PROJECT REPORT

Team Id	PNT2022TMID46202
Project Name	Smart Lender-Applicant Credibility Prediction for Loan Approval

TEAM LEAD : KAMALI.A

TEAM MEMBER 1 :RAJESHWARI.V

TEAM MEMBER 2 :TAMILARASI.S

TEAM MEMBER 3 :KAVIYARASI.A

1. INTRODUCTION

1.1 Project Overview

Today a lot of people/companies are applying for bank loans. The core business part of every bank is the distribution of loans. The main objective of the banking sector is to give their assets in safe hands. But the banks or the financial companies take a very long time for the verification and validation process and even after going through such a regress process there is no surety that whether the applicant chosen is deserving or not. To solve this problem, we have developed a system in which we can predict whether the applicant chosen will be a deserving applicant for approving the loan or not. The system predicts on the basis of the model that has been trained using machine learning algorithms. We have even compared the accuracy of different machine learning algorithms. We got a percentage of accuracy ranging from 75-85% but the best accuracy we got was from Logistic Regression i.e., 88.70% The system includes a user interface web application where the user can enter the details required for the model to predict. The drawback of this model is that it takes into consideration many attributes but in real life sometimes the loan application can also be approved on a single strong attribute, which will not be possible using this system.

1.2 Purpose

Despite the fact that our banking system has many products to sell, the main source of income for a bank is its credit line. So, they can earn from interest on the loans they credit. The credit risk is defined as the likelihood that borrowers will fail to meet their loan obligations [5].To predict whether the borrower will be good or bad is a very difficult task for any bank or organization. The banking system uses a manual process for checking whether aborrower is a defaulter or not. No doubt the manual process will be more accurate and effective, but this process cannot work when there are a large number of loan applications at the same time. If there occurs a time like this, then the decision-making process will take a very long time and also lots of manpower will be required. If we are able to do the loan prediction it will be very helpful for applicants and also for the employees of banks.

2. LITERATURE SURVEY

2.1 Existing problem

Account firms and banks need to automatize the credit qualification activity (continuously) essentially dependent on data given by customers when rounding out an online structure. Sex, Marital Status, Education, Number of Dependents, Salary, Loan Amount, Credit History, and different subtleties are incorporated. To digitize this interaction, they made an issue to group the client sections that can apply for a credit sum, permitting them to focus on these clients explicitly. They have introduced a fractional informational collection for this situation.

2.2 References

[1] Ashwini S. Kadam, Shraddha R Nikam, Ankita A. Aher, Gayatri V. Shelke, Amar S. Chandgude. “Prediction for Loan Approval using Machine Learning Algorithm”, Apr 2021 International Research Journal of Engineering and Technology (IRJET)

[2] Mohammad Ahmad Sheikh, Amit Kumar Goel,Tapas Kumar. "An Approach for Prediction of Loan Approval using Machine Learning Algorithm", 2020 International Conference on Electronics and Sustainable Communication Systems (ICESC), 2020

[3] X.FrencisJensy, V.P.Sumathi,Janani Shiva Shri, “An exploratory Data Analysis for Loan Predict ion based on nature of clients”, International Journal of Recent Technology and Engineering (IJRTE),Volume-7 Issue-4S, November 2018

[4] J. Tejaswini1, T. Mohana Kavya, R. Devi Naga Ramya, P. Sai Triveni Venkata Rao Maddumala. “ACCURATE LOAN APPROVAL PREDICTION BASED ON MACHINE LEARNING APPROACH” Vol 11, www. jespublication.com, page 523 Issue 4, April/ 202

[5] “Prediction for Loan Approval using Machine Learning Algorithm” International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056 Volume: 08 Issue: 04 | Apr 2021 www.irjet.net p-ISSN: 2395-0072

[6] Vaidya, "Predictive and probabilistic approach using logistic regression: Application to prediction of loan approval," 2017 8th International Conference on Computing, Communication and Networking Technologies (ICCCNT), Delhi, 2017, pp. 1-6.doi: 10.1109/ICCCNT.2017.8203946

[7] M. Bayraktar, M. S. Aktaş, O. Kalıpsız, O. Susuz and S. Bayracı, "Credit risk analysis with classification Restricted Boltzmann Machine," 2018 26th Signal Processing and Communications Applications Conference (SIU), Izmir, 2018, pp. 1-4.doi: 10.1109/SIU.2018.840

S.no	Title	Author Name	Journal Name & Year	Methodology	Advantages	Disadvantages
1.	Loan Approval prediction	Shubham Nalawade, Suraj Andhe, Siddhesh Parab	IRJET & Apr,2022	Logistic Regression, Naive Bayes	We got a percentage of accuracy ranging 75-85	It takes into consideration many attributes in real life.
2.	Loan Approval with Machine Learning :A Survey	Ms.Kathe Rutika Pramod, Arhad pooja prakash, Mr.Ghorpade Dinesh B	IJCRT & 6 June 2021	DT is a Supervised Learning Algorithm	A key important approach in predictive analytics used.	Logistic Regression is didn't calculate the accuracy percentage.
3.	Application of Data Mining Tools in CRM for selected	Dilleep B.Desai, Dr.R.V.Kulkarni	IJCSIT & 2013	Machine Learning Logic Regression	This system can Automatically calculate the weight of each Features taking part.	This model that is emphasize different weight to each factor but in real life.

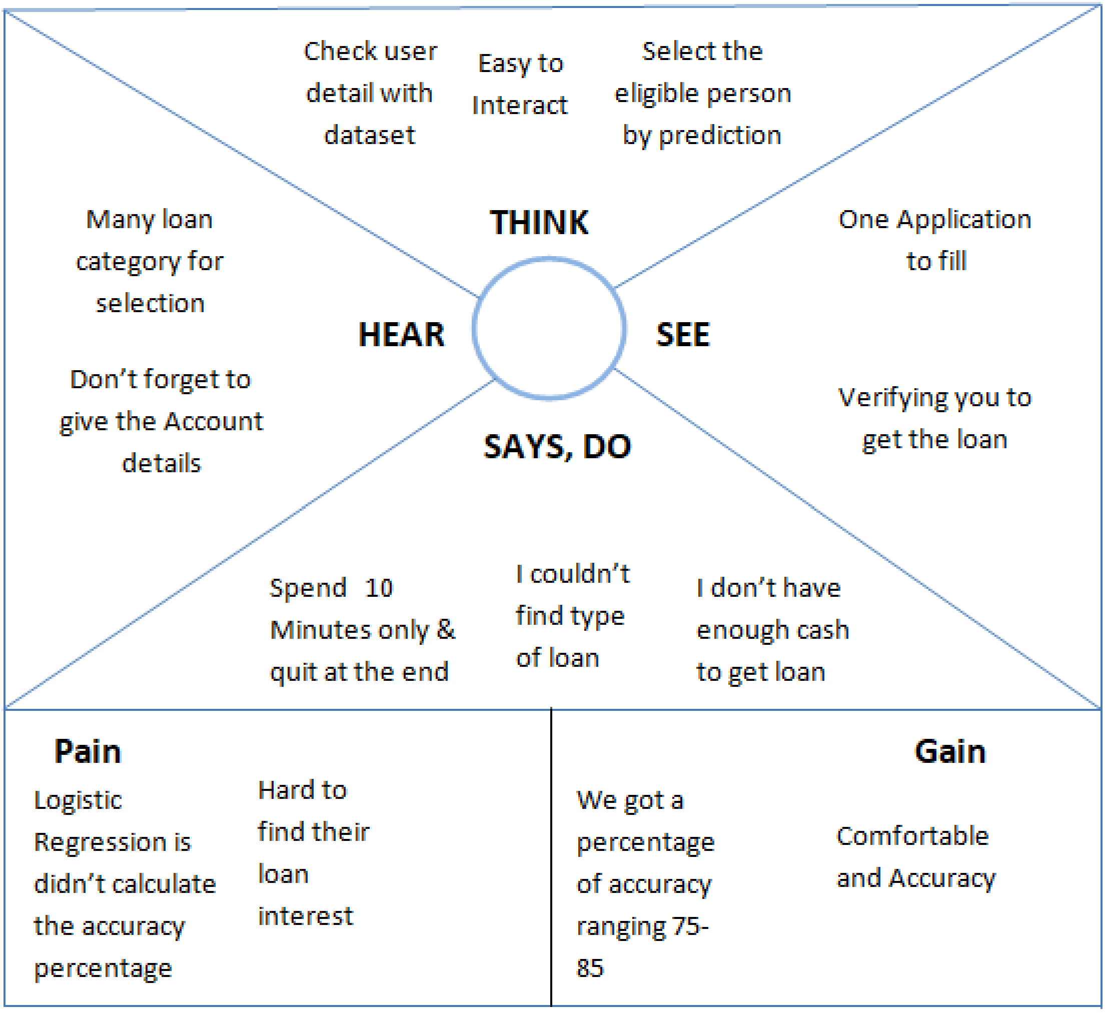
	Bank					
4.	Loan Prediction by using Machine Learning Models	Pidikiti Supriya, K.Vikas, Namburi Vimala Kumari	IJET & Mar-Apr 2019	Logic Regression Machine Learning Decision Tree Python	Data mining is the Process of analyzing data from different Perspectives.	Sometimes loan can be approved on the basis of single strong Factor only ,which is not possible in this system.
5.	Developing Prediction Model of Loan Risk is Banks using Data mining	J.H.Aboobyda,MA. Tarig	MLAIJ & 2016	Machine Learning Logic Regression	Loan processing and on new test data same features are processed with respect to their data.	It emphasize the different weight to each of the ueser in the real life.

2.3 Problem Statement Definition

Banks are making major part of profits through loans. Loan approval is a very important process for banking organizations. It is very difficult to predict the possibility of payment of loan by the customers because there is an increasing rate of loan defaults and the banking authorities are finding it more difficult to correctly access loan requests and tackle the risks of people defaulting on loans.Machine Learning has eased today's world by developing these prediction models .

3. IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



THINK

Check user detail with dataset

Easy to Interact

Select the eligible person by prediction

HEAR

Many loan category for selection

Don't forget to give the Account details

SEE

One Application to fill

Verifying you to get the loan

SAYS, DO

Spend 10 Minutes only & quit at the end

I couldn't find type of loan

I don't have enough cash to get loan

Pain

Logistic Regression is didn't calculate the accuracy percentage

Hard to find their loan interest

Gain

We got a percentage of accuracy ranging 75-85

Comfortable and Accuracy

3.2 Ideation & Brainstorming

KAMALI.A

- The system predicts the basis of model that has been trained using **Machine learning** Algorithml.We have even compared the accuracy of different Machine Learning Algorithm.Accurecy ranging from **75-85%.**
- The data is collected from the Kaggle for studying and prediction **Logistic Regression** models have been performed and the different measures of performance are computed.

TAMILARASI.S

- **Decision Tree** algorithm in **Machine Learning** methods which efficiently performs both Classification and Regression task.
- The data is collected from the Kaggle for studying and prediction **Logistic Regression** models have been performed and the different measures of performance are computed.

RAJESHWARI.V

- In **Machine Learning** the Decision Tree algorithm the work proves that the R package is an efficient visualizing tool that applies data mining techniques.
- Using **R package** customer's data analysis can be done and depends on that bank can sanction or reject the Loan.

KAVIYARASI.A

- Machine Learning algorithm we using the **XGBoost,**this algorithm only works with the quantitative variable.
- In this project we will be using the fine techniques of **Machine Learning - Decision Tree** algorithm to build this prediction model for Loan assessment.

Best of Three:

- Machine Learning algorithm we using the **XGBoost,**this algorithm only works with the quantitative variable.
- The data is collected from the Kaggle for studying and prediction **Logistic Regression** models have been performed and the different measures of performance are computed.
- **Decision Tree** algorithm in **Machine Learning** methods which efficiently performs both Classification and Regression task.

3.3 Proposed Solution

Machine learning was used to predict loan acceptance. The prediction method begins with data pre-processing, filling the missing values, experimental data analysis. After evaluating model on test dataset, each of these algorithms obtained a precision rate between 70% and 80%. Although here it can be concluded with certainty that the

Support Vector Machine model is very efficient and produces superior results than other models.

3.4 Problem Solution fit

The prediction method begins with data pre-processing, filling the missing values, experimental data analysis. After evaluating model on test dataset, each of these algorithms obtained a precision rate between 70% and 80%. Although here it can be concluded with certainty that the Support Vector Machine model is very efficient and produces superior results than other models.

1. It generates random forests and then uses these random forests to seek the solutions.

2. It is an ensemble learning in which significant number of classifiers are used to solve a

3. Random forest analyzes each tree for prediction rather than just one to avoid overfitting issues

4. The greater the number of trees, the greater the accuracy in problem solving.

4. REQUIREMENT ANALYSIS

4.1 Functional requirement

The functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	User can Registration through Form Registration through Gmail
FR-2	User Confirmation	The user can Confirmation via Email Confirmation via OTP
FR-3	User Verification	The user is verified with the previous dataset using Machine Learning.
FR-4	User Conformation	After user get tested by the Dataset ,If He eligible to get loan send conformation through Gmail
FR-5	Authentication & Authorization	The user is verified by using Authentication control protocol by Login details.

4.2 Non-Functional requirements

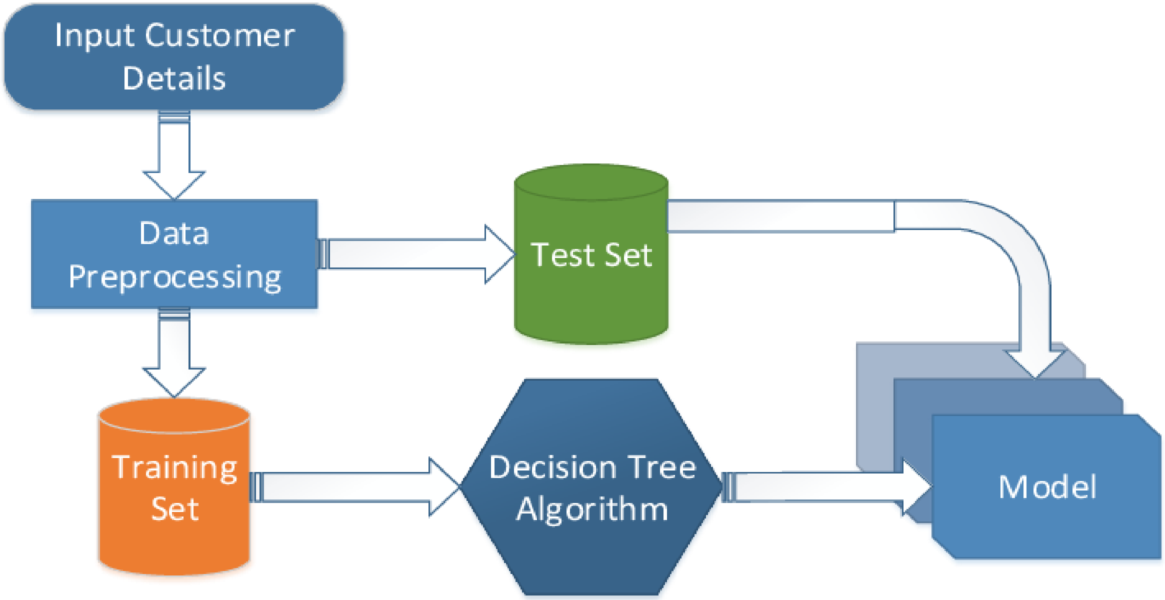
The non-functional requirements of the proposed solution.

FR No	Non-Functional Requirement	Description
NFR-1	Usability	This system is very comfortable to use for Applicant
NFR-2	Security	It is very Secured to Access by Authentication control.
NFR-3	Reliability	This is completely Reliable for the applicant and management.
NFR-4	Performance	It has very high performance by Machine Learning.
NFR-5	Availability	The applicant can access this system by Mobile Phone ,PC and any Browser ,etc..
NFR-6	Scalability	Many applicant can access this system at the same time.It is very scalable.

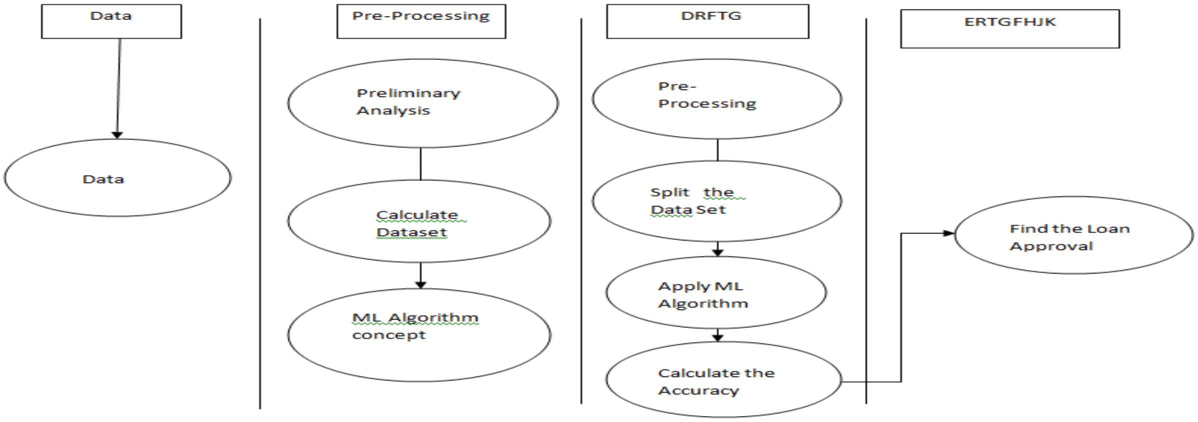
5.PROJECT DESIGN

5.1 Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically.

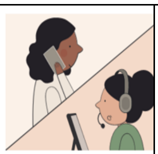
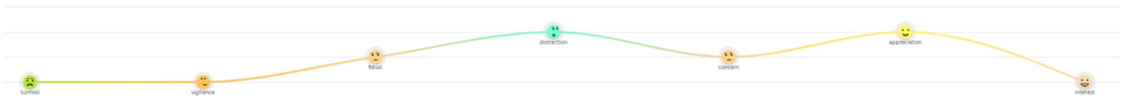


5.2 Solution & Technical Architecture



5.3 User Stories

A customer journey map is a visual representation of the customer journey (also called the buyer journey or user journey). It helps you tell the story of your customers’ experiences with your brand across all touchpoints. Whether your customers interact with you via social media, email, livechat or other channels, mapping the customer journey out visually helps ensure no customer slips through cracks.

Story Board							
Process	It would seem that the client has not yet entered, but their experience with your organization is already being formed.	For a new client, the first visit to your branch forms a lot of stereotypes, and if they turn.	What can go wrong while communicating with a bank employee? For instance, a client may approach	Contracts are a serious thing. Someone treats them lightly and signs without checking out, but interest .	Clients often have questions : they may be far from financial subtleties , deal with bugs in a mobile banking	To find out about problems in customer experience, you need to communicate with the people serve.	Additional services should be commensurate with the capabilities of your customers.
Client Goal	Get the loan without any network issue	Get the loan quickly and leave	Clarify the loan Details:Terms,interest, etc..	Take out the Loan	Find out whether there are early repayment charge.	Leave Feedback.	Learn more about the terms of getting a loan.
Client expectations	He won't have to wait too long.	They do not distract other people.	There are several loan option in this system.	There are no hidden traps in the contract.	Contract a support agent quickly get answer.	The feedback will be passed to the agent.	Learn the details and get the Loan.
Process and Channel	Mobile App ⇨	Bank ⇨	Production ⇨	Get loan ⇨	Callcenter ⇨	Website ⇨	Mobile App ⇨
Experience							

Problems	If a client arrives by car, will they be able to park at our building	Is the queuing system easy to use	Does the employee pitch additional services at inopportune moment	Can the employee briefly describe in simple terms	How do support staff behave if they don't know the answer to a custom	Do we respond to feedback, or does it gather dust	Doesn't our customer's email box look like a graveyard of sales offers
Ideas/ Opperation	Can the customer be sure they will be accepted if there is not much time left before the bank closes	Can clients sit comfortably or do they have to stand while waiting in line	Does the bank employee express themselves in an understandable language	Is it possible to delay the signing so the client can read the contract at their own pace	When is support available , given that our customers may be in different time zones	you can check bank review sites and forums and search social media for clients' opinion.	A person in a difficult situation has taken out a loan, it makes no sense to promote favorable insurance plans or a new loan to them.

6.PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a user, I can register for the application by entering my email, password, and	2	High	4

			confirming my password			
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	1	High	4
Sprint-2		USN-3	As a user, I can register for the application through Facebook	2	Low	4
Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	4
Sprint-1		USN-5	As a user, I can log into the application by entering email & password	1	High	4
	Dashboard					

6.2 Sprint Delivery Schedule

Sprint	**Total Story Points**	**Duration**	**Sprint Start Date**	**Sprint End Date (Planned)**	**Story Points Completed (as on Planned End Date)**	**Sprint Release Date (Actual)**
Sprint-1	20	6 Days	24 Oct 2022	29 Oct 2022	20	29 Oct 2022

Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	20	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	20	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	20	19 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let’s calculate the team’s average velocity (AV) per

7. CODING & SOLUTIONING (Explain the features added in the project along with code)

7.1 Feature 1

// Code Starts Here

```
import pandas as pd

import numpy as np

import matplotlib.pyplot as plt

import seaborn as sns

from sklearn.ensemble import GradientBoostingClassifier

#Read CSV data

data = pd.read_csv("../input/train_u6lujuX_CVtuZ9i (1).csv")

#preview data

data.head()

#Check missing values

data.isnull().sum()

# percent of missing "Gender"
```

```
print('Percent of missing "Gender" records is %.2f%%' %((data['Gender'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by gender :")

print(data['Gender'].value_counts())

sns.countplot(x='Gender', data=data, palette = 'Set2')

print("Number of people who take a loan group by marital status :")

print(data['Married'].value_counts())

sns.countplot(x='Married', data=data, palette = 'Set2')

# percent of missing "Dependents"

print('Percent of missing "Dependents" records is %.2f%%' %((data['Dependents'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by dependents :")

print(data['Dependents'].value_counts())

sns.countplot(x='Dependents', data=data, palette = 'Set2')
```

//Code End Here

7.2 Feature 2

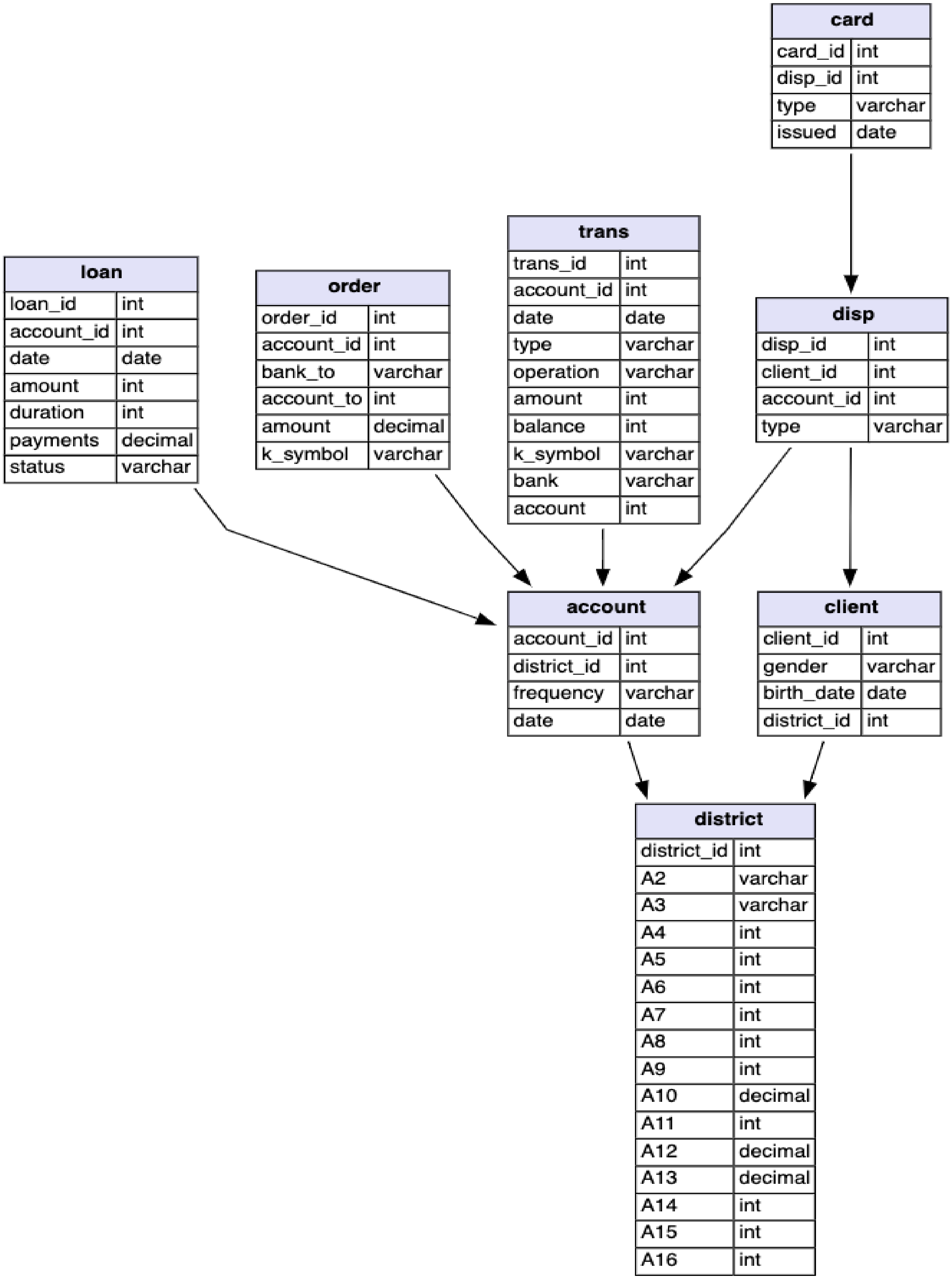
// Code Starts Here

```
import matplotlib.pyplot as plt

import seaborn as sns

from sklearn.ensemble import GradientBoostingClassifier

#Read CSV data

data = pd.read_csv("../input/train_u6lujuX_CVtuZ9i (1).csv")

#preview data

data.head()
```

```
#Check missing values

data.isnull().sum()

# percent of missing "Gender"

print('Percent of missing "Gender" records is %.2f%%'
%((data['Gender'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by gender :")

print(data['Gender'].value_counts())

sns.countplot(x='Gender', data=data, palette = 'Set2')

print("Number of people who take a loan group by marital status :")

print(data['Married'].value_counts())

sns.countplot(x='Married', data=data, palette = 'Set2')

# percent of missing "Dependents"

print('Percent of missing "Dependents" records is %.2f%%'
%((data['Dependents'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by dependents :")

print(data['Dependents'].value_counts())

sns.countplot(x='Dependents', data=data, palette = 'Set2')

# percent of missing "LoanAmount"

print('Percent of missing "LoanAmount" records is %.2f%%'
%((data['LoanAmount'].isnull().sum()/data.shape[0])*100))

ax = data["LoanAmount"].hist(density=True, stacked=True, color='teal', alpha=0.6)

data["LoanAmount"].plot(kind='density', color='teal')

ax.set(xlabel='Loan Amount')

plt.show()

# percent of missing "Loan_Amount_Term"

print('Percent of missing "Loan_Amount_Term" records is %.2f%%'
%((data['Loan_Amount_Term'].isnull().sum()/data.shape[0])*100))
```

```
print("Number of people who take a loan group by loan amount term :")

print(data['Loan_Amount_Term'].value_counts())

sns.countplot(x='Loan_Amount_Term', data=data, palette = 'Set2')

# percent of missing "Credit_History"

print('Percent of missing "Credit_History" records is %.2f%%'
%((data['Credit_History'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by credit history :")

print(data['Credit_History'].value_counts())

sns.countplot(x='Credit_History', data=data, palette = 'Set2')

from sklearn.model_selection import train_test_split

from sklearn.preprocessing import StandardScaler, MinMaxScaler

import numpy as np

import pandas as pd

sc = StandardScaler()

data=pd.read_csv(r"C:\Users\ELCOT\Downloads\Dataset\Churn_Modelling.csv")

x = data.iloc[:, 0:2]

x_scaled = sc.fit_transform(x)

y=data['Geography']

x_train, x_test, y_train, y_test = train_test_split(x_scaled, y, test_size =
0.1,random_state = 0)

x_train

x_train.shape

x_test

x_test.shape
```

7.3 Database Schema (if Applicable)



card	
card_id	int
disp_id	int
type	varchar
issued	date

loan	
loan_id	int
account_id	int
date	date
amount	int
duration	int
payments	decimal
status	varchar

order	
order_id	int
account_id	int
bank_to	varchar
account_to	int
amount	decimal
k_symbol	varchar

trans	
trans_id	int
account_id	int
date	date
type	varchar
operation	varchar
amount	int
balance	int
k_symbol	varchar
bank	varchar
account	int

disp	
disp_id	int
client_id	int
account_id	int
type	varchar

account	
account_id	int
district_id	int
frequency	varchar
date	date

client	
client_id	int
gender	varchar
birth_date	date
district_id	int

district	
district_id	int
A2	varchar
A3	varchar
A4	int
A5	int
A6	int
A7	int
A8	int
A9	int
A10	decimal
A11	int
A12	decimal
A13	decimal
A14	int
A15	int
A16	int

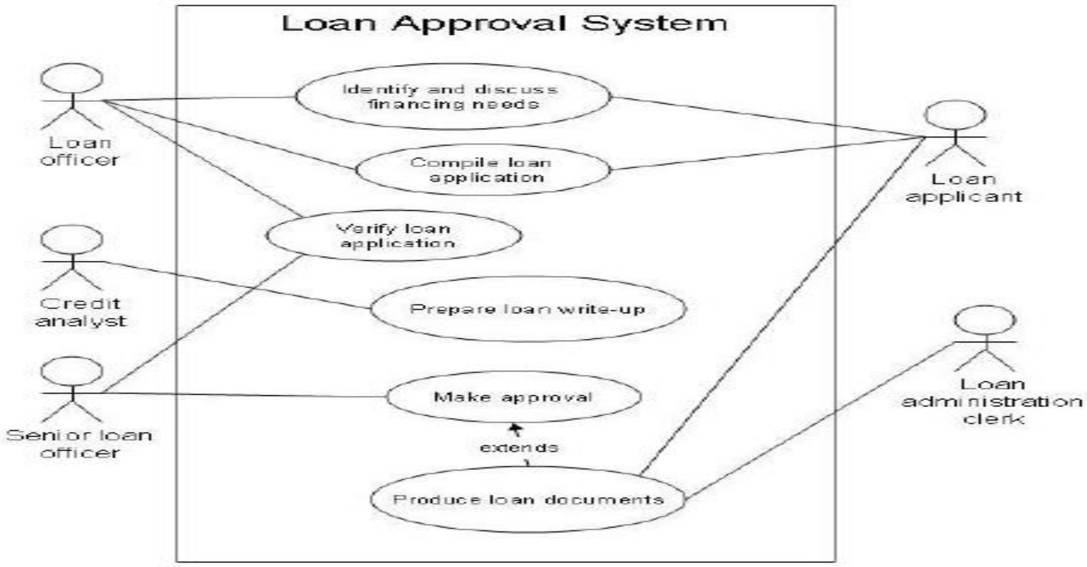
8. TESTING

8.1 Test Cases

Using decision tree algorithm, the outcomes of all applicant can be stored in any file. In this milestone you will start the project development and expected to perform the coding & solutioning, acceptance testing, performance testing based as per the sprint and submit them. In this activity you are expected to develop & submit the developed code by testing it.

Algorithm:

1. Import all the required python modules
2. Import the database for both TESTING and TRAINING.
3. Check any NULLVALUES are exists
4. If NULLVALUES exits ,fill the table with corresponding coding
5. Exploratory Data Analysis for all ATTRIBUTES from the table
6. Plot all graphs using MATPLOTLIB module
7. Build the DECISIONTREE MODEL for the coding
8. Send that output to CSV FILE



8.2 User Acceptance Testing

Purpose of Document

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

1. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

3 .Test Case Analysis

This report shows the number of test cases that have passed,failed, and untested.

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource	3	0	0	3

Shipping				
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

9. RESULTS

9.1 Performance Metrics

Performance matrices	**Condition output**
Human interference cut down	**good**
Reduction of wastage	**good**
Economical efficiency	**better**
reliablity	**excellent**

10.Advantages and Disadvantages:-

Advantages:

- The user can be remote at any time.
- The user interference is not required .
- Reduces over irrigation.
- Reliability is high.
- Enhances the process of irrigation.
- Reduce wastage of resources.
- Improves lifestyle of farmers.
- Makes the progression to be easy.
- Improves ground water level in a periodical manner.
- Improved yield for farmers.
- Attracts most of the people to involve in this schema.
- Since the agriculture improves, human life also improves.

Disadvantages:-

- work for the people is reduced .
- sensors and the components should be maintained .
- there may be a threat of damaging sensors by animals present in the field .

11. CONCLUSION

The interaction of expectation begins from cleaning and handling of information, attribution of missing qualities, exploratory investigation of informational collection and afterward model structure to assessment of model and testing on test information. On Data set, the best-case precision acquired on the first informational collection is 0.811. The accompanying ends are reached after examination that those candidates whose credit score rating was most noticeably awful will neglect to get advance endorsement, because of a higher likelihood of not repaying the credit sum. More often than not, those candidates who have top level salary and requests for lower measure of advance are bound to get affirmed which bodes well, bound to take care of their credits. Some other trademark like gender and conjugal status appears to be not to be mulled over by the organization.

12. FUTURE SCOPE

We hope that this project is able to tackle the problems present in the real and could be developed further more in the process of automation on feeding pest killer, insect killer sprays, and feeding fertilizer for the land,etc…

13. APPENDIX

Source Code

// Code Starts Here

```
#Import packages
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.ensemble import GradientBoostingClassifier
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import cross_val_score
from sklearn.tree import DecisionTreeClassifier
from sklearn.neighbors import KNeighborsClassifier
from  sklearn import svm

#Read CSV data
data = pd.read_csv("../input/train_u6lujuX_CVtuZ9i (1).csv")
```

```
#preview data

data.head()

#Preview data information

data.info()

#Check missing values

data.isnull().sum()

# percent of missing "Gender"

print('Percent of missing "Gender" records is %.2f%%'
%((data['Gender'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by gender :")

print(data['Gender'].value_counts())

sns.countplot(x='Gender', data=data, palette = 'Set2')

# percent of missing "Married"

print('Percent of missing "Married" records is %.2f%%'
%((data['Married'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by marital status :")

print(data['Married'].value_counts())

sns.countplot(x='Married', data=data, palette = 'Set2')

# percent of missing "Dependents"

print('Percent of missing "Dependents" records is %.2f%%'
%((data['Dependents'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by dependents :")

print(data['Dependents'].value_counts())

sns.countplot(x='Dependents', data=data, palette = 'Set2')

# percent of missing "Self_Employed"

print('Percent of missing "Self_Employed" records is %.2f%%'
%((data['Self_Employed'].isnull().sum()/data.shape[0])*100))
```

```
print("Number of people who take a loan group by self employed :")

print(data['Self_Employed'].value_counts())

sns.countplot(x='Self_Employed', data=data, palette = 'Set2')

# percent of missing "LoanAmount"

print('Percent of missing "LoanAmount" records is %.2f%%'
%((data['LoanAmount'].isnull().sum()/data.shape[0])*100))

ax = data["LoanAmount"].hist(density=True, stacked=True, color='teal', alpha=0.6)

data["LoanAmount"].plot(kind='density', color='teal')

ax.set(xlabel='Loan Amount')

plt.show()

# percent of missing "Loan_Amount_Term"

print('Percent of missing "Loan_Amount_Term" records is %.2f%%'
%((data['Loan_Amount_Term'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by loan amount term :")

print(data['Loan_Amount_Term'].value_counts())

sns.countplot(x='Loan_Amount_Term', data=data, palette = 'Set2')

# percent of missing "Credit_History"

print('Percent of missing "Credit_History" records is %.2f%%'
%((data['Credit_History'].isnull().sum()/data.shape[0])*100))

print("Number of people who take a loan group by credit history :")

print(data['Credit_History'].value_counts())

sns.countplot(x='Credit_History', data=data, palette = 'Set2')

train_data = data.copy()

train_data['Gender'].fillna(train_data['Gender'].value_counts().idxmax(), inplace=True)

train_data['Married'].fillna(train_data['Married'].value_counts().idxmax(), inplace=True)

train_data['Dependents'].fillna(train_data['Dependents'].value_counts().idxmax(),
inplace=True)
```

```
train_data['Self_Employed'].fillna(train_data['Self_Employed'].value_counts().idxmax(),
inplace=True)
train_data["LoanAmount"].fillna(train_data["LoanAmount"].mean(skipna=True),
inplace=True)
train_data['Loan_Amount_Term'].fillna(train_data['Loan_Amount_Term'].value_counts().
idxmax(), inplace=True)
train_data['Credit_History'].fillna(train_data['Credit_History'].value_counts().idxmax(),
inplace=True)
#Check missing values
train_data.isnull().sum()
train_data
#Convert some object data type to int64
gender_stat = {"Female": 0, "Male": 1}
yes_no_stat = {'No' : 0,'Yes' : 1}
dependents_stat = {'0':0,'1':1,'2':2,'3+':3}
education_stat = {'Not Graduate' : 0, 'Graduate' : 1}
property_stat = {'Semiurban' : 0, 'Urban' : 1,'Rural' : 2}

train_data['Gender'] = train_data['Gender'].replace(gender_stat)
train_data['Married'] = train_data['Married'].replace(yes_no_stat)
train_data['Dependents'] = train_data['Dependents'].replace(dependents_stat)
train_data['Education'] = train_data['Education'].replace(education_stat)
train_data['Self_Employed'] = train_data['Self_Employed'].replace(yes_no_stat)
train_data['Property_Area'] = train_data['Property_Area'].replace(property_stat)
#Preview data information
data.info()
data.isnull().sum()
```

```
#Separate feature and target
x = train_data.iloc[:,1:12]
y = train_data.iloc[:,12]

#make variabel for save the result and to show it
classifier = ('Gradient Boosting','Random Forest','Decision Tree','K-Nearest Neighbor','SVM')
y_pos = np.arange(len(classifier))
score = []
clf = GradientBoostingClassifier()
scores = cross_val_score(clf, x, y,cv=5)
score.append(scores.mean())
print('The accuration of classification is %.2f%%' %(scores.mean()*100))
clf = RandomForestClassifier(n_estimators=10)
scores = cross_val_score(clf, x, y,cv=5)
score.append(scores.mean())
print('The accuration of classification is %.2f%%' %(scores.mean()*100))
clf = DecisionTreeClassifier()
scores = cross_val_score(clf, x, y,cv=5)
score.append(scores.mean())
print('The accuration of classification is %.2f%%' %(scores.mean()*100))
clf = KNeighborsClassifier()
scores = cross_val_score(clf, x, y,cv=5)
score.append(scores.mean())
print('The accuration of classification is %.2f%%' %(scores.mean()*100))
```

```
clf  =  svm.LinearSVC(max_iter=5000)

scores = cross_val_score(clf, x, y,cv=5)

score.append(scores.mean())

print('The accuration of classification is %.2f%%' %(scores.mean()*100))

plt.barh(y_pos, score, align='center', alpha=0.5)

plt.yticks(y_pos, classifier)

plt.xlabel('Score')

plt.title('Classification Performance')

plt.show()
```

//Code End Here

Source Code Link : https://git hub.com/IBM-EPBL/IBM-Project-29566-1660127178

GitHub Link : https://git hub.com/IBM-EPBL/IBM-Project-29566-1660127178

Project Demo video Link : https://bit.ly/30Dd0oF

Thank You