



# Customer Loan Approval Classification by Supervised Learning Model

K. Gana Sai Prasad, P. Vamsi Sai Chidvilas, V. Vijay Kumar

**Abstract:** *The loan is one of the most important schemes of bank. Usually the Banks are willing to give loans to the customers based on their requirements. However, unfortunately there are some customers who delay the payment of loan or unable to pay the loans due to financial status. In order to solve this problem, banks need to use the help of some techniques in predicting the loan repayment status. Machine Learning models are known to have a high accuracy on prediction problems, so in this paper we use some of the machine learning models in default loan prediction.*

**Keywords:** banking, loan, prediction, classification

## I. INTRODUCTION

Loan repayment delay will cause loss for the banks, so they need to make a careful examination on the loan approval process. The two critical questions in the Banking Sector are 1) How risky is the customer? 2) Given the customer's risk should the bank approve his loan or not? The answer to the first question determines the interest rate of the customer, i.e. the customer, the higher the interest rate. With this interest rate we can determine the customer's eligibility for the loan. Bank give credits to clients in return for the guarantee of reimbursement with premium. That implies the Bank just makes benefits if the client satisfies the advance. Nonetheless in the event if the client doesn't reimburse the advance, at that point the bank loses cash.

Client first applies for the loan after the Bank verifies the customers details and makes expectations about the advance endorsement status. Notwithstanding doing this physically takes a great deal of time. Thus, Bank attempts to make the procedure of loan qualification straightforward dependent on client data. Along these lines, the last thing is to recognize the client portions that are qualified for taking loan. By what means will the Bank advantage if we give the client fragments is the prompt inquiry that emerges? Banks would endorse loans to just those clients that are qualified with the goal that they can be guaranteed of recovering the cash.

Thus, the more we are in anticipating the qualified clients the more advantageous it would be for the bank. The term default suggests disregard to meet the authentic responsibilities of a credit loan, for example when a buyer fails to influence a home advance portion, to or when an organisation or government fails to pay bond which has landed at improvement. To shield a credit loan from turning default, banks need to understand how to make figures subject to customers practice. Along these lines the purpose of this paper is to build up a supervised model of learning.

The procedure of the credit scoring, however in the past required specialists close by measurable calculations to accurately anticipate the value of a contender for loan approval or dismissal. Recently, in any case the researchers and the organisations have decided on developing classifiers dependent on AI calculations and neural systems to naturally foresee the credit score of an individual dependent on their authentic and sift through credit defaulters before the loan is approved.

The motivation behind this study is to bifold together the review of the writing on Loan Default and Credit Scoring. To introduce future bearings to researchers in the area of Loan Default forecast. The remainder of this study is organized in accompanying arrangement, the following section will talk about the models executed for foreseeing advance endorsement competitors, and the third section will include the discussion and the conclusion.

## II. LITERATURE REVIEW

Sudhamathy G and Jothi Venkat Eswaran developed a tree-based classification decision-making system for predicting defaulters. This paper tested and trained the prototype utilizing the information record available in the study archive. The information record is refined, shortened and prepared to procure enough forecasts before building the prototype. Arun Jothi's goal is to create a template of credit scoring for credit data. The design of the financial credit scoring system is based on various machine learning systems. This paper used a classifier K-Nearest Neighbour (K-NN) to create the credit data model. Six mining techniques were applied to the dataset (FLDA, Naïve Bayes, J48, Logistic Regression, MLP and IBK) to compare the performance of the algorithms in predicting the credit defaults. The reason for this research is to use different data mining techniques to compare the predictive accuracy of the default payment of the customer. The model is a classification dependent upon a choice algorithm that utilizes the accessible features in the r-package.

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SHIYI CHEN and W.K. HARDLE proposed the idea of finding a hyper plane to predict the German Corporations default risk. In every one of the tests directed in this paper, the non – linear model portrayed by SVM outperforms the benchmark logit model. Jose Francesco Martinez Sanchez and Gilberto Perez introduced the assessment of a credit scoring framework as far as cost-proficiency for the investment funds and advance establishments in explicit for the SOFIPO'S and as far as money saving advantage for the specialist coop appraisal of advance application. As a robustness measure to compare the performance of different models' techniques like ROC curves, Gini Coefficients and the Kolmogorov-Smirnov curves are used.

In an examination (Sawant and Chavan) a near investigation of five diverse arrangement classifications are done on client advance data records of little, intermediate and huge contents in aspiration of choosing a calculation for most accurate forecast if the advance is met or default. Naive Bayes, Decision Tree, Boosting and Random Forest are the plans to be considered. The remaining three are the assortment technique, which includes several game plans to help perceptions in planning. Sporadic Forest comprises of numerous choice trees and yields the method of the considerable number of trees yields. This paper doesn't have any significant bearing to which arrangements have been utilized to make outfits for advancing and packing.

Amira Kamil Ibrahim Hassan, Ajith Abraham used three multiple neural network training algorithms to build a loan default prediction model. The aim is to use the attribute filter to check accuracy and to create a model called the ensemble by combining the results of the three algorithms. The test did the correlation iteration on several variables such as the training time, MSE, R. Levenberg-Marquardt (LM) was the best algorithm because it has the biggest R and the slowest algorithm is One Step Secant (OSS). The filtering function was applied to the original dataset, which generated two other datasets for the purpose of accuracy. Then specific neural network training algorithm is implemented for each dataset and filtering function is provided the better model among other models.

Paper (Ramakrishnan, Mirzaei 2015) Compares AdaBoost classification performance with four different base learners with single learners' performance. AdaBoost is a form of classifier for boosting. It utilizes a benchmark arrangement K times where K is indicated by the client and the preparation is centred around an alternative sub-division of learning models offering inclination to already misclassified relations in each cycle. This classifier works with the weights of the principles of training. Appropriately evaluated tuples are given less significance in each iteration and mistakenly ordered ones are given more significance to build their odds of being picked in the preparation re-emphasis. After the training iterations have been finished individual arrangements got from the K cycles are consolidated to frame a profoundly precise solid arrangement. The solid arrangement is framed as a straight blend of the K arrangements burdened by the mistake of each arrangement from the relating cycle. Outcomes show that AdaBoost in all circumstances outflanked the individual arrangements. It was

the best in accuracy with and without AdaBoost, Linear Regression was second.

## III. PROPOSED METHODOLOGY

### A. Data Collection

Our Proposed System implements the machine learning techniques or algorithms on the banking loan data set which contains 13 attributes and 615 observations that represents the details of the customers to predict and classify the loan approval.



### B. Data Pre-Processing

Data Pre-Processing is a data mining process involving the transformation of raw knowledge into a legitimate organization. Since our dataset of banking loan is a real-world data it is inconsistent and incomplete, so it is data cleaning, data imputation, data normalization and transformation. Data pre-processing is a proven method of resolving issues such as the and incomplete data which are mentioned above.

### C. Building a Model

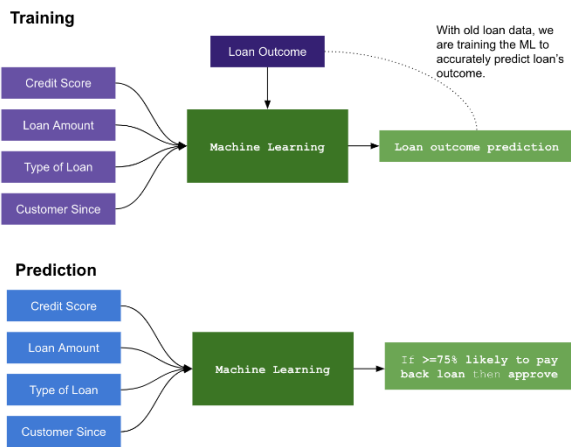
After the Pre-processing we will do the exploratory analysis to analyse the data set and to get a clear idea of the characteristics of the data. After the Exploratory Data Analysis is complete it can be used for developing Supervised and Unsupervised learning models. We initially make several hypotheses by looking at the data before we hit the modelling. EDA helps in confirming and validating the hypotheses we make. For the most part, the Exploratory Information Review is carried out using the accompanying Univariate Analysis Strategies, which outlines the insights of each field in the raw information index and the Bivariate Analysis performed to determine the link between each factor in the information index and the objective factor.

### D. Block Diagram

The Random Forest and Support Vector Machine Algorithms are used in this paper to construct and develop a model on dataset in order to predict the loan approval. In this paper we focus on improving the accuracy of the random forest model by adjusting the values of the tuning parameters.



The SVM was fitted using the R-Statistical software as a machine learning algorithm. The machine was trained to assume a linear boundary between the loan defaults and the non-defaults. The SVM Linear Kernel Model is the best in terms of the predictive accuracy.



**E. Evaluation Metrics for Machine Learning Model**

Evaluating a model is a centre piece of building a successful model

There are few assessment metrics like Confusion Matrix, Cross-Validation, ROC Curve and so on. Distinctive assessment metrics are utilized for various types of issues. Building AI models chips away at a useful criticism rule. You assemble a model, get criticism from the measurements, cause enhancements and proceed until you accomplish an alluring exactness.

Assessment measurements clarify the presentation of a model. A significant part of assessment measurements is their capacity to segregate among model results.

Evaluation of Machine Learning Model is a fundamental part of any function.

Since we are using the models of Random Forest and Support Vector Machine Linear Model it is necessary in order to use the evaluation metrics or assessment measurements for predicting the accuracy. Most of the times we use the precision of arrangement to measure model's results, it's not enough to really pass judgement on the model.

In this Paper we are utilizing various measurements to assess our model. The Evaluation Metrics we are utilizing to foresee our model are clarified in detail beneath.

**F. Classification Accuracy**

Precision of Identification is generally what we say when we use the word exactness. This functions admirably just if there are equivalent number of tests having a place with each class

**G. Confusion Matrix**

Confusion Matrix as the title proposes gives us a yield protocol and portrays the model's all-out execution. Since our paper chips at the Binary Classification issue have two classes yes/no, we use the perplexity framework.

Network Accuracy can be determined by taking over the slanting the normal amounts.

**H. Mean Absolute Error**

Thenormal of the distinction between truevalues and the estimated values is known as Mean Absolute Error. Thisprovides us the proportion of how accurate the assumptionsare from the true output. In any case, we are not given any thought about mix-up course, no matter what.

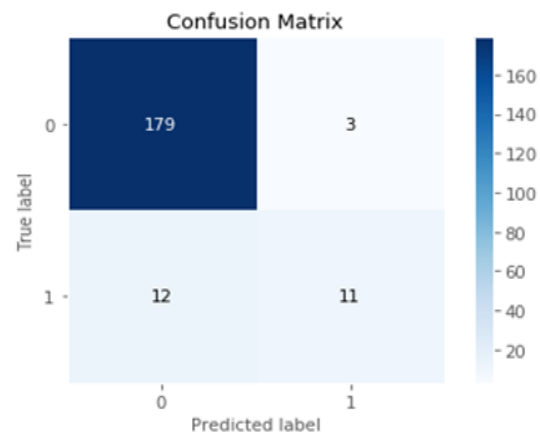
**IV. EXPERIMENTAL RESULTS**

**A. Random Forest**

Random forest is an association research procedure for the arrangement, relapse and that work by creating numerous choice trees at the planning time and resulting in the arrangement that is the strategy of the arrangements or average relapse of the separate results.

**B. Support Vector Machine**

A support vector machine is a rare training framework that separates statistics and detaches both order and relapse strategy material plans. The order approach is advantageous to choose at intervals of at least two dynamically potential end results depending on consistent pointing factors. The SVM approximation doles out the target data into any of these classes provided,considering data. The count of SVM is used on straight forward data-based speed and not necessarily forecasting. Selection tree models are memory-concentrated students in this way they are not appropriate for gigantic sets, after which we operate on cost-sensitive mortgage liabilityexpectation when usingtwo-class support vector machine and switch over to parallel sets on the rehashed instructive machine a short time later



**V. CONCLUSIONS**

This Study Provides a solution in response to predict whether the bank's credit application is satisfied or defaulted. The Procedure for finding a response consisted of accompanying basic steps like information investigation, which are the researchattributes of the information index , data pre-treatment , which is setting up information for the investigation and arrangement , which involves a considerable overview with different calculations of arrangement and different parameters of tuning in those calculations to locate the best model of characterisation.



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The best grouping model was accomplished using Random Forest and SVM Linear Kernel Model. In this paper we also performed the evaluation metrics in order to predict the accuracy of the model which provides an evident proof whether the model is accurate or not.

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