	0.1378065
II.	100487103	6763351	0.2618205	0.314159
III.	17002355	2353409	0.8187241	0.8372556
IV.	456948359	159199	0.4062245	0.5932768
V.	47486461	3478307	0.2212886	0.2573687

The above table determines the accuracy of ARIMA Model when it was applied to the dataset. The Base paper used the dataset of Honeypots of 166 IP addresses. A honeypot is a system which is used for tracking hackers or any other tracking device attacking on your system. They belonged to the five-year periods in the interval of 2010 to 2011. The Model first splits the data into training and testing sets. The dataset will then be applied to ARIMA Model with seasonality to be set as TRUE. The Model gets trained from the training data and then predicts the future values. The predicted data is then compared with the test data and then we determine by how much difference both the values differ from each other. The accuracy of model will be calculated on the basis of prediction. Further measurement parameters such as MSE (Mean Square Error), MAD (Mean Absolute Deviation), PMAD



(Percentage Mean Absolute Deviation) and MAPE (Mean Absolute Percentage Error). There are two types of ARIMA Model which includes Seasonal and Non-Seasonal Models.

#### BRNN-LSTM Model [1]

Recursive Neural Network (RNN) is referred to as a neural network in which the output of the previous iteration is fed as an input to the next iteration in order to gain accuracy in predictions. A simple neural network consists of an input layer, a hidden layer and an output layer. Traditionally, all the inputs and outputs are kept independent from each other. But as an improvement to the previous inputs as a part of continuous data, the previous outputs are also required. So RNN is considered to be a “memory” which can retain a state of output into it.

$$h_t = \sigma^*(W_x \cdot x_t + W_h \cdot h_{t-1} + b_h) \quad (1)$$

where  $W_x \in R^{m \times n}$  is the weight matrix connecting the input layer and the hidden layer with  $m$  being the size of the input and  $n$  being the size of the hidden layer,  $W_h \in R^{n \times n}$  is the weight matrix between two consecutive hidden states  $h_{t-1}$  and  $h_t$ ,  $b_h$  is the bias vector of the hidden layer, and  $\sigma$  is the activation function to generate the hidden state. As a result, the network output can be described by

$$y_t = \sigma^*(W_y \cdot h_t + b_y) \quad (1)$$

where  $W_y \in R^n$  is the weight connecting the hidden layer and the output layer,  $b_y$  is the bias vector of the output layer, and  $\sigma$  is the activation function of the output layer.

The BRNN generally suffers from vanishing gradients. It carries the errors from one stage to other along with itself which means if there occurs an error in one of the iterations of the past, the errors get carried to the final output. This problem of Uni-directional RNN can be solved by using Long-Short Term Memory (LSTM). The LSTM is composed of different units which are often called as memory-blocks used to store the values of outputs. The temporary state of the network are being stored by the LSTM and other gates which behaves as a multiplicative unit. Each of the memory unit has three separate parts. One is the *input gate* which will define the different activations of the input flow in the network. The second one is the *output gate* which determines the output flow of data in the network and the third one is called *forget gate*.

The activation at step  $t$ , namely,  $h_t$ , is computed based on four pieces of gate input, namely, the information gate  $i_t$ , the forget gate  $f_t$ , the output gate  $o_t$ , and the cell gate  $c_t$  [1]. Specifically, the information gate input at step  $t$  is

$$i_t = \sigma^*(U_i \cdot h_{t-1} + W_i \cdot x_t + b_i) \quad (1)$$

where  $\sigma(\cdot)$  is a sigmoid activation function,  $b_i$  is the bias,  $x_t$  is the input vector at step  $t$ , and  $W_i$  and  $U_i$  are weight matrices. The forget gate input and the output gate input are respectively computed as

$$f_t = \sigma^*(U_f \cdot h_{t-1} + W_f \cdot x_t + b_f) \quad o_t = \sigma^*(U_o \cdot h_{t-1} + W_o \cdot x_t + b_o) \quad (1)$$

The BRNN-LSTM is composed of three parts- input layer, a number of hidden layers and output layer. Here each hidden layer is replaced by the LSTM cells. The different inputs from each input layers denoted by  $x_t$  is passed to the forward and backward both iterations. The outputs of both the states or iterations are combined together to make the final prediction of output. The following objective function has been used to make the prediction of attacks:-

$$J = \frac{1}{2m} \sum_{i=1}^m (y_i - \hat{y}_i)^2 + \frac{\lambda}{2} (\|W\|^2 + \|U\|^2) \quad (1)$$

where  $m$  is the size of input,  $y_i$  are respectively the output of the network.  $W$  and  $U$  are the matrices of the network and  $\|\cdot\|^2$  represents the L2 norm of these weight matrices.

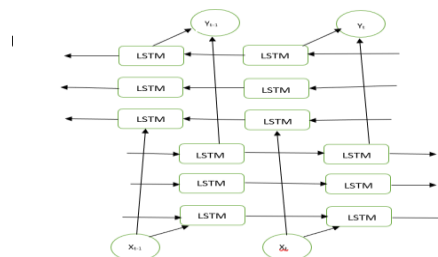


Fig. 2. BRNN-LSTM Framework [1]

The paper that we have referred here takes 10,000 iterations as an example and uses the value  $\lambda = 0.001$  because trying with the similar values of parameters does not lead to any better results. Also, the batch size are taken different for different set of data and applied the model onto it. The forward propagations are undertaken using the values of LSTM in each iteration and supplied to the next. The accuracy of BRNN- LSTM when applied to the datasets of honeypot consisting of 166 IP addresses is calculated as below.

Table 2. Accuracy of BRNN- LSTM Models [1]

Dataset	Test	R	L	MSE	MAD	PMAD	MAPE
I.	120	20	4	3628266	463.2715	0.1243741	0.1387808
II.	120	30	2	16497941	1036.6035	0.4012863	0.4819186
III.	120	40	4	30637599	675.7551	0.4299127	0.2304677
IV.	120	20	3	2165707	508.3557	0.1658243	0.26563720
V.	120	20	3	1085361	297.3440	0.1034426	0.13385770
VI.	120	20	2	20415119	1396.7624	0.3564086	0.4787385

Parameters of selected models and prediction accuracy metrics of these selected models where IV\* indicates the rolling approach of the dataset IV.

#### Linear/Polynomial Regression [2]

Linear Regression is the most widely used machine learning algorithms. It is specifically used to find the relationship between two variables in which one is dependent on the other. Here the time series data has to distinguish between different types of forecast that can be used which depends on what type of assumptions we make for the forecasts. The features of the data are taken into consideration and analyzed to find the correlations between each of them keeping in mind the time series that keeps on continuously changing. These correlations help to find the relations that different features might have with each other. The ones with the highest correlation values are said to be highly affecting each other.

It is not always necessary that the relations of different features tend to be linear with each other. There may be some form of nonlinearity between them. In such cases, the polynomial regression methods are used. Also, the linear regression suffers from the over and under fitting of data which results into the wrong prediction of datasets. To overcome such situations, polynomial regression came into effect. The linear models [2] are defined by the following formula: -

$$= 0 + \theta_1 * x \quad (2)$$

where Y and x are said to be any two features of datasets. Similarly, the formulas for polynomial regression [2] is given as,

$$= 0 + \theta_1 * x + \theta_2 * x^2$$

(2) where x2 represents the polynomials in the equation.

The experiments were carried out on the advanced malware data. The results have shown that Stealthy and Stuxnet features of the advanced malware time series data are highly correlated with each other. Thus, small machine learning algorithms are usually less complex and provides many useful information as it processes only small sets of data. These often leads to high performance of models and provides higher accuracy in terms of prediction of data. The Stuxnet is often related to the API calls that are made to attack a particular system thus it makes it suitable for regression analysis of algorithms. The larger the number of API calls may increase the closeness score to attack. These might need to use the complex machine learning algorithms.

When the correlations between the features of datasets goes below 0.5 then the application of linear and polynomial machine learning algorithms becomes insufficient. The threshold values of these algorithms depend upon the datasets and the area in which it is applied. Also, potential distinguishing between conventional and advanced malware cannot be determined with the algorithms.

Thus, the need arises to focus on a new method called Random Forest Regression

#### 4. Random Forest Regression [2]

The Random Forest Regression is a method of performing both the regression and classification onto the datasets using multiple regression trees. These regression trees are combined to form an entire forest. This method is mostly focused on performing nonlinear multiple regressions on the datasets. Here each decision tree is trained with different samples of data where sampling of data is done while replacing the old data. The idea is to combine the results of each tree instead of just lying on the results of one decision tree. The accuracy of data gets improved with such models as shown in the above table. The Random Forest regression depends upon the ensemble method which is divided into two parts as boosting and bootstrap aggregation (Bagging). Here the

research has applied the bagging technique so that the sampling can be done with replacement. The bias and variance in the datasets are easily computed while training the models. Though complex, the model can easily provide better prediction of attacks. The experiments provide better results when applied to advanced malware datasets. Stuxnet closeness score has been calculated and it provides better results as compared to linear and polynomial regression. Properties of malware varies with different scores and different algorithms. The closeness score determines the values which can help in making predictions much more accurate and valid. The threshold values also depend upon the area from which the datasets are used.

The total number of features that gets separated at each iteration has limitations on total percentage called hyper parameter. It fairly makes the use of each potentially predictive features and does not have full dependence on the individual features. Each tree when separating the trees draws a sample data and then adds another feature to it. This process prevents the over fitting or under fitting of the model. The aggregation of the trees is performed on the number of votes or averaging the results of each tree. Random forest becomes the great and highly accurate classifier. The time series data can be easily handled by such datasets. It can easily handle the missing data and also maintains accuracy in such cases. The accuracy results with these two machine learning algorithms are given as: -

Table 3. Accuracy of Linear/Polynomial/Random Forest Regression [2]

Algorithm	$R^2$ scores	RMSE	MSE	MAE
Polynomial Regression (d = 7)	0.7759	0.0102	0.0001	0.0057
Polynomial Regression (d = 4)	0.7539	0.0107	0.0001	0.0059
Linear Regression	0.7109	0.0116	0.0001	0.0077
Random Forest Regression (tree = 3)	0.8208	0.0092	0.0001	0.0041

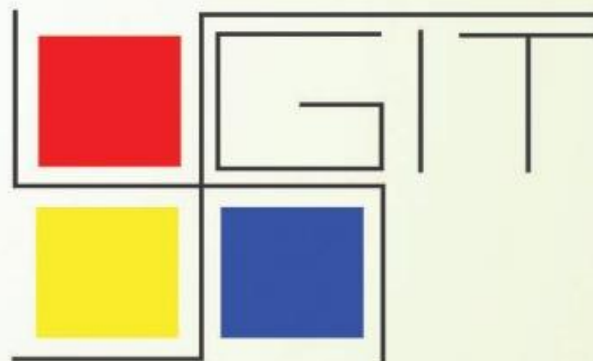
## 5. Conclusion

The survey paper has described the models which were able to predict the attacks occurring over time series. The proposed ARIMA Model is the simplest model in machine learning algorithms which is based on three different parameters easy to calculate based on data. The ARIMA Model can perform best when the data has seasonality, patterns and trends within it. The proposed BRNN-LSTM model is also widely used for predicting cyber-attacks. This model can accommodate complex phenomena such as long-range dependence of data on each other and highly non-linear data. BRNN-LSTM is said to outperform prediction accuracy of attacks on systems and is one of the best models to use in an organization which can help them to take proactive measures to protect their systems and prevent it from further attacks.

Another method contains a brief explanation of conventional malware and advanced malware prediction model. Here we have analyzed the Stuxnet instances to distinguish their properties from conventional malware system. The review determines that the correlations of Stuxnet and Stealthy properties of advanced malware are highly correlated to each other. This can help in the prediction of malware attacks as it can lead to better accuracy of data. The API calls of malware has been analyzed over five separate datasets and obtained the accuracy over different measurement metrics. The highest correlation of 0.829 was achieved between the above two features. The linear and polynomial regression methods were found to be less useful. Then Random Forest Regression was analyzed which gave us better accuracy scores over the other two models.

## References

1. XingFang, MaochaoXu, ShouhuaiXu andPengZhao. *A deep learning framework for predicting cyber-attacks rates*, 2019 Springer etal. EURASIP Journal on Information Security.
2. Serif Bahtiyar, Mehmet Bari, s YamanI, Can Yılmaz Altini~ gneI *A multi-dimensional machine learning approach to predict advanced malware*, 2019, Science Direct Transactions.
3. Athor Subroto and Andri Apriyana *Cyber risk prediction through social media big data analytics and statistical machine learning*, 2019, Springer Journal.
4. Zhenxin Zhan, Maochao Xu, and Shouhuai Xu *Predicting Cyber Attack Rates with Extreme Values*, 2015 IEEE Transations.
5. George Onoh *Predicting Cyber-Attacks Using Publicly Available Data*, 2018 Researchgate Journal.
6. Baatarsuren Munkhdorj and Sekiya Yuji, *Cyber-attack prediction using social data analysis*, 2017, Semantic Scholar Transaction.
7. Mohamed Abdlhamed, Kashif Kifayat, Qi Shi, and William Hurst *Intrusion Prediction Systems*, 2016, Springer Transactions.



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