



Applications of Artificial Neural Network: A Survey

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Abstract: The characteristic like parallel performance, self-organizing adaptive, robustness and fault tolerance made Neural Network (NN) to be widely used in Data Mining applications. Neural Network is used to find the pattern and classify the data. The efficiency of the Data Mining method will be increased by grouping the NN models with it. Artificial Neural Network (ANN) combines with other algorithm to find the high accurate data as compared to the traditional algorithms. This paper discusses the application of ANN in different fields.

Keywords: Data Mining, Artificial Neural Network, Classification, Knowledge Mining

I. INTRODUCTION

Data Mining refers to extracting or mining the knowledge from large amount of data. The term Data Mining is appropriately named as ‘Knowledge mining from data’ or ‘Knowledge mining’. Data collection and storage technology has made it possible for organizations to accumulate huge amounts of data at lower cost. Exploiting this stored data, in order to extract useful and actionable information, is the overall goal of the generic activity termed as Data Mining.

Data Mining is an interdisciplinary subfield of computer science which involves computational process of large data sets’ patterns discovery. The goal of this advanced analysis process is to extract information from a data set and transform it into an understandable structure for further use. The methods used are at the juncture of artificial intelligence, machine learning, statistics, database systems and business intelligence. Data Mining is about solving problems by analyzing data already present in databases [1].

Data Mining functionalities are used to specify the kind of patterns to be found in Data Mining tasks. Data Mining tasks can be classified in two categories-descriptive and predictive. Descriptive mining tasks characterize the general properties of the data in database. Predictive mining tasks perform inference on the current data in order to make predictions.

The purpose of a Data Mining effort is normally either to create a descriptive model or a predictive model. A descriptive model presents, in concise form, the main characteristics of the data set. It is essentially a summary of the data points, making it possible to study important aspects of the data set. Undirected Data Mining finds patterns in the data set but leaves the interpretation of the patterns to the data miner.

The purpose of a predictive model is to allow the data miner to predict an unknown (often future) value of a specific variable; the target variable. If the target value is one of a predefined number of discrete (class) labels, the Data Mining task is called classification. If the target variable is a real number, the task is regression. The predictive model is thus created from given known values of variables, possibly including previous values of the target variable.

At the core of the Data Mining process is the use of a Data Mining technique. Some Data Mining techniques directly

obtain the information by performing a descriptive partitioning of the data. More often, however, Data Mining techniques utilize stored data in order to build predictive models. From a general perspective, there is strong agreement among both researchers and executives about the criteria that all Data Mining techniques must meet. Most importantly, the techniques should have high performance. This criterion is, for predictive modeling, understood to mean that the technique should produce models that will generalize well, i.e. models having high accuracy when performing predictions based on novel data.

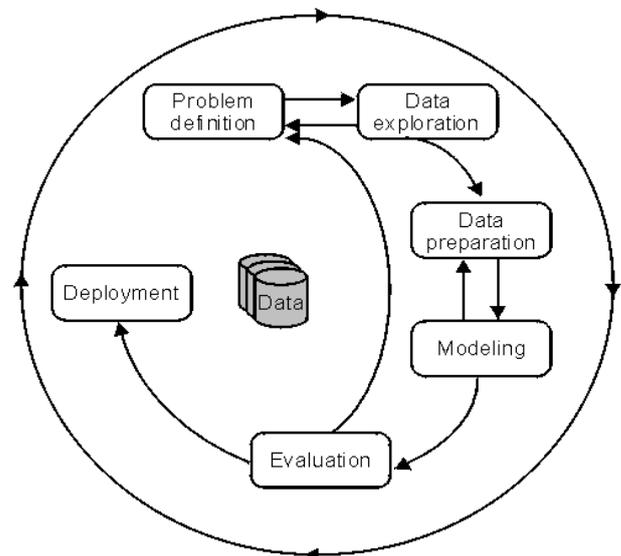


Figure 1: Data Mining process

Classification and prediction are two forms of data analysis that can be used to extract models describing the important data classes or to predict the future data trends. Such analysis can help to provide us with a better understanding of the data at large. The classification predicts categorical (discrete, unordered) labels, prediction model, and continuous valued function. This paper focuses on how Artificial Neural Network is used to classify the data set and helps to mine the required knowledge from the data.

The paper is organized as follows: Section 2 describes the Artificial Neural Network (ANN) and Section 3 reviews the literature based on ANN. Section 4 summarizes the paper.

II. ARTIFICIAL NEURAL NETWORK

An Neural Network model which is the branch of artificial intelligence is generally referred to as Artificial Neural Networks (ANNs). ANN teaches the system to execute task, instead of programming computational system to do definite tasks [14]. To perform such tasks, Artificial Intelligence System (AI) is generated. It is a pragmatic model which can quickly and precisely find the patterns buried in data that replicate useful knowledge. One case of these AI models is neural networks. AI systems should discover from data on a constant basis. In the areas of medical diagnosis relationships with dissimilar data, the most available techniques are the Artificial Intelligence techniques.

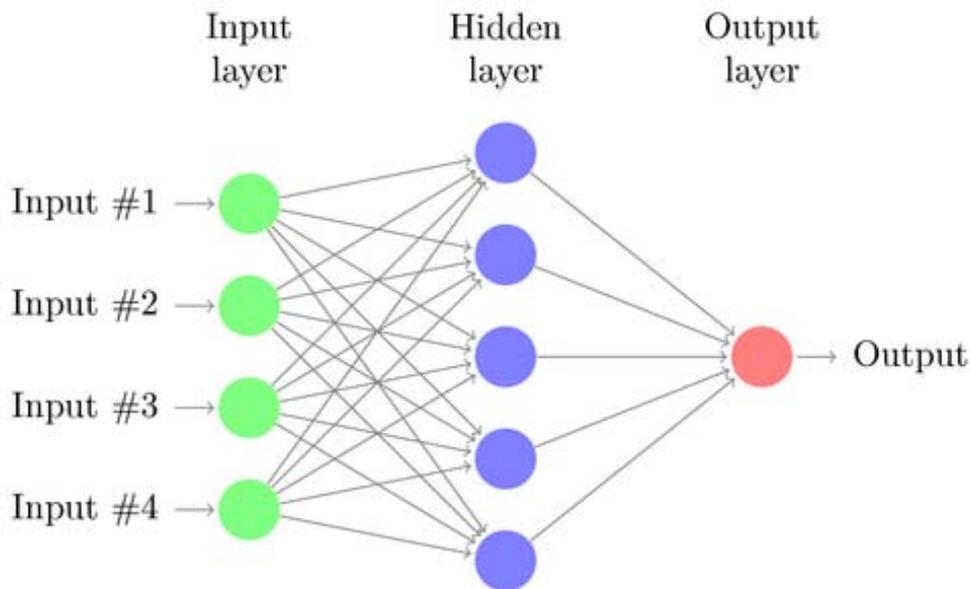


Figure 2: Artificial Neural Network

An artificial neural network is made up of many artificial neurons which are correlated together in accordance with explicit network architecture. The objective of the neural network is to convert the inputs into significant outputs. The teaching mode can be supervised or unsupervised. Neural Networks learn in the presence of noise.

Artificial Neural Networks considers classification as one of the most dynamic research and application areas. The major disadvantage in using ANN is to find the most appropriate grouping of training, learning and transfer function for classifying the data sets with growing number of features and classified sets. The different combinations of functions and its effect while using ANN as a classifier is studied and the correctness of these functions are analyzed for various kinds of datasets.

The real world problems which are represented by multidimensional datasets are taken from medical background. The classification and clustering of these data sets are significant. The data set is divided into training set and testing set and it has no usage in the training process. The results are produced with the help of these datasets and it is used for testing. The training set is taken from $2/3^{\text{rd}}$ of the dataset and remaining has been taken as test set.

This is made through the assessment of the accuracy achieved through testing against these data sets. Then the network is simulated with the same data.

The back propagation algorithm trains the neural network. With the appropriate combination of training, learning and transfer functions the dataset classification uses the most successful tool called back propagation neural network. The following parameters are considered to measure the efficiency of the network,

- Rate of convergence
- No of epochs taken to converge the network.
- The calculated Mean Square Error (MSE).

III. LITERATURE BASED ON ANN

A method proposed [2] for classifying the remote sensing Satellite image. It was done in three steps. As the initial step, first order histogram measures the features extracted. In the second step, the feature is extracted using Back Propagation Neural Network. The outcomes are compared with the maximum likelihood classification (MLC) method in the third step. The overall preciseness using the Back Propagation Neural Network was 85.19%. Jing Lu et al [13] presented an interval pattern matcher that identifies the patterns with interval elements using Neural Networks. It can handle interval input values and output values. The experiments had shown that the error intervals are highly closed with the output. An accuracy of 100% was obtained.

Sudip Mandal and Indrojit Banerjee [3] implemented NN and tested on two dataset, Breast Cancer and Lung Adenocarcinoma. Experimentation was carried on Matlab 7.6. it was concluded that the accuracy of the network increases with the increase in the number of samples used for training. Hayder M, Albeahdaili, Haider A. Alwawazy and Naz E. Islalm [4] used Convolutional NN for image recognition. The experimentation was conducted on MNIST, CIFAR-10 and

CIFAR-100 datasets. Experimental results showed that the CNN outperformed the most contemporary approaches. Htet Thanzin Tike Thein and Khin Mo Mo Tun [5] constructed a Feed Forward NN with island differential evolution propagation algorithm. The proposed algorithm was tested on Winconsin Breast Cancer Diagnosis problem. An automated classification of various types of breast cancer was performed by using the proposed model. Two different migration topologies are compared in this work.

Nesibe Yalcin, Gulay Tezel and Cihal Karakuzu [6] developed a Particle Swarm Optimization (PSO) based NN model which was diversified according to the PSO version. A total of 7 PSO-based NN models were described. Among the seven, PSO3 and PSO4 were determined to be the appropriate models for classifying the epilepsy disease with an accuracy of 99.67% and 98.75% respectively. The testing accuracy was 100% for both the models. Mahammad Abhal Hannan, Chew Teik Gee and Mahammad Saleh Javadi [7] introduced an automatic vehicle classification for traffic monitoring using image processing. Fast NN (FNN) was used as a primary classifier and Classical Neural Network (CNN) was applied as a final classifier to achieve high classification performance. The correlation between the input and weighted neurons was gained by FNN. Fourier Transform was applied to speed up the procedure. A lighting normalization method was applied to reduce the effect of variations in illuminations. Experimental results demonstrated that the proposed method performed with low false positive rate in both simple and complex scenario in detecting vehicles.

Nagabhushan T, Ko H, Park J, Padma S and Nijagunarya Y [8] tell that by using the auto-configuring Radial Basis Function (RBF) Network, the symbolic data can be classified with better generalization. In the first step, the symbolic representation is shown in binary form and then for clustering the binary symbolic data hamming distance is used. Cluster which have specific percentage of significant data samples were picked and trained using Adaptive Auto-Configuring Neural Network. The benchmark data set for experimentation is taken from UCI. The samples which were trained using Fuzzy Radial Basis Function NN reported very good results.

Liu Q, Bao F, Xu H and Xia B [9] describe the implementation of artificial neural network in field of solid ducted rocket test. Furthermore it tells that ANN is combined with RBF (radial basis function) to recover the abnormal data. The ANN model is based on three layered architecture. Which takes data on input node then transform it to middle layer called hidden node then it moves toward the output node. When data moves toward the hidden node then it applies data mining techniques on large data and finds the correlation between different data. This algorithm detects and recovers the irregular parameters rapidly and efficiently.

Huang C L, Hsu T S and Liu C M [10] described a novel approach called Mahalanobis Taguchi System (MTS) ANN for expert system application. The algorithm was implemented in the dynamic environment. The experimental outcomes of this algorithm proved that this algorithm is vastly valid in pattern recognition and is computationally efficient in addition to the ANN algorithm, is a straightforward and

resourceful system for assembling a dynamic structure. From this it can be accomplished that MTS-ANN algorithm can be effectively useful to dynamic environment for data-mining troubles.

Mohammed Junaid [11] presented a cost effective approach to classify the normal, malignant and benign tumour using two layer NN back propagation algorithm. Back propagation algorithm was used to train the NN. Parallelization techniques were used to speed up the computation process. The highest accuracy of 97.12% was achieved using the two layer NN back propagation algorithm. Gurleen Kaur and Harpreet Kaur [12] proposed a combination of Principal Component Analysis (PCA) and Linear Discriminant Analysis (LDA) for the extraction of facial features and classification of faces with ANN. Euclidean distance was used to compare the results obtained using two techniques. PCA, LDA and ANN with Euclidean distance shown an accuracy of 100% where PCA and LDA has shown only 85.33% and 90.6% respectively.

IV. CONCLUSION

This paper studied the application of Artificial Neural Network in every other field. The parallel performance and robustness of ANN to fit into every solution made it widely acceptable technique in Data Mining. Moreover, the predicting and classification ability of the Data Mining techniques have also been increased by the ANN. The future direction of this work is to test the ANN in every field by collecting different data from different fields with experimental results.

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