Loan Analyzer using Artificial Intelligence

Mukul Anand¹, Gaurav Faujdar²
IT Scholar¹,²
Department of Information Technology
Galgotias College of Engineering & Technology, Greater Noida, Uttar Pradesh, India

Abstract:
The objective of this paper is to calculate the percentage risk and to determine whether the applicant can get a loan, to reduce the efforts during the process of loan, and it also determine the suitable amount of loan that can be borrowed by the applicant. Loan analysis is a big problem for the banks while processing their work. It’s a time taking process and also it is very risky. Using artificial neural network, the bank can calculate the percentage risk and overcome this problem. With the help of feed forward network and back propagation algorithm we can determine whether the applicant is suitable for borrowing the loan or not.

Keywords: Artificial Neural Network, Mean square error, Credit rating System, training, Artificial Intelligence, Prediction.

I. INTRODUCTION
The main role of the banks is to take money from the people at a particular rate of interest and then lending it to others at a rate which is higher than the rate taken from the people. This way banks function in a healthy economy. But real problem arises when people borrow from the bank but in the end are not able to repay the loans leading to bad loans for the banks. This has been a very major cause of concern especially when the economy of the world is moving at a very fast pace. Bad Loans reduces the efficiency of banks in any financial setup and is very bad for the economy. The better the banks are, the more economically developed a country is. They are the engines of an economy. Banks face problems such as the probability of non-repayment of received loans at the due date. This likelihood of non-repayment of loans at the payable date is termed as Credit Risk. Credit Risk is a broadly studied topic in banks’ lending decisions and cost-effectiveness. Borrowers usually have the better information for the projects to be financed, but lenders usually don’t have sufficient information about the projects. If a bank has good customers it is more likely to increase its efficiency and allow the banks to lend more but here can be a contradictory case of banks itself going bankrupts when they face bad loans and bad customers. Risk analysis of loans in financial markets is one of the major tools that can be applied with neural networks. Artificial Neural Networks play an increasingly important role in financial applications for tasks such as pattern recognition, classification and various others such as time series forecasting. Credit Risk is dependent upon number of factors and can be divided into two groups- one within the organization and the other outside the organization. i.) Factors outside the banks are not under the purview of banks and cannot be controlled by banks. These factors include Political Changes, Earthquakes, and War etc. ii.) Factors inside the banks are the factors which the bank organization have their hold upon. These are called Endogenous factors. [2] In this research we are trying to find out the factors which are endogenous to the banks and are affecting the credit risk of the banks significantly. The main purpose of this project is to identify the range of factors which play a very significant role in credit risk analysis and thereby after analyzing the range of factors we will try to come up with a Credit Rating which can be given to every customer of the bank. The advantage of Credit Rating would be such that if the customer does not possess the sufficient credit rating, he will not be granted the loan. Likewise if the customer does possess the required credit rating he will be granted the loan. ANN model is used in this research to achieve the above mentioned. It consists of the input layer, hidden layer and the output layer which will be used to implement the described above.

II. LITERATURE REVIEW
Credit rating is one of technical factor in credit risk evaluation (Khashman, 2010). The aim of credit rating is to categorize the applicants into two groups; applicants with good credit and applicants with bad credit (Ghodselaahi & Amirmadahi, 2011). [9] Multilayer feedforward networks are a class of universal approximation (Hornik, Stinchcombe, & White, 1989). The concept of “universal approximation” is one of the fundamental and important features in ANN models. These models have a high predictive power (Steiner, Neto, Soma, Shimizu, &Nievola, 2006). This means that the networks are capable of adapting to arbitrary and unknown functional forms, with an arbitrarily specified degree of precision. These non-parametric models are well-known in many areas, especially in computing because of their highly-sophisticated pattern recognition (Hall, Muljawan, Suprayogi, &Moorena, 2009). Universal approximation leads us towards regarding neural networks generally as flexible non-linear statistical methods (Curry, Morgan, & Silver, 2002). Extracting rules from a neural network are different. Steiner et al. (2006) analyse a credit risk data set by using the NeuroRule extraction technique. Angelini et al. (2008) indicate applicability of neural networks in credit risk applications, especially as black-box non-linear systems to be used in cohesion with classical rating and assortment systems. In order to forecast credit risk in banks, sometimes a combination of methods is used. Pacelli and Azzollini (2011) conclude that neural network models in combination with linear methods have further supported. [5] Use
of modern indicators in addition to traditional financial ratio indicators provides considerable improvement in forecast accuracy (Atiya, 2001). Salehi and Mansoury (2011) investigate the efficiency of neural network and logistic regression in forecasting customer credit risk. They state that both models have same efficiency. Credit rating is also investigated with other methods of artificial intelligence. Ghodselahi and Amirmadhi (2011) use a hybrid method for credit rating. They use Support Vector Machine, Neural Networks and Decision Tree as base classifiers. They found that accuracy of this hybrid model is more than other credit rating methods. [9] Credit rating is also investigated with three methods including Logistic Regression, Neural Networks and Genetic Algorithms (Gouvêa&Gonçalves, 2007). [10] According of this research’s result, logistic regression and neural networks are good and similar. Although neural network is slightly better and genetic algorithms take third place. The important roles of ANN in financial application are pattern recognition, classification and time series forecasting (Eleter&Yaseen, 2010). [1] Some researchers focus on learning approach in neural network models. In this field, Yu et al. (2008) use a multistage neural network ensemble learning approach. They state that this technique can provide a promising solution to credit risk analysis.

III. METHODOLOGY

The methodology that is used in this study is that of artificial intelligence. Artificial Intelligence can be defined as the imparting the intelligence to the machine in order to solve complex problem. For Example, facial recognition, speech recognition, Natural language processing, robotics etc. Artificial Intelligence is the designing the computer which can execute function intimating humans like visual perception, decision-making etc. The desired model is be achieved by artificial neural network. Artificial neural network is the neural network designed to function in the way biological nervous system. It is model after the human brain. It is made up of highly interconnected processing elements called Neurons. The neurons are the fundamental element of the neural network. For any given problem, these neurons work together to achieve the desired result. A neuron is processing unit. It has many outputs and have only one output. There are basically two mode of using the neurons. The first mode is the training mode in which we train the neuron or the neural network. Then comes the using mode where the taught neuron is used for processing and generating the output Any neural network has three layers. These are input layer, hidden layer, output layer. The input layer consists of the input neurons that act like input unit. All the weights are to be provided to the neural network are through input layer. The hidden layer acts like C.P.U. of the computer. This layer is responsible for adjusting the weights and mapping the input weights with the output weights. It transforms the inputs into something that the output layer can use. Finally, the output layer acts like the output unit that produces the final result.

Figure 1. A Simple Neuron

TABLE 1. Loan deciding Factors

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1 if it is above 25 else 0</td>
</tr>
<tr>
<td>Income</td>
<td>0 if less than 3.25L pa, 1 if between 3.25 to 12L pa, 2 if more than 12L pa</td>
</tr>
<tr>
<td>Loan amount</td>
<td>1 if less than 10L, 2 if between 10L to 20L, 3 for more than 30L</td>
</tr>
<tr>
<td>Account type</td>
<td>1 for salary account, 2 for savings account</td>
</tr>
<tr>
<td>Residency</td>
<td>1 for resident, 0 otherwise</td>
</tr>
<tr>
<td>Job experience</td>
<td>0 if less than 2 years, 1 if between 2 and 5 years, 2 for than 5 years</td>
</tr>
<tr>
<td>Debt Balance Ratio</td>
<td>1 if dbr is good, 0 otherwise</td>
</tr>
<tr>
<td>PAN Card</td>
<td>1 if the applicant has PAN Card, 0 otherwise</td>
</tr>
<tr>
<td>Guarantor</td>
<td>1 if the applicant has guarantor, 0 otherwise</td>
</tr>
<tr>
<td>Type of Company</td>
<td>1 if the company is endorsed by the bank, 0 otherwise</td>
</tr>
<tr>
<td>Nationality</td>
<td>1 if the nationality is Indian, 0 otherwise</td>
</tr>
</tbody>
</table>
V. EXPERIMENTS AND RESULTS

The model was designed on MATLAB. The nntool (Neural Network Toolbox) was used for the designing and simulating the network. The Neural Network Toolbox provides user interface which allows you to import, create, use, and export neural networks and data. Using this tool we import our input data, target data and also test data. Target data for the training of the neural network and test data for the simulation of the neural network. Figure 4. Shows the Neural Network Toolbox for data selection.

After the importing the data for training and simulating the neural network, we create the neural network and specify its parameters like type of the network, input data, target data, training function, number of neurons, transfer function etc. Figure 5 shows the tool network size selection.

After creating the network, the important task is to train the network with the training vectors which consist of an input variable and a corresponding target output variable. The neural network was trained using Levenberg-Marquardt Back propagation. The training stops automatically when the mean squared error i.e. the difference between the desired output and the expected output is below some threshold value or the number of iterations or epochs is above some threshold value. Figure 6 shows the training process of the network.

We can also see the performance graph, training state and the regression of the neural network.

Now the important task is to simulate the network. We provide the sample input to the network and we get the predicted value by the network. Then on the basis of these values, network made the decision about the loan. The predicted values are then copied into a text file. We then, write a function in MATLAB to load the predicted values from the text file. In this function we calculate the sum of the predicted values of the network. Now this sum is compared with threshold value of the credit score. The threshold value is calculated by summing the minimum values of the 11 factors of loan data. If the sum of the predicted values is greater than the threshold value, then the message is
displayed that, “loan is approved” else another message is displayed that,” loan not approved”.

Figure 8. Function to calculate the decision for the loan.

The final result of the model will be after the calculation of the predicted values of the neural network and comparing it with the threshold value of the credit score. The neural network correctly predicted the value and also displayed the message about the approval of the loan.

Figure 9. Final Result of the neural network.

VI. CONCLUSION

As we have seen the credit worthiness of an individual can be calculated by using artificial intelligence system. The neural network can be very useful in analyzing the creditability of the customer and can improve the efficiency and also can speed up the time taken in loan approving process using Credit scoring system. Loan Analyzer using artificial neural network can also reduce the excessive work load on the loan officer and helps in quickly analyzing the creditability of the applicant and in making the decision about the loan approval i.e. whether the loan for the applicant is approved or not.

VII. REFERENCES

[1] Neuro-Based Artificial Intelligence Model for Loan Decisions Shoroq FathiEletter, Saad Ghaleb Yaseen and Ghaleb Awad Elrefae

[2] Measuring Credit Risk of Bank Customers Using Artificial Neural Network Mohsen Nazari, Mojtaba Alidadi (Corresponding author) doi:10.5296/jmr.v5i2.2899


