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Prediction of Banking Loan Fraud using Different ML Approach: A Review

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Abstract: -
The banking industry is the backbone of every country's economy and financial system which helps in determining its economic development. In today's competitive environment, a bank's performance is determined by the by the new technology services it offers. After the introduction of liberalization globalization and privatization policy, the Indian banking industry has seen enormous expansion. One of the most significant financial advancements is the use of internet banking services. Users of online banking are expanding very rapidly. Furthermore, with the implementation of initiatives such as Digitization, Demonetization, and Make in India, there has been a significant increase in online banking transactions across the country. As a result, new concepts such as payment banks and e-wallets emerge. Because it is a relatively new idea, the number of users in India is now fairly restricted, and teens are more likely than any other age group to use payment banks or e-wallets. Furthermore, as the number of people who use online banking services increases, so does the number of persons who conduct online banking fraud is present. Consumers are increasingly becoming victims of online banking scams. In this paper the study of different types of bank fraud and different ML algorithm.
Keywords: -Machine Learning (ML), Banking, Loan Fraud

I. INTRODUCTION

The banking industry is the lifeline blood of any country's economy and financial system and is used to determine a country's economic development. Commercial banks are critical for resource mobilization and better allocation in emerging and underdeveloped countries. The banking industry is primarily customer-driven, and its development and success are largely dependent on the services it provides. The grade of service that a bank delivers is connected to attracting the public's attention to pick that bank. Today, almost all banks offer the same kind of services and facilities to their consumers. Every bank wants to compete with other banks, therefore, it must be more effective in providing services and managing client relationships. The single element that separates one banking service from another is the "Customer Perception" of the bank's current service. Customer impression is the most important aspect in deciding which bank to use. In today's environment, a bank's performance is also determined by the new technology services it offers. Technology has a remarkable impact on the banking industry's ability to provide high-quality services. Banking services have undergone a paradigm shift as a result of internet technology. The adoption of internet technology by the banking industry has erased the conventional barriers of time, geography, and communication between a banker and a consumer.

II. FRAUD

Bank frauds are classified as white collar crime, and they are both illegal and penalized offenses. When a person utilizes illegal methods to get money, assets, or other property from financial institutions, it is referred to as bank fraud. Fraudulent information and false promises are frequently exploited in order to gain more money. The two reasons that are responsible for the ever-increasing bank frauds are the complexity of bank transactions and inability to follow branch operating procedures. The number of bank frauds is increasing year after year due to the availability of several flaws in the financial system.

Online Banking Frauds: - Online banking fraud is a common way for criminals to steal information

from banks, merchants, and customers. Intentionally obtaining a person's online banking data by the use of a trick or device and abusing the information to make purchases, withdraw money from the account, or transfer funds to another person using a number of tactics meant to deceive and with the use of contemporary technology. In today's world, almost all banks offer online banking services in some form or another using electronic media, which is referred to as "brick-to-click" banking.

Reasons: The occurrence of frauds in the banks is not a recent phenomenon, In fact crime of forgery is perhaps as old as the writing itself. Any organisation which deals in money is always vulnerable to frauds and this is more so in the case of financial institutions like banks which are dealing only in money and that too as a business commodity. The fraud involves two components: (i) the intention of the person to commit fraud and (ii) the opportunity available to facilitate such fraud. These two components are, therefore, important from the viewpoint of detecting and preventing the frauds.

2.1 Types of Bank Fraud
1. Cheque Kiting: Cheque kiting is when someone writes a cheque that doesn't have enough money to cover it. This happens because it can take a few days for a bank to realize that the cheque is fake.

2. Cheque Fraud: Cheque fraud is a very common type of crime where people use stolen cheques or fake signatures to take money from other people.

3. Accounting Fraud: To hide a financial problem, some companies make up records to make their business look better than it is. This can help them get loans, or other financial support.

4. Letter of Credit Fraud: A letter of credit is a document that allows someone to take on a debt or credit obligation, usually with a certain amount of time to pay back. Letters of credit are usually used in international trading, where people might need to borrow money to buy something from another country. Fraudsters sometimes try to use false letters of credit to cheat banks, by providing documents that show that the goods have been shipped, when in fact, no goods have actually been shipped.

5. Payment Card Fraud: Payment card fraud involve dishonest activities that are carried out with payment cards like a debit card or credit card.

6. Phishing and Internet Fraud: Phishing is a type of internet fraud where someone uses email to send unwanted messages to a lot of people at once. This can be done by forging websites, getting people's personal information illegally, or just sending a lot of emails in a short period of time.

7. OTP Fraud: OTP codes are used to communicate securely between two people. Someone could change the code so that the money goes to a different account, which could be used to commit fraud. Counterfeit Securities: Counterfeit documents (like securities) can be used to get a loan from a bank by using them as collateral. This means that the documents may be fake or not really related to the real thing.

9. Forged Document Fraud: Forged documents can be used to get things like loans or insurance from banks.

10. Money Laundering Fraud: Money laundering is a scam where someone tries to hide the true source of money so they can get an unfair advantage.

11. Bank hacking Fraud: Bank fraud is when someone hacks into a computer to steal money or information from a bank. This can be done either by damaging or accessing the computer, or by spreading malware.

12. Wire transfer Fraud: Banks use wire transfer networks to transfer money between each other quickly and easily. This makes it susceptible to fraud, where people try to use fake documents to get money wired to an offshore account.
13. Fraudulent loan applications: There are a number of ways that people can use false information to hide their credit history or financial problems. Some people do this by lying about their past, while others do it by falsifying financial records to make them look better. And sometimes company will use accounting fraud to overstate their profits in order to get a risky loan.

14. Identity theft: Identity theft is when someone takes your personal information, like your name and number, and uses it to get things like a credit card or a loan.

15. Loan Fraud: Loan fraud happens when someone takes out a loan they can't afford to pay back. This often happens with people who have too much credit card debt or who don't have a good credit history.

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16. Bill discounting Fraud: A fraudster uses a company they control to get a bank to trust them. The fraudster makes regular, small payments to the company, pretending they are from legitimate customers. Once the bank trusts the fraudster, the fraudster requests that the bank start paying the company for bills it will later collect from real customers. This allows the fraudster to keep the money the bank pays up front and avoid having to pay the bills themselves.

III. LITERATURE REVIEW

Raj Gaurav et al. [1], these days, banking areas/monetary establishments are dealing with intense issues of advance default. Their advance resources are changing over into non-performing resources quickly. This issue makes these foundations reaching a dead end financially and creating their gain into weighty obligation. Throughout the previous few years, there has been insight about converging of banks and other monetary organizations because of weighty misfortune, and the primary justification behind their misfortune is defaulting of credits. The crucial target of this paper is to gauge the gamble of credit default of applying people, establishments, or some other association sooner endorsing them an advance. Different boundaries like instructive foundation, age, wards part size, certain pay, nature of pay, these are some fundamental premise, would be seen into observable prior to tolerating the sans npa advance. This paper likewise has a goal to mechanize the cycle that will decrease the interaction time and human energy and convey the assistance all the more proficiently. In this paper, various ML models are contrasted and the few advance guaging models, and precision has arrived at in excess of 90% which is obviously superior to existing models where exactness depends on 80%. This precision would be useful for monetary establishments in the viable world to estimate on the off chance that the credit ought to be acknowledged or not, making them NPA while returning back their advances. That will be useful in attaching the advance loaning process with less expected assets to acknowledge the credit applications and channel the reliable candidates for loaning sans npa credits.

Infant Cyril Gnanasamy et al. [2], the advance qualification expectation model utilizes an investigation procedure that changes authentic and present credit client data to make forecasts. A critical issue in foreseeing credit qualification is, making exact advance forecasts utilizing hazard and assessment examination. To estimate credit qualification, this examination proposes a remarkable strategy called Versatile Social Line Collie Improvement based Profound Neuro Fluffy Organization (ASBCO-based DNFN). Here, versatile box cox change is utilized to make the info advance information reasonable for additional handling. Covering based highlight determination is then used to pick the most suitable elements to improve expectation. Following component choice, Gullible Bayes is utilized to meld the elements. At last, a proposed versatile Social Boundary Collie improvement is utilized to prepare a profound neurofuzzy organization to foresee credit qualification. Here, the Social Ski-driver (SSD), Line Collie Improvement (BCO), and the versatile idea are consolidated to make the Versatile SBCO, which creates the most reliable outcomes. When contrasted with the ongoing technique, the recommended strategy performs better, with greatest exactness, responsiveness, and particularity of generally 95%, 95.4%, and 97.3%, individually.

Joseph Bamidele et al. [3], monetary establishments need progressed, current, and tweaked prescient examination to shield themselves from the disappointing fraudster. Man-made reasoning, AI and measurable strategies are popular from information researchers and analysts who grasp them; in this way the interest for them is developing as of late. The disturbing rate by which credit recipients default banks have course a ton of misfortunes among many banks, and denied numerous likely recipients of admittance to the credit. This misrepresentation prompts wasteful as well as erroneous administration of credits in banks, and tragically, many banks have close down and have not yet understood that the work escalated ways to deal with advance administration are not sufficiently proficient. The pattern has made many banks laborers lose their employment. The conventional approaches to distinguishing extortion in bank advance administration are not successful in light of the fact that the credit official can without much of a stretch be controlled and not even found many credit defaulters. Accordingly, this paper utilized Fake Brain Organization to distinguish credit extortion in bank advance administration to stay away from advance defaulter control the official accountable for credit organization. A credit dataset of 600 clients in a microfinance bank was utilized in this review. Notwithstanding, significant elements from the dataset were separated to fabricate a model that yields 98% precision. This promising arrangement makes extortion discovery simpler, and too offer

help to the bank to recognize misrepresentation in credit the executives.

Shinde et al. [4], credits are the significant prerequisite of the cutting edge world. By this main, Banks get a significant piece of the all out benefit. It is advantageous for understudies to deal with their schooling and everyday costs, and for individuals to purchase any sort of extravagance like houses, vehicles, and so on.

Be that as it may, with regards to concluding whether the candidate's profile is applicable to be allowed with advance or not. Banks need to take care of numerous viewpoints. In this way, here we will utilize AI no sweat their work and anticipate regardless of whether the up-and-comer's profile is important utilizing key highlights like Conjugal Status, Schooling, Candidate Pay, Record, and so on.

Praveen Tumuluru et al. [5], although banks offer a variety of products through our banking system, their primary source of revenue is their credit line. so that they can earn money from the interest on the loans they credit. Whether customers pay back loans or default on them is a significant factor in determining a bank's profit or loss. The bank has the ability to reduce its Non-Performing Assets by anticipating loan defaulters. Because of this, studying this phenomenon is crucial. There are a plethora of approaches to studying the issue of controlling loan default, as previous research conducted in this era has demonstrated. However, since accurate predictions are crucial to maximizing profits, It is essential to compare and contrast the various approaches. The problem of predicting loan defaulters is investigated using a crucial predictive analytics strategy: The model of logistic regression. The data for research and forecasting are gathered with the help of the Kaggle. The various performance metrics were calculated using logistic regression models. Sensitivity and specificity are used as performance metrics to compare the models. The final outcomes have demonstrated that the model produces distinct outcomes. Because it includes variables (customer personal characteristics like age, purpose, credit history, credit amount, credit duration, and so on), the model is marginally superior. To accurately estimate the likelihood of loan default, this information must be taken into consideration in addition to the customer's wealth-indicating information on their checking account. Consequently, by evaluating their likelihood of loan default, the appropriate customers to target for loan approval can be easily identified using a

logistic regression approach. According to the model, a bank should not only focus on lending to wealthy customers but also evaluate the customer's other characteristics, which play a crucial role in granting credit and predicting loan defaulters.

Baodong Li et al. [6], internet-based loan default prediction is especially crucial given the rapid growth of Internet loans and the demand for Internet loans. The Internet is the foundation for peer-to-peer online lending. The borrower's financing cost has decreased significantly as a result of the widespread use of personal computers and mobile devices, as has the borrower's capital utilization efficiency. The primary directions for development in the future are making full use of the online lending platform's existing data, integrating data from third parties, and predicting user default behavior. This paper focuses primarily on the DPNN-based network loan default prediction model. It then goes into detail about the premise and characteristics of BPNN and decides how to rate the credit risk of online lending using BPNN. After cleaning and variable selection of credit customer data provided by lending clubs, data analysis and processing software is used to establish a set of corresponding online lending default risk assessment models through BPNN. The network loan default assessment model of the BPNN model is simulated and contrasted with the support vector machine and regression models in this paper. The results of the experiments indicate that, in comparison to the other two models, the BPNN model has a recall rate of 99.82 percent and an accuracy rate of 98.01 percent; Compared to support vector machines and regression models, BPNN has a significantly higher AUC value of 0.79. Above results show that the web-based credit default expectation model in light of DPNN has high application esteem by and by. P2P lenders' and P2P companies' risk will be reduced, P2P lending institutions will become more competitive, and domestic P2P platforms will become more stable as a result of anticipating the likelihood of customer default risk.

Marion O. Adebiyi et al. [7], an important factor in determining a financial institution's loss or gain at the end of a fiscal year is loan approval. The banks are looking for ways to guarantee that these loans will be repaid within the allotted time frame. As a result, the goal of this research is to create an artificial neural network-based loan prediction system that can tell you whether a loan is a good or bad one, as well as whether it is a payable debt or a bad debt. Additionally, the system can assist in determining whether a loan applicant will default

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on repayment. An algorithm for artificial neural networks was used in the study to create a loan prediction plan. Python was used as the programming language, HTML was used for the front end, Cascading Style Sheet (CSS) was used for the back end, and PHP was used for the system's back end. Additionally, the system evaluated the accuracy of the system using the confusion matrix as performance metrics. The result demonstrates that the developed system can accurately predict whether a loan applicant will default on repayment with 92 percent accuracy. The system can also tell if a loan has a bad debtor who hasn't paid it back. Finally, the accuracy of the system was used to compare the system to other studies that had been done before, and the results showed that the proposed system performed better than those studies.

Ebenezer Owusu et al. [8], lending institutions have trouble accurately projecting loan defaults. Lending institutions suffer a significant loss as a result of the large amounts of money owed as loans. A model for classifying a loan instance as in default or fully paid is presented in the study, which delves into loan default in online peer-to-peer lending. Because of the awkwardness idea of the credit default dataset removed from Kaggle, a Versatile Manufactured Inspecting (ADASYN) approach is utilized to adjust the information by oversampling the minority class. For the requirements of training and validation, a Deep Neural Network (DNN) is utilized. It is possible to obtain a prediction accuracy of 94.1%. This performance received the highest score across a number of experiments conducted at various epochs and batch sizes. The results clearly show that the proposed method holds a lot of promise.

Ch. Naveen Kumar et al. [9], in order to analyze the data based on the parameters that are necessary to integrate with machine learning techniques, customer data are collected from a variety of banks and accessed through customer profiles. In order to grant loans using a machine learning approach, which is more advanced than traditional loan approval-based systems, analyze the data and provide results based on the customer profile. Data cleansing, selecting key attributes, and comparing decision tree, random forest, support vector machine, K-nearest neighbor, and decision tree with AdaBoost machine learning methods for predicting customer loan eligibility are the project's primary goals. The training and testing portions of the data are separated, and the model is trained using the train dataset before its performance is evaluated using the test dataset. The findings demonstrate that the ensemble model decision tree implemented using the adaboost technique provided greater accuracy than other models.

Shefik IIkin Serengil et al. [10], financial institutions that offer loans to people and businesses rely heavily on credit risk estimation and risk evaluation of credit portfolios. The term "non-performing loan" (NPL) refers to a type of loan where the borrower is in default; because they haven't paid their bills on time for a while. Both finance and data science have conducted extensive research on NPL prediction. Machine learning algorithms and analytical big data technologies are also empowering the majority of banks and financial institutions' business models. This paper proposes a comparative study of some of the most commonly used non-performing loan models on a customer portfolio dataset in a private bank in Turkey in order to find a solution to this issue. Additionally, we employ class weights to address a class imbalance issue. The analysis, which took into account a variety of performance metrics is (such as Precision, Recall, F1 Score, Imbalance Accuracy (IAM), and Specificity), was carried out using a dataset consisting of 181.276 samples. In addition, we compared the outcomes obtained and assessed the algorithms' efficiency. Additionally, using a variety of explainable AI tools, we investigated the explainability of the benchmarked methods. Light GBM outperformed the logistic regression, support vector machines, random forest classifier, bagging classifier, XGBoost, and LSTM models for the dataset in terms of these performance metrics.

IV. MACHINE LEARNING ALGORITHM

Uproarious information is available in the heap of substance that will be identified through the anomaly strategies. The information can be spatial or can be a transient method spatial connected with the geological conditions and worldly connected with the time perspectives [7, 8]. The principle point of exception identification is to deal with the loud information that is introduced in the heap of text. Different methods for recognizing abnormalities in Text are specified in below:

Learning
The main property of an ML is its capability to learn. Learning or preparing is a procedure by methods for which a neural system adjusts to a boost by making legitimate parameter

modifications, bringing about the generation of wanted reaction. Learning in an ML is chiefly ordered into two classes as [9].

- Supervised learning
- Unsupervised learning

Supervised Learning
Regulated learning is two stage forms, in the initial step: a model is fabricated depicting a foreordained arrangement of information classes or ideas. The model developed by investigating database tuples portrayed by traits. Each tuple is expected to have a place with a predefined class, as dictated by one of the qualities, called to have a place with a reclassified class, as controlled by one of the traits called the class name characteristic. The information tuple are dissected to fabricate the model all things considered from the preparation dataset [10].

Unsupervised learning
It is the kind of learning in which the class mark of each preparation test isn't knows, and the number or set of classes to be scholarly may not be known ahead of time. The prerequisite for having a named reaction variable in preparing information from the administered learning system may not be fulfilled in a few circumstances.
Data mining field is a highly efficient techniques like association rule learning. Data mining performs the interesting machine-learning algorithms like inductive-rule learning with the construction of decision trees to development of large databases process. Data mining techniques are employed in large interesting organizations and data investigations. Many data mining approaches use classification related methods for identification of useful information from continuous data streams.

Nearest Neighbors Algorithm
The Nearest Neighbor (NN) rule differentiates the classification of unknown data point because of closest neighbor whose class is known. The nearest neighbor is calculated based on estimation of k that represents how many nearest neighbors are taken to characterize the data point class. It utilizes more than one closest neighbor to find out the class where the given data point belong termed as KNN. The data samples are required in memory at run time called as memory-based technique. The training points are allocated weights based on their distances from the sample data point. However, the computational complexity and memory requirements remained key issue. For addressing the memory utilization problem, size of data gets

minimized. The repeated patterns without additional data are removed from the training data set [11].

Naive Bayes Classifier
Naive Bayes Classifier technique is functioned based on Bayesian theorem. The designed technique is used when dimensionality of input is high. Bayesian Classifier is used for computing the possible output depending on the input. It is feasible to add new raw data at runtime. A Naive Bayes classifier represents presence (or absence) of a feature (attribute) of class that is unrelated to presence (or absence) of any other feature when class variable is known. Naïve Bayesian Classification Algorithm was introduced by Shinde S.B and Amrit Priyadarshi (2015) that denotes statistical method and supervised learning method for classification. Naive Bayesian Algorithm is used to predict the heart disease. Raw hospital dataset is employed. After that, the data gets preprocessed and transformed. Finally by using the designed data mining algorithm, heart disease was predicted and accuracy was computed.

Support Vector Machine
SVM are used in many applications like medical, military for classification purpose. SVM are employed for classification, regression or ranking function. SVM depends on statistical learning theory and structural risk minimization principal. SVM determines the location of decision boundaries called hyper plane for optimal separation of classes as described in figure 1. Margin maximization through creating largest distance between separating hyper plane and instances on either side are employed to minimize upper bound on expected generalization error. Classification accuracy of SVM not depends on dimension of classified entities. The data analysis in SVM is based on convex quadratic programming. It is expensive as quadratic programming methods need large matrix operations and time consuming numerical computations. [12, 13]
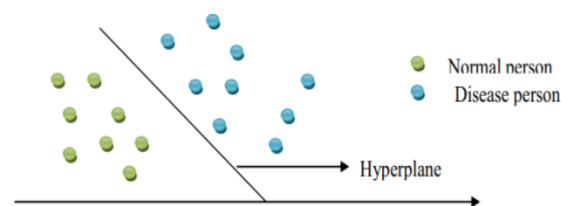

Fig. 1: Support Vector Classification

Decision Tree

A decision tree classifier, for example, is a simple classification model that can be very effective. In this supervised learning model, the dataset is used to create a training model with a flowchart-like structure. A decision tree is a technique for extracting patterns, relationships, and knowledge from large amounts of data. Decision trees are a straightforward way to visualise data. These are simple to interpret for decision-making in real-time applications. When it comes to training, large data sets and decision trees present a variety of challenges. In the literature, researchers have proposed a number of solutions to these problems. A summary of the various approaches to decision trees can be found here. The importance of accurate and optimised decision trees is emphasised. Decision trees, for example, are unsupervised classifiers that use nodes to form a tree structure. The two main types of nodes found in this plant are internal nodes and leaves. Internal nodes are also known as "decision nodes" because they are in charge of making decisions and dividing the data set by testing different attributes. Leaves represent the predicted class or decision class. When creating a decision tree, splitting criteria are used for attribute partitioning.

V. METHODOLOGY

The first step in the data preparation process is feature engineering. In this step the features will be analysed and changed to better represent the information in the data set. Feature engineering is not a static approach that is identical for each data set, it is a dynamic process that is highly dependent on the features in the original data set. It might consist of merging, splitting or adding features. An example could be to split a feature that contains information about two characteristics. In one of the data sets used in this research, a single feature contains information about late payments and about no use of available credit. It might be a good idea to represent the data more logically by splitting the feature. The effect of the engineered features should be tested by training and testing the algorithms on the altered data set. Another possible operation can be to divide to features to get a ratio, for example how close a balance is to its limit.

The next phase of the experiment is the training and testing phase. The data set constructed in the previous phase is used to train and test the different algorithms. An overview of this phase is schematically shown in Figure 4. As can be seen in the figure, this phase can roughly be split in two separate processes, training and testing.
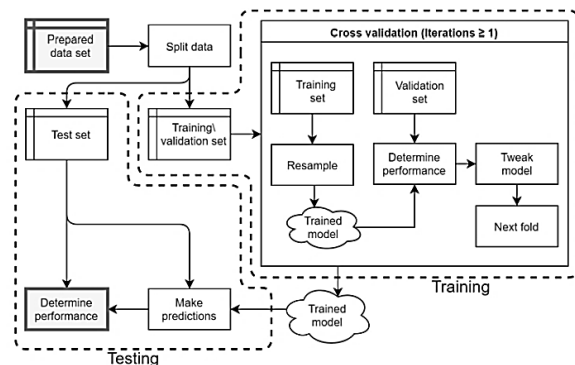

Fig. 4: Schematic overview of the training and testing phase

VI. SIMULATION PARAMETER

Accuracy gives a proportion of how precise your model is in anticipating the real up-sides out of the absolute up-sides anticipated by your framework. Review gives the quantity of real up-sides caught by our model by grouping these as obvious positive. F-measure can give a harmony among accuracy and review, and it is liked over precision where information is uneven.

Accordingly, F-measure was used in this review as a presentation metric to give a decent and fair measure utilizing the equation.

$$Precision = TP\ TP + FP \times 100$$

$$Recall = TP\ TP + FN \times 100$$

$$F - measure = 2 * Precision * Recall$$
$$Precision + Recall \times 100$$

Where,
TP—True Positive, FP—False Positive, FN—False Negative

VII. CONCLUSION

Every bank has its own strategy, rules and regulations and systems and procedures to fight against the frauds. The Audit Committee of the Board is responsible for internal control mechanism of the bank. Banks have to report the incidences of frauds to RBI upon detection, within a specified time frame.

A survey of various banks was done to see if they were making any attempts or taking any initiatives to prevent banking fraud. The study of online banking services and frauds was conducted using both primary and secondary sources of data. The data was then separated into categories based on various socioeconomic factors and studied in both tabular and graphical formats. On the basis of

the analytical tools, conclusions have been formed on the numerous segregations.

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