Analysis and Classification of Internet activity Logs Based on Patterns of Traffic Rates

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Abstract - *Nowadays internet becomes necessity in our daily lives. Thus, whenever a person want to access a website then at time of that there is creation of log record which contains username, source IP, destination IP, the number of bytes read, duration of file, etc. For one web access, a web proxy generates one log record. Proxy logs can be used to investigate the web usage. In this paper we use data mining classification and clustering to find the hidden knowledge. This can be used in this educational sector like a watch dog.*

Keywords*:* Data mining, Classification, Clustering, k-mean algorithm, Euclidian distance, Manhattan distance, Log dataset.

1. INTRODUCTION

With increase in awareness and availability of Internet, information of any kind has become available at different websites. To promising this thing it is up-to the college administrator how easily and shortly they provide the meaningful data to user end. Today, addiction to the Internet is a serious issue amongst everyone, especially in campus-wide networks where Internet is freely available to everyone. An administrator in a campus may wish to ensure controls on Internet usage. In general, most campuses end up restricting usage. This has the disadvantage that a genuine user who wants to access information is also denied. Internet traffic data can be collected from various hardware devices as routers or proxy servers. In this paper, we analyse a large log to study “user access patterns”. Such a study can assist a network management system in traffic shaping and monitoring thus removing the necessity of regimentation. this is the main motivation of this paper. Besides all other things, this paper also focuses on performance and precision of the system. There are studies on the analysis of proxy log [1], [2], [3].

In this paper, we first discuss a tool that we have implemented to analyses the behaviour of logs of user. Second, we apply clustering and classification on logs to calculate precision and recall. The contributions of this paper can be stated as follows

1. Related work
2. Proposed methodology

There are so many classification algorithms the researchers have already used. Classification is the process to assign an object into pre-defined classes by evaluating their membership into class according to attribute values for that objects. For making significant improvement in classification process many researchers have employed different approaches and adopt different learning methods which are better than previous traditional approaches but very few researchers have tried for classification process preceded by clustering approach. [2]. The algorithm, decision table, is found in the Weka classifiers under Rules. The simplest way of representing the output from machine learning is to put it in the same form as the input. The use of the classifier rules decision table is described as building and using a simple decision table majority classifier. The output will show a decision on a number of attributes for each instance. It evaluates feature subsets using best-first search and can use cross-validation for evaluation.

This paper show how clustering and classification approach gives better results than Approri algorithm. There are several clustering algorithm exist in research but k-mean algorithm popular because of its simplicity for implementation and capability to produce good results. Cluster analysis or clustering is the task of assigning a set of objects into groups (called clusters) so that the objects in the same cluster are more similar to each other than to those in other clusters. It is a partitioning based approach which divides dataset into predefined k partition known as clusters which have minimum intra cluster using Manhattan distance. Although it is a basic algorithm but it has some shortcomings such as the result of the algorithm mostly depends upon initial value of centroid chosen for each cluster the other drawback is in error function of k-mean where several minima is are possible and can easily fall to local minima [4][5]. So aim of this paper is to give classification and clustering together with certain improvement in k-mean clustering [3]. The paper is organized in multiple sections where section 2 describes simple k-mean clustering and classification and talks about limitation and advantages of k-mean. Section three describes the proposed work. Section four shows the results and discussion. Section five shows the conclusion and future scope.

2. RELATED WORKS

Web mining is the technique of data mining into the documents on the World Wide Web. The overall process is the mining extraction of information from the World Wide Web. The extracted information should be reliable for administrator. Xiao J. et al. [2001] focused on the user behaviour between client and server. To differentiate the nature of different user, they use session, so there will be automatically updating and deletion of user behaviour. Bommepally K. et al. [2010] author describes that web-based tool is proposed to analyses the Internet activity. Next, step is to collect the data from a proxy server at a campus-wide network. Traffic Rates of different types of users are studied. Finally, the paper concludes with different strategies for monitoring and control of traffic. Grace L. et al.[2011] author gives a detailed discussion about the log files, their formats, their creation, access procedures, their uses, various algorithms used and the additional parameters that can be used in the log files which in turn gives way to an effective mining. It also provides the idea of creating an extended log file and learning the user behaviour.

Singh N. et al 2013] focused on accuracy of algorithm. With the advancement of World Wide Web there will be enormous change in the data, the data collection at server side is large that it take time to prefetch the data. To reduce this problem sing et al proposes technique of catching with prefetching technique. Prefetching technique fetches objects that are likely to be accessed in the near future and store them in advance thus the response time of the user request is reduced. The main aim of college administration is to provide the fair bandwidth of internet between all users. Kiatkumjounwong N. et al. [2014] proposed that there would be the classification of the logs on the basis of their size. They proposes the three steps as follow-: Pre-processing- In this step there would be data cleaning, Outlier detection- In this there will be division of logs on the basis of their characteristics, Log classification-In this there would be classification of the logs on the basis of their size so there would be less time taken to analyse the log.

3. PROPOSED METHODOLOGY

In this study, we firstly collect user history from the log file with the help of college administrator. By analysis all of their traffic rates, we built up 15 categories on the basis of their pattern.

After collection of dataset, preprocessing and data cluster was performed in which k-mean clustering algorithms used is discussed below

K-mean clustering uses two different distance formulas Manhattan distance formulas-: To compute the absolute differences between coordinates of pair of objects.

$Dist_{xy} = |X_{ik} - X_{jk}|$

Euclidian distance formula:- Euclidean metric is the "ordinary" (i.e. straight-line) distance between two points in

Steps of k-mean algorithm:

- Choose randomly k data objects from given dataset which works as centroid for k clusters initially.
- Compute distance of each data object from k centroids and then allocate each data object to the closest cluster with minimum centroid distance.
- Compute new centroid for each cluster by taking mean of the all data objects belonging to particular cluster. Calculate the total mean-square quantization error function. If error function reduces from previous one than these centroids will work as new centroids.
- Repeat step 2 and 3 until error function get constant [12].

a. Classification Accuracy

Classification gives better result in single node of data. For better use of classification, we divide the log into small node. Bayes net classification:- Bayes net classification works on the basis of problistic directed acyclic graph. The primary goal of classification for measuring performance is to determine the percentage of test samples that are correctly classified. The parameters on which Accuracy depend upon are: Success: Instance`s class are correctly defined. Error: Object instance are incorrectly defined. Error rate: proportion of errors made over the complete set of instances Accuracy: proportion of correctly classified instances over the complete set of instances

Accuracy=1-error rate

b. Prediction Accuracy

Prediction can be viewed as a type of classification. The prediction accuracy is given by:

Accuracy = 1 – error rate

c. Runtime

The serial runtime of a program is the time elapsed between the beginning and the ending of execution on a sequential computer.

d. Precision and Recall

Precision and Recall are two widely used measures for evaluating the quality of results in their specific domains such as Information Retrieval [12]. Precision can be defined as a measure of exactness, whereas Recall is a measure of completeness. In a statistical classification [15] task, the Precision of a class is the number of true positives (i.e. the number of items correctly defined to belonging the class) divided by the total number of elements belonging the class (i.e. the sum of true positives and false positives, which are items incorrectly defined in belonging of that class). Recall in this context is termed as the number of true positives to the total number of elements that actually belong to the class (i.e. the sum of true positives and false negatives, which are items which were not labelled as belonging to that class but should have been).

There are following steps shows the pseudo codes for the proposed framework.

1. The very first step is preprocessing of data. In this step we choose the attributes which we used for applying the algorithm. In this we cleansed the data into proper format.

2. Second step of proposed technique is to apply k-mean algorithm on the unsupervised data.

3. While using k-mean algorithm in weka tool, we have firstly calculated distance by using the Euclidian distance.

4. Next step is to change the distance formula from Euclidian to Manhattan distance.

5. Now we have to impose the bayes net classification on the results of visualization logs of distance formulas.

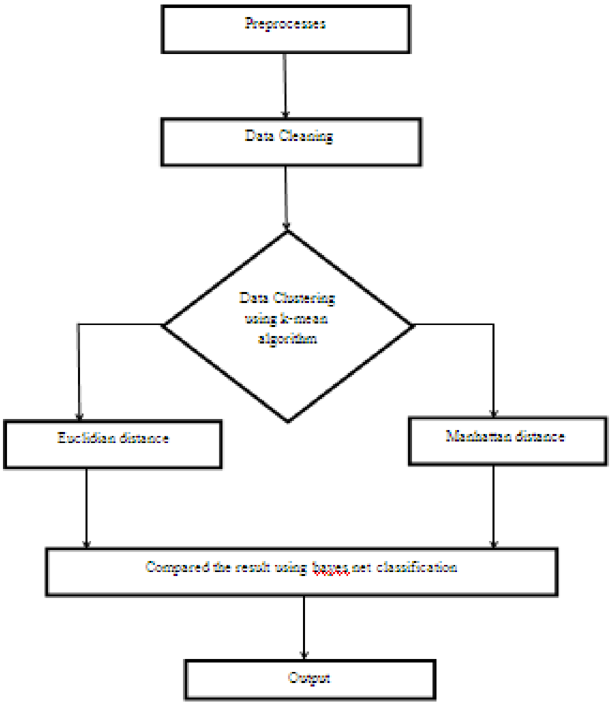
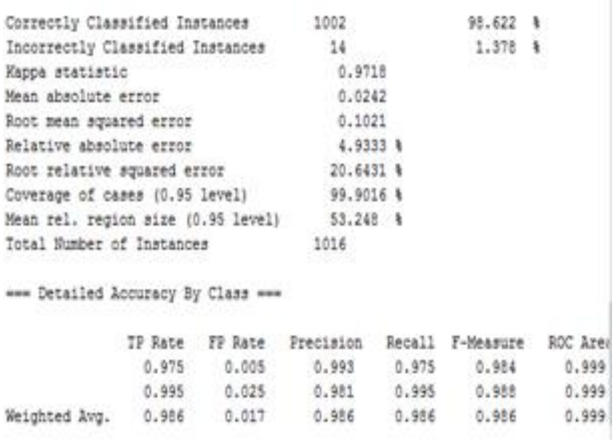

Preprocesses
Data Cleaning
Data Clustering using k-mean algorithm
Euclidian distance
Manhattan distance
Compared the result using bayes net classification
Output

Fig. 1: Proposed Methodology

4. RESULT AND DISCUSSION

In very first section results would be based upon the classification accuracy: From the Table 1, it can be inferred that while comparing the k-mean algorithm using manhattan and euclidian distances So, Bayes network was used to data classification. Correctly classification instances were higher in k-mean using Euclidian (98.622%) than k-mean using Manhattan distances (97.633%). In second section results would be based upon the prediction accuracy: Similarly the average magnitude of error measure by mean absolute error (MAE) was higher in k-mean using manhattan distance (0.217) as compared to Euclidian distance. The accuracy of both distances was again calculated while using the criteria of root mean square error (RMSE), while inferred that RMSE of (.265) as compared to k-mean (.2771). From the above discussion it can be concluded that k-mean using Euclidian distance is accurate and measure in data classification. Next step is to pre-process data against null values followed by normalization and prioritize dataset attribute according to expert knowledge [1].

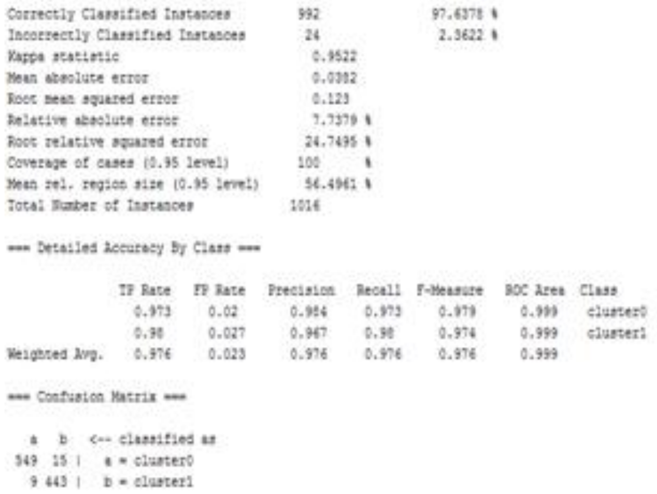


```
Correctly Classified Instances        1002               98.622  %
Incorrectly Classified Instances        14                1.378  %
Kappa statistic                          0.9718
Mean absolute error                      0.0242
Root mean squared error                  0.1021
Relative absolute error                  4.9333 %
Root relative squared error             20.6431 %
Coverage of cases (0.95 level)          99.9016 %
Mean rel. region size (0.95 level)      53.248  %
Total Number of Instances             1016

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Are
                 0.975     0.005      0.993     0.975     0.984     0.999
                 0.995     0.025      0.981     0.995     0.988     0.999
Weighted Avg.    0.986     0.017      0.986     0.986     0.986     0.999
```

Fig. 2: Results of k-mean algorithm using Euclidian distance



```
Correctly Classified Instances         992               97.6378 %
Incorrectly Classified Instances        24                2.3622 %
Kappa statistic                          0.9522
Mean absolute error                      0.0382
Root mean squared error                  0.123
Relative absolute error                  7.7379 %
Root relative squared error             24.7495 %
Coverage of cases (0.95 level)         100      %
Mean rel. region size (0.95 level)      56.4961 %
Total Number of Instances             1016

=== Detailed Accuracy By Class ===

               TP Rate   FP Rate   Precision   Recall  F-Measure   ROC Area  Class
                 0.973     0.02      0.984      0.973    0.979      0.999    cluster0
                 0.98      0.027     0.967      0.98     0.974      0.999    cluster1
Weighted Avg.    0.976     0.023     0.976      0.976    0.976      0.999

=== Confusion Matrix ===

   a   b   <-- classified as
 549  15 |   a = cluster0
   9 443 |   b = cluster1
```

Fig. 3: Results of k-mean algorithm using Manhattan distance

Table 1: Comparison of results by k-mean using Euclidian and Manhattan distance

Particulars	K-mean cluster using Manhattan distance	K-mean cluster Using Euclidian distance
Correctly classified instances	97.63%	98.63%
Incorrectly classified instances	2.33%	1.37%
Mean absolute error	0.0382	0.0242
Root mean squared error	0.123	0.1021
Relative absolute error	7.739%	4.933%
Root relative squared error	24.704%	20.64%

5. CONCLUSION AND FUTURE SCOPE

Data mining techniques are very useful in web proxy logs, by using the technique we can easily auditing and logging the personal information of the user. This help to find the hidden knowledge in log files. We use this method in education institute to reduce the malicious activity. By using this we enhance the usability of internet and also enhance the security of individual. To meet the goal we use the approri algorithm and k mean algorithm.

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