

$\bar{x} = \frac{\sum x}{n}$ is the mean of x data
 $\bar{y} = \frac{\sum y}{n}$ is the mean of y data

For Logistic Regression with regularization we can apply Equation (4) where the value of Equation (1) is applied for non-regularization cost [13].

$$\text{Cost} = \text{Non-regularization-cost} + \lambda (\alpha \cdot \sum \|\Theta_i\| + (1 - \alpha) \cdot \sum \Theta_i^2) \quad (4)$$

The equation (4) [13] avoids an over fitting problem L1 regularization is also called lasso regression $\|\Theta_i\|$ and L2 regularization is also called Ridge regression Θ_i^2 is added to the cost along with logistic regression [13].

3.2 Classification

Classification is similar to regression whereas it is used to predict the categorical values of the given input. Based on some specific set of rules defined by certain algorithm classifier are formed. The efficiency of the classifier depends on how well the input data is classified into certain class.

3.2.2 Neural Network – Back Propagation Algorithm

Back propagation is the neural network learning algorithm which comprises the set of neurons. Each network input or output neurons are associated with weights [14]. During the training phase the neurons adjust the weights so as to predict the correct class labels [14].

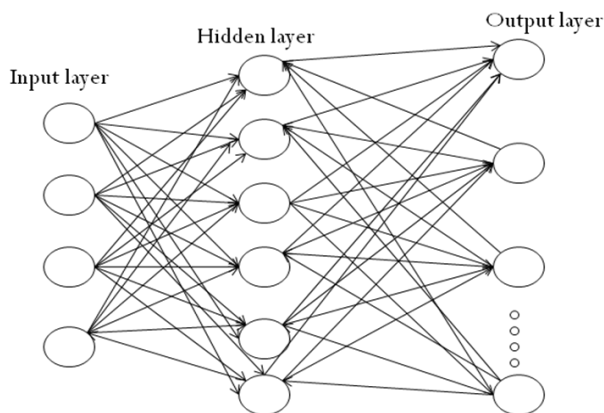


Figure 2: Architecture of Neural Network

The Algorithm uses feed forward and back propagation methods. For the feed forward method, first compute the net input value, this is done by multiplying the input unit and the corresponding weight associated with it [14] as shown in equation (5).

$$I_j = \sum w_{ih} O_i \quad (5)$$

The output unit is computed by taking the sigmoid function of the net input value [14] as shown in equation (6).

$$O_j = \frac{1}{1 + e^{-I_j}} \quad (6)$$

The error is back propagated and the error at the output unit [14] is calculated by the equation (7).

$$Err_j = O_j(1 - O_j)(T_j - O_j) \quad (7)$$

The error at the hidden layer is computed [14] as shown in equation (8).

$$Err_j = O_j(1 - O_j) \sum_k Err_k W_{jk} \quad (8)$$

Weights are updated by the following equations which are as shown in equation (9) and (10) where Δw_{ij} the updated weight of is w_{ij} [14].

$$\Delta w_{ij} = (1) Err_j O_j \quad (9)$$

$$w_{ij} = w_{ij} + \Delta w_{ij} \quad (10)$$

3.3 Association

Association shows the frequency of the attribute value pairs for the given set of inputs. Association rule mining is usually used where frequent item set mining is used. Usually this type of mining is used in transactional databases where frequent items keep occurring throughout the database. Apriori Algorithm, FP-Growth is the types of Association rule mining.

3.3.1 Apriori Algorithm

Mining frequent item sets lead for the discovery of association rule mining in the transactional and relational datasets. Large datasets are collected thus mining such frequent patterns are important [14].

The set of items $I = \{I_1, I_2, \dots, I_n\}$ are called item sets. The set of these items occurs in a database are called as transactions T which is a subset of item I [14]. Support and confidence is calculated for each item set. Support s , is the probability that the transaction T contains both A and B i.e. $(A \cup B)$. Confidence c is the probability of A will also contain B in the transaction T [14].

$$\text{support}(A \rightarrow B) = P(A \cup B) \quad (11)$$

$$\text{confidence}(A \rightarrow B) = P(B|A) \quad (12)$$

The minimum support is the threshold which is given either in percentage from 0% to 100% or in 0 to 1.0 forms [14].

The k-itemset is an itemset that contains k items. Conventionally we use 1-itemset, 2-itemset and so on [14]. By the equation (12) we have,

$$\text{confidence}(A \rightarrow B) = P(B|A) = \frac{\text{support}(A \cup B)}{\text{support}(A)} \quad (13)$$

Equation (13) is used to find the frequent itemset. Therefore the apriori algorithm runs on finding all the possible frequent itemsets and then finding the frequent itemset which is more than the min_support count [14].

3.4 Cluster Analysis

Cluster analysis is the process of analysing the objects which are similar to each other into one cluster and the objects which are dissimilar forms a different cluster. Conceptual Clustering is type of cluster analysis where clusters are formed for each concept. K-means, DB Scan are the clustering methods which form iteratively whereas

COBWEB is the conceptual clustering algorithm which keeps incremented rationally [12].

3.4.1 COBWEB Algorithm

COBWEB is a type of conceptual clustering algorithm. It generates a concept descriptor for each cluster. The cluster of COBWEB algorithm forms a tree like structure where root node represents entire dataset and the leaves represent individual concept and the branches represents the hierarchical clusters of the dataset. The total number of clusters depends on the size of the datasets. Each node of the tree represents certain concept of the dataset [11]. Figure 3 represents an example of COBWEB algorithm where C0 refers the probability of the entire dataset and C1, C2 and C3 represents the probability of the individual concept [11].

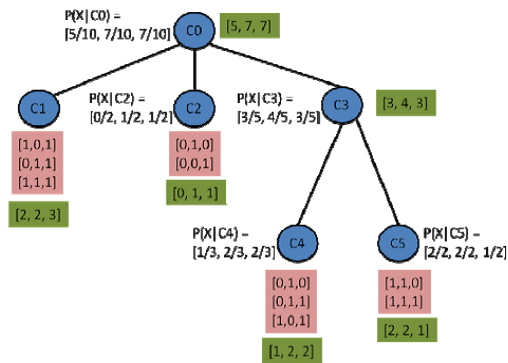


Figure 3: An example of the COBWEB Algorithm

4. Experimental Results

At first three different datasets are collected such as Healthcare dataset, movie lens dataset and weather dataset from different sources. These datasets are then pre-processed. Using Apache Hadoop and Apache Hive as SQL like query language these datasets are processed individually to find out the analytics and the results are stored back into HDFS (Hadoop Distributed File System). Using machine learning algorithms these results which were stored in HDFS are applied to find out the analytics of the datasets and to find out the accuracy of Machine learning algorithms.

4.1 Accuracy of Machine Learning Algorithms in Healthcare

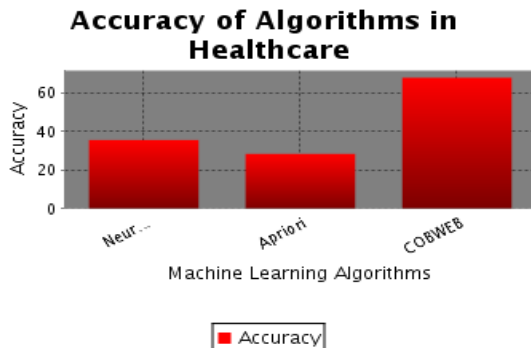


Figure 4: The accuracy of Machine Learning algorithms for healthcare dataset

In the Figure 4 the Neural Network –Back propagation algorithm, Apriori – Frequent item set and COBWEB algorithm when applied to healthcare dataset, the accuracy of

COBWEB algorithm shows 68% of accuracy which is found better among the three.

4.2 Accuracy of Machine Learning Algorithms in Movie Dataset

Accuracy of Algorithms of Movie Dataset

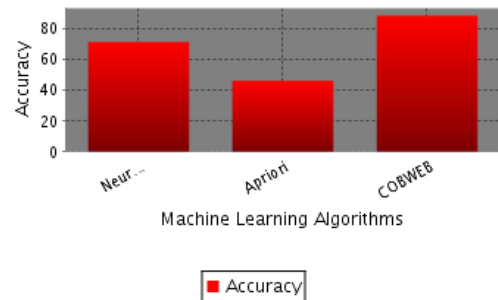


Figure 5: The Accuracy of Machine Learning Algorithms for movie lens dataset

In the Figure 5 the Neural Network –Back propagation algorithm, Apriori – Frequent item set and COBWEB algorithm when applied to movie lens ratings dataset, the accuracy of COBWEB algorithm shows 88% of accuracy which is found better among the three.

4.3 Correlation of Logistic Regression on Multiple Datasets

Correlation among all the three datasets such as healthcare, movie lens and weather data set are found to be same which is 0.99 which means that both the values x and y are dependent with each other which is shown in Figure 6.

Correlation of Logistic Regression on Multiple datasets

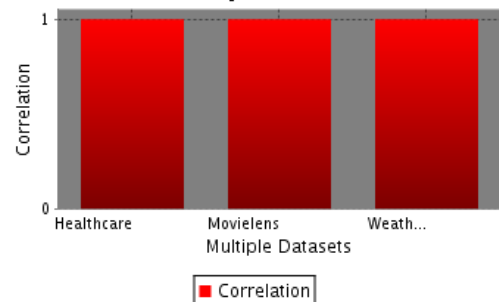


Figure 6: Correlation of Logistic regression on multiple datasets

4.4 Accuracy of Neural Network algorithm on multiple datasets

Accuracy of Neural Network on Multiple datasets

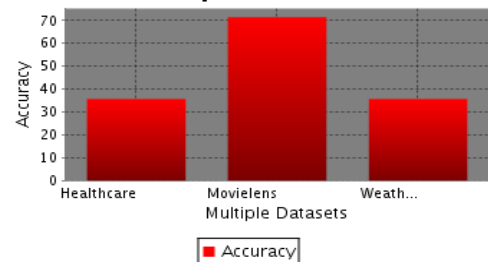


Figure 7: Accuracy of Neural Network Algorithm on Multiple Datasets

In the figure 7 the Neural Network – Back Propagation algorithm when applied to healthcare dataset, movie lens rating dataset and weather dataset it is found that the algorithm shows 71% of accuracy for movie lens ratings dataset.

5. Conclusion and Future Scope

In this paper big data analytics framework using machine learning on multiple datasets, different machine learning algorithms such as regression, classification, association and clustering algorithms are implemented on multiple datasets such as Healthcare Informatics, Movie Lens Rating and Weather Forecasting. The datasets are processed using Apache Hive for faster query access and the results of the queries are stored back in HDFS. Then the machine learning algorithms are applied for these datasets. The efficiency of the algorithm depends on the datasets used. The accuracy and the execution time are the metrics used.

For better accuracy this work can be extended using Mahout which is a part of Hadoop ecosystem. Mahout has inbuilt machine learning algorithms. Due to the complexity of the usage of mahout tool, this was not used in our work. In future mahout can be used as machine learning tool for Big Data for better algorithm efficiency.

References

- [1] Shamil Humbetov, "Data-Intensive Computing with Map-Reduce and Hadoop", IEEE, 978-1-4673-1740-5 /12, 2012
- [2] Sanjay Rathee, "Big Data and Hadoop with components like Flume, Pig, Hive and Jaql", International Conference on Cloud, Big Data and Trust 2013, Nov 13-15, RGPV.
- [3] Avita Katal, Mohammad Wazid, R H Goudar, "Big Data: Issues, Challenges, Tools and Good Practices", IEEE, 978-1-4799-0192-0/13, 2013.
- [4] Zaiying Liu, Ping Yang, Lixiao Zhang, "A Sketch of Big Data Technologies", 2013 Seventh International Conference on Internet Computing for Engineering and Science.
- [5] Puneet Singh Duggal, Sanchita Paul, "Big Data Analysis: Challenges and Solutions", International Conference on Cloud, Big Data and Trust 2013, Nov 13 -15, RGPV.
- [6] Shweta Pandey, Dr.Vrinda Tokekar, "Prominence of MapReduce in BIG DATA Processing", 2014 Fourth International Conference on Communication Systems and Network Technologies.
- [7] Parth Chandarana, M. Vijayalakshmi, "Big Data Analytics Frameworks", 2014 International Conference on Circuits, Systems, Communication and Information Technology Applications (CSCITA).
- [8] Ashish Thusoo, Joydeep Sen Sarma, Namit Jain, Zheng Shao, Prasad Chakka, Ning Zhang, Suresh Antony, Hao Liu, Raghotham Murthy, "Hive –A Petabyte Scale Data Warehouse Using Hadoop", Facebook Team, ICDE, 2010.

- [9] Wullianallur Raghupathi, Viju Raghupathi, "Big data analytics in healthcare: promise and potential", Health Information Science and Systems 2014.
- [10] Divya Tomar and Sonali Agarwal, "A survey on Data Mining approaches for Healthcare", International Journal of Bio-Science and Bio-Technology, 2013
- [11] Yuni Xia, Bowei Xi, "Conceptual Clustering Categorical Data with Uncertainty", 19th IEEE International Conference on Tools with Artificial Intelligence, 2007.
- [12] D. Karina Trejo T., Ma. Auxilio Medina N, Jorge de la Calleja M., Érika A. Martínez M, J. Alfredo Sánchez, "An approach to visualize unorganized collections of documents", IEEE, 978-1-4799-3469-0/14, 2014.
- [13] Ricky Ho, "Big Data Machine Learning: Patterns for Predictive Analytics", Dzone Refcardz
- [14] Jiawei Han and Micheline Kamber, "Data Mining concepts and techniques", Elsevier, Morgan kaufmann publishers, second edition, 2006
- [15] <http://grouplens.org/datasets/movielens/>

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