RESEARCH ARTICLE OPEN ACCESS

Survey of Papers for Data Mining with Neural Networks to Predict the Student's Academic Achievements

Richa Shambhulal Agrawal [1], Prof. Mitula Hirenkumar Pandya [2]
Student [1], Assistant Professor [2]
Department of Computer Science and Engineering
Alpha College of Engineering and Technology, Khatraj
Gujarat -India

ABSTRACT
Predicting student's academic performance is very crucial to any university management to replace the rate of attrition among the students upon graduation/ post-graduation. This dissertation/ paper describes a Neural Network Prediction Model that is used to predict the academic performance of students over the years. This Dissertation/ Paper present a study of effects of Chartered Accountancy course on overall performance of students. The study will be carried out on the INSTITUTE OF CHARTERED ACCOUNTANTS OF INDIA, WIRC OF ICAI, AHMEDABAD BRANCH, GUJARAT. Marks of student's fundamental subjects and results are being used as output or dependent variables. There are three levels here CPT, IPCC and Final. Outcomes will help improve the student's outlook on course being brought up as "Tough and difficult to Pass"
Keywords:- Artificial Neural Networks, Data Mining, Student's academics, achievements

I. INTRODUCTION

Students are an important stakeholder and students' achievement is of dire concern to any university management, thus early prediction of students' performance become crucial so that strategic steps and intervention can be suggesting improving students' academic achievement. Early prediction was the best sought after so that the rate of attrition among students can be reduced before reaching the final semester. This has led many researchers in performance prediction work that covered students from different background and academic areas such as MBA students, nursing schools and that of Computer background. [1] [2-4] However, the input predictor variables or the independent variables used by previous researchers were based on socio-demographic profiles. Such demographic included former school background, hometown location, types of boarding school, gender and previous academic achievement. The data was collected mostly from survey forms and random interviews. But none has been done in a coveted field like ICAI.

Statistical Package for Social Sciences (SPSS) has been very popular among past researchers which included Linear Regression, Data Mining Technique and Decision Trees. NN has also been used before for the purpose of students' performance prediction and such models again considered demographic background as input parameters. There was one study that used NN model for prediction by using real data of Tests, Quizzes and assignment as input parameters to predict the final examination mark. [5]

However, the study only focused on one course namely Thermodynamics

There were two papers recently published in the years 2013 and 2014 respectively, which had a comparison of two methods. This gave me an inspiration to develop an analysis based on their papers.

The study presented herewith predicts the overall performance of students by considering the Grade Points (GP) scored by
the students in fundamental core subjects as input parameters of the prediction model. We ignore past history of student's achievement once they are accepted into the Degree program.

II. BASIC CONCEPTS

DATA MINING

It is the term used to describe the process of extracting value from a database. A **data warehouse** is a location where information is stored. The **type of data** stored

largely depends on the industry or the company. Many companies store every piece of data they have collected, while others are more ruthless in what they deem to be "important".

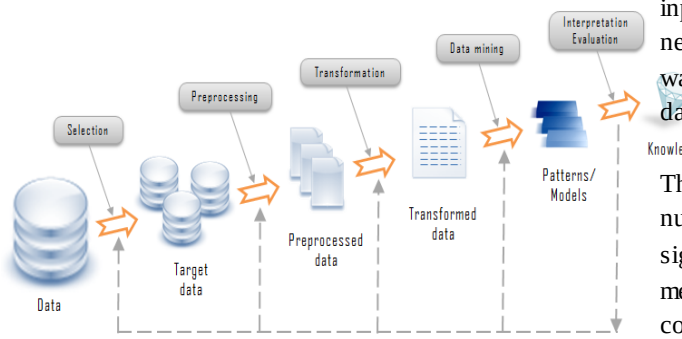

Figure 1. **Process of Data Mining**

ARTIFICIAL NEURAL NETWORKS

An Artificial neural network, is often called a Neural Network (NN), is a mathematical model or a computational model based on biological neural networks, in other words, is an emulation of biological neural system, It consists of an interconnected group of artificial neurons and processes information using a connectionist approach to computation. In most cases an ANN is an adaptive system that changes its structure based on external or internal information that flows through the network during the learning phase.

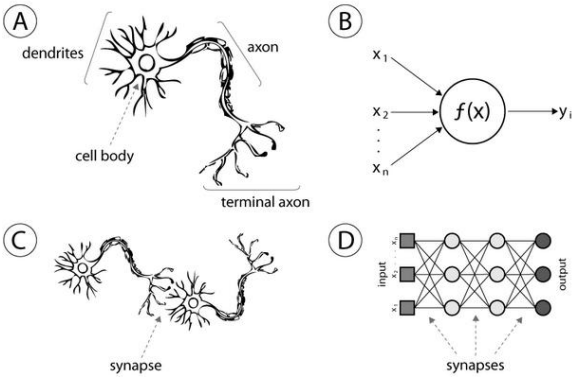

Figure 2. **How Artificial Neural Network is created using Neurons.**

Data Mining And Neural Networks

Neural Networks are non-linear statistical modelling tools. They can be used to model complex relationships between inputs and outputs or to find patterns in data. Using neural networks as applications in Data Mining as a tool, data warehousing firms are harvesting information from datasets is the process known as data mining.

The data mining with neural networks can only handle numerical data, so it is needed to transform any sign or signal based data into numerical data. The simplest method is to establish a table with one-to-one correspondence between the sign data and the numerical data. The other most common approach is to adopt a hash function to generate a unique numerical data according to given string.

Neural networks are programmed or trained to:

- Store, recognize, and associatively retrieve patterns or database entries
- To solve combination based optimization problems.
- To filter noise from measurement data
- To control ill-defined problems
- To estimate sampled functions when we do not know the form of the functions

It is precisely the two abilities (pattern recognition and function estimation) which make artificial neural networks (ANN) so prevalent utility in data mining. Types of Network: (1) Feed Forward Neural Network.(2) Backward Propagation

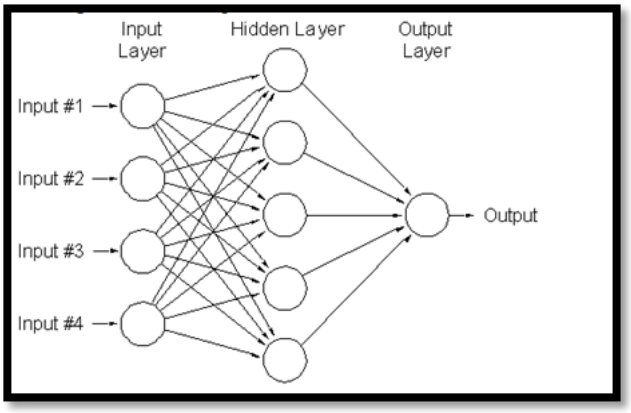

Figure 3. **Process of Data Mining in Neural Networks.**

III. BACKGROUND AND RELATED WORK

I have studied various papers on the given subject, all from IEEE portal. The survey ensues:

In [6], student's performance was measured pertaining to field of higher education. There is no specific field defined here. CRISP-DM (Cross Industry Standard Process-for Data Mining) was used to analyse the data and no Neural Network was used. CHAID (Chi Square Automatic Interaction Detection) algorithm was used here.

In [7], a comparison of Artificial Neural Networks and Linear Regression was done on student data to predict the outcomes. This was done in the year 2013. The comparison of two methodologies was not something I was looking for but it gave me the inspiration to follow the Neural Network Path. The advantage of this paper was that the role of academic advisors (AA) and lecturers are critical this time around to motivate, convince and inculcate positive thinking to under achieving students until graduation. While the disadvantage was stated that the subject matter is more difficult for the students as they progress further into the higher semesters of the electrical engineering courses.

In [8]- [9], presented in 2014, by authors of [7], a comparison of Artificial Neural Networks and Linear Regression was done on student data to predict the outcomes. The advantage of this paper was that the role of academic advisors (AA) and lecturers are critical that time around to motivate, convince and inculcate positive thinking to under achieving students until graduation. While the disadvantage was stated that the subject matter is more difficult for the students as they progress further into the higher semesters of the electrical engineering courses.

In [10], a Network Model was developed to predict the Electrical Student's performance academically. The comparison was done amongst simple graduates and diploma holders. Here only data mining was used which inspired me to go for data mining first. The paper also stated that Neural network could be used for prediction of student's academic performance. The same is being done for my paper wherein the outcome of data analysis using a data mining technique will be used as an input for Neural Network Algorithm.

In [11], a Neural Network Student's performance prediction Model was developed in order for Prediction of academic performance of engineering students. The research was mainly on comparison between the targeted and predicted models. A Feed forward with Levenberg-Marquart algorithm was used for the prediction. The accuracy and speed for the algorithm was found to be better than other algorithms. In the disadvantages it was stated that, the grades of students might suffer if they put same effort at all levels of course as the course gets harder and more complicated as it advances. The paper concluded that Neural Network model can be used to predict student's academic performance.

In [12], neural networks based data mining approach was used to assess the learning performance. In this paper, the E-Learning concept was assessed. Analyzing student's behavior and adopting different learning system to predict their grades. A multilayered feed forward network was used here. The analysis was aided using linear function normalized conversion. A staggering 89.96% accuracy was obtained here. The results of the study provided useful information for educators to classify their E-Learners or students more accurately and to plan their teaching strategies.

In [13], a Neural Network Model was developed to Predict academic performance of students. Analysis of students results of core and advanced subjects was done in order to predict their performance. Decision trees and Levenberg Marquart Algorithm were used in methodology. It was concluded that, there is a direct correlation between results of core subjects and final overall academic performance. Model could be used as an evaluation tool also to predict the future results of the students based on their present performance.

IV. CONCLUSION

After researching on the above stated material [1] -[15] and many more, it can be easily concluded that in today's world, Data Mining plays an important role and Neural Networks can be considered an integral part of our research when need to predict. Different algorithms have been established for prediction using Neural Networks. They are Gauss Newton Algorithm, Gradient Descent Algorithm and the Levenberg Marquart Algorithm. The studies show that Levenberg Marquart Algorithm suits the best because of its speed, accuracy, robustness and various other positive points. What remains to be seen is whether we are able to find an algorithm or methodology easier than the Levenberg Marquardt Algorithm in Neural Networks. Also, it is seen here that, Student's performance can be analyzed using different Data mining techniques and furthermore, it can be easily handled using Neural Networks.

REFERENCES

[1] R. S. Naik B, "Using Neural Network to Predict MBA Student Success" College Student Journal, 2004.

[2] O. M. N. Alfan E, "Undergraduate Students' Performance: a case of University Malaya," Emerald Quality Assurance in Education vol 13 no 4, vol. 13 2005.

[3] R. D. Ibrahim Z, "Predicting Students' Academic Performance: Comparing Artificial Neural Network, Decision Tree and Linear Regression, 2007," in 21st Annual SAS Malaysia Forum, 5th September 2007, Shangri-La Hotel, Kuala Lumpur, 2007.

[4] I. Z. Rusli N M, Janor R M "Predicting Students' Academic Achievement: Comparison between Logistic Regression, Artificial Neural Network, and Neuro-Fuzzy," in IEEE, 2008.

[5] N. M. M. Kadirgama K, Sani M S M, M.M.Rahman, M M, Rejab M R M, M.Y.Taib M Y, Sulaiman A, Ibrahim A , Bakar R A "Development of Genetic Algorithms and (MPNN) model to Study The Student

[6] Alan Cheah Kah Hoe, Mohd Sharifuddin Ahmad, Tan Chin Hooi, Mohana Shanmugam, Saraswathy Shamini Gunasekaran, Zaihisma Che Cob, Ammuthavali Ramasamy College of Information and Technology, Universiti Tenaga Nasional, Jalan IKRAM-UNITEN 43009 Kajang, Selangor, Malaysia. Grant Scheme no.: J510050264. Analyzing Students records to Identify Patterns of Student's performance.

[7] Pauziah Mohd Arsad, Norlida Buniyamin, Faculty of Electrical Engineering, Universiti Teknologi Mara, 40450 Shah Alam Malaysia, pauzia167@salam.uitm.edu.my, nbuniyamin@salam.uitm.edu.my, Jamalul-lail Ab Manan, Mimos Malaysia Berhad, Technology Park Malaysia, amalul.lail@mimos.my. IEEE 2013, 978-1-4799-2332-8Prediction of Engineering Students' Academic Performance Using Artificial Neural Network and Linear Regression: A comparison.

[8] Pauziah Mohd Arsad, Norlida Buniyamin, Faculty of Electrical Engineering, Universiti Teknologi Mara, 40450 Shah Alam Malaysia, pauzia167@salam.uitm.edu.my,nbuniyamin@salam.uitm.edu.my, Jamalul-lail Ab Manan, Mimos Malaysia Berhad, Technology Park Malaysia, amalul.lail@mimos.my. IEEE 2014 978-1-4799-3190-3. Neural Network and Linear Regression Methods for Prediction of Students' Academic Achievement

[9] Pauziah Mohd Arsad, Norlida Buniyamin, Faculty of Electrical Engineering, Universiti Teknologi Mara, 40450 Shah Alam Malaysia, pauzia167@salam.uitm.edu.my, nbuniyamin@salam.uitm.edu.my, Jamalul-lail Ab Manan, Mimos Malaysia Berhad, Technology Park Malaysia, amalul.lail@mimos.my. IEEE 2011.

[10] Arsad P M, Buniyamin N, Manan J A, Hamzah N, "Proposed Academic Students' Performance Prediction Model: A Malaysian Case Study," 3rd International Congress on Engineering Education (ICEED), 7-8 December 2011,

[11] Pauziah Mohd Arsad, Norlida Buniyamin, Faculty of Electrical Engineering, Universiti Teknologi Mara, 40450 Shah Alam Malaysia, pauzia167@salam.uitm.edu.my,A Neural Network Student's Performance Prediction Model (NNSPM). 26-27 November 2013, Kuala Lumpur, Malaysia. IEEE 2013.

[12] Jieqiong Zheng E-Iearning Lab Shanghai Jiao Tong University Shanghai, China zjq8858@yahoo.com.cn Zeyu Chen E-Iearning Lab Shanghai Jiaotong University Shanghai,China zychen@sjtu.edu.cn Changjun Zhou Department of Computer Technology Shanghai Jiao Tong University Shanghai, China zchangjun@gmail.com. Applying NN-based Data Mining to Learning Performance Assessment. 2013-2014

[13] Arsad P M, Buniyamin N, J A Manan, "Neural Network Model to Predict Electrical Students' Academic Performance," in International Congress on Engineering Education, pauzia167@salam.uitm.edu.my,A ICEED 2012, Park Royal Penang Malaysia, 2012.

[14] Arsad P M, Buniyamin N, J A Manan, "Neural Network Model to Predict Electrical Students' Academic Performance," in International Congress on Engineering Education, ICEED 2012, Park Royal Penang Malaysia, 2012.

[15] Arsad P M, Buniyamin N, Manan A J, Kasim A R, "Female Electrical Engineering Degree Students' Performance Based on Different Entry Levels: A Malaysian Case Study" in Recent Researches in Educational Technologies 2011 (WSEAS), 2011.

[16] Y. Y. M. Zaharim A, Omar M Z, Mohamed A, Muhamad N, Mustapha R, "Employers Perception towards Engineering Employability Skills In Asia," WSEAS TRANSACTIONS on ADVANCES in ENGINEERING EDUCATION, vol. Volume 6, September 2009, 2009.