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## Software & Data Engineering

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Discovering Thoughts, Inventing Future

VOLUME 18 ISSUE 1 VERSION 1.0



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# Employee's Performance Analysis and Prediction using K-Means Clustering & Decision Tree Algorithm

By Ananya Sarker, S.M. Shamim, Dr. Md. Shahiduz Zama  
& Md. Mustafizur Rahman

*Mawlana Bhashani Science and Technology University*

**Abstract-** Employee is the key element of the organization. The success or failure of an organization depends on the employee performance. Hybrid procedure based on Data Clustering and Decision Tree of Data mining method may be used by the authority to predict the employees' performance for the next year. This paper presents how data clustering method can be applied for evaluating the employee's performance as well in decision making process. Different performance evaluation factors like personality, punctuality, tact oral expression etc has been studied. The result of this paper predicts the number of employee those are selected for promotion or designation and discharged according to their performance. This study help to find out the inefficient employee, magnitude of inefficiency and aids to eliminate inefficiencies with a relatively easy to employ framework.

**Keywords:** data clustering, data mining, decision tree, employee's performance, prediction.

**GJCST-C Classification:** I.5.3, H.3.3



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# Employee's Performance Analysis and Prediction using K-Means Clustering & Decision Tree Algorithm

Ananya Sarker <sup>α</sup>, S.M. Shamim <sup>σ</sup>, Dr. Md. Shahiduz Zama <sup>ρ</sup> & Md. Mustafizur Rahman <sup>ω</sup>

**Abstract-** Employee is the key element of the organization. The success or failure of an organization depends on the employee performance. Hybrid procedure based on Data Clustering and Decision Tree of Data mining method may be used by the authority to predict the employees' performance for the next year. This paper presents how data clustering method can be applied for evaluating the employee's performance as well in decision making process. Different performance evaluation factors like personality, punctuality, tact oral expression etc has been studied. The result of this paper predicts the number of employee those are selected for promotion or designation and discharged according to their performance. This study help to find out the inefficient employee, magnitude of inefficiency and aids to eliminate inefficiencies with a relatively easy to employ framework.

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## I. INTRODUCTION

Most of the organizations or companies have a formal performance evaluation system in which employee job performance is graded on a regular basis, usually once or twice a year. A good performance evaluation system can prominently benefit an organization. It helps employee behavior toward organizational aims by permitting employees know what is expected for them, and it yields information for making employment decisions, such as those regarding pay raises, promotion or releases. Developing and implementing an effective system is no easy task [1]. An Employee can improve their performance by way of monitoring the progression of their performance [2]. Machine learning algorithms i.e. clustering algorithm and decision tree of data mining technique can be used to find out the key characteristics of future prediction of an organization. Clustering is a method to group data into classes with identical characteristics in which the similarity of intra-class is maximized or minimized [3]. This method is most widely used procedure for future prediction.

The main objective of this paper isto partition Employees into homogeneous group according to their characteristics and abilities using clustering. This study

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makes use of cluster analysis to segment employees in to groups according to their performance. Decision tree has been used for making meaningful decision for the Employee. Based on the employee's performance results possible to take decision whether advanced training, talent enrichment or further qualification required or not. These applications also help administrative staff to enhance the quality of the organizations.

The structure of this paper is as follows. Section 2, the technical background described. In Section 3, Test Bed Setup has been explained. Section 4, evaluates the results after the experiment. Section 5, concludes the paper with future work.

## II. BACKGROUND

Data Clustering is unsupervised and arithmetic data analysis procedure. Cluster analysis is used to segment a large set of data into subsets called clusters. Each cluster is a collection of data objects that are similar to one another place within the same cluster but are dissimilar to objects place other clusters. It is used to classify the same data into a homogeneous group. It's also used to operate on a large data-set to discover hidden pattern and relationship which helps to make decision quickly and efficiently. Data clustering and decision tree algorithm [4] has been used to evaluate the employee performance. Firstly, apply K-means clustering for separating Employees performance into four clusters which is Excellent, Good, Average and Poor according their Performance. Then apply Decision tree Algorithm for predicting next year Performance.

### a) K-Means Clustering

K-means clustering [5] is a type of unsupervised learning, which is used in unlabeled data (i.e., data without defined categories or groups). The goal of this algorithm is to find groups in the data, with the number of groups represented by the variable K. The algorithm works iteratively to assign each data point to one of K groups based on the features that are provided. Data points are clustered based on feature similarity.

K-Means clustering intends to partition n objects into k clusters in which each object belongs to the cluster with the nearest mean. This method

produces exactly  $k$  different clusters of greatest possible distinction. The best number of clusters  $k$  leading to the greatest separation (distance) is not known as a priori and must be computed from the data. The objective of K-Means clustering is to minimize total intra-cluster variance, or, the squared error function. Given a set of data or documents  $(x_1, x_2, \dots, x_i)$ , where each data point is an  $M$ -dimensional real vector, the objective of the algorithm is to partition  $n$  documents into  $k$  clusters ( $k \leq n$ ) with minimizing an objective function, which may be expressed as,

$$J = \sum_{j=1}^k \sum_{i=1}^n ||x_i^j - c_j||^2$$

Where  $J$  is the object function,  $k$  number of cluster,  $n$  number of cases, and  $||x_i^j - c_j||^2$  is a chosen distance measure between a data point  $x_i^j$  and the cluster center  $c_j$ , [6, 7]. The algorithm and flow-chart of K-means clustering is given below.

**Step 1:** Accept the number of clusters to group data into and the dataset to cluster as input values

**Step 2:** Initialize the first  $K$  clusters

- Take first  $k$  instances or
- Take Random sampling of  $k$  elements

**Step 3:** Calculate the arithmetic means of each cluster formed in the dataset.

**Step 4:** K-means assigns each record in the dataset to only one of the initial clusters.

**Step 5:** K-means re-assigns each record in the dataset to the most similar cluster and re-calculates the arithmetic mean of all the clusters in the dataset.

The flow chart of the k-means algorithm is given below.

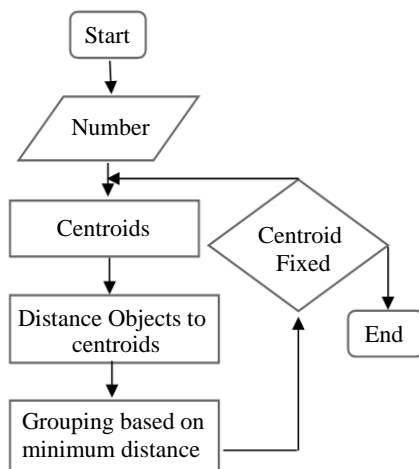


Fig. 1: Flowchart of K-Means Clustering

b) **Decision Tree**

Data mining [8] consists a set of techniques that can be used to extract relevant and interesting knowledge from data. It has several tasks such as

association rule mining, classification and prediction and clustering. All classification methods are supervised learning techniques that classify data item into predefined class label. It is one of the most useful techniques in data mining to build classification models from an input data set. The used classification techniques commonly build prototypes that are used to guess future data developments. The basic algorithm for decision tree induction is a greedy algorithm that constructs decision trees in a top-down recursive divide-and-conquer manner [9].

Decision Tree generates a decision tree from the given training data. It is one of the most used techniques, since it creates the decision tree from the data given using simple equations depending mainly on calculation of the gain ratio, which gives automatically some sort of weights to attributes used, and the researcher can implicitly recognize the most effective attributes on the predicted target. As a result of this technique, a decision tree would be built with classification rules generated from it. Here Decision tree is used for predict Employee Performance.

III. **TEST BED SETUP**

Employee evaluations are an important part of maintaining a motivated and skilled workforce. Every company maintains a confidential report form for measuring the quality of an employee throughout the year. The assessment is comparison with other stead of the same grade, should be recorded by putting their initials in the appropriate. For experiment confidential form has been used which are nineteen categories. These are Intelligence & Mental alertness, Initiative & Drive, Oral Expression, Written Expression, Ability to plan & organize work, Ability to supervise work, Quality of Work, Perseverance & Devotion to duty, Capacity to guide & train subordinates, Attitude towards superiors, Ability to work with others, Tact, Moral integrity, General sense of responsibility, Responsibility in financial matters, Personality, Public relations, Punctuality and Observance of security measures. The rating scale is the user input to the organization.

Table 1: Performance Rating Scale

Very good	5
Good	4
Average	3
Below Average	2
Poor	1

#### IV. RESULT AND ANALYSIS

The main objective of this paper is to cluster/group employee according to their performance using K-means clustering and decision tree algorithm.

Four years data have been collected from an organization employee's database which consist 100 samples of data.

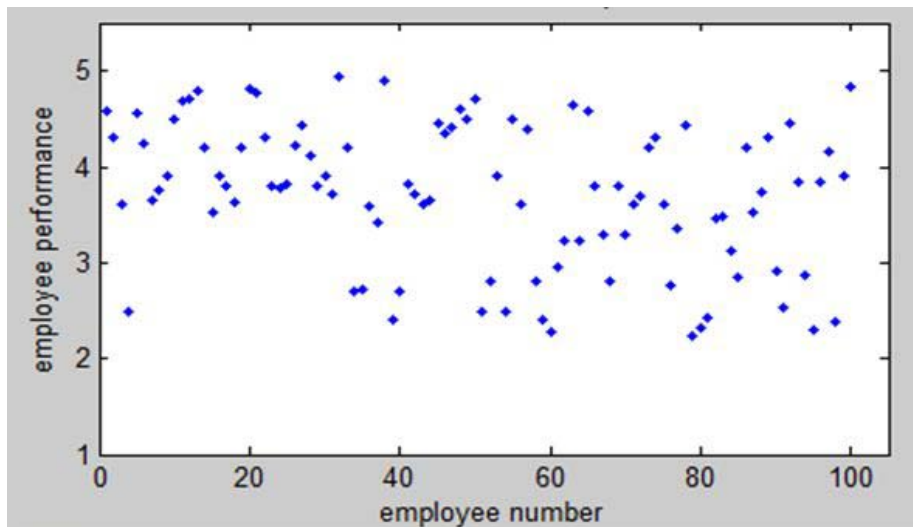


Fig. 2: Data without Clustering

By applying K-means clustering algorithm on the training data four group Excellent, Good, Medium and Poor has created according to employee's previous year performance. Figure 2 shows the initial values

before clustering. One is excellent, second is good, third is average and the last one is poor. Figure 3 shows the 4 cluster such as Excellent, good, medium and poor based on their performance throughout 1<sup>st</sup> year.

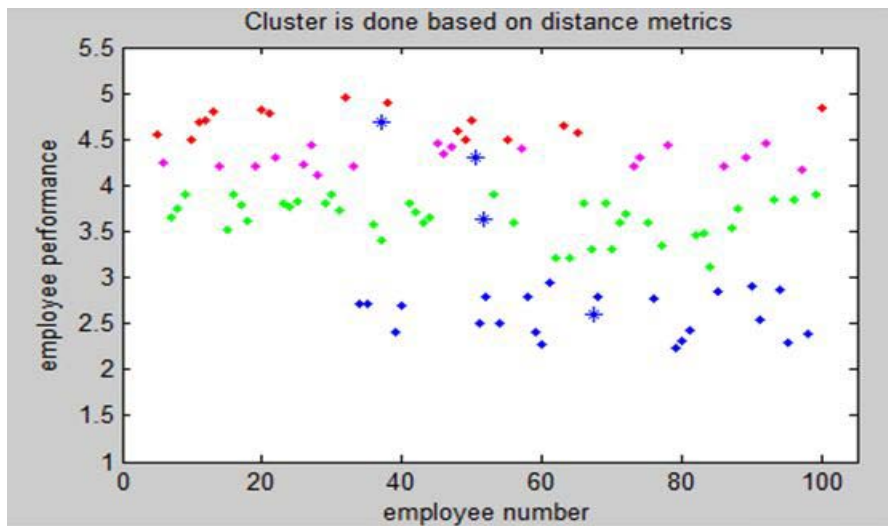


Fig. 3: Clustered Employee into Four Different Regions in 1st Year

Figure 4 shows the clustering result after applying K-Means clustering on 2nd year database of Employee.



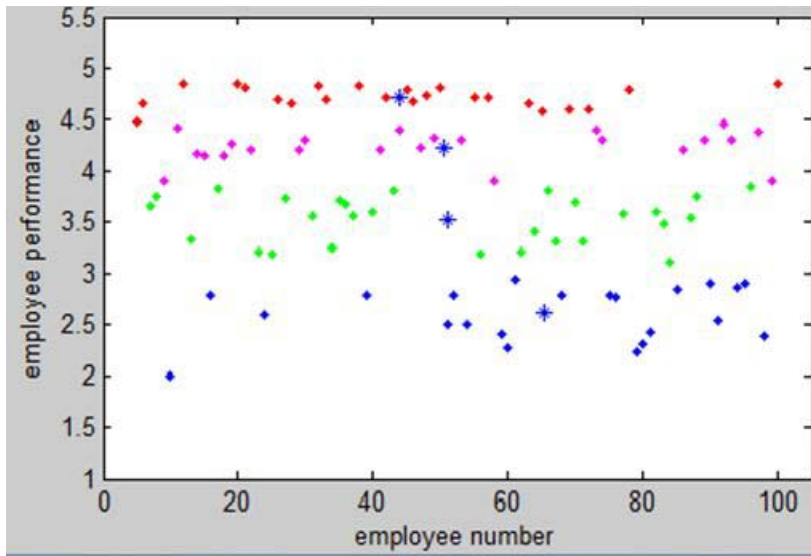


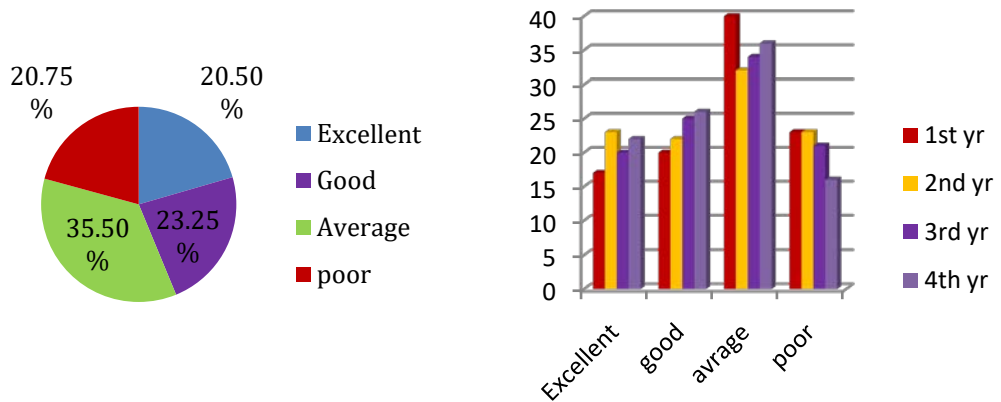
Fig. 4: Cluster Employee into Four Different Regions in 2<sup>nd</sup> Year

In the similar way 3<sup>rd</sup> and 4<sup>th</sup> year performance of 100 employees has been clustered. After clustering calculates the percentage of different cluster around 4 year get the following result.

Table 2: Employee Performance Clustered into 4 Categories

Cluser	Range of Category	No of Employee in different cluster				Percentage
		1 <sup>st</sup> yr	2 <sup>nd</sup> yr	3 <sup>rd</sup> yr	4 <sup>th</sup> yr	
Excellent	Quality >= 4.5	17	23	20	22	20.50%
Good	4.0 <= Quality < 4.5	20	22	25	26	23.25%
Average	3.0 <= Quality < 4.0	40	32	34	36	35.50%
Poor	Quality < 3.0	23	23	21	16	20.75%

Now the Employees four group has been created. One is excellent, second is good, third is average and the last one is poor. Graphical representation of these four categories is given below.



(a). Percentage curve of 4 year Performance (b). Categorical curve of 4 year Performance

Fig. 5: Performance Analysis Graph

Using decision tree algorithms first calculate the entropy from which Information Gain (IG) has to estimate. There are 4 attributes which are 1<sup>st</sup> year, 2<sup>nd</sup> year, 3<sup>rd</sup> year and 4<sup>th</sup> year Performance of Employee. Maximum Information Gain attribute will be the root

node. 1<sup>st</sup> year attribute has highest Information Gain which is the root node and the 4<sup>th</sup> year attribute has the lowest Information Gain. Figure 6 shows the decision tree based on some rules.

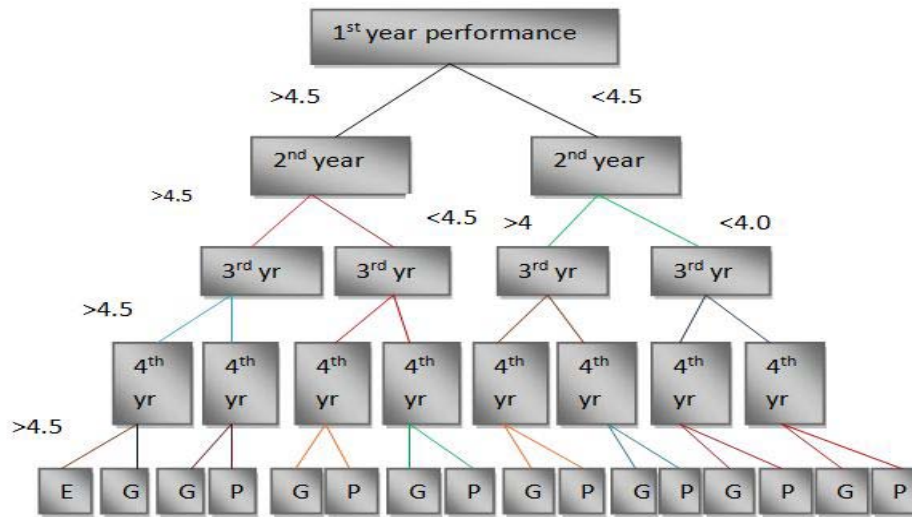


Fig. 6: Decision Tree Based on Rules.

The following rules have been generated after calculating the entropy and information gain:

- If 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> year Performance is greater than 4.5 then the final result Excellent.
- If 1<sup>st</sup> year Performance is greater than 4.5 but 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> year Performance is greater than 4.0 and less than 4.5 then the final result will be good.
- If 1<sup>st</sup> year and 2<sup>nd</sup> year performance is greater than 4.0, but less than 4.5 and 3<sup>rd</sup> year and 4<sup>th</sup> year performance is greater than 3.0, but less than 4.0 then the final result Average.
- If 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> year Performance is less than 3.0 then the final result will be poor.

From the generated rules administrative staff or authorities can easily predict he next year performance. Moreover, from this prediction authority can take necessary steps for the qualified and inexpert Employees. The authority may take the following action based on the performance-

- If the Employee is excellent then he/she will get the opportunity of promotion.
- If the Employee's Performance is good he/she need not to take special care but involved themselves with some development activities.
- If the Employee's Performance is medium he/she need some training and try to understand the weak area of him/her, then always prepared for improving themselves.
- If the Employee's Performance is Poor he/she will be selected for expulsion.

Several rules have been created based on four year performance of an organization's employee. If

generated rules apply to predict 5<sup>th</sup> year performance based on previous years, prediction result will be nearly closed to the actual performance.

## V. CONCLUSIONS

This paper presents an overview of k-means clustering algorithm and decision tree algorithm. K-means clustering algorithm is a common way to define classes of jobs. Here we apply K-means clustering algorithm for partitioning Employee into different cluster based on their quality of Performance. We use decision tree algorithm for classify Employee easily and take appropriate decision quickly. Several actions can be taken in this circumstance to avoid any danger related to hiring poorly performed employee. Future work involves more proper data from several companies. When the appropriate model is generated, these algorithms could be developed for predicting performance of employees in any kind of organization.

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## Monitoring Unscheduled Leaves using IVR

By Syed Usman Ahmed

*Aligarh Muslim University*

**Abstract-** Leaves are inherent part of a work and employees do take leaves at some point of this work life. Different types of leaves are provided by various employers in India. Some leaves are more informal in nature (also called as unscheduled leaves) compared to formal type of leaves (also called as scheduled leaves), one such unscheduled type of leave is Causal Leave (CL). These leaves are availed by employees in case some causality occurs with him/her or in his/her known ones. As the nature of CL is more of informal, it is believed that employee can take it as and when required and inform the authorities when he/she resumes his/her work. Currently most of the leave applications available are either in form of proforma (paper based) or web-based (online system). Many employees at the time of taking CL do not have both this options available, so even if they wish to inform about their leaves they have no mechanism to do so. Through this paper, we will to explore Interactive Voice Response (IVR) based Leave Management wherein we can provided a third option by high he/she can register his/her CL in his/her organization.

**Keywords:** *unscheduled leaves, interactive voice response system, DTMF, casual leaves.*

**GJCST-C Classification:** *H.5.2, B.4.2*



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Syed Usman Ahmed

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## I. INTRODUCTION

Interactive Voice Response (IVR) systems began to appear in various organization in early 1990's and subsequently by various refinements in both telephone and computer based technology it has expanded its range of traditional fax and e-mail based applications that were used across that the organizations.

IVR based systems today, covers various features like speech recognition, Voice over IP telephony and IVR-Web host integration etc. In this paper we have discussed a possibility of using IVR for managing a special type of informal leave, causal leave, in an organization efficiently. Skilled class employee in any organization is more comfortable in handling phones and it is easy and cost effective to integrate the exiting telephone network with Automatic Speech Recognition (ASR) system or Interactive Voice Response (IVR) systems.

This paper studies various ways in which IVR can be implemented in efficient and effective way to benefit peoples in their day to day works. Also it proposes a mechanism that can be used in various offices and department in order to apply for unscheduled leaves like CL or Sick Leave and validate the request, so that an employee even with a minimum knowledge of operating a phone can avail his/her

informal leaves at the same time his application is officially recorded for future analysis.

## II. RELATED WORK

Interactive Voice Response (IVR) systems can be implemented with three different types of inputs, namely: simply digit recognition, simple command recognition and as full sentence recognition inputs. Dual-Tone Multi-Frequency (DTMF) is a touch tone technology used in pushed button telephone systems. In case of simple digit recognition system, we capture and recognize only digit from one to nine, whereas simple command can capture some basic but discrete commands like "yes", "no", "next" etc. Implementing a full sentence system is more complex than the two types mentioned earlier, as it involves capturing continues input rather than discrete input. The DTMF input system can be implemented in simple digit and simple command recognition system [1].

The query based system [2] developed at IIT Guwahati enables users to access the latest price of the commodity by calling the system using a landline/mobile phone. It implements a Spoken Query (SQ) system which consist of IVR and ASR modules which was developed using open source resources.

As per Madelaine Plauché et al [3] speeches driven approach have been suggested as a key universal access in countries like India, where two-thirds of the 870 millions illiterates in the world today are found. Unlike traditional speech technology techniques their design addresses the problem of multilingualism, literacy and linguistic variation. J. Sherwani et al [4] presents a prototype for speech-based health information access, for community health workers in a rural health sector. Their design consists of a VoIP interface and a Microsoft Speech Server.

A comparative study of use of speech and DTMF keypad for navigation was done by Kwan M. Lee et al [5]. Their results indicate that DTMF is more effective and efficient for linear task whereas speech is better for non-linear task. DTMF is advantageous as it is instantaneous and 100% accurate, however the other side of DTMF is that it is severely constrained. Speech input on the other hand is highly unconstrained but often misrecognized.

Delogu et al. (1998), compared the use of simple speech input and DTMF and found no difference in terms of task completion time and the number of turns per task when comparing DTMF input for an IVR

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system with the three aforesaid types of speech inputs. Foster et al. (1998) also carried out a similar study that showed that user prefer connected word (CW) speech input (in a CW-based system, users say a string of words after a system prompt, without any pause required between the words) and DTMF input system to an isolated word (IW) speech input system (in a IW-based system, user say one word after a system prompt).

### III. PROPOSED APPROACH

Most of the organization across India, categorizes unscheduled leaves from the work that is not requested or approved in advance. Unscheduled leave could contribute to increased compensation expenses by requiring management to increase work-hours and overtime hours [6].

In this paper we propose a method by which we can monitor unscheduled leaves that could potentially affect productivity, efficiency, costs and employee morale.

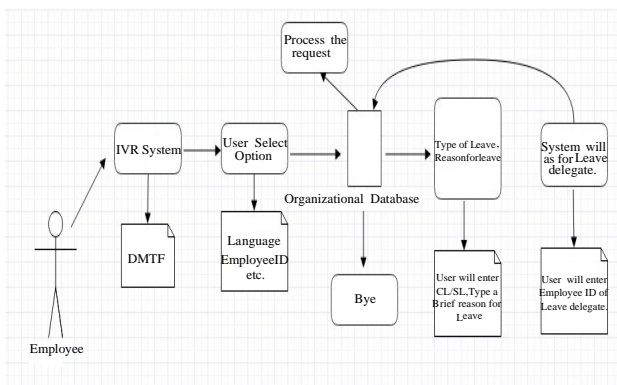


Figure 1: Flow Graph for the Proposed System

The proposed system is shown in Figure 1 above. As per the figure:

1. An employee of the organization will have to call the IVR system on a designated number provided by the organization.
2. With the help of DTMF, he will select the options as Language and type of employee (e.g. permanent, temporary, adhoc etc.).
3. The employee will enter his/her employee identification number.
4. Once the employee will enter his/her employee identification number, the organizational database will be searched for his validity.
5. If not found valid, the system will exit.
6. Else, the system will ask for type of leave and reason for leave.
7. As this is an unscheduled leave and it may hamper the work, the system will ask for entering a leave delegate employee identification number who can work in his/her absence.

8. The system will again check the database for validity of leave delegate and if found fit will process the request and store the request in the organization database. Else, process step 5.

The pre-requisite for the aforesaid method is a pre-populated database with employee identification numbers. This method will lead to the following types of matrices.

- a) No. of unscheduled leaves availed vs scheduled leaves availed by an employee.
- b) Cost vs productivity of the employee.
- c) Employee morale in case of scheduled vs unscheduled leaves.
- d) Efficiency of an employee.

Based on these matrices, we can calculate the variances in the process of unscheduled leaves and streamline the process accordingly to increase the efficiency, productivity and reduce the cost incurred due to unscheduled leaves.

### IV. CONCLUSION

The proposed system will automate the process of unscheduled leaves application by using IVR. It will not only help organization with capturing data for future analysis but also will greater efficiency lots employees who cannot fill leave application or use web based application can use the IVR system.

This system can be enhanced in future to incorporate simple word or IW-based IVR system or CW-based IVR system. Moreover, once we have all three systems in place we can do a comparative study and analyze the efficiency of these systems in any organization.

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# Performance Analysis of Different Openflow based Controller Over Software Defined Networking

By Sm Shamim, Shahadat Shisir, Ahosanul Hasan, Mehedi Hasan  
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**Abstract-** Software Defined Networking (SDN) is a new networking paradigm where control plane is separated from data plane. Over the past several years, SDN has emerged as a compelling paradigm for developing and deploying new network capabilities and services. OpenFlow is the most commonly deployed Software Defined Networking architecture. Multiple networking switches can be controlled by a single centralized controlled OpenFlow controller. Different Python and Java based OpenFlow controller are available for Software Defined Networking. This paper implements Ryu, POX and Pyretic OpenFlow based Python controller in tree networking topology over Software Defined Networking. The result of this paper shows that these Python based OpenFlow controller performs well over SDN. All the implementation of different controller has been done using Mininet Emulator.

**Keywords:** *software-defined networking; openflow; mininet emulator; openflow controller; network topology.*

**GJCST-C Classification:** C.2.6



PERFORMANCEANALYSISOFDIFFERENTOPENFLOWBASEDCONTROLLEROVERSOFTWAREDEFINEDNETWORKING

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# Performance Analysis of Different Openflow based Controller Over Software Defined Networking

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**Abstract-** Software Defined Networking (SDN) is a new networking paradigm where control plane is separated from data plane. Over the past several years, SDN has emerged as a compelling paradigm for developing and deploying new network capabilities and services. OpenFlow is the most commonly deployed Software Defined Networking architecture. Multiple networking switches can be controlled by a single centralized controlled OpenFlow controller. Different Python and Java based OpenFlow controller are available for Software Defined Networking. This paper implements Ryu, POX and Pyretic OpenFlow based Python controller in tree networking topology over Software Defined Networking. The result of this paper shows that these Python based OpenFlow controller performs well over SDN. All the implementation of different controller has been done using Mininet Emulator. The result of this paper also shows Pyretic controller has an excellent performance over Software Defined Networking compare to POX and Ryu Controller.

**Keywords:** software-defined networking; openflow; mininet emulator; openflow controller; network topology.

## I. INTRODUCTION

Software-defined Networking [1, 2, 3] (SDN) has emerged as a new paradigm of networking that enables network operators, vendors, and even third parties to innovate and create new capabilities at a faster pace. This SDN paradigm shows potential for all domains of users. SDN played an important role in increasing the capabilities of traditional networking system [4]. Software-Defined Networking (SDN) has recently gained an unprecedented attention from industry and research communities. SDN provides us a simplified network management by enabling network automation, fostering innovation through programmability. Different types of controller in SDN technology are being used for observing the performance of networking system.

SDN provides some great features that allow the network providers and administrators to act as fast as possible to access, interchange and update any system easily [5]. It consists of decoupling the control

and data planes of a network. It relies on the fact that the simplest function of a switch is to forward packets according to a set of rules. However, the rules followed by the switch to forward packets are managed by a software-based controller. One motivation of SDN is to perform network tasks that could not be done without additional software for each of the switching elements [6]. It allows abstracting the underlying infrastructure and program and open flow of data into the network by separating the control plane and the data plane. It has been gaining a great popularity both in the research communication & industry. Most network operators and owners are actively exploring SDN. For example, Google has switched over to Open Flow and SDN for its inter-datacenter network [7]. Different types of controller in SDN technology are being used for observing the performance of networking system. This paper analyzes performance of different OpenFlow based controllers in Software Defined Networking.

The structure of this paper is as follows. Section II, the research methodology is described. In Section III, proposed model Test Bed Setup is illustrated. Section IV, evaluates the results after the experiment. Section V; conclude the paper with future work.

## II. RESEARCH METHODOLOGY

A literature review is performed to find out details about the routing algorithm over Software Defined Networking. After studying required software tools and hardware equipment are selected for implementing the different controller. Then software tools have been selected for the experiment. After then a preliminary experiment setup is designed which include the hardware setup and software configurations. Various software tools have been performed among OFNet [8], Maxinet [9], EstiNet [10], NS-3 [11], OMNET++ [12] and Mininet [13, 14]. Above discussion appears that for simulating Software Defined Networking open source networking Simulator Mininet has good potential.

Mininet is the most widely used open source networking Simulator. It can construct a vast network with the collection of networking elements such as switches, end-hosts, routers based on Linux kernel. Complicated network topology can be designed to virtualizes using Mininet. Most popular examples for

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developing SDN controller are Open Daylight, NOX, POX, Floodlight, and Beacon, Ryu and Pyretic. Ryu Controller is an open, software-defined networking (SDN) Controller designed to increase the agility of the network by making it easy to manage and adapt how traffic is handled. Pyretic controller is Python based controller that works on the control layer of SDN. Controllers are distinct from the switches in SDN. This separation of the control from the forwarding allows more sophisticated traffic management. OpenFlow communication protocol gives access to the forwarding plane of a network switch or router over the network.

### III. TEST BED SETUP

All the simulation has been done over Software Defined Networking using Mininet Emulator. In order to simulate tree networking topology has been used which shows on Figure-1. Mininet creates virtual hosts by using a process-based virtualization method and the network namespace mechanism, which is a feature supported since Linux version 2.2.26, to separate network interfaces, routing tables, and ARP tables of different virtual hosts.

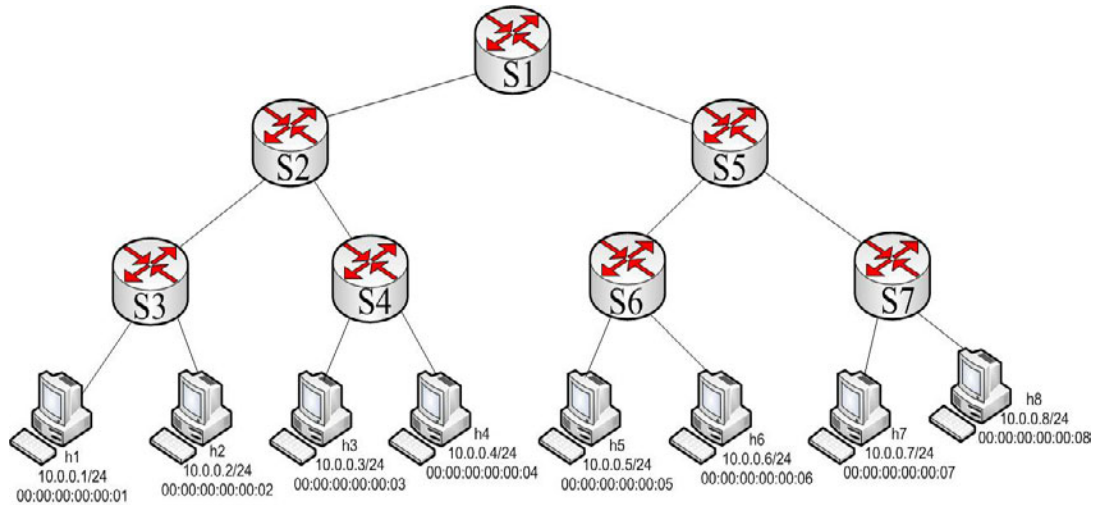


Fig. 1: Designed Network Topology

Designed tree networking topology consists of seven OpenFlow switch and eight hosts where two hosts is connected each of the switch. Host h1, h2 is connected to switch S1 and host h3, h4 is connected to switch S2. In addition, host h4, h5 is connected to switch S3 and host h5, h6 connected with switch S4.

Networking. Firstly, Ryu controller has been implemented in designed tree network topology. In the designed network topology Ping executed from host h1 to host h5 and host h4 to host h8. Figure 2 shows the corresponding Ping result with statistics.

### IV. RESULT AND ANALYSIS

Different Python based OpenFlow controller has been implemented separately over Software Defined

```

Node: h1
root@sdnhubvm:~# ping -c7 10.0.0.5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data:
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=0.284 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=0.142 ms
64 bytes from 10.0.0.5: icmp_seq=3 ttl=64 time=0.139 ms
64 bytes from 10.0.0.5: icmp_seq=4 ttl=64 time=0.187 ms
64 bytes from 10.0.0.5: icmp_seq=5 ttl=64 time=0.141 ms
64 bytes from 10.0.0.5: icmp_seq=6 ttl=64 time=0.145 ms
64 bytes from 10.0.0.5: icmp_seq=7 ttl=64 time=0.187 ms

--- 10.0.0.5 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6013ms
rtt min/avg/max/mdev = 0.139/0.175/0.284/0.048 ms
root@sdnhubvm:~#
    
```

(a) Ping Message from h1 to h15

```

Node: h4
root@sdnhubvm:~# ping -c7 10.0.0.8
PING 10.0.0.8 (10.0.0.8) 56(84) bytes of data:
64 bytes from 10.0.0.8: icmp_seq=1 ttl=64 time=0.215 ms
64 bytes from 10.0.0.8: icmp_seq=2 ttl=64 time=0.172 ms
64 bytes from 10.0.0.8: icmp_seq=3 ttl=64 time=0.230 ms
64 bytes from 10.0.0.8: icmp_seq=4 ttl=64 time=0.187 ms
64 bytes from 10.0.0.8: icmp_seq=5 ttl=64 time=0.145 ms
64 bytes from 10.0.0.8: icmp_seq=6 ttl=64 time=0.144 ms
64 bytes from 10.0.0.8: icmp_seq=7 ttl=64 time=0.146 ms

--- 10.0.0.8 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6001ms
rtt min/avg/max/mdev = 0.144/0.177/0.230/0.032 ms
root@sdnhubvm:~#
    
```

(b) Ping Message from h4 to h8

Fig. 2: Ping Test Result for OpenFlow Controller

Secondly, OpenFlow POX controller performance has been implemented. For the designed network topology two Ping have been performed from

host h1 to host h5 and host h4 to host h8. The obtained result has been shown in Figure 3 with Ping statistics.

```

root@sdnhubvm:~# ping -c7 10.0.0.5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data:
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=0.192 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=0.155 ms
64 bytes from 10.0.0.5: icmp_seq=3 ttl=64 time=0.201 ms
64 bytes from 10.0.0.5: icmp_seq=4 ttl=64 time=0.205 ms
64 bytes from 10.0.0.5: icmp_seq=5 ttl=64 time=0.143 ms
64 bytes from 10.0.0.5: icmp_seq=6 ttl=64 time=0.158 ms
64 bytes from 10.0.0.5: icmp_seq=7 ttl=64 time=0.153 ms

--- 10.0.0.5 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6006ms
rtt min/avg/max/mdev = 0.143/0.172/0.205/0.026 ms
root@sdnhubvm:~#
    
```

(a) Ping Message from h1 to h5

```

root@sdnhubvm:~# ping -c7 10.0.0.8
PING 10.0.0.8 (10.0.0.8) 56(84) bytes of data:
64 bytes from 10.0.0.8: icmp_seq=1 ttl=64 time=0.191 ms
64 bytes from 10.0.0.8: icmp_seq=2 ttl=64 time=0.197 ms
64 bytes from 10.0.0.8: icmp_seq=3 ttl=64 time=0.197 ms
64 bytes from 10.0.0.8: icmp_seq=4 ttl=64 time=0.147 ms
64 bytes from 10.0.0.8: icmp_seq=5 ttl=64 time=0.195 ms
64 bytes from 10.0.0.8: icmp_seq=6 ttl=64 time=0.145 ms
64 bytes from 10.0.0.8: icmp_seq=7 ttl=64 time=0.227 ms

--- 10.0.0.8 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6003ms
rtt min/avg/max/mdev = 0.145/0.185/0.227/0.030 ms
root@sdnhubvm:~#
    
```

(b) Ping Message from h4 to h8

Fig. 3: Ping Test Result for OpenFlow POX Controller

Finally, OpenFlow based controller Pyretic have been implemented over Software Defined Networking using Mininet Emulator. Similarly in previous two Ping message has been executed from host h1 to host h5

and host h5 to host h8. The result obtained for Pyretic controller has been shown in Figure 4 with Ping statistics.

```

root@sdnhubvm:~# ping -c7 10.0.0.5
PING 10.0.0.5 (10.0.0.5) 56(84) bytes of data:
64 bytes from 10.0.0.5: icmp_seq=1 ttl=64 time=0.191 ms
64 bytes from 10.0.0.5: icmp_seq=2 ttl=64 time=0.186 ms
64 bytes from 10.0.0.5: icmp_seq=3 ttl=64 time=0.144 ms
64 bytes from 10.0.0.5: icmp_seq=4 ttl=64 time=0.181 ms
64 bytes from 10.0.0.5: icmp_seq=5 ttl=64 time=0.146 ms
64 bytes from 10.0.0.5: icmp_seq=6 ttl=64 time=0.137 ms
64 bytes from 10.0.0.5: icmp_seq=7 ttl=64 time=0.143 ms

--- 10.0.0.5 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6002ms
rtt min/avg/max/mdev = 0.137/0.161/0.191/0.022 ms
root@sdnhubvm:~#
    
```

(a) Ping Message from h1 to h5

```

root@sdnhubvm:~# ping -c7 10.0.0.8
PING 10.0.0.8 (10.0.0.8) 56(84) bytes of data:
64 bytes from 10.0.0.8: icmp_seq=1 ttl=64 time=0.134 ms
64 bytes from 10.0.0.8: icmp_seq=2 ttl=64 time=0.140 ms
64 bytes from 10.0.0.8: icmp_seq=3 ttl=64 time=0.108 ms
64 bytes from 10.0.0.8: icmp_seq=4 ttl=64 time=0.140 ms
64 bytes from 10.0.0.8: icmp_seq=5 ttl=64 time=0.140 ms
64 bytes from 10.0.0.8: icmp_seq=6 ttl=64 time=0.179 ms
64 bytes from 10.0.0.8: icmp_seq=7 ttl=64 time=0.142 ms

--- 10.0.0.8 ping statistics ---
7 packets transmitted, 7 received, 0% packet loss, time 6004ms
rtt min/avg/max/mdev = 0.108/0.140/0.179/0.022 ms
root@sdnhubvm:~#
    
```

(b) Ping Message from h4 to h8

Fig. 4: Ping Test Result for OpenFlow Pyretic Controller

Each of the OpenFlow based controller perform well over Software Defined Networking. The

performance analysis graph has been drawn for Ping message from host h1 to host h5 in Figure 5.

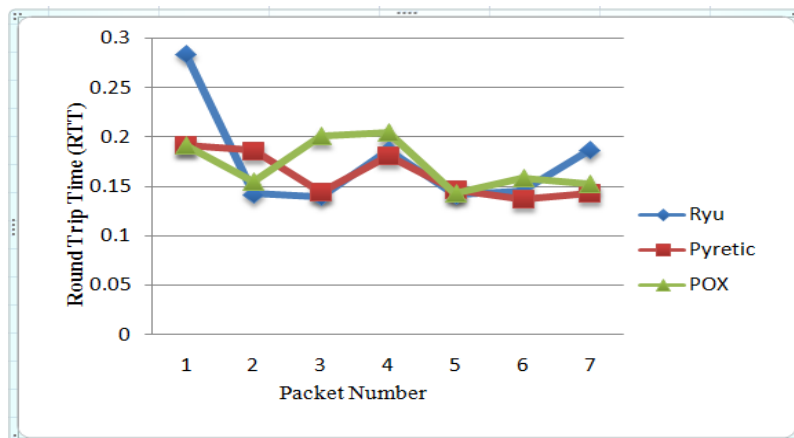


Fig. 5: Performance Analysis Graph while Ping from host h1 to host h5

Round Trip Time (RTT) is the length of time it takes for a signal to be sent plus the length of time it takes for an acknowledgment of that signal to be received. This time delay therefore consists of the propagation times between the two points of a signal. Smallest Round Trip Time is always expected for analyzing networks performance. While Ping from host h1 to host h5 corresponding minimum, maximum and average Round Trip Time for each controller has been shown in table-1.

Table 1

Name of Controller	Minimum RTT (ms)	Maximum RTT (ms)	Average RTT (ms)
Ryu	0.139	0.284	0.175
POX	0.143	0.205	0.172
Pyretic	0.137	0.191	0.161

From table-1, Pyretic controller has smallest minimum RTT 0.137ms, maximum RTT 0.191ms and average RTT 0.161ms. Ryu controller has largest maximum RTT 0.284ms and largest average RTT 0.175ms. Since average RTT larger for Ryu controller compare to other controller, it has the lower performance. Performance analysis graph for Ping Message from host h4 to host h8 is shown in Figure 6.

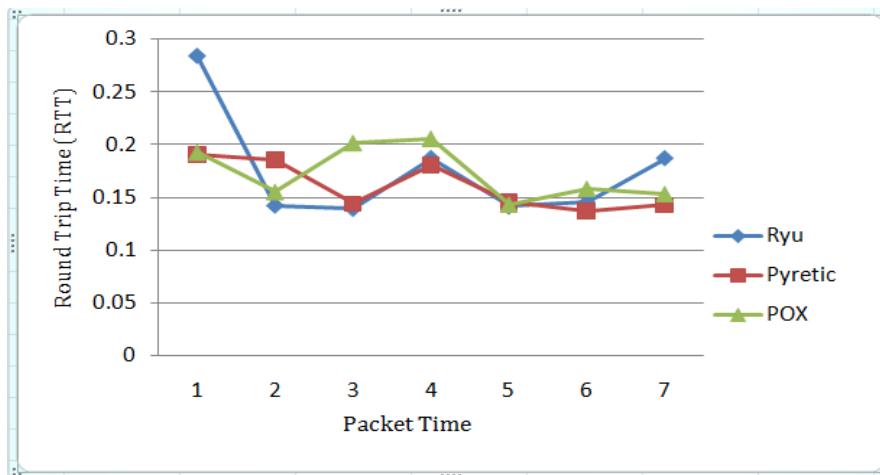


Fig. 6: Performance Analysis Graph while Ping from host h4 to host 8

Table-2 shows the corresponding minimum, maximum and average Round Trip Time for Ping message from host h4 to host h8.

Table 2

Name of Controller	Minimum RTT (ms)	Maximum RTT (ms)	Average RTT (ms)
Ryu	0.144	0.230	0.177
POX	0.145	0.227	0.185
Pyretic	0.108	0.179	0.140

From the table-2, OpenFlow POX controller has largest average RTT 0.185ms and largest minimum RTT 0.145ms while Ping from host h4 to host h8. Among the three OpenFlow based controller, Pyretic controller has smallest minimum RTT 0.108ms, maximum RTT 0.179ms and average RTT 0.140ms. From the network performance analysis graph Figure 4 and Figure 5, Pyretic controller has better performance over Software Defined Networking compare Ryu and POX controller.

## V. CONCLUSIONS

For the Next Generation Networks (NGN) and future internet technologies, Software Defined Networking using OpenFlow protocol will be the most deployed networking architecture. OpenFlow protocols provide standards for routing and delivery of packets on a switch. OpenFlow Controller uses the OpenFlow protocol to connect and configure the network devices in order to determine the best path for application traffic. In this paper, several OpenFlow based controller has been implemented separately over Software Defined Networking. All the evaluation has been done using Mininet Emulator. The result of this paper shows Pyretic controller shows better performance over Software Defined Networking compare to Ryu and POX controller. Future works involves performance analysis of different OpenFlow based controller over Software Defined Wireless Networks (SDWN).



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# Analysis of Heart Disease using in Data Mining Tools Orange and Weka

By Sarangam Kodati & Dr. R. Vivekanandam

*Sri Satya Sai University*

**Abstract-** Health care is an inevitable task to be done in human life. Health concern business has become a notable field in the wide spread area of medical science. Health care industry contains large amount of data and hidden information. Effective decisions are made with this hidden information by applying patient; however, with data mining these tests could be reduced. But there is a lack of analyzing tool according to provide effective test outcomes together with the hidden information, so and such system is developed using data mining algorithms for classifying the data and to detect the heart diseases. Data mining acts so a solution by many healthcare problems. Naïve Bayes, SVM, Random Forest, KNN algorithm is one such data mining method which serves with the diagnosis regarding heart diseases patient. This paper analyzes few parameters and predicts heart diseases, thereby suggests a heart diseases prediction system (HDPS) based total on the data mining approaches.

**Keywords:** data mining, weka, orange, heart disease, data mining classification techniques.

**GJCST-C Classification:** J.3



*Strictly as per the compliance and regulations of:*



# Analysis of Heart Disease using in Data Mining Tools Orange and Weka

Sarangam Kodati <sup>α</sup> & Dr. R. Vivekanandam <sup>σ</sup>

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**Keywords:** data mining, weka, orange, heart disease, data mining classification techniques.

## I. DATA MINING

Data mining is concerned together with the method of computationally extracting unknown knowledge from vast sets of data. Extraction of useful knowledge from the enormous data sets and providing decision-making results for the diagnosis or remedy of diseases is very important. Data mining can stand used to extract knowledge by analyzing and predicting some diseases. Health care data mining has a large potential according to discover the hidden patterns among the data sets about the medical domain. Various data mining methods are available with their suitability dependent on the healthcare data. Data mining applications in health care can have a wonderful potential and effectiveness. It automates the process of finding predictive information in large databases. Disease prediction plays an important role in data mining. Finding of heart disease requires the performance of some tests on the patient. However, use of data mining techniques can reduce the number of tests. This reduced test set plays a significant role in performance and time. Health care data mining is an important task because it allows doctors to see which attributes are more important for diagnosis such as age,

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weight, symptoms, etc. This will help the doctors diagnose the disease more efficiently. Knowledge discovery in databases is the method of finding useful information and patterns into data. Knowledge discovery within databases can be do using data mining. It makes use of algorithms after extract the information and patterns derived by the knowledge discovery in databases process. Various stages of knowledge discovery in databases process are highlighted in Fig.1.

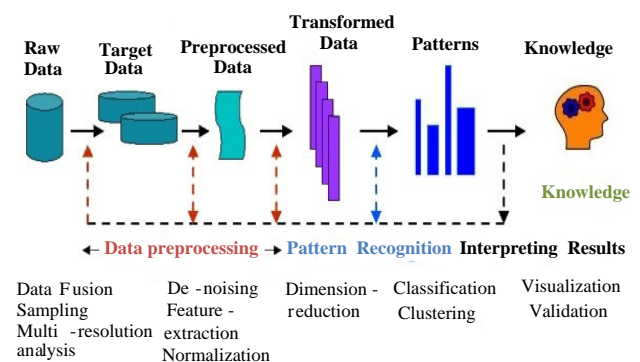


Fig. 1: KDD Process

Various stages concerning knowledge discovery of databases method are described as follows. In Selection stage, that obtains the different data resources. In preprocessing stage, it removed the unwanted missing and noisy data and furnished the clean data which execute format in accordance including a common format of transform stage. Then data mining techniques are applied according to get desired output. Finally into the between the signification stage, that will present the result after end user in a meaningful manner.

## II. DATA MINING TECHNIQUES

The most frequently used Data Mining techniques are specified below:

- Classification learning:** The learning algorithm takes a set of classified examples (training set) and uses it for training the algorithms. With the trained algorithms, classification of the test data takes place based over the patterns and rules extracted from the training set.
- Numeric predication:** This is a variant of classification learning with the exception that

instead of predicting the discrete class the outcome is a numeric value.

- c) *Association rule mining*: The association and patterns between the some attributes are extracted or from its attributes, rules are created. The rules and patterns are used predicting the categories or classification of the test data.
- d) *Clustering*: The grouping of similar instances into clusters takes place. The challenges or drawbacks considering this type of machine learning is that we have according to first identify clusters and assign a new instance according to these clusters[8].

Out of this four types of learning methods, we need to identify the algorithm as performs better. The application of data mining methods depends on the types of data which is fitted to be used in the techniques, or solving data mining troubles depend on the types of data to stand used and the selection about data mining technique which is most suitable for the data used.

### III. MACHINE LEARNING

Machine learning (ML), employed as like a method in data science, is the process of programming computers after learning from past experiences (Mitchell, 1997). Machine Learning seeks to develop algorithms to that amount learn out of data directly with little or no human intervention. Machine Learning algorithms perform a range of tasks such so like prediction, classification, or decision making. Machine Learning stems from artificial intelligence research and has become an essential aspect of data science. Machine learning begins with input so a training data set. In this phase, the Machine Learning algorithm employs the training dataset after learning from the data and structure patterns. The learning phase outputs a model so much is used by way of the testing phase. The testing phase employs any other dataset, applies the model from the training phase, and results are presented for analysis. The overall performance regarding the test dataset demonstrates the model's ability in conformity with performing its task against data. Machine learning extends beyond a statically coded set regarding statements into statements, so a lot are dynamically generated based as regards the input data.

### IV. OPEN SOURCE SOFTWARES

Open source has, in the minds regarding many, come to be synonymous with free software (Walters, 2007). Open source software is software where the development then the source code are made publically available and designed after denying everyone the right according to exploit the software (Laurent, 2004). Open source general refers in conformity with the source code concerning the application being freely and openly

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### V. HEART DISEASES

The highest mortality in both India and abroad is due to heart disease. So it is vital time to check this death toll by correctly identifying the disease between initial stage. The matter becomes a headache for all medical doctors both in India and abroad. Nowadays doctors are adopting many scientific technologies and methodology for both identifications or diagnosing not only the common disease but also many fatal diseases. The successful treatment is continually attributed to right and accurate diagnosis. Doctors may also sometimes fail to take accurate decisions while diagnosing the heart disease about a patient, therefore heart disease prediction systems which use machine learning algorithms assist in such cases to get accurate results [1].

### VI. HEART DISEASE DATASET

The dataset used for this work is from UCI Machine Learning repository from which the Cleveland heart disease dataset is used. The dataset has 303 instance and 76 attributes. However, only 14 attributes are used of this paper. These 14 attributes are the consider factors for the heart disease prediction [8]. Even though it has 303 instances as only 297 are completed and the remaining rows contained missing values and removed out of the experiment.

### VII. OVERVIEW OF DATA MINING TOOLS

Data mining has a wide number of applications ranging from marketing and advertising about goods, functions and products, artificial intelligence research, biological sciences, crime investigations to high-level government intelligence. Due to its widespread usage and complexity involved in building information mining applications, a vast number of Data mining tools hold been developed over decades. Every tool has its advantages and disadvantages. [6] Within data mining, there is a group of tools that have been developed by a research community and data analysis enthusiasts; he are provided free of the price using one on the existing open-source licenses. An open-source development model means that the tool is a result of a community effort, not necessarily supported by a single

organization but alternatively the result regarding contributions from an international and informal development team. This development style affords a means on incorporating the various experiences Data boring gives many excavation techniques according to extract data from databases. Data mining tools predict future trends, behaviors, allowing business according to make proactive, knowledge-driven decisions. The development and application concerning data mining algorithms require the use of very powerful software tools. As the number of accessible tools continues to grow the choice of the most suitable tool becomes increasingly difficult. [6] The top 6 open source tools available because data mining is briefed as below.

Data mining tools like Weka and Orange are used to perform various data mining techniques. The first step of the methodology consists of selecting a number of available open source data mining tools in accordance with being tested. Many open data mining tools are available for free on the Web. After surfing the Internet, some tools were chosen; including the Waikato Environment for Knowledge Analysis (WEKA) durability and Orange Canvas.

### VIII. WEKA

The Waikato Environment for Knowledge Analysis (WEKA) [7] is an open source software and machine learning toolkit introduced by Waikato University, New Zealand. WEKA helps several standard data mining tasks as data preprocessing, clustering, classification, regression, visualization and feature selection. New algorithms can also be implemented the usage concerning WEKA with existing data mining and machine learning techniques. WEKA gives a number of sources because loading data, which include files, URLs then databases. It helps file formats include WEKA's own ARFF format, CSV, Lib SVMs format, and C4.5's format. Many evaluation criteria are also provided of WEKA certain as confusion matrix, precision, recall, true positive and false negative, etc. Some of the advantages of WEKA tool includes Open source, platform independent and portable, graphical user interface and contains a very vast collection of different data mining algorithms.

### IX. ORANGE

Orange is an open source machine learning technology or data mining software. Orange can be used for explorative data analysis and visualization[3]. It gives a platform for experiment selection, predictive modeling, and recommendation systems and can be used of genomic research, biomedicine, bioinformatics, and teaching. Orange is always preferred when the factor of innovation, quality, or reliability is involved[10],[4].

## X. THE COMPARATIVE STUDY

The methodology of the study constitutes regarding collecting a set of free data mining and knowledge discovery tools according to be tested, specifying the data sets to be used, and selecting a set of classification algorithm according to test the tools' performance. Demonstrates the overall methodology followed for fulfilling the goal of its research.

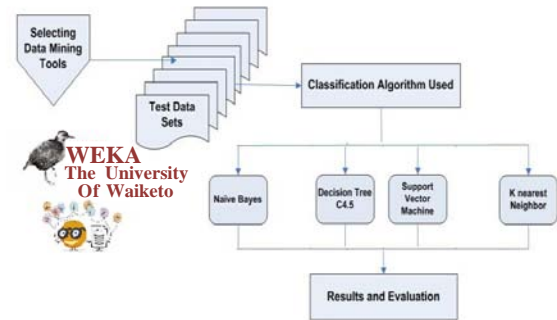


Fig. 2: Tools Implementation Methodology

#### a) Precision and Recall

It is also known as positive predictive value. It is defined as the average probability of relevant retrieval.  $\text{Precision} = \frac{\text{Number of true positives}}{\text{Number of true positives} + \text{False positives}}$ .

#### b) Recall

It is defined as the average probability of complete retrieval.  $\text{Recall} = \frac{\text{True positives}}{\text{True positives} + \text{False negative}}$

#### c) Navie Bayes

When the dimensionality of the inputs is high, the Naïve Bayes Classifier method is particularly suited. The problem including the Naïve Bayes Classifier is so that assumes all attributes are independent on each other which in general cannot be applied. Naive Bayes is harder to debug and understandable [2]. Naive Bayes used into robotics and computer vision. In naive Bayes, decision tree perform poorly. Comparative analysis of precession and recall analyzing for heart disease data sets precession in Orange 82.4% and Recall 80.6%. In WEKA precession 83.7% and Recall 83.7%. Compare to Orange tool and WEKA, weka is best precession and Recall.

#### d) Support Vector Machine

Support Vector Machines proved themselves to be very fine into a variety of pattern classification tasks and accordingly received a great deal of attention recently. Support vector machine is a supervised machine learning technique. The SVM algorithm predicts the occurrence about heart disease by ability on plotting the disease predicting attributes regarding the multidimensional hyperplane or classifies the classes optimally by creating the approach between two

data clusters[5]. This algorithm attains high accuracy by the use regarding nonlinear features called kernels. Comparative analysis of precession and recall analyzing for heart disease data sets precession in Orange 81.7% and Recall 70.5%. In WEKA precession 81.8% and Recall 81.9%. Compare to Orange tool and WEKA, weka is best precession and Recall.

#### e) *Random Forest*

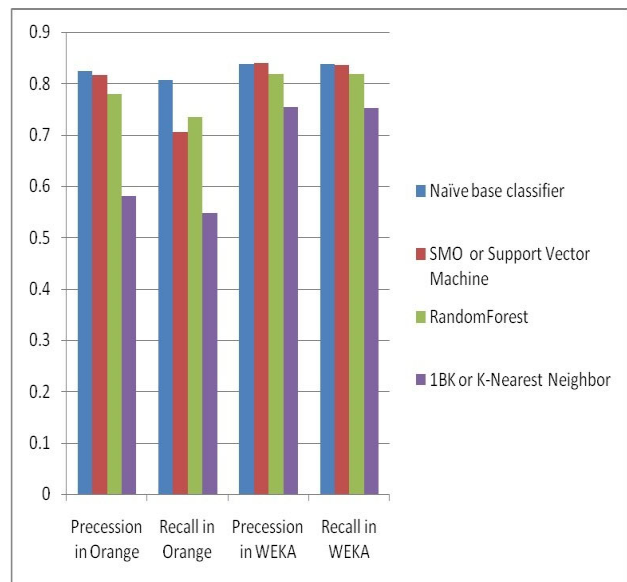
Random Forest is essentially an ensemble of unpruned classification trees. It gives excellent performance concerning a number about practical problems, largely because such is not sensitive to noise in the dataset, and it is not subject to overfitting. It works fast and generally exhibits a substantial performance improvement over many other tree-based algorithms. Random forests are built by combining the predictions on a number of trees, each of which is trained within isolation. There are three main choices to stand performed when constructing a random tree. Comparative analysis of precession and recall analyzing for heart disease data sets precession in Orange 77.9% and Recall 73.4%. In WEKA precession 81.8% and Recall 81.9%. Compare to Orange tool and WEKA, weka is best precession and Recall.

#### f) *KNN Classifier*

K-nearest neighbor is a sophisticated approach for classification that finds a group of K objects in the training documents that are close to the test value. To classify an unlabeled object, the distance between it object and labeled object is computed and it's K nearest neighbors are identified. Classification accuracy commonly depends of the choice value of K and will be better than that of using the nearest neighbor classifier[9]. For vast data sets, K can be larger to reduce the error. Choosing K can be done experimentally, where a number concerning patterns taken out from the training set can be categorised using the remaining training patterns for different values over k. The value of K which gives the least error in classification will be chosen. If same class is shared in various of K-nearest neighbors, then per-neighbor weights of as class are added together, and the resulting weighted sum is used as the likelihood score of that class with respect to the test document [8]. Comparative analysis of precession and recall analyzing KNN for heart disease data sets precession in Orange 58% and Recall 54.7%. In WEKA precession 75.3% and Recall 75.2%. Compare to Orange tool and WEKA weka is best precession and Recall.

*Table 1:* Classification Algorithm Compare Precession And Recall In Orange And Weka Tools Heart Disease

Algorithm classification Average	Precession in Orange	Recall in Orange	Precession in WEKA	Recall in WEKA
Naïve base classifier	0.824	0.806	0.837	0.837
SVM or Support Vector Machine	0.817	0.705	0.84	0.8365
Random Forest	0.779	0.734	0.818	0.819
1BK or K-Nearest Neighbor	0.58	0.547	0.753	0.752



*Fig. 3:* Classification Algorithm Graph for Precession and Recall in Weka Tool Heart Disease

## XI. CONCLUSION AND FUTURE SCOPE

Data mining techniques help in finding the hidden knowledge in a team of disease data that can remain used to analyze and predict the future behavior of diseases. Classification is one the records mining methods which assigned a class label to a set of unclassified cases. Comparative analysis concerning precession and recall weka is the best overall performance compared to an orange. The main objective concerning this paper is to compare the data mining tools on the basis of their classification precession and recall. According to the result of three data mining tools used in this paper, such has been observed so different data mining tools are furnishing different results concerning same data set with different classification algorithm. WEKA and ORANGE are

showing best classification Precision and Recall. In future, more disease dataset can be used for classification methods, and other data mining techniques such as clustering can be used according to compare the performance of various data mining tools.

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Unless specified in the notification, the Editorial Board's decision on publication of the paper is final and cannot be appealed before making the major change in the manuscript.

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## PREPARING YOUR MANUSCRIPT

Authors can submit papers and articles in an acceptable file format: MS Word (doc, docx), LaTeX (.tex, .zip or .rar including all of your files), Adobe PDF (.pdf), rich text format (.rtf), simple text document (.txt), Open Document Text (.odt), and Apple Pages (.pages). Our professional layout editors will format the entire paper according to our official guidelines. This is one of the highlights of publishing with Global Journals—authors should not be concerned about the formatting of their paper. Global Journals accepts articles and manuscripts in every major language, be it Spanish, Chinese, Japanese, Portuguese, Russian, French, German, Dutch, Italian, Greek, or any other national language, but the title, subtitle, and abstract should be in English. This will facilitate indexing and the pre-peer review process.

The following is the official style and template developed for publication of a research paper. Authors are not required to follow this style during the submission of the paper. It is just for reference purposes.



### ***Manuscript Style Instruction (Optional)***

- Microsoft Word Document Setting Instructions.
- Font type of all text should be Swis721 Lt BT.
- Page size: 8.27" x 11", left margin: 0.65, right margin: 0.65, bottom margin: 0.75.
- Paper title should be in one column of font size 24.
- Author name in font size of 11 in one column.
- Abstract: font size 9 with the word "Abstract" in bold italics.
- Main text: font size 10 with two justified columns.
- Two columns with equal column width of 3.38 and spacing of 0.2.
- First character must be three lines drop-capped.
- The paragraph before spacing of 1 pt and after of 0 pt.
- Line spacing of 1 pt.
- Large images must be in one column.
- The names of first main headings (Heading 1) must be in Roman font, capital letters, and font size of 10.
- The names of second main headings (Heading 2) must not include numbers and must be in italics with a font size of 10.

### ***Structure and Format of Manuscript***

The recommended size of an original research paper is under 15,000 words and review papers under 7,000 words. Research articles should be less than 10,000 words. Research papers are usually longer than review papers. Review papers are reports of significant research (typically less than 7,000 words, including tables, figures, and references)

A research paper must include:

- a) A title which should be relevant to the theme of the paper.
- b) A summary, known as an abstract (less than 150 words), containing the major results and conclusions.
- c) Up to 10 keywords that precisely identify the paper's subject, purpose, and focus.
- d) An introduction, giving fundamental background objectives.
- e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition, sources of information must be given, and numerical methods must be specified by reference.
- f) Results which should be presented concisely by well-designed tables and figures.
- g) Suitable statistical data should also be given.
- h) All data must have been gathered with attention to numerical detail in the planning stage.

Design has been recognized to be essential to experiments for a considerable time, and the editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned unrefereed.

- i) Discussion should cover implications and consequences and not just recapitulate the results; conclusions should also be summarized.
- j) There should be brief acknowledgments.
- k) There ought to be references in the conventional format. Global Journals recommends APA format.

Authors should carefully consider the preparation of papers to ensure that they communicate effectively. Papers are much more likely to be accepted if they are carefully designed and laid out, contain few or no errors, are summarizing, and follow instructions. They will also be published with much fewer delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and suggestions to improve brevity.



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***It is necessary that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.***

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The title page must carry an informative title that reflects the content, a running title (less than 45 characters together with spaces), names of the authors and co-authors, and the place(s) where the work was carried out.

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The full postal address of any related author(s) must be specified.

### **Abstract**

The abstract is the foundation of the research paper. It should be clear and concise and must contain the objective of the paper and inferences drawn. It is advised to not include big mathematical equations or complicated jargon.

Many researchers searching for information online will use search engines such as Google, Yahoo or others. By optimizing your paper for search engines, you will amplify the chance of someone finding it. In turn, this will make it more likely to be viewed and cited in further works. Global Journals has compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

### **Keywords**

A major lynchpin of research work for the writing of research papers is the keyword search, which one will employ to find both library and internet resources. Up to eleven keywords or very brief phrases have to be given to help data retrieval, mining, and indexing.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy: planning of a list of possible keywords and phrases to try.

Choice of the main keywords is the first tool of writing a research paper. Research paper writing is an art. Keyword search should be as strategic as possible.

One should start brainstorming lists of potential keywords before even beginning searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in a research paper?" Then consider synonyms for the important words.

It may take the discovery of only one important paper to steer in the right keyword direction because, in most databases, the keywords under which a research paper is abstracted are listed with the paper.

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Numerical methods used should be transparent and, where appropriate, supported by references.

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Authors must list all the abbreviations used in the paper at the end of the paper or in a separate table before using them.

### **Formulas and equations**

Authors are advised to submit any mathematical equation using either MathJax, KaTeX, or LaTeX, or in a very high-quality image.

### **Tables, Figures, and Figure Legends**

Tables: Tables should be cautiously designed, uncrowned, and include only essential data. Each must have an Arabic number, e.g., Table 4, a self-explanatory caption, and be on a separate sheet. Authors must submit tables in an editable format and not as images. References to these tables (if any) must be mentioned accurately.



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Figures are supposed to be submitted as separate files. Always include a citation in the text for each figure using Arabic numbers, e.g., Fig. 4. Artwork must be submitted online in vector electronic form or by emailing it.

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Although low-quality images are sufficient for review purposes, print publication requires high-quality images to prevent the final product being blurred or fuzzy. Submit (possibly by e-mail) EPS (line art) or TIFF (halftone/ photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Avoid using pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings). Please give the data for figures in black and white or submit a Color Work Agreement form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

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## TIPS FOR WRITING A GOOD QUALITY COMPUTER SCIENCE RESEARCH PAPER

Techniques for writing a good quality computer science research paper:

**1. Choosing the topic:** In most cases, the topic is selected by the interests of the author, but it can also be suggested by the guides. You can have several topics, and then judge which you are most comfortable with. This may be done by asking several questions of yourself, like "Will I be able to carry out a search in this area? Will I find all necessary resources to accomplish the search? Will I be able to find all information in this field area?" If the answer to this type of question is "yes," then you ought to choose that topic. In most cases, you may have to conduct surveys and visit several places. Also, you might have to do a lot of work to find all the rises and falls of the various data on that subject. Sometimes, detailed information plays a vital role, instead of short information. Evaluators are human: The first thing to remember is that evaluators are also human beings. They are not only meant for rejecting a paper. They are here to evaluate your paper. So present your best aspect.

**2. Think like evaluators:** If you are in confusion or getting demotivated because your paper may not be accepted by the evaluators, then think, and try to evaluate your paper like an evaluator. Try to understand what an evaluator wants in your research paper, and you will automatically have your answer. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

**3. Ask your guides:** If you are having any difficulty with your research, then do not hesitate to share your difficulty with your guide (if you have one). They will surely help you out and resolve your doubts. If you can't clarify what exactly you require for your work, then ask your supervisor to help you with an alternative. He or she might also provide you with a list of essential readings.

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**8. Make every effort:** Make every effort to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in the introduction—what is the need for a particular research paper. Polish your work with good writing skills and always give an evaluator what he wants. Make backups: When you are going to do any important thing like making a research paper, you should always have backup copies of it either on your computer or on paper. This protects you from losing any portion of your important data.

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Verbs have to be in agreement with their subjects. In a research paper, do not start sentences with conjunctions or finish them with prepositions. When writing formally, it is advisable to never split an infinitive because someone will (wrongly) complain. Avoid clichés like a disease. Always shun irritating alliteration. Use language which is simple and straightforward. Put together a neat summary.

**14. Arrangement of information:** Each section of the main body should start with an opening sentence, and there should be a changeover at the end of the section. Give only valid and powerful arguments for your topic. You may also maintain your arguments with records.

**15. Never start at the last minute:** Always allow enough time for research work. Leaving everything to the last minute will degrade your paper and spoil your work.

**16. Multitasking in research is not good:** Doing several things at the same time is a bad habit in the case of research activity. Research is an area where everything has a particular time slot. Divide your research work into parts, and do a particular part in a particular time slot.

**17. Never copy others' work:** Never copy others' work and give it your name because if the evaluator has seen it anywhere, you will be in trouble. Take proper rest and food: No matter how many hours you spend on your research activity, if you are not taking care of your health, then all your efforts will have been in vain. For quality research, take proper rest and food.

**18. Go to seminars:** Attend seminars if the topic is relevant to your research area. Utilize all your resources.

**19. Refresh your mind after intervals:** Try to give your mind a rest by listening to soft music or sleeping in intervals. This will also improve your memory. Acquire colleagues: Always try to acquire colleagues. No matter how sharp you are, if you acquire colleagues, they can give you ideas which will be helpful to your research.



**20. Think technically:** Always think technically. If anything happens, search for its reasons, benefits, and demerits. Think and then print: When you go to print your paper, check that tables are not split, headings are not detached from their descriptions, and page sequence is maintained.

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**23. Upon conclusion:** Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium through which your research is going to be in print for the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects of your research.

## INFORMAL GUIDELINES OF RESEARCH PAPER WRITING

### **Key points to remember:**

- Submit all work in its final form.
- Write your paper in the form which is presented in the guidelines using the template.
- Please note the criteria peer reviewers will use for grading the final paper.

### **Final points:**

One purpose of organizing a research paper is to let people interpret your efforts selectively. The journal requires the following sections, submitted in the order listed, with each section starting on a new page:

*The introduction:* This will be compiled from reference matter and reflect the design processes or outline of basis that directed you to make a study. As you carry out the process of study, the method and process section will be constructed like that. The results segment will show related statistics in nearly sequential order and direct reviewers to similar intellectual paths throughout the data that you gathered to carry out your study.

### **The discussion section:**

This will provide understanding of the data and projections as to the implications of the results. The use of good quality references throughout the paper will give the effort trustworthiness by representing an alertness to prior workings.

Writing a research paper is not an easy job, no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record-keeping are the only means to make straightforward progression.

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Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

**To make a paper clear:** Adhere to recommended page limits.



### *Mistakes to avoid:*

- Insertion of a title at the foot of a page with subsequent text on the next page.
- Separating a table, chart, or figure—confine each to a single page.
- Submitting a manuscript with pages out of sequence.
- In every section of your document, use standard writing style, including articles ("a" and "the").
- Keep paying attention to the topic of the paper.
- Use paragraphs to split each significant point (excluding the abstract).
- Align the primary line of each section.
- Present your points in sound order.
- Use present tense to report well-accepted matters.
- Use past tense to describe specific results.
- Do not use familiar wording; don't address the reviewer directly. Don't use slang or superlatives.
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Choose a revealing title. It should be short and include the name(s) and address(es) of all authors. It should not have acronyms or abbreviations or exceed two printed lines.

**Abstract:** This summary should be two hundred words or less. It should clearly and briefly explain the key findings reported in the manuscript and must have precise statistics. It should not have acronyms or abbreviations. It should be logical in itself. Do not cite references at this point.

An abstract is a brief, distinct paragraph summary of finished work or work in development. In a minute or less, a reviewer can be taught the foundation behind the study, common approaches to the problem, relevant results, and significant conclusions or new questions.

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*Reason for writing the article—theory, overall issue, purpose.*

- Fundamental goal.
- To-the-point depiction of the research.
- Consequences, including definite statistics—if the consequences are quantitative in nature, account for this; results of any numerical analysis should be reported. Significant conclusions or questions that emerge from the research.

### **Approach:**

- Single section and succinct.
- An outline of the job done is always written in past tense.
- Concentrate on shortening results—limit background information to a verdict or two.
- Exact spelling, clarity of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else.

### **Introduction:**

The introduction should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable of comprehending and calculating the purpose of your study without having to refer to other works. The basis for the study should be offered. Give the most important references, but avoid making a comprehensive appraisal of the topic. Describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will give no attention to your results. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here.





*The following approach can create a valuable beginning:*

- Explain the value (significance) of the study.
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- Present a justification. State your particular theory(-ies) or aim(s), and describe the logic that led you to choose them.
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#### **Approach:**

Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done. Sort out your thoughts; manufacture one key point for every section. If you make the four points listed above, you will need at least four paragraphs. Present surrounding information only when it is necessary to support a situation. The reviewer does not desire to read everything you know about a topic. Shape the theory specifically—do not take a broad view.

As always, give awareness to spelling, simplicity, and correctness of sentences and phrases.

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This part is supposed to be the easiest to carve if you have good skills. A soundly written procedures segment allows a capable scientist to replicate your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order, but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt to give the least amount of information that would permit another capable scientist to replicate your outcome, but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section.

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#### **Materials:**

*Materials may be reported in part of a section or else they may be recognized along with your measures.*

#### **Methods:**

- Report the method and not the particulars of each process that engaged the same methodology.
- Describe the method entirely.
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures.
- Simplify—detail how procedures were completed, not how they were performed on a particular day.
- If well-known procedures were used, account for the procedure by name, possibly with a reference, and that's all.

#### **Approach:**

It is embarrassing to use vigorous voice when documenting methods without using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result, when writing up the methods, most authors use third person passive voice.

Use standard style in this and every other part of the paper—avoid familiar lists, and use full sentences.

#### **What to keep away from:**

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings—save it for the argument.
- Leave out information that is immaterial to a third party.



**Results:**

The principle of a results segment is to present and demonstrate your conclusion. Create this part as entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Use statistics and tables, if suitable, to present consequences most efficiently.

You must clearly differentiate material which would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matters should not be submitted at all except if requested by the instructor.

**Content:**

- Sum up your conclusions in text and demonstrate them, if suitable, with figures and tables.
- In the manuscript, explain each of your consequences, and point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation of an exacting study.
- Explain results of control experiments and give remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or manuscript.

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- Do not include raw data or intermediate calculations in a research manuscript.
- Do not present similar data more than once.
- A manuscript should complement any figures or tables, not duplicate information.
- Never confuse figures with tables—there is a difference.

**Approach:**

As always, use past tense when you submit your results, and put the whole thing in a reasonable order.

Put figures and tables, appropriately numbered, in order at the end of the report.

If you desire, you may place your figures and tables properly within the text of your results section.

**Figures and tables:**

If you put figures and tables at the end of some details, make certain that they are visibly distinguished from any attached appendix materials, such as raw facts. Whatever the position, each table must be titled, numbered one after the other, and include a heading. All figures and tables must be divided from the text.

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Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact, you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved the prospect, and let it drop at that. Make a decision as to whether each premise is supported or discarded or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."



Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work.

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- Give details of all of your remarks as much as possible, focusing on mechanisms.
- Make a decision as to whether the tentative design sufficiently addressed the theory and whether or not it was correctly restricted. Try to present substitute explanations if they are sensible alternatives.
- One piece of research will not counter an overall question, so maintain the large picture in mind. Where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

**Approach:**

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Describe generally acknowledged facts and main beliefs in present tense.

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Topics	Grades		
	A-B	C-D	E-F
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<i>Introduction</i>	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
<i>Methods and Procedures</i>	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
<i>Result</i>	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
<i>Discussion</i>	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
<i>References</i>	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring



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