# Smart Lender Applicant Credibility Prediction for Loan Approval

## Project Report

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# Chapter 1: INTRODUCTION

## 1.1 Project Overview

The credit system governed by the banks is one of the most important factors which affect our country's economy and financial condition. Also, credit risk is one of the main functions of the banking community. The prediction of credit defaulters is one of the difficult tasks for any bank. This problem occurs when the banks need to provide loans to the customers who are in need of the money. But by forecasting the loan defaulters, the banks definitely may reduce their loss by reducing their non-profit assets.

## 1.2 Purpose

People who need loan and want to check whether they are eligible for loan or not

## Chapter 2: LITERATURE SURVEY

### 2.1 References

[1] Sai Aparna Vangaveeti et al, In this paper, Logistic Regression algorithm had been used for predicting whether the loan is approved or not. They have used various input variables to get the efficient output. The output will be in form of binary (0 or 1). If the output is 0, then there is no approval. If the output is 1 means it is approved

[2] Kumar Arun et al, This paper's major goal is to forecast whether or not issuing a loan to a specific person will be secure. There are four components in this paper: (i)Data Collection (ii) Comparison of machine learning models on collected data (iii) Training of system on most promising model (iv) Testing. They have used six machine learning methods decision tree, random forest, support vector machine, neural network, adaboost,linear model

[3] Yamuna B et al, In this paper, they have used five different machine learning model to find the best fitting model. The five different models are linear regression, random forest, support vector machine, decision tree classifier, extreme gradient boost (XG Boost). Among all these machine learning algorithms XGBoost proved to be the best with accuracy 0.82

[4] Rekha A.G et al, In this paper, to analyze the relationship between financial transactions and loan defaults, two methods based on LSTM (Long Short Term Memory) and a hybrid neural network architecture are proposed. 94% accuracy is attained via bidirectional LSTMs with hybrid architecture. This work's utilization of hybrid neural network architectures offers the right path toward developing an early warning system through online loan default prediction

[5] Kumar T et al, In this paper, data from former clients of several banks who had loans accepted based on a set of criteria were used. The machine learning model is trained on the record to get reliable results. To forecast loan safety, the logistic regression approach is applied. The data is initially cleaned in order to remove any missing values from the data set. A data set of 1500 examples with 10 numerical and 8 categorical features were used to train the model. When crediting a loan to a customer,a number of factors, including the customer's CIBIL Score (Credit History), business value, and customer assets, have been considered

[6] Vaidya, This paper, discusses logistic regression and its mathematical representation. In order to implement the predictive and probabilistic approaches to a specific problem of loan approval prediction, his study uses logistic regression as a machine learning technique. This is to decide whether to approve a loan for a set of records belonging to an applicant. It also discusses a few other practical applications for the Machine Learning mode

[7] Chandan Soni et al, In this paper, a loan prediction system is presented that aids organizations in choosing whether to approve or deny loan requests from clients. The input variables such as loan ID, Marriage, loan amount, gender etc.., have been sent to train the model. The prediction is made using the Decision Tree Algorithm

[8] Tanvir Anzum et al, In this paper, in order to predict fraudulent loan requests from
clients, they have used six machine learning algorithms such as Decision tree, Support vector machine, Random forest, K closest neighbors, Ada-Boost, and Logistic regression. The K-Nearest Neighbors algorithm provided accuracy of 83.75%, which was superior to the other five machine learning techniques

[9] Jayapandian N et al, In this paper, they have used two different kind of datasets. One is used for training the model and the other dataset is used for testing the model. They used random forest, machine learning algorithm to train the model. The suggested random forest model offers a higher level of accuracy. This approach offers a level of accuracy that is 28% higher than that of conventional prediction

[10] Suresh Kumar et al, The primary goal of this paper is to decide whether or not the loan offered to a specific individual or organization should be approved. They have used two machine learning algorithms one is random forest and another one is decision tree classifier. The parameter setting for decision tree are Min Split=20, Max Depth=30, Min Bucket=7. The parameter setting for random forest are Number of trees=450, number of variables=8

### 2.2 Problem Statement Definition

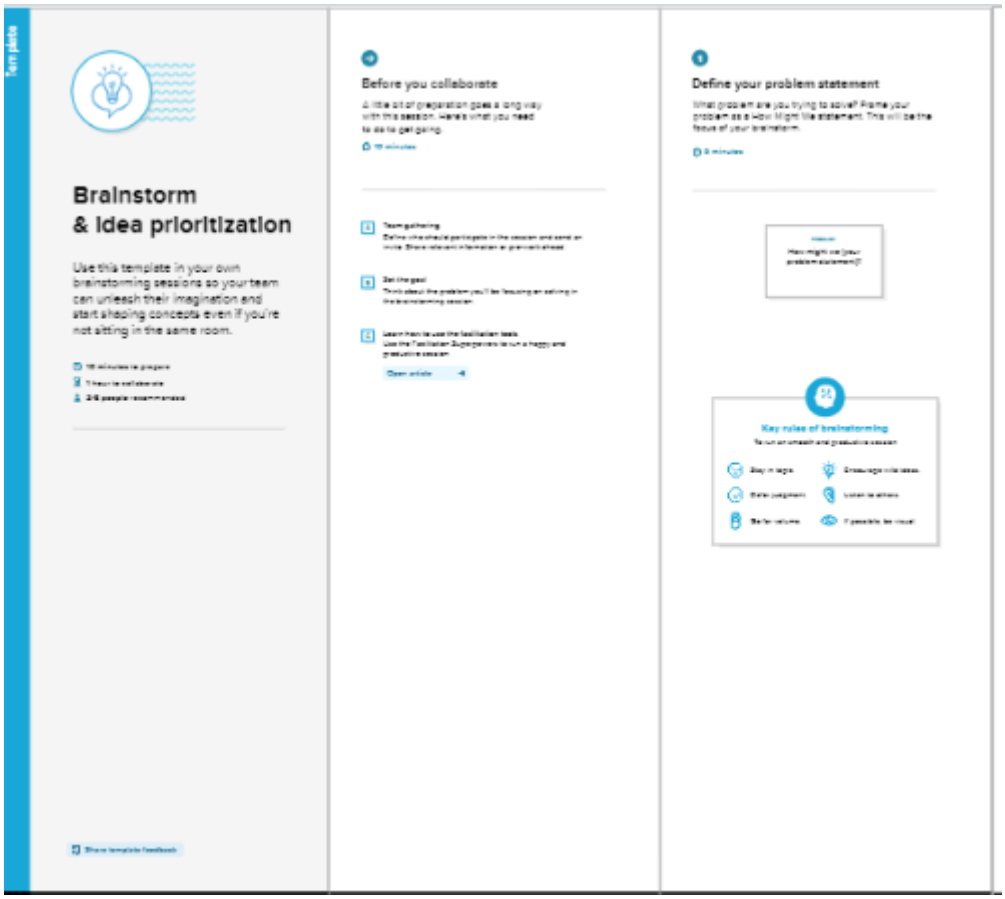
The credit system governed by the banks is one of the most important factors which affect our country's economy and financial condition. Also, credit risk is one of the main functions of the banking community. The prediction of credit defaulters is one of the difficult tasks for any bank. This problem occurs when the banks need to provide loans to the customers who are in need of the money. But by forecasting the loan defaulters, the banks definitely may reduce their loss by reducing their non-profit assets.

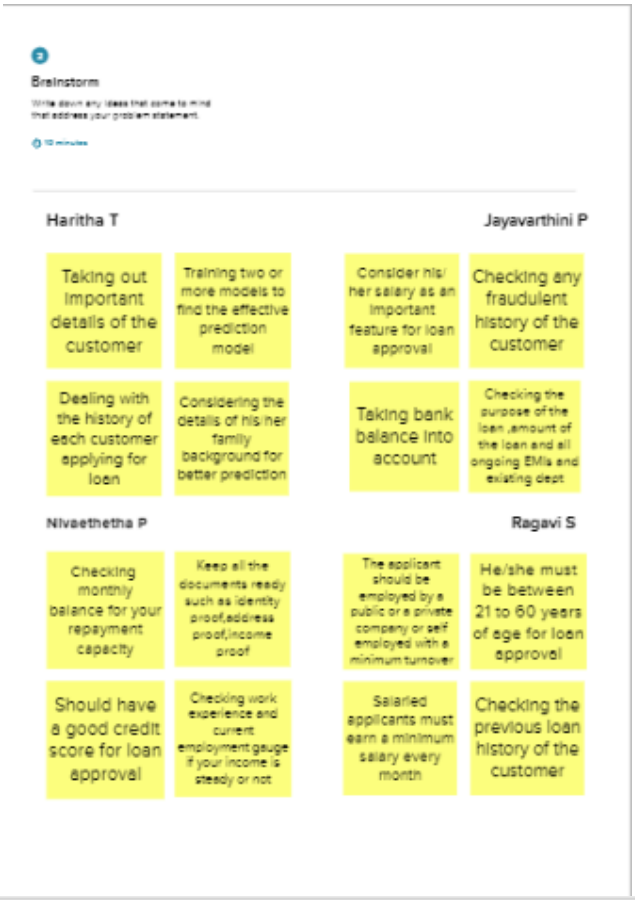
# Chapter 3: IDEATION & PROPOSED SOLUTION

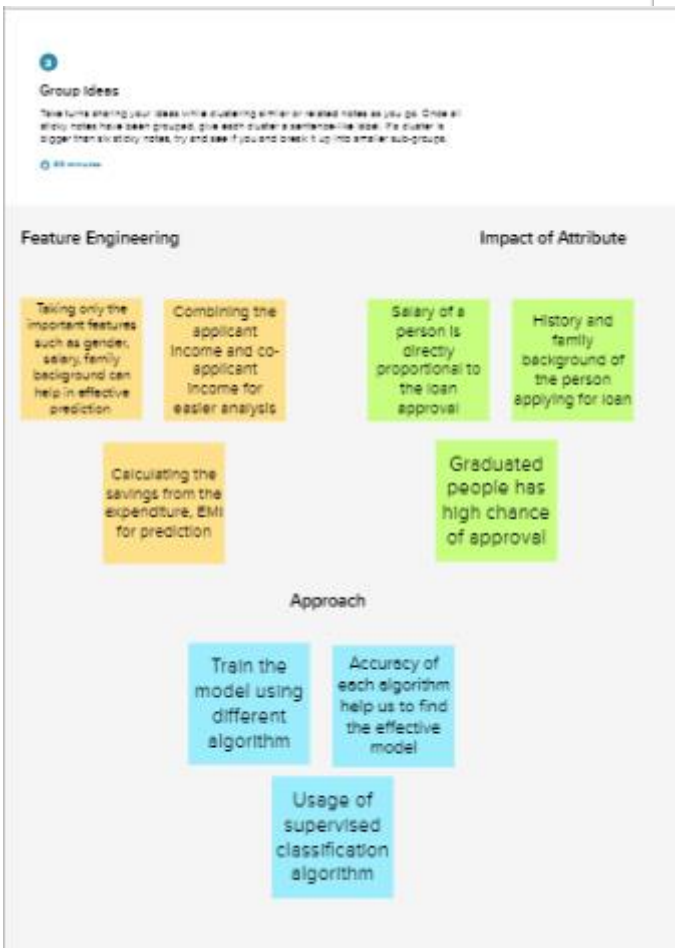
## 3.1Empathy Map Canvas

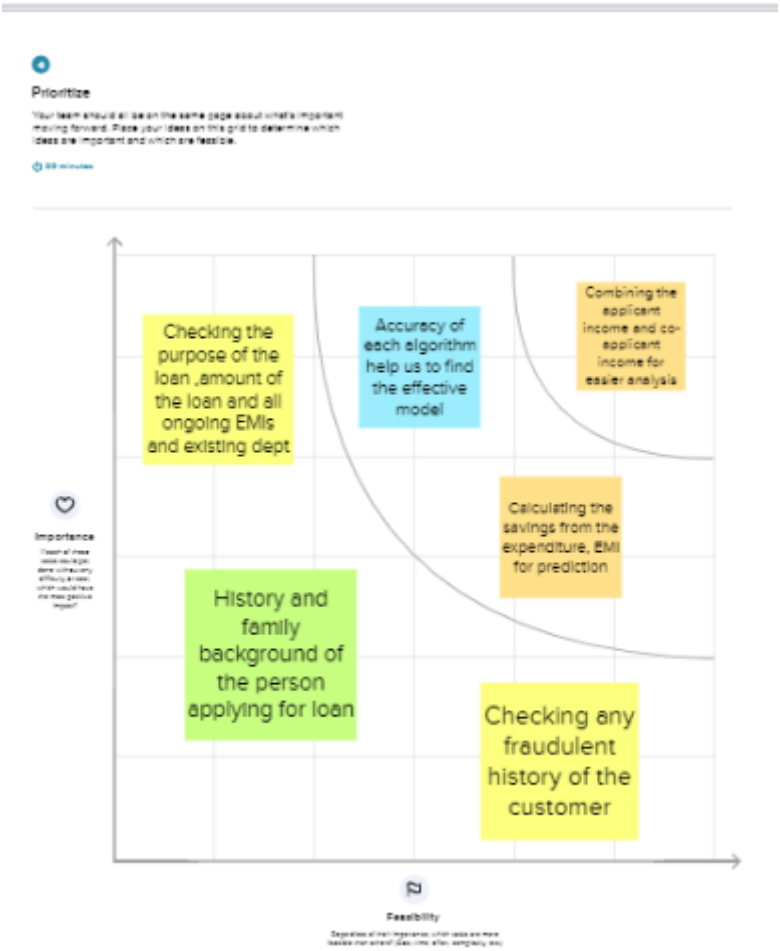
An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

## 3.2 Ideation & Brainstorming




Brainstorm
Write down any ideas that come to mind that address your problem statement.
10 minutes
Haritha T
Taking out important details of the customer
Training two or more models to find the effective prediction model
Dealing with the history of each customer applying for loan
Considering the details of his/her family background for better prediction
Jayavarthini P
Consider his/her salary as an important feature for loan approval
Checking any fraudulent history of the customer
Taking bank balance into account
Checking the purpose of the loan ,amount of the loan and all ongoing EMIs and existing dept
Nivaethetha P
Checking monthly balance for your repayment capacity
Keep all the documents ready such as identity proof,address proof,income proof
Should have a good credit score for loan approval
Checking work experience and current employment gauge if your income is steady or not
Ragavi S
The applicant should be employed by a public or a private company or self employed with a minimum turnover
He/she must be between 21 to 60 years of age for loan approval
Salaried applicants must earn a minimum salary every month
Checking the previous loan history of the customer


Group Ideas
Take turns sharing your ideas while clustering similar or related notes as you go. Once all sticky notes have been grouped, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and create it up into smaller sub-groups.
20 minutes
Feature Engineering
Taking only the important features such as gender, salary, family background can help in effective prediction
Combining the applicant income and co-applicant income for easier analysis
Calculating the savings from the expenditure, EMI for prediction
Impact of Attribute
Salary of a person is directly proportional to the loan approval
History and family background of the person applying for loan
Graduated people has high chance of approval
Approach
Train the model using different algorithm
Accuracy of each algorithm help us to find the effective model
Usage of supervised classification algorithm

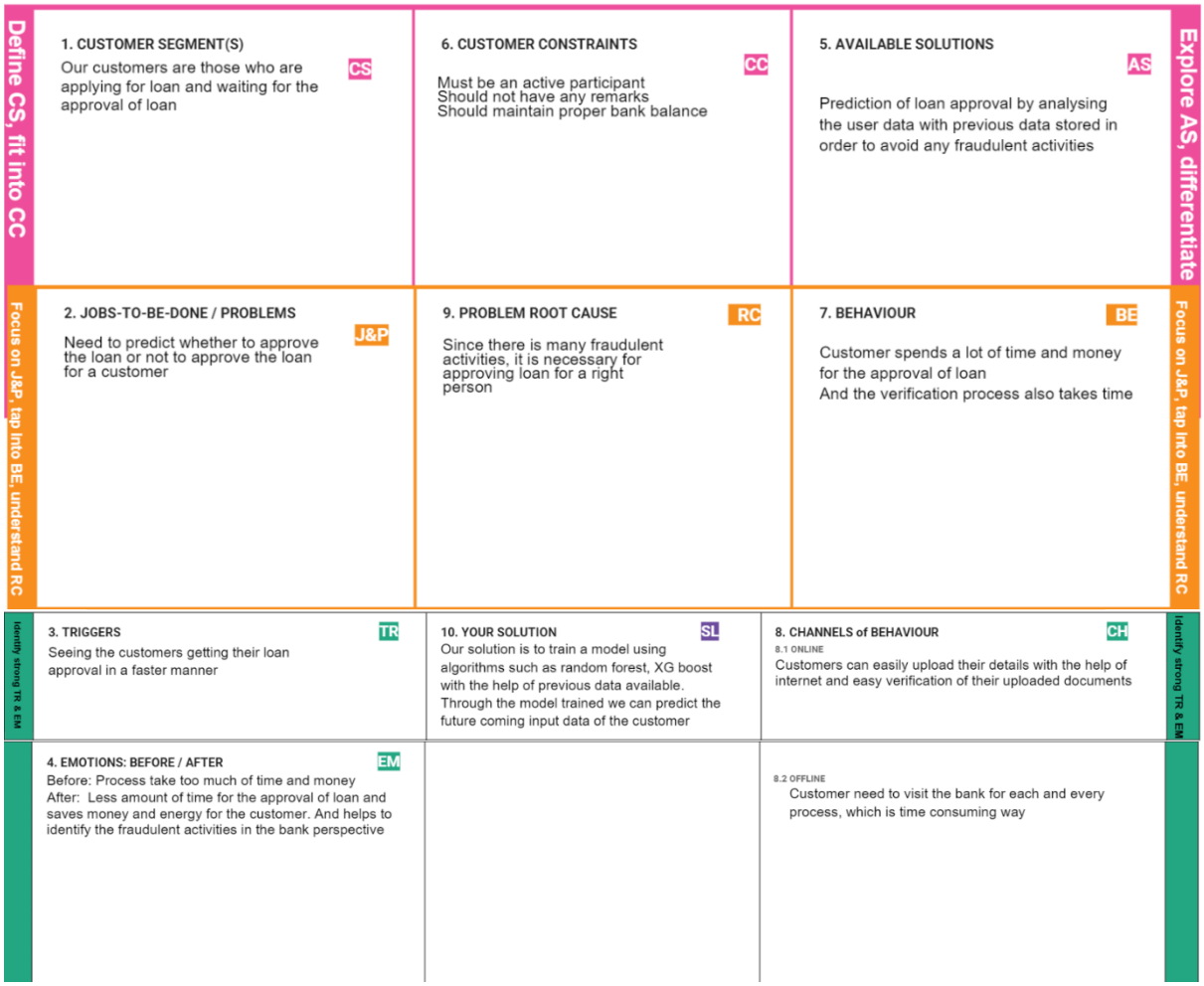



### 3.2 Proposed Solution

| S.No. | Parameter | Description |
|---|---|---|
| 1. | Problem Statement (Problem to be solved) | To predict the loan approval for an applicant by considering features such as salary, gender, family background |
| 2. | Idea / Solution description | By taking some important features such as salary, EMI, savings, employment, property area, gender, age and class label (supervised learning), we can apply a classification algorithm such as Random Forest, Decision Tree Classifier and XGBoost on the dataset to train the model. The trained model will help us in better prediction of loan approval |
| 3. | Novelty / Uniqueness | Here we will be comparing the accuracy of all the algorithms to find the efficient model and to give a good customer experience in tracking the status of the loan |

| | | |
|---|---|---|
| 4. | Social Impact / Customer Satisfaction | The applicant can easily come to know their<br>loan approval status. Minimal time and Manpower |
| 5. | Business Model (Revenue Model) | The customer has to subscribe to the application if their loan amount is higher than the margin level and also if they are applying for the second time |
| 6. | Scalability of the Solution | The applicant will be able to know about their eligibility for loan approval from home itself and can apply from anywhere. This will save time and reduce manpower for both applicant and the respective bank |

### 3.4 Problem Solution fit



# Chapter 4: REQUIREMENT ANALYSIS

## 4.1 Functional requirement

| FR No. | Functional Requirement | Sub Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | User Requirement | To check the loan eligibility using the credit score, prediction for loan approval |
| FR-2 | User Confirmation | Through one time verification and using captcha etc..,. |
| FR-3 | Profile Updation | The user can update their profile when there is need to add any add-ons to it |
| FR-4 | User Registration | The user gets login/signup using Gmail account or by using mobile number |
| FR-5 | User Authentication | The OTP/verification code the user gets authenticated and OTP is used for mobile number registration |
| FR-6 | Feedback Evaluation | The user provided feedbacks are used for evaluation of app performance and Updation is made over that |

### 4.2 Non-functional Requirements:

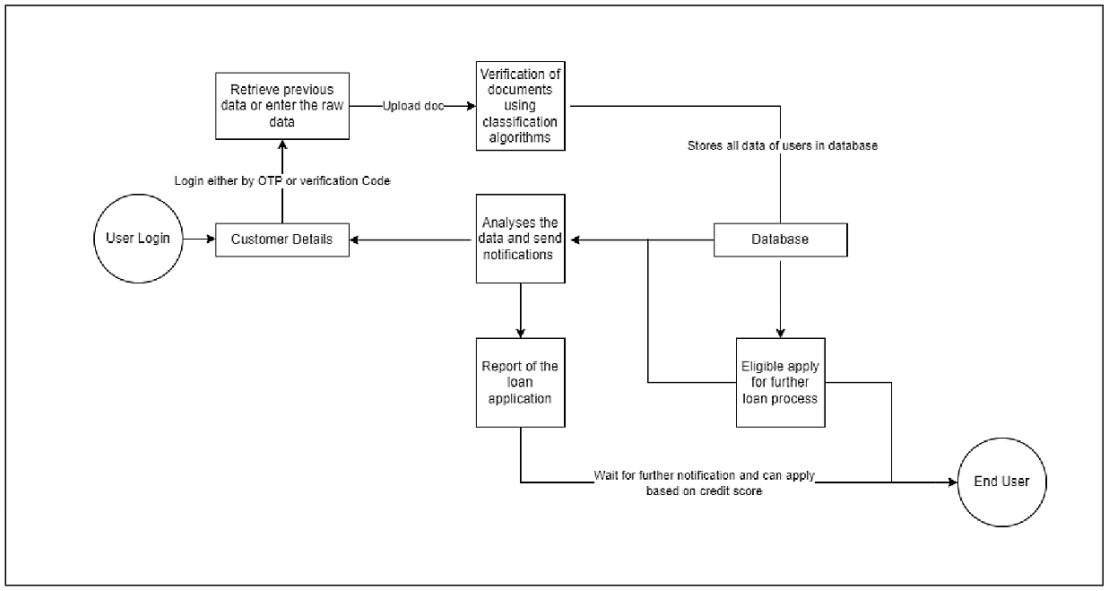
| FR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | **Usability** | This application is mainly used to analyse cibil score and predict the eligibility for users to avail for loan approval by following community guidelines |
| NFR-2 | **Security** | It uses OTP and verify code verification for each user and uses and hybrid security features over internet to safely maintain the updated documents of user |
| NFR-3 | **Reliability** | Maintaining the app up to date for reliant future, durability and efficiency of the mobile app by releasing patch fix and software updates |
| NFR-4 | **Performance** | It has a user-friendly interface and can check multiple persons cibil score parallels irrespective of server traffic. It stores the data collected over in an efficient database |
| NFR-5 | **Availability** | It is platform independent and it is available where the users are able to wish it want to be. Depending upon the user requirements all services get offered |
| NFR-6 | **Scalability** | Provides accurate prediction for user eligibility by using highly efficient algorithms and testing all the documents uploaded by the user at highly efficient rate |

# Chapter 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. It shows how data enters and leaves the system, what changes the information, and where data is stored.


**DFD Level 0:**




## 5.2 Solution & Technical Architecture

**Solution Architecture:**

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

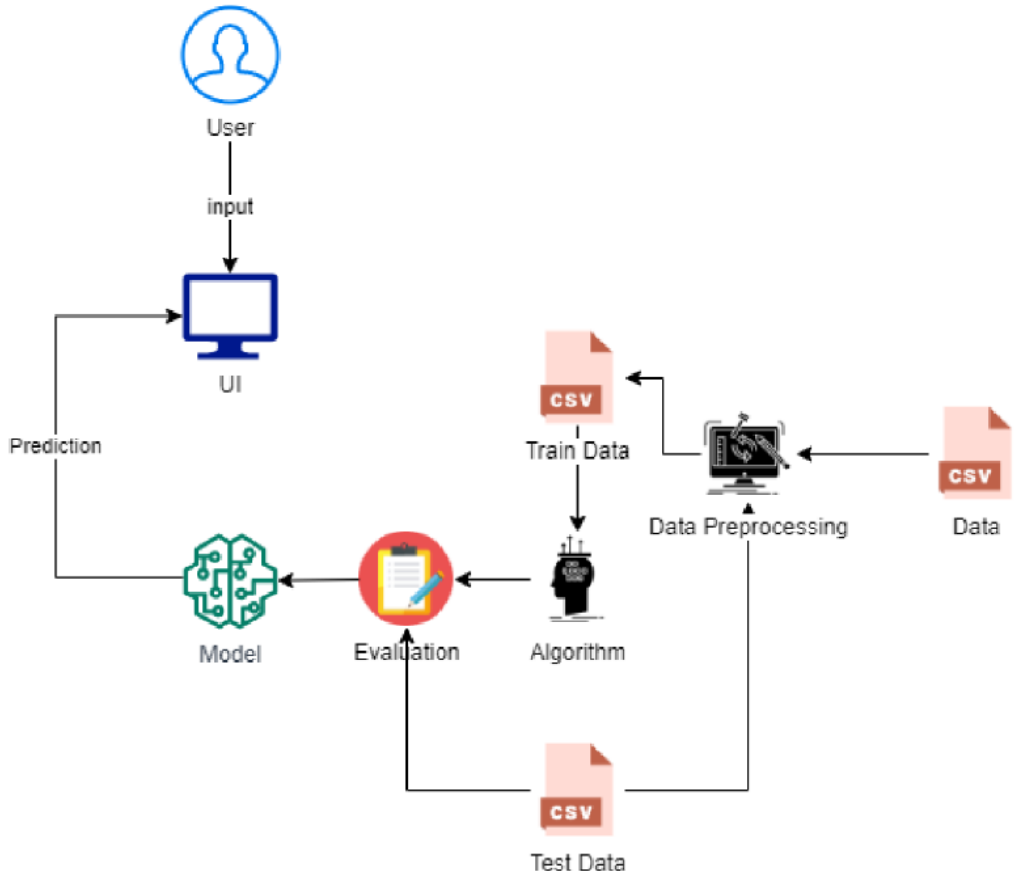
- Find the best tech solution to solve existing business problems

. ● Describe the structure, characteristics, behavior, and other aspects of the software to project stakeholders

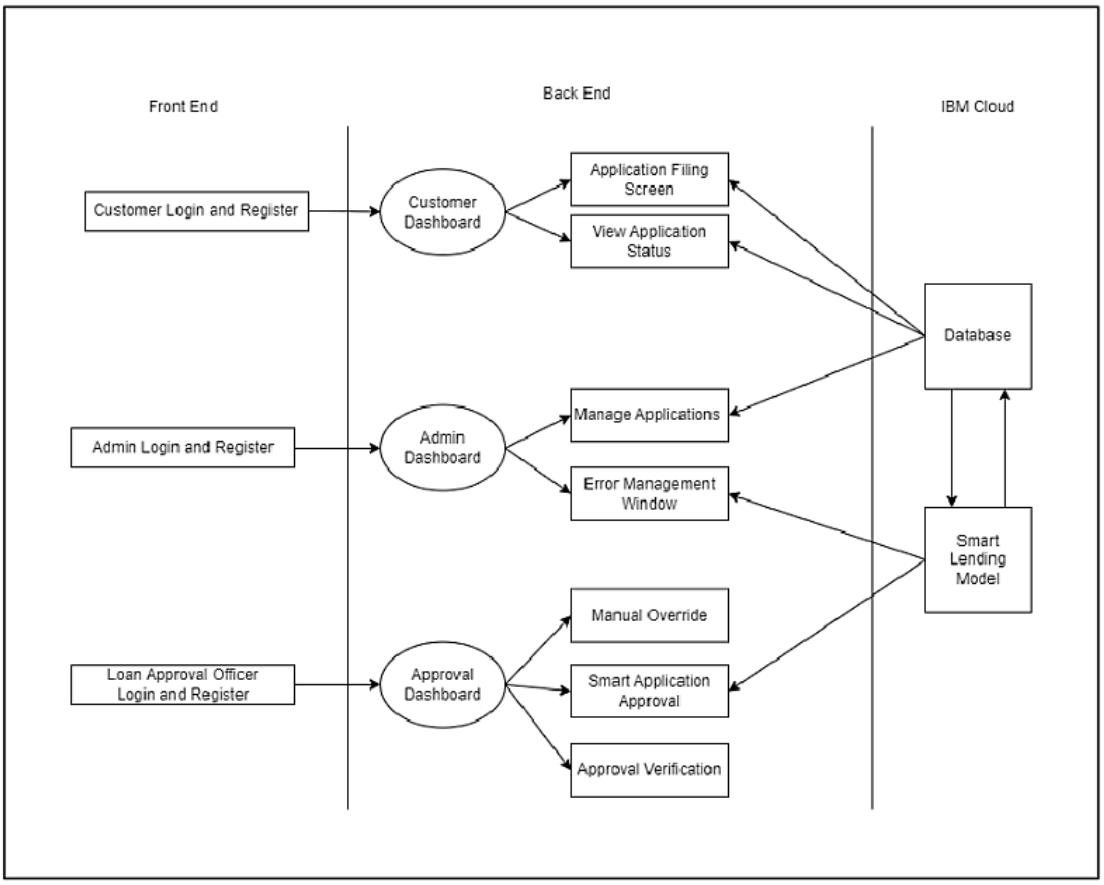
. ● Define features, development phases, and solution requirements

. ● Provide specifications according to which the solution is defined, managed, and delivered.

Solution Architecture



## Technical Architecture



## 5.3 User Stories

| User Type | Functional Requirement (Epic) | User Story Number | User Story / Task | Acceptance criteria | Priority | Release |
|---|---|---|---|---|---|---|
| Customer (Mobile user) | Registration | USN-1 | As a user, I can register for the application by entering my email, password, and confirming my password. | As a user I can enter Gmail and set a password | High | Sprint-1 |
| | | USN-2 | As a user, I will receive confirmation email once I have registered for the application | I can get a code for confirmation | High | Sprint-1 |
| | | USN-3 | Registration as a user can be confirmed using OTP or verification code | Aa a user can get OTP or verification code | Low | Sprint-1 |
| | Login | USN-4 | Users can login to web/mobile interface by storing or using the registered login credentials | Able to login | Medium | Sprint-1 |
| | | USN-5 | As a user, I can log into the application by entering email & password | Can be able to login using Gmail | Medium | Sprint-1 |
| | Dashboard | USN-6 | As a user, I should be able to login the profile or status dashboard | Able to access dashboard account | Medium | Sprint-2 |
| Customer (Web user) | | USN-7 | Checks the user feedback and provide essential technical support | Access the account/able to access the dashboard | | Sprint-2 |
| Loan Approval Executive | Automated analysis of score | USN-8 | As a loan approval officer, I can make decisions by checking and monitoring all the feeded applications and getting to a prediction | Get a decision for loan prediction based on the details provided in the loan application | High | Sprint-3 |
| | | USN-9 | As a admin cibil score which represents credit history plays major role in analysis | Cibil score/credit history place major role | High | Sprint-3 |
| Admin | Login/Register | USN-10 | As an admin I should be able to login with the unique email and password | Able to logged in | High | Sprint-4 |
| | Dashboard | USN-11 | As an admin I need the access of full authority towards the dashboard | Access the dashboard | Medium | Sprint-4 |

# Chapter 6:PROJECT PLANNING & SCHEDULING

## 6.1 Sprint Planning & Estimation

Product Backlog, Sprint Schedule, and Estimation

| Sprint | Functional Requirement (Epic) | User Story Number | User Story/Task | Story Points | Priority | Team Members |
|---|---|---|---|---|---|---|
| Sprint-1 | Dataset | USN-4 | Download the dataset | 1 | High | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-1 | | USN-5 | Visualize the dataset | 2 | Low | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-1 | | USN-6 | Pre-Process the dataset | 3 | Medium | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-1 | Machine Learning Model | USN-7 | KNN Model Building | 5 | High | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-2 | | USN-8 | Decision Tree Model Building | 5 | High | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-2 | | USN-9 | Naïve Bayes Model Building | 5 | High | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-2 | | USN-10 | Fine Tuning of the Model | 3 | Low | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-2 | | USN-11 | Evaluation and saving of the model | 5 | High | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-3 | Customer User Interface | USN-12 | Model Integration with flask | 5 | High | Haritha Jayavarthini Nivaethetha Ragavi |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sprint-3 | | | USN-1 | As a user,I should be able to access the dashboard | 3 | Medium | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-3 | | | USN-2 | Selecting the loan type | 3 | Low | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-3 | | | USN-3 | Fill the application and check the eligibility for loan approval | 5 | High | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-4 | Deployed website | the | USN-13 | Register on IBM Cloud | 3 | Low | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-4 | | | USN-14 | Train the ML Model on IBM Cloud | 5 | Medium | Haritha Jayavarthini Nivaethetha Ragavi |
| Sprint-4 | | | USN-15 | Deploy the website on IBM Cloud | 5 | High | Haritha Jayavarthini Nivaethetha Ragavi |

### 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 | 11 | 6 Days | 24 Oct 2022 | 30 Oct 2022 | 11 | 30 Oct 2022 |
| Sprint-2 | 18 | 6 Days | 01 Nov 2022 | 07 Nov 2022 | 18 | 07 Nov 2022 |
| Sprint-3 | 16 | 6 Days | 04 Nov 2022 | 10 Nov 2022 | 16 | 10 Nov 2022 |
| Sprint-4 | 16 | 6 Days | 12 Nov 2022 | 18 Nov 2022 | 16 | 18 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 iteration unit(story points per day)

$$AV = \frac{\text{sprint duration}}{\text{velocity}} = \frac{20}{10} = 2$$

**Our Project velocity**

Sprint-1 = 11/6 = 1.833

Sprint-2 = 18/6 = 3

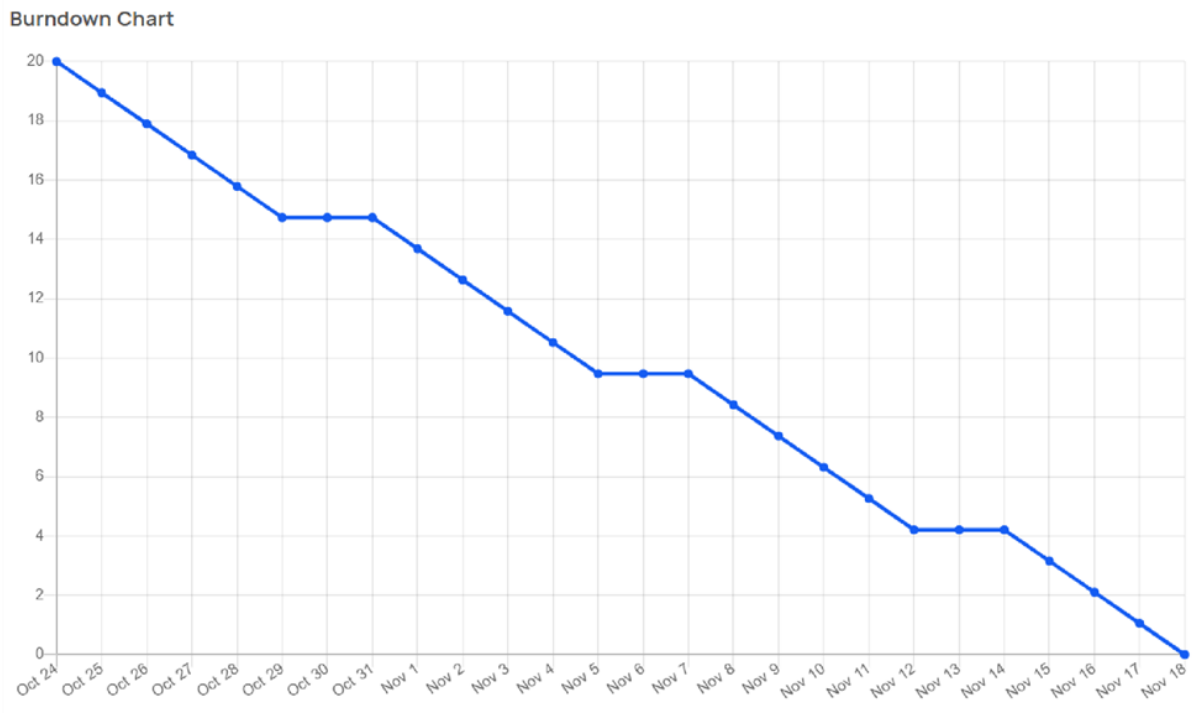
Sprint-3 = 16/6 = 2.67

Sprint-4 = 61/24 = 2.54

**Burndown Chart**

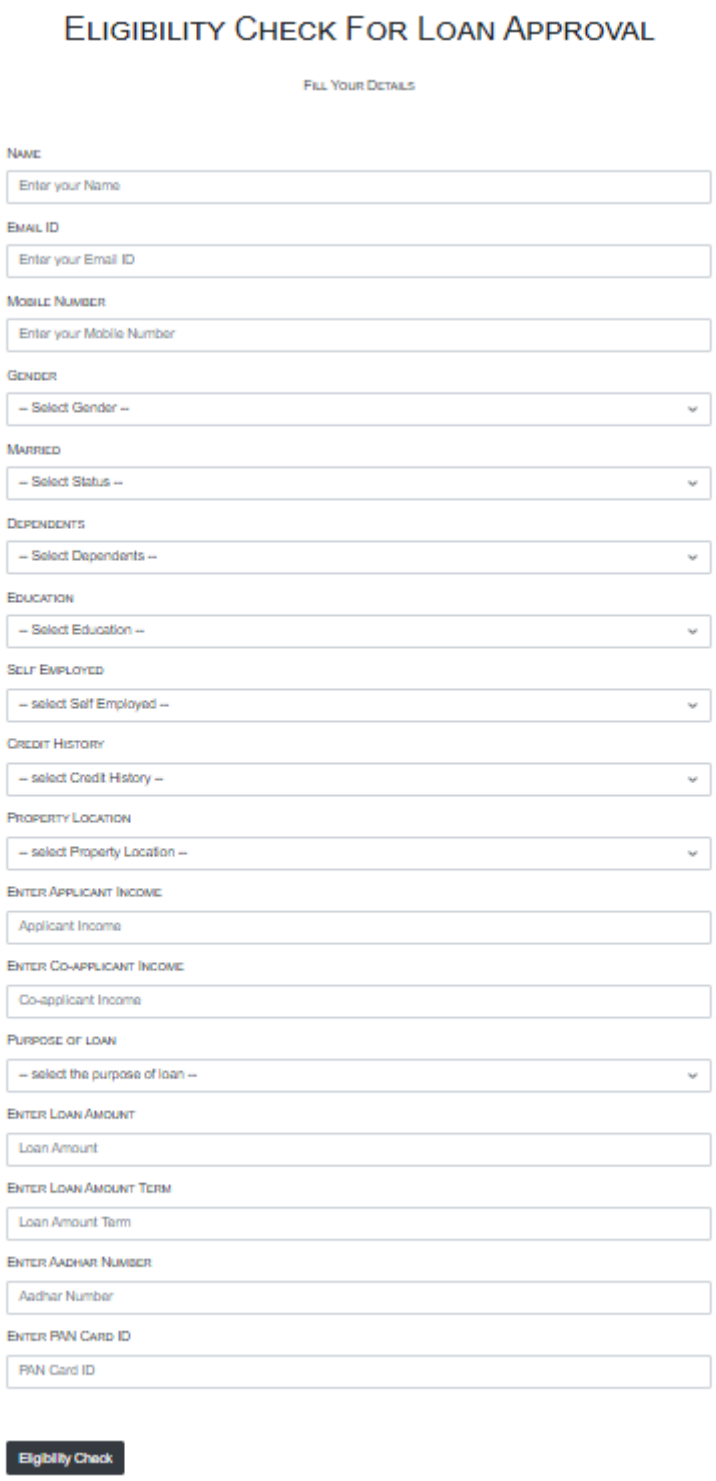
A burndown chart is a graphical representation of work left to do versus time.It is often used in agile software development methodologies such as Scrum.However,burndown charts can be applied to any project containing measurable progress over time.

**Burndown Chart**



## Chapter 7: CODING & SOLUTIONING

### 7.1 Feature 1



app.py × model.py ×

```
import ...
app= Flask(__name__, template_folder='templates')

model = pickle.load(open("model.pkl",'rb'))

@app.route('/')
def home():...
@app.route('/login.html')

@app.route('/home.html')
def home1():...
@app.route('/prediction.html')
def formpg():
    return render_template('prediction.html')

@app.route('/prediction.html',methods = ['POST'])
def predict():
    if request.method=='POST':
        name=request.form['Name']
        gender=request.form['gender']
        married=request.form['married']
        dependents=request.form['dependents']
        education=request.form['education']
        employed=request.form['employed']
        credit=request.form['credit']
        proparea=request.form['proparea']
        ApplicantIncome=float(request.form['ApplicantIncome'])
        CoapplicantIncome=float(request.form['CoapplicantIncome'])
        LoanAmount=float(request.form['LoanAmount'])
        Loan_Amount_Term=float(request.form['Loan_Amount_Term'])
```

app.py × model.py ×

```
        employed = 0

    if dependents == '3+':
        dependents = 3
    if credit == 'Yes':
        credit = 1
    else:
        credit = 0
    if proparea == 'Urban':
        proparea = 2
    elif proparea == 'Rural':
        proparea = 0
    else:
        proparea = 1

    features = [gender,married,dependents,education,employed,ApplicantIncome,CoapplicantIncome,LoanAmount,Loan_Amount_Term,credit,p

    con_features = [np.array(features)]

    prediction = model.predict(con_features)
    print(prediction)
    if prediction==1:
        return render_template('approve.html',prediction_text ='Congratulations! '+name+' Your Loan is Approved')
    else:
        return render_template('reject.html',prediction_text ='Sorry '+name+' Your Loan is Denied')


if __name__ == "__main__":
    app.run(debug=True)
```

## 7.2 Feature 2


```
<!DOCTYPE html>
<html lang="en" dir="ltr">
  <head>
    <meta charset="utf-8">
    <title>Status</title>
    <link rel="stylesheet" href="https://cdnjs.cloudflare.com/ajax/libs/font-awesome/5.15.3/css/all.min.css"/>
    <link rel="stylesheet" href="https://cdn.jsdelivr.net/npm/bootstrap@4.0.0/dist/css/bootstrap.min.css" integrity="sha384-Gn5384xqQ1aoWXA+058RXPxPg6fy4IWvTNh0E263XmFcJlSAwiG
  <body>
    <h2 style="text-align:center">{{prediction_text}}</h2>
    <p style="text-align:center">
    <img src="../static/approved.jpeg" width="30%" height="75%">
    </p>
  </body>
</html>
```

# Chapter 8: TESTING

## 8.1 Test Cases

| Test case ID | Feature Type | Component | Test Scenario | Pre-Requisite | Steps To Execute | Test Data | Expected Result | Actual Result | Status | Comments | TC for Automation(Y/N) | BUG ID | Executed By |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| tc01 | Functional | Home Page | Verify user is able to click on Predict button | | 1.Enter URL and fill the form<br>2.Click on Predict button | | Loan form should display | Working as expected | Pass | | | | |
| tc02 | Functional | Home Page | The web page is getting refreshed | | 1.Automatic page reload | | Loan form must appear automatically after page reload | Working as expected | Fail | No steps needed | Y | BUG-1234 | |
| tc03 | Functional | Home page | Field address validation | | 1. Double-click on the E-mail address field | | User should navigate to E-mail address field | Working as expected | Pass | | | | |
| tc04 | Functional | Output page | Loan Credibility predicted output | | 1. Click on eligibility chek button<br>2. View the predicted results | | User should access the Loan credibility predicted result | Working as expected | Pass | | | | |

## 8.2 User Acceptance Testing

### 1. 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).

### 2. 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 | 9 | 3 | 1 | 2 | 15 |
| Duplicate | 0 | 0 | 4 | 0 | 4 |
| External | 1 | 2 | 0 | 0 | 3 |
| Fixed | 10 | 5 | 4 | 21 | 40 |
| Not Reproduced | 0 | 0 | 0 | 0 | 0 |
| Skipped | 0 | 0 | 0 | 0 | 0 |
| Won't Fix | 0 | 0 | 0 | 0 | 0 |
| Totals | 20 | 9 | 9 | 23 | 64 |

### Test Case Analysis

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

| | | | | |
|---|---|---|---|---|
| Outsource Shipping | 3 | 0 | 0 | 3 |
| Exception Reporting | 7 | 0 | 0 | 7 |
| Final Report Output | 4 | 0 | 0 | 4 |
| Version Control | 2 | 0 | 0 | 2 |

# Chapter 9: RESULTS

### 9.1 Performance Metrics

Model Performance Testing:
Project team shall fill the following information in the model performance testing template.

| S.No. | Parameter | Screenshot / Values |
|---|---|---|
| 1. | Data Responsiveness | The ML model takes about 0.3 seconds to process the dataset. The credibility result is predicted in approximately 0.9 seconds |
| 2. | Utilization of Data Filters | Sufficient data filters have been used for ideal model building |
| 3. | Effective User Story | No of Scene Added - 15 |
| 4. | Descriptive Reports | No of Visualizations / Graphs - 13 |

## Chapter 10: ADVANTAGES & DISADVANTAGES

**Advantages:**

**Keep Control of the Company**

A bank loans money to a business based on the value of the business and its perceived ability to service the loan by making payments on time and in full. Unlike with equity finance where the business issues shares, banks do not take any ownership position in businesses. Bank personnel also do not get involved in any aspect of running a business to which a bank grants a loan. This means you ghet to retain full management and control of your business with no external interference.

**Bank Loan is Temporary**

Once a business borrower has paid off a loan, there is no more obligation to or involvement with the bank lender unless the borrower wishes to take out a subsequent loan. Compare this with equity finance, where the company may be paying out dividends to shareholders for as along as the business exists.

**Interest is Tax Deductible**

The interest on business bank loans is tax-deductible. In addition, especially with fixed-rate loans, in which the interest rate does not change during the course of a loan, loan servicing payments remain the same throughout the life of the loan. This makes it easy for businesses to budget and plan for monthly loan payments. Even if the loan is an adjustable-rate loan, business owners can use a simple spreadsheet to compute future payments in the event of a change in rates

**Disadvantages:**

**Tough to Qualify**

One of the greatest disadvantages to bank loans is that they are very difficult to obtain unless a small business has a substantial track record or valuable collateral such as real estate. Banks are careful to lend only to businesses that can clearly repay their loans, and they also make sure that they are able to cover losses in the event of default. Business borrowers can be required to provide personal guarantees, which means the borrower's personal assets can be seized in the event the business fails and is unable to repay all or part of a loan.

**High Interest Rates**

Interest rates for small-business loans from banks can be quite high, and the amount of bank funding for which a business qualifies is often not sufficient to completely meet its needs. The high interest rate for the funding a business does receive often stunts its expansion, because the business needs to not only service the loan but also deal with additional funding to cover funds not provided by the bank. Loans guaranteed by the U.S. Small Business Administration offer better terms than other loans, but the requirements to qualify for these subsidized bank loans are very strict

# Chapter 11:

## CONCLUSION

The analysis starts from data cleaning and processing missing value, exploratory analysis and finally model building and evaluation of the model. The best accuracy on public test set is when we get higher accuracy score and other performance metrics which will be found out. This project can help to predict the approval of bank loan or not for a candidate.

# Chapter 12:

## FUTURE SCOPE

In order to analyse the risk associated for the bank, credit evaluation largely involves gathering information about the customer and examining the project's technical, financial, and economic viability and this process developed a lot

# Chapter 13:

## APPENDIX

### 13.1 Source Code

### index.html

```
<!doctype html>
<html lang="en">

<head>
  <!-- Required meta tags -->
  <meta charset="utf-8">
  <meta name="viewport" content="width=device-width, initial-scale=1">

  <!-- Bootstrap CSS -->
  <link rel="stylesheet" href="{{url_for('static', filename='/prediction.css')}}">
  <link href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.0-
beta3/dist/css/bootstrap.min.css" rel="stylesheet"
    integrity="sha384-
eOJMYsd53ii+scO/bJGFsiCZc+5NDVN2yr8+0RDqr0Ql0h+rP48ckxlpbzKgwra6"
crossorigin="anonymous">
  <link href="https://unpkg.com/tailwindcss@^2/dist/tailwind.min.css"
rel="stylesheet">
  <link rel="stylesheet"
href="https://cdn.jsdelivr.net/npm/bootstrap@4.0.0/dist/css/bootstrap.min.css"
    integrity="sha384-
Gn5384xqQ1aoWXA+058RXPxPg6fy4IWvTNh0E263XmFcJlSAwiGgFAW/dAiS6JXm"
crossorigin="anonymous">
  <title>Details Page</title>
</head>

<body>
  <script>
    function valid() {
      var Ai = document.getElementById("ApplicantIncome").value;
      var Co = document.getElementById("CoapplicantIncome").value;
      var LA = document.getElementById("LoanAmount").value;
      var LT = document.getElementById("Loan_Amount_Term").value;
      if (Ai > 10000000000000000000000000000000000000000) {
        alert("Applicant income is too large enter a valid number")
        return false;
      }
      if (Co > 10000000000000000000000000000000000000000) {
        alert("Coapplicant income is too large enter a valid number")
        return false;
      }
      if (LA > 10000000000000000000000000000000000000000) {
        alert("Loan Amount is too large enter a valid number")
        return false;
      }
      if (LT > 10000000000000000000000000000000000000000) {
        alert("loan amount term is too large enter a valid number")
        return false;
      }
      var name = document.getElementById("Name").value;
      var letters = /^[a-zA-Z]*$/;
      if (!name.match(letters)) {
```

```
        alert("Name must contain only alphabets")
        return false;
      }
      var num = /^[0-9]+$/;
      if (!Ai.match(num)) {
        alert("Enter only valid numbers alphabets are not allowed  ")
        return false;
      }
      if (!Co.match(num)) {
        alert("Enter only valid numbers alphabets are not allowed  ")
        return false;
      }
      if (!LA.match(num)) {
        alert("Enter only valid numbers alphabets are not allowed  ")
        return false;
      }
      if (!LT.match(num)) {
        alert("Enter only valid numbers alphabets are not allowed  ")
        return false;
      }
      var mo = document.getElementById("mon").value;
      var mn = /^[0-9]{10}$/;
      if (!mo.match(mn)) {
        alert("Please enter only 10 digit mobile number")
        return false;
      }

    }
  </script>
  <section class="black body-font">
    <div class="container px-1 py-12 mx-auto">
      <div class="flex flex-col text-center mb-10">

        <h1 class="Heading">Eligibility Check For Loan Approval</h1><br>
        <p class="fill">Fill Your Details</p>
      </div>
      <div>
      </div>


      <form action='/prediction.html' method="post" onsubmit="return valid()"
class="px-24 mx-12">
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Name</label>
          <input type="text" class="form-control" id="Name" name="Name"
placeholder="Enter your Name" required>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Email ID</label>
          <input type="email" class="form-control" id="email" name="email"
placeholder="Enter your Email ID" required>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Mobile
Number</label>
          <input type="text" class="form-control" id="mon" name="mon"
placeholder="Enter your Mobile Number" required>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Gender</label>
```

```
          <select class="form-select" id="gender" name="gender" aria-label="Default
select example" required>
            <option selected>-- Select Gender --</option>
            <option value="Male">Male</option>
            <option value="Female">Female</option>
          </select>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Married</label>
          <select class="form-select" id="married" name="married" aria-
label="Default select example" required>
            <option selected>-- Select Status --</option>
            <option value="Yes">Yes</option>
            <option value="No">No</option>
          </select>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-
label">Dependents</label>
          <select class="form-select" id="dependents" name="dependents" aria-
label="Default select example" required>
            <option selected>-- Select Dependents --</option>
            <option value="0">0</option>
            <option value="1">1</option>
            <option value="2">2</option>
            <option value="3+">3+</option>
          </select>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Education</label>
          <select class="form-select" id="education" name="education" aria-
label="Default select example" required>
            <option selected>-- Select Education --</option>
            <option value="Graduate">Graduate</option>
            <option value="Not Graduate">Not Graduate</option>
          </select>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Self
Employed</label>
          <select class="form-select" id="employed" name="employed" aria-
label="Default select example" required>
            <option selected>-- select Self Employed --</option>
            <option value="Yes">Yes</option>
            <option value="No">No</option>
          </select>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Credit
History</label>
          <select class="form-select" id="credit" name="credit" aria-label="Default
select example" required>
            <option selected>-- select Credit History --</option>
            <option value="Yes">Yes</option>
            <option value="No">No</option>

          </select>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Property
Location</label>
```

```
          <select class="form-select" id="proparea" name="proparea" aria-
label="Default select example" required>
            <option selected>-- select Property Location --</option>
            <option value="Semiurban">Semiurban</option>
            <option value="Urban">Urban</option>
            <option value="Rural">Rural</option>
          </select>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Enter Applicant
Income</label>
          <input type="text" class="form-control" id="ApplicantIncome"
name="ApplicantIncome"
            placeholder="Applicant Income" required>

        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Enter Co-
applicant Income</label>
          <input type="text" class="form-control" id="CoapplicantIncome"
name="CoapplicantIncome"
            placeholder="Co-applicant Income" required>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Purpose of
loan</label>
          <select class="form-select" id="pur" name="pur" aria-label="Default select
example" required>
            <option selected>-- select the purpose of loan --</option>
            <option value="person">Personal Loan</option>
            <option value="Bussiness">Business Loan</option>
            <option value="Education">Education Loan</option>
            <option value="Home">Home Loan</option>
            <option value="Other">Other</option>
          </select>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Enter Loan
Amount</label>
          <input type="text" class="form-control" id="LoanAmount" name="LoanAmount"
placeholder="Loan Amount" required>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Enter Loan Amount
Term</label>
          <input type="text" class="form-control" id="Loan_Amount_Term"
name="Loan_Amount_Term"
            placeholder="Loan Amount Term" required>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Enter Aadhar
Number</label>
          <input type="text" class="form-control" id="Adhar" name="Adhar"
placeholder="Aadhar Number" required>
        </div>
        <div class="mb-3">
          <label for="exampleFormControlInput1" class="form-label">Enter PAN Card
ID</label>
          <input type="text" class="form-control" id="PAN " name="PAN "
placeholder="PAN Card ID" required>
        </div>
```

```
        <br><br>
        <div class="mb-3">
          <button type="submit" value="PREDICT" class="btn btn-dark">Eligibility
Check</button>
        </div>
      </form>


    </div>
  </section>
  <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.0.0-
beta3/dist/js/bootstrap.bundle.min.js"
    integrity="sha384-
JEW9xMcG8R+pH31jmWH6WWP0WintQrMb4s7ZOdauHnUtxwoG2vI5DkLtS3qm9Ekf"
    crossorigin="anonymous"></script>

</body>
<style>
  body{
    font-family: Arial, Helvetica, sans-serif;
    font-variant: small-caps;
}
</style>
</html>
```

**app.py**

```
from flask import render_template,Flask,request
import numpy as np
import pickle
from sklearn.preprocessing import scale
app= Flask(__name__, template_folder='templates')

model = pickle.load(open("model.pkl",'rb'))

@app.route('/')
def home():
    return render_template('home.html')
@app.route('/login.html')

@app.route('/home.html')
def home1():
    return render_template('home.html')
@app.route('/prediction.html')
def formpg():
    return render_template('prediction.html')

@app.route('/prediction.html',methods = ['POST'])
def predict():
    if request.method=='POST':
        name=request.form['Name']
        gender=request.form['gender']
        married=request.form['married']
        dependents=request.form['dependents']
        education=request.form['education']
```

```
        employed=request.form['employed']
        credit=request.form['credit']
        proparea=request.form['proparea']
        ApplicantIncome=float(request.form['ApplicantIncome'])
        CoapplicantIncome=float(request.form['CoapplicantIncome'])
        LoanAmount=float(request.form['LoanAmount'])
        Loan_Amount_Term=float(request.form['Loan_Amount_Term'])
    if gender == 'Male':
        gender = 1
    else:
        gender = 0

    if married == 'Yes':
        married = 1
    else:
        married = 0

    if education == 'Graduate':
        education = 0
    else:
        education = 1

    if employed == 'Yes':
        employed = 1
    else:
        employed = 0

    if dependents == '3+':
        dependents = 3
    if credit == 'Yes':
        credit = 1
    else:
        credit = 0
    if proparea == 'Urban':
        proparea = 2
    elif proparea == 'Rural':
        proparea = 0
    else:
        proparea = 1

    features =
[gender,married,dependents,education,employed,ApplicantIncome,CoapplicantIncome,Loan
Amount,Loan_Amount_Term,credit,proparea]

    con_features = [np.array(features)]

    prediction = model.predict(con_features)
    print(prediction)
    if prediction==1:
        return render_template('approve.html',prediction_text ='Congratulations!
'+name+' Your Loan is Approved')
    else:
        return render_template('reject.html',prediction_text ='Sorry '+name+' Your
Loan is Denied')


if __name__ == "__main__":
    app.run(debug=True)
```

### 13.2 GitHub& Project Demo Link

**GitHub link:**

https://github.com/IBM-EPBL/IBM-Project-12158-1659438917

**Project Demo Link:**

https://drive.google.com/file/d/1uWsqoquSirn6lhVu72MoaPIKYPl_fPxF/view?usp=share_link