SMART LENDER - APPLICANT CREDIBILITY PREDICTION FOR LOAN APPROVAL

TEAM ID

PNT2022TMIDO1442

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BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

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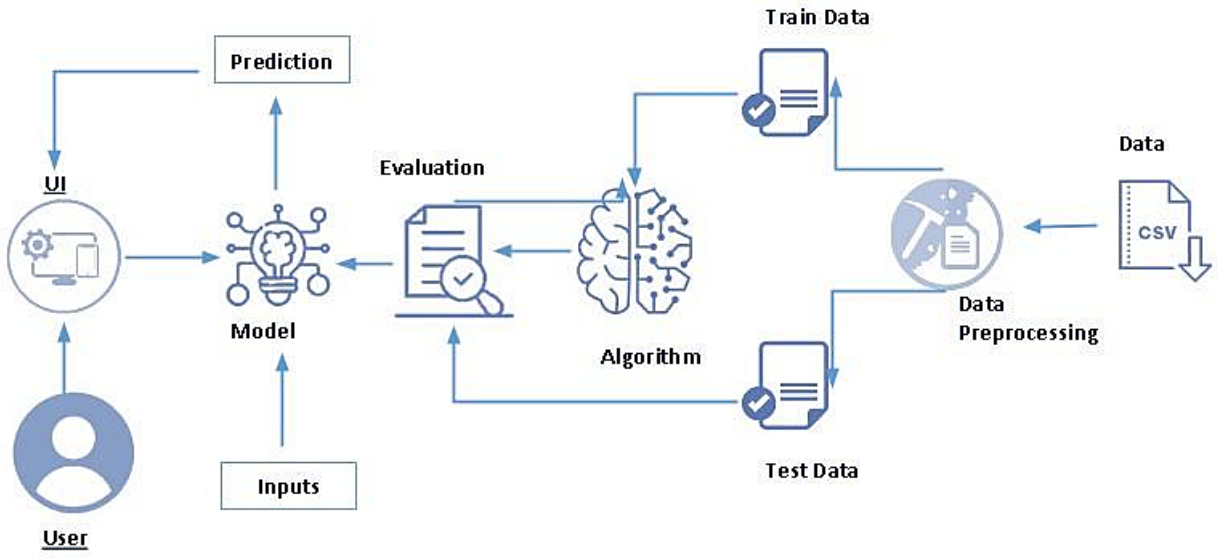
1. INTRODUCTION

1.1 Project Overview

One of the most important factors which affect our country's economy and financial condition is the credit system governed by the banks. The process of bank credit risk evaluation is recognized at banks across the globe. As we know credit risk evaluation is very crucial, there is a variety of techniques are used for risk level calculation. In addition, 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. But by forecasting the loan defaulters, the banks definitely may reduce their loss by reducing their non-profit assets, so that recovery of approved loans can take place without any loss and it can play as the contributing parameter of the bank statement. This makes the study of this loan approval prediction important. Machine Learning techniques are very crucial and useful in the prediction of these types of data. We will be using classification algorithms such as Decision tree, Random-forest, KNN, and XGboost. We will train and test the data with these algorithms. From this best model is selected and saved in pkl format. We will be doing flask integration, develop a web interface and IBM deployment



1.2 Purpose

The purpose of Smart Lender System is to provide a comprehensive web based platform to manage different lenders & borrowers. Lenders can specify their loan criteria, lending terms, rate of interest, mandatory documentation and agreements etc. Borrowers can then apply for loans in the system. The loan origination software checks borrower eligibility and matches it with the lending criterion according to the algorithm. The loan is disbursed after approval of the lending terms. Smart Lending system finds algorithmic match for borrower eligibility, loan terms and conditions. It eliminates repetitive manual steps that are best executed digitally and allows human expertise to be applied where it works best. Integration with credit data sources and services such as LexisNexis or Experian lets lenders automatically and quickly verify applicant information. No lost or misplaced documents. Paper documents converted to digital images are immediately and securely accessible by the underwriter, so they can review applicant materials more quickly. The combination of decision rules and integration with credit data sources and services lets lenders automatically calculate optimum loan structures and terms.

2. LITERATURE SURVEY

2.1 Existing Problem

Banks need to analyze for the person who applies for the loan will repay the loan or not. Sometime it happens that customer has provided partial data to the bank, in this case person may get the loan without proper verification and bank may end up with loss. Bankers cannot analyze the huge amounts of data manually, it may become a big headache to check whether a person will repay its loan or not. It is very much necessary to know the person getting loan is going in safe hand or not. So, it is pretty much important to have a automated model which should predict the customer getting the loan will repay the loan or not

2.2 Reference

1. “Survey on Prediction of Loan Approval Using Machine Learning Techniques” - Ambika and Santosh Biradar/ Department of Computer Engineering, D. Y. Patil College of Engineering,Pune, India

2. “Process Evaluation and Improvement: A Case Study of The Loan Approval Process” - MAJA PUSNIK, KATJA KOUS, ANDREJ GODEC and BOASTJAN SUMAK, University of Maribor

3. “Loan Approval Prediction based on Machine Learning” - Kumar Arun, Garg Ishan, Kaur Sanmeet

4. “Predict Loan Approval in Banking System Machine Learning Approach for Cooperative Banks Loan Approval” - Amruta S. Aphale ,Prof. Dr. Sandeep. R. Shinde Department of Computer Science and Engineering Savitribai Phule Pune University Vishwakarma Institute of Technology, Pune

2.3. Problem Statement Definition

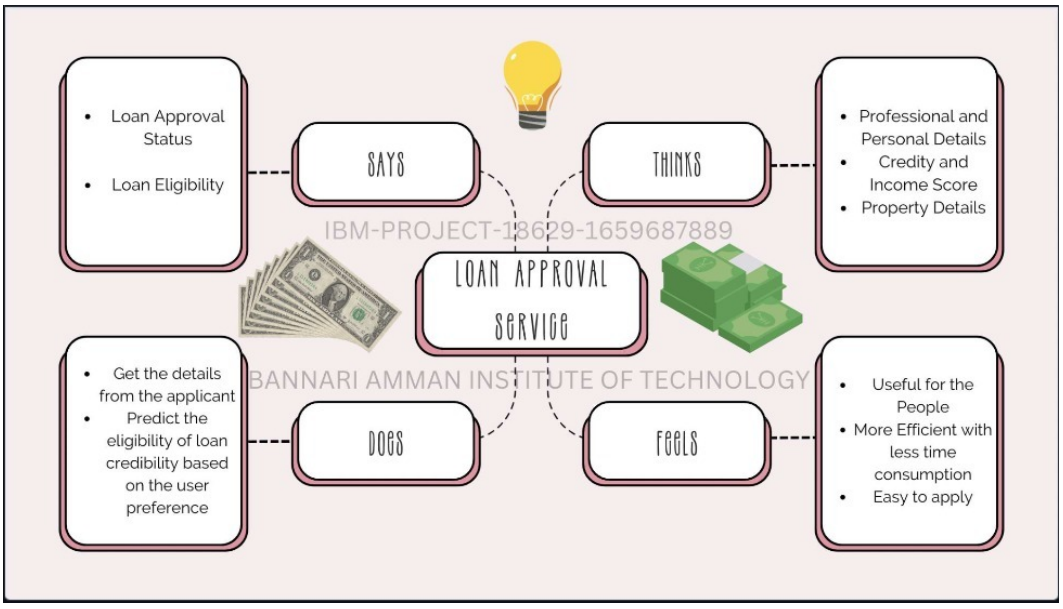
A bank is a financial institution licensed to receive deposits and make loans needs a way to verify and trust the customer details and their documents for getting loan because they need an trustable customer with proper assets, cash flow, documents and background who can repay the loan amount and interest on time. The prediction of credit defaulters is one of the difficult tasks for any bank. But by forecasting the loan defaulters, the banks definitely may reduce their loss by reducing their non-profit assets, so that recovery of approved loans can take place without any loss and it can play as the contributing parameter of the bank statement. This makes the study of this loan approval prediction important. Machine Learning techniques are very crucial and useful in the prediction of these types of data. We will be using classification algorithms such as Decision tree, Random-forest, KNN, and XGboost. We will train and test the data with these algorithms.

3. IDEATION & PROPOSED SOLUTION

3.1. Empathy Map Canvas

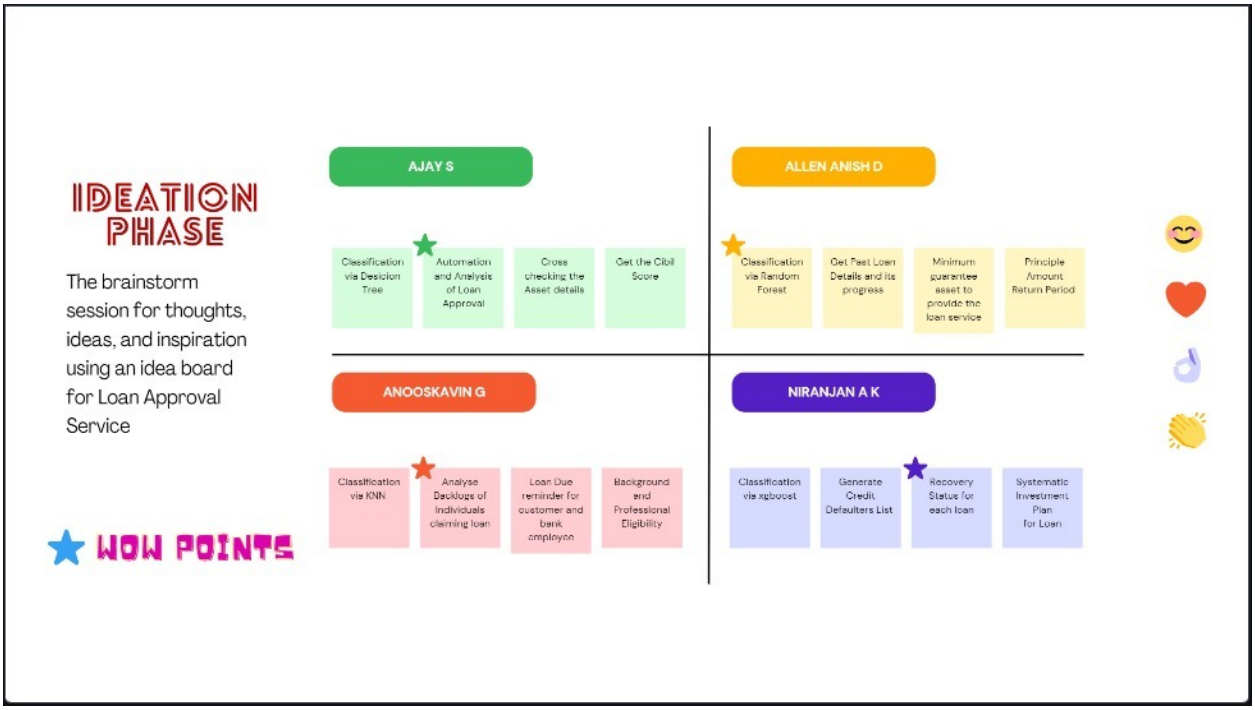
Empathy maps are a straightforward, effective technique for developing knowledge of your people. Empathy, the capacity to comprehend another person's feelings and thoughts, is the name's etymological source. When grounded in actual data and used in conjunction with other mapping techniques, they can:

i. Eliminate bias from our designs and bring the team together around a single, shared knowledge of the user
ii. Find the gaps in our study's findings
iii. Find out what the user needs—needs that the user may not even be aware of
iv. Learn what motivates user action. Point us in the direction of genuine innovation



3.2. Ideation & Brainstorming

By posing a problem to a group of individuals or team members and engaging them in an open dialogue, the brainstorming approach allows for the generation of ideas. Agile Brainstorming is the name given to this method when it is used in agile projects since it may provide creative ideas. Our group speaks aloud each danger as it is identified. They can take notes so they won't forget a concept before their turn if an increased risk prompts a fresh thought for someone who is not yet in line.



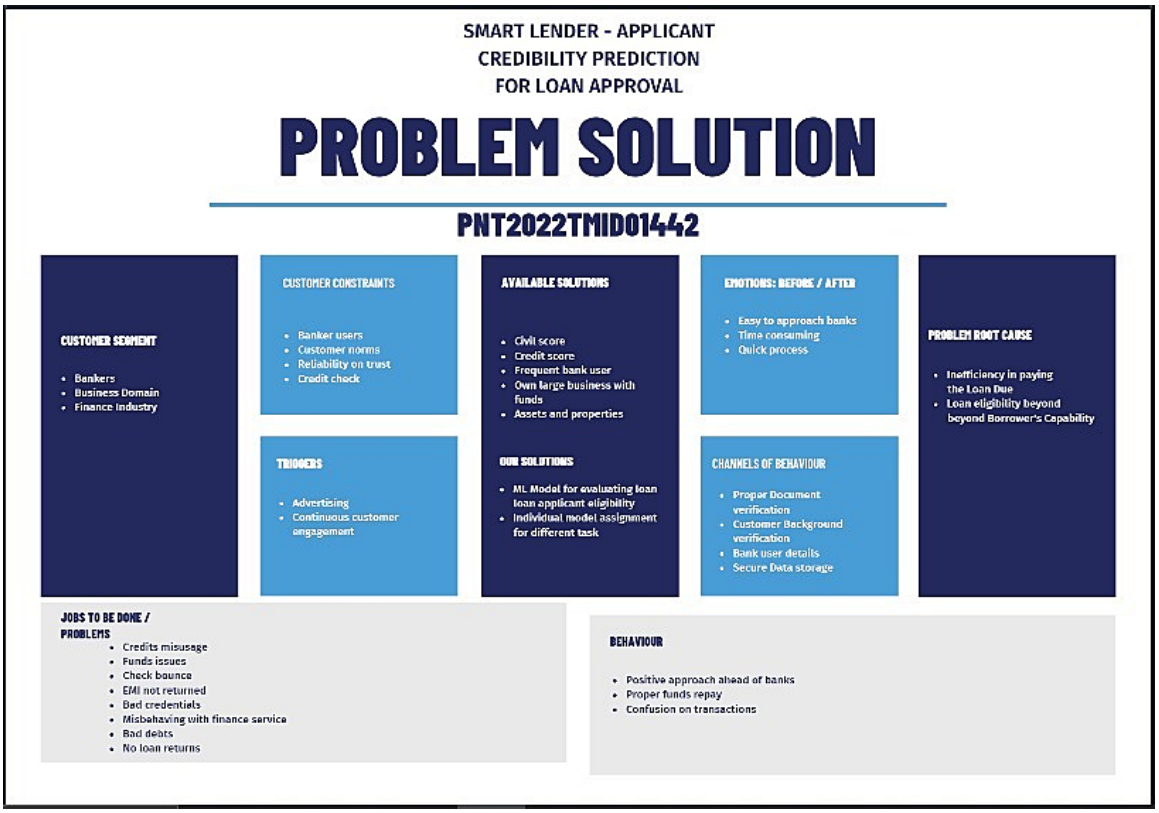
3.3. Proposed Solution

The prediction of credit defaulters is one of the difficult tasks for any bank. But by forecasting the loan defaulters, the banks definitely may reduce their loss by reducing their non-profit assets, so that recovery of approved loans can take place without any loss and it can play as the contributing parameter of the bank statement. This makes the study of this loan approval prediction important. Machine Learning techniques are very crucial and useful in the prediction of these types of data. We will be using classification algorithms such as Decision tree, Random-forest, KNN, and XGboost. We will train and test the data with these algorithms. From this best model is selected and saved in pkl format. We will be doing flask integration, develop a web interface and IBM deployment.

- The customer only needs to enter the details, the loan approval status is then predicted automatically and quickly. The property documents of the customer need to be submitted and the customer should agree to the terms and conditions of the bank. The loan approval will also depend on the CIBIL score of the customer. Provide captcha security.
- Automatic calculation of interest rate and repayment date based on loan amount. Varies efficient machine learning algorithms can be used to predict the loan eligibility of the customer. Provide customer ratings and reviews for understanding the customer. Adding digital signature of the customer on agreement of the terms and conditions.
- Provides data security. The customer details will not be shared to the third party. Instant Loan

approval status. Easy and fast loan approval process for the customer. Approves Loan to a trustable person. Bank can find a genuine person to provide loan

3.4. Problem Solution Fit



4. REQUIREMENT ANALYSIS

Functional Requirement

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIN
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP
FR-3	User Application	Filling of application Modification of application Verification of application
FR-4	Loan Issuance	Checking status of loan Loan Approval Loan Rejection
FR-5	Credit history analysis	Credit score auditing Income auditing
FR-6	User management	Choosing appropriate loan program for users Categorising users according to credit history.

Non-Functional Requirement

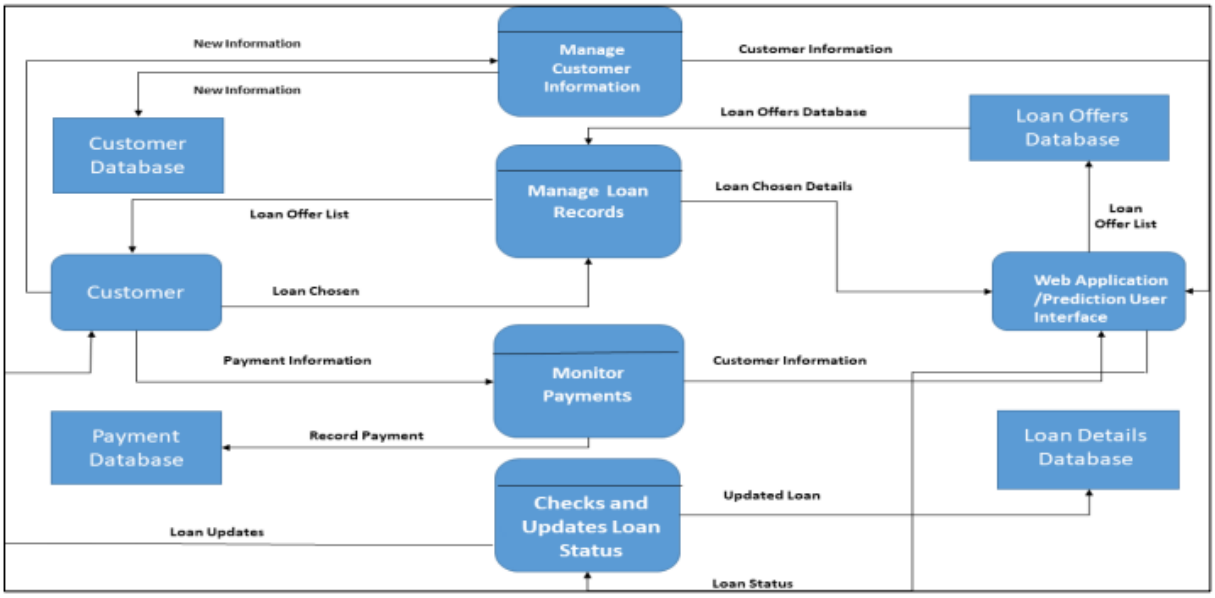
FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	Simple and understandable UI. Easy to navigate Smooth and seamless Easy to comprehend
NFR-2	**Security**	Restricted access to data. Login verification Registration verification Upholding privacy of user
NFR-3	**Reliability**	Backup to prevent data loss Negation of data loss due to lag.

NFR-4	**Performance**	Web based application. Requires minimum Intel Pentium 4 processor, 4 GB RAM, 1280x1024 screen with application window size 1024x680

5. PROJECT DESIGN

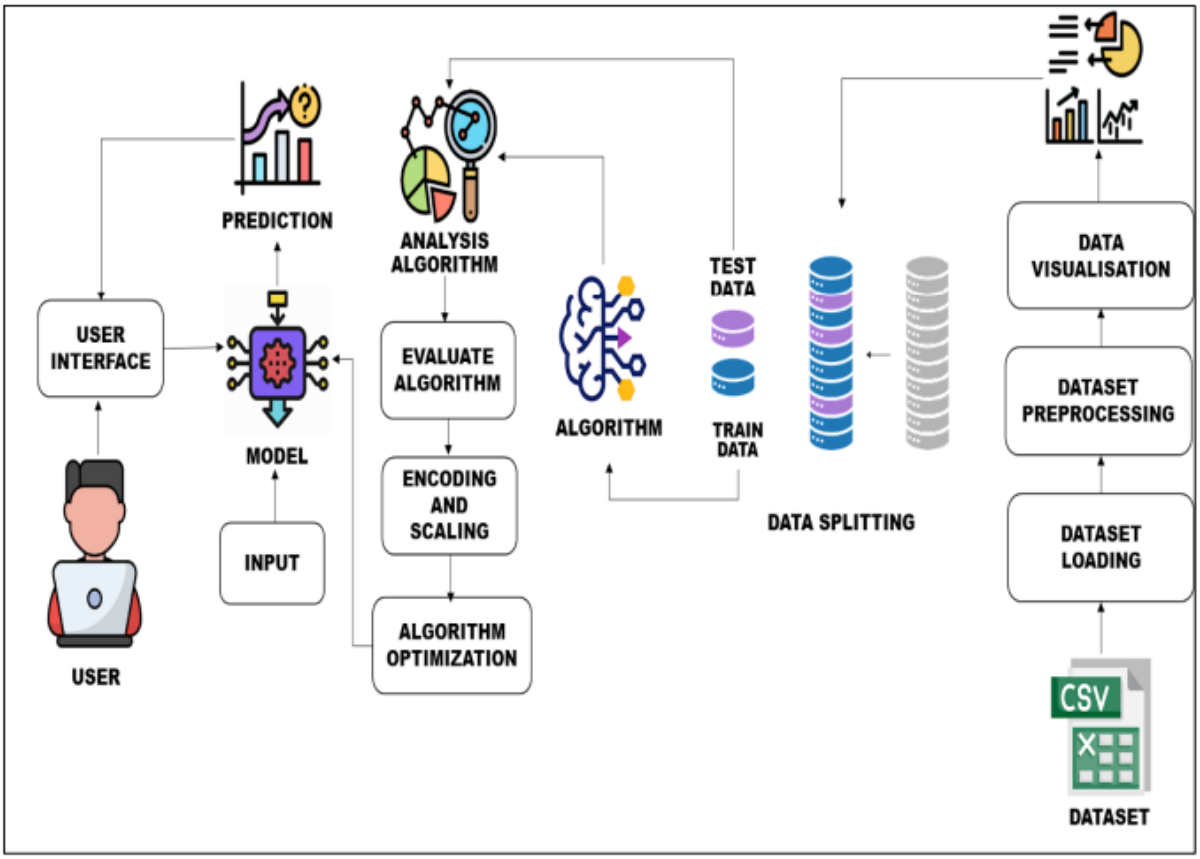
5.1. Data Flow Diagram

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 rightamount of the system requirement graphically. It shows how data enters and leaves the system, what changes theinformation, and where data is stored.



5.2. Solution & Technical Architecture

1. First the Model is trained with the obtained dataset. The data set is given by IBM.
2. Next the dataset will be pre-processed and then the data would be split to train and test data.
3. Then then model would be saved as a PKL file
4. A website would be created for the interaction and Flask would be used to integrate the model and website
5. The User would give the input, the inputs would be processed and then the prediction would be made.
6. After the prediction is made the output would be given as “Eligible” or “Not Eligible”
7. This can be scaled even more as an API and integrated into the Mobile banking application, making it even more convenient for the customer to know the eligibility.



5.3 User Stories

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Web user)	**Forms**	USN – 1	As a user, I can enter the data which I have and also the data which the website asks to me	Submit the required data for prediction	**High**	Sprint – 1
	Prediction	USN – 2	As I have given the data into the webpage, now the data can be predicted for the loan avail	Pre-processing is done and data is scaled in Backend and sent to the model for prediction	**High**	Sprint – 3

	Deployment of the Webpage in Cloud	USN – 3	As a user, I require global access to the web page as a user	I can get to the Webpage using the provided Web address	**Medium**	Sprint – 4
	Deployment of AI model in the cloud	USN – 4	Model would be running on the Cloud	I can access the model through the web address where I typed my data that's been set up on the IBM cloud.	**Medium**	Sprint – 4
	Model building	USN – 5	I require an ML model that can categorise Credit defaulters	I can use the ML model to classify the Credit defaulters	**High**	Sprint – 2
	User Interface building	USN – 6	As a User, I need a medium to enter my data	I can use the webpage which uses Flask at the backend to integrate with the ML Model created	**Medium**	Sprint – 3

6. PROJECT PLANNING & SCHEDULING

6.1 Sprint Planning & Estimation

Activity List: In Project Management Planning is an important task to scheduling the phrase of the project to the Team Member. In this Activity can shows the various activity are allocated and Done by the Team Members! In Project we can Split into the Four Step of Phrases are:

Phrase 1: Information Collection and Requirement Analysis
Phrase 2: Project Planning and Developing Modules
Phrase 3: Implementing the High Accuracy Deep Learning Algorithm to Perform
Phrase 4: Deploying the Model on Cloud and Testing the Model and UI Performance

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 confirming my password.	3	High	AJAY S ALLEN ANISH D
Sprint-1		USN-2	As a user, I will receive confirmation email once I have registered for the application	3	High	ANOOSKAVIN G NIRANJAN A K
Sprint-1		USN-3	As a user, I can register for the application through Facebook	1	Low	AJAY S NIRANJAN A K

Sprint-1		USN-4	As a user, I can register for the application through Gmail	2	Medium	ALLEN ANISH D

Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
Sprint-1	Login	USN-5	As a user, I can log into the application by entering email & password	3	High	ANOOSKAVIN G NIRANJAN A K
Sprint-1	Dashboard	USN-6	As a user, I should be able to access the dashboard with everything I am allowed to use.	2	Medium	AJAY S NIRANJAN A K
Sprint-1	Registration	USN-7	As a user, I can register for the application by entering my email, password, and confirming my password.	3	High	AJAY S ALLEN ANISH D
Sprint-1		USN-8	As a user, I will receive confirmation email once I have registered for the application	3	High	AJAY S ALLEN ANISH D
Sprint-1		USN-9	As a user, I can register for the application through Facebook	1	Low	ANOOSKAVIN G NIRANJAN A K

Sprint-1		USN-10	As a user, I can register for the application through Gmail	2	Medium	AJAY S ALLEN ANISH D
Sprint-1	Login	USN-11	As a user, I can log into the application by entering email & password	3	High	AJAY S ALLEN ANISH D ANOOSKAVIN G NIRANJAN A K
Sprint-1	Dashboard	USN-12	As a user, I should be able to access the dashboard with everything I am allowed to use.	2	Medium	AJAY S NIRANJAN A K

Sprint	**Functional Requirement (Epic)**	**User Story Number**	**User Story / Task**	**Story Points**	**Priority**	**Team Members**
Sprint-2	Register	USN-13	As a loan approval officer, I should be able to register myself as one using unique email and password.	5	Medium	AJAY S ANOOSKAVIN G
Sprint-2	Login	USN-14	As a loan approval officer I should be able to login myself as one using unique email and password.	5	Medium	ANOOSKAVIN G ALLEN ANISH D

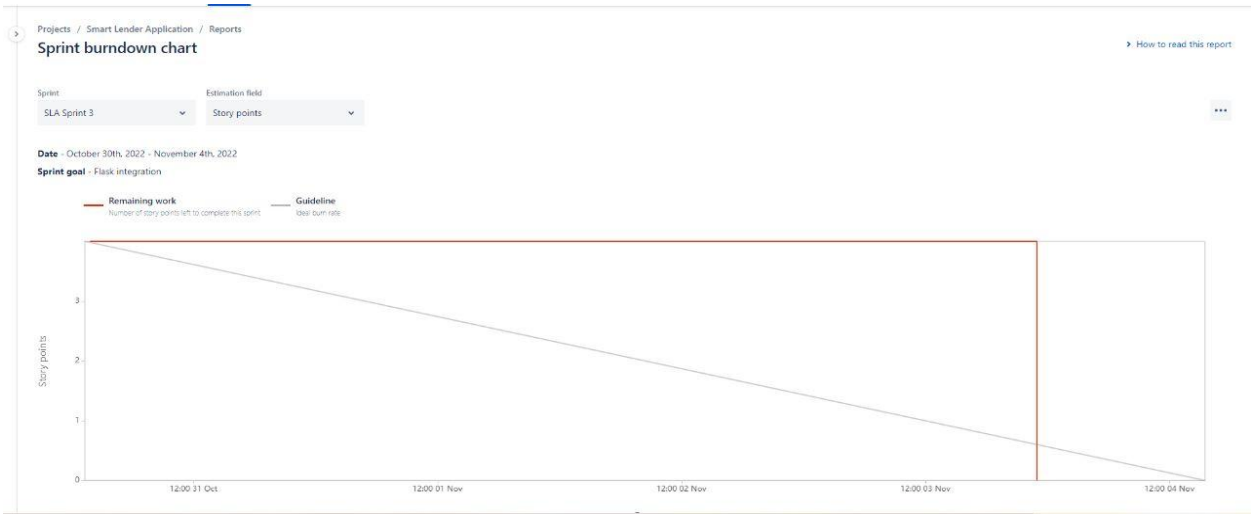
Sprint-3	Automated analysis of credit history	USN-15	As a loan approval officer, I can access the dashboard where I feed application for loan prediction.	10	High	AJAY S ALLEN ANISH D
Sprint-3		USN-16	As a loan approval officer, I can get a decision followed by some details for the decision when I feed an application for loan prediction.	15	High	ANOOSKAVIN G NIRANJAN A K
Sprint-4	Register	USN-17	As an admin, I should be able to register myself as one using unique email and password.	2	Medium	AJAY S ALLEN ANISH D ANOOSKAVIN G NIRANJAN A K
Sprint-4	Login	USN-18	As an admin I should be able to login myself as one using unique email and password.	2	Medium	AJAY S NIRANJAN A K

Sprint-4	Dashboard	USN-19	As a admin, I should be able to access the dashboard with everything I am allowed to use.	2	Medium	ANOOSKAVIN G ALLEN ANISH D

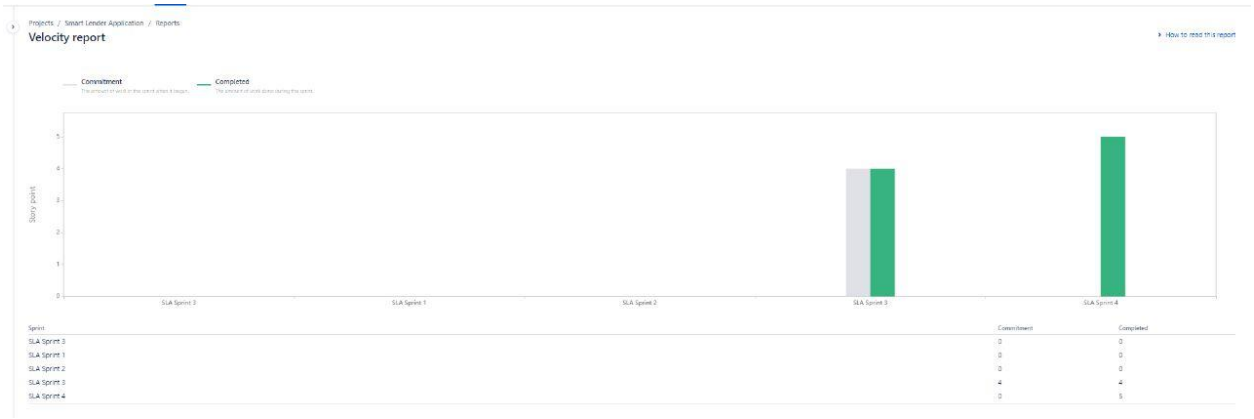
6.2 Sprint Delivery Schedule

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	28	29 Oct 2022
Sprint-2	20	6 Days	31 Oct 2022	05 Nov 2022	10	05 Nov 2022
Sprint-3	20	6 Days	07 Nov 2022	12 Nov 2022	25	12 Nov 2022
Sprint-4	20	6 Days	14 Nov 2022	19 Nov 2022	6	19 Nov 2022

6.3 Reports from JIRA




Projects / Smart Lender Application / Reports
Sprint burndown chart
How to read this report
Sprint
SLA Sprint 4
Estimation field
Story points
Date - November 3rd, 2022 - November 19th, 2022
Sprint goal - Cloud Deployment
Remaining work
Guideline
Story points
Nov 05
Nov 07
Nov 09
Nov 11
Nov 13
Nov 15
Nov 17
Nov 19
Date


Velocity report
How to read this report
Commitment
Completed
Story point
SLA Sprint 3
SLA Sprint 1
SLA Sprint 2
SLA Sprint 3
SLA Sprint 4
Sprint
Commitment
Completed
SLA Sprint 3
SLA Sprint 1
SLA Sprint 2
SLA Sprint 3
SLA Sprint 4

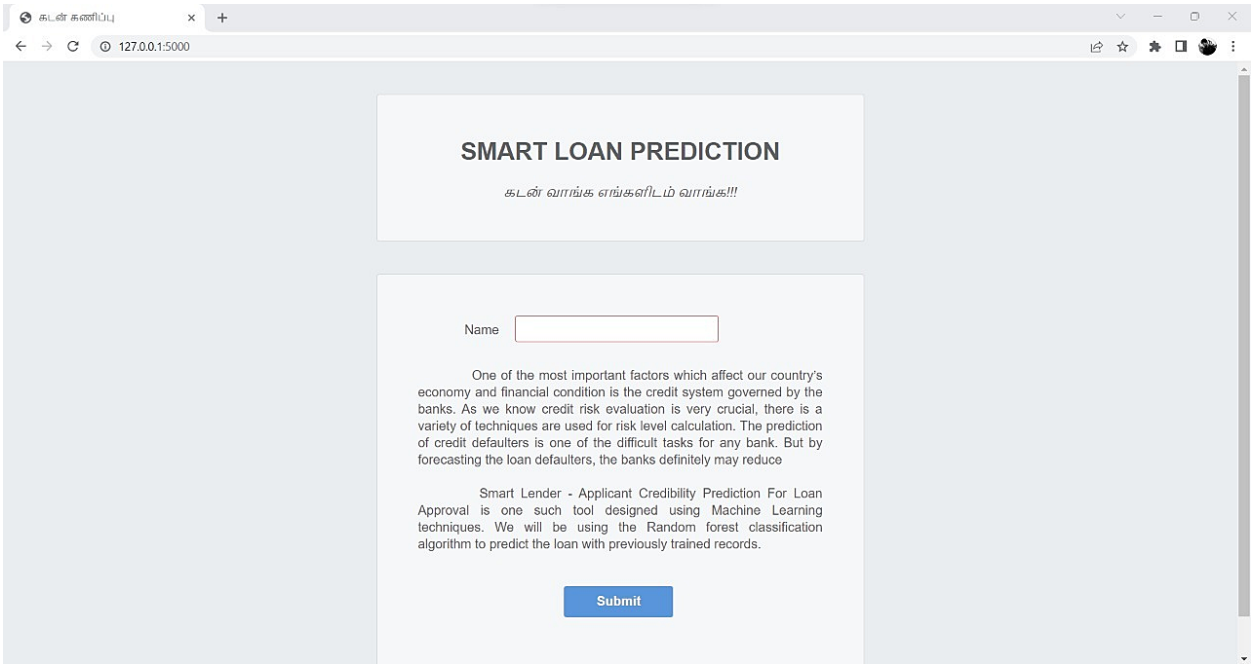
7. CODING AND SOLUTIONING

7.1 HTML Application

home.html

```
<!DOCTYPE html>
<html lang="en">
 <head>
  <meta charset="UTF-8" />
  <title>கடன் கணிப்பு</title>
  <link rel="stylesheet" href="{{ url_for('static',     filename='css/styles.css') }}" />
 </head>
 <body>
  <header class="speaker-form-header">
   <h1>SMART LOAN PREDICTION</h1>
   <p><em>கடன் வாங்க எங்களிடம் வாங்க!!!</em></p>
  </header>
  {% block content %}
  <form action="{{ url_for('predict') }}" method="post" class="speaker-form">
   <div class="form-row">
    <label for="full-name">Name</label>
    <input id="full-name" name="full-name" type="text" required/>
   </div>
   <div >
    <label >

      <p style="text-align: justify;">One of the most important factors which affect our country’s economy and financial condition is the credit system governed by the banks. As we know credit risk evaluation is very crucial, there is a variety of techniques are used for risk level calculation. The prediction of credit defaulters is one of the difficult tasks for any bank. But by forecasting the loan defaulters, the banks definitely may reduce
        <br><br>

        Smart Lender - Applicant Credibility Prediction For Loan Approval is one such tool designed using Machine Learning techniques. We will be using the Random forest classification algorithm to predict the loan with previously trained records.</p>

</label>
   </div>
```

```
    <br><br>
    <div class="form-row">

      <button style="text-align: center;margin-left: 180px;">Submit</button>
    </div>
  </form>
  {% endblock %}
 </body>
</html>
```



predict.html

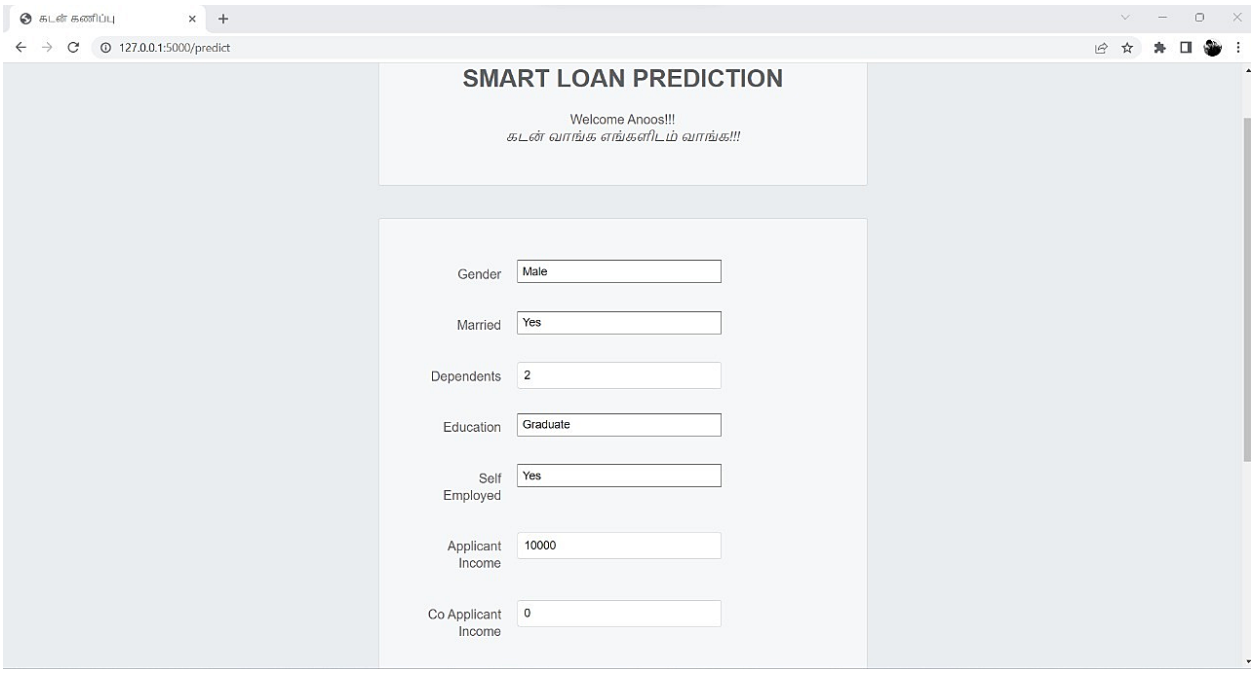
```
<!DOCTYPE html>
<html lang="en">
 <head>
  <meta charset="UTF-8" />
  <title>கடன் கணிப்பு</title>
  <link rel="stylesheet" href="{{ url_for('static',     filename='css/styles.css') }}" />
 </head>
 <body>
  <header class="speaker-form-header">
   <h1>SMART LOAN PREDICTION</h1>
   <p>Welcome {{project_name}}!!!</p>
   <p><em>கடன் வாங்க எங்களிடம் வாங்க!!!</em></p>
```

```
</header>
<form action="{{ url_for('evaluate') }}" method="post" class="speaker-form">
  <!-- <div class="form-row">
    <label for="full-name">Name</label>
    <input id="full-name" name="full-name" type="text" required/>
  </div>
  <div class="form-row">
    <label for="email">Email</label>
    <input
      id="email"
      name="email"
      type="email"
      placeholder="joe@example.com"
    />
  </div>
  <fieldset class="legacy-form-row">
    <legend>Type of Talk</legend>
    <input
      id="talk-type-1"
      name="talk-type"
      type="radio"
      value="main-stage"
    />
    <label for="talk-type-1" class="radio-label">Main Stage</label>
    <input
      id="talk-type-2"
      name="talk-type"
      type="radio"
      value="workshop"
      checked
    />
    <label for="talk-type-2" class="radio-label">Workshop</label>
  </fieldset> -->
  <div class="form-row">
    <label for="Gender">Gender</label>
    <select id="Gender" name="Gender" required>
      <option value="1">Male</option>
      <option value="0">Female</option>
    </select>
  </div>
  <div class="form-row">
```

```
  <label for="Married">Married</label>
  <select id="Married" name="Married" required>
    <option value="1">Yes</option>
    <option value="0">No</option>
  </select>
</div>
<div class="form-row">
  <label for="Dependents">Dependents</label>
  <input
    id="Dependents"
    name="Dependents"
    type="number"
    min="0"
    max="3"
    placeholder="No of Dependents on you....."
    required
  />
</div>
<div class="form-row">
  <label for="Education">Education</label>
  <select id="Education" name="Education" required>
    <option value="0">Graduate</option>
    <option value="1">Not Graduate</option>
  </select>
</div>
<div class="form-row">
  <label for="Self Employed">Self Employed</label>
  <select id="Self Employed" name="Self Employed" required>
    <option value="1">Yes</option>
    <option value="0">No</option>
  </select>
</div>
<div class="form-row">
  <label for="Applicant Income">Applicant Income</label>
  <input
    id="Applicant Income"
    name="Applicant Income"
    type="number"
    min="0"
    placeholder="Your Income....."
    required
```

```
  />
</div>
<div class="form-row">
  <label for="Co Applicant Income">Co Applicant Income</label>
  <input
    id="Co Applicant Income"
    name="Co Applicant Income"
    type="number"
    min="0"
    placeholder="Your Co Applicant Income....."
    required
  />
</div>
<div class="form-row">
  <label for="Loan Amount">Loan Amount</label>
  <input
    id="Loan Amount"
    name="Loan Amount"
    type="number"
    min="0"
    placeholder="Enter the Loan Amount....."
    required
  />
</div>
<div class="form-row">
  <label for="Loan Amount Term">Loan Amount Term</label>
  <input
    id="Loan Amount Term"
    name="Loan Amount Term"
    type="number"
    min="0"
    placeholder="Enter the Loan Amount Term in days....."
    required
  />
</div>
<div class="form-row">
  <label for="Credit History">Credit History</label>
  <select id="Credit History" name="Credit History" required>
    <option value="1">Yes</option>
    <option value="0">No</option>
  </select>
```

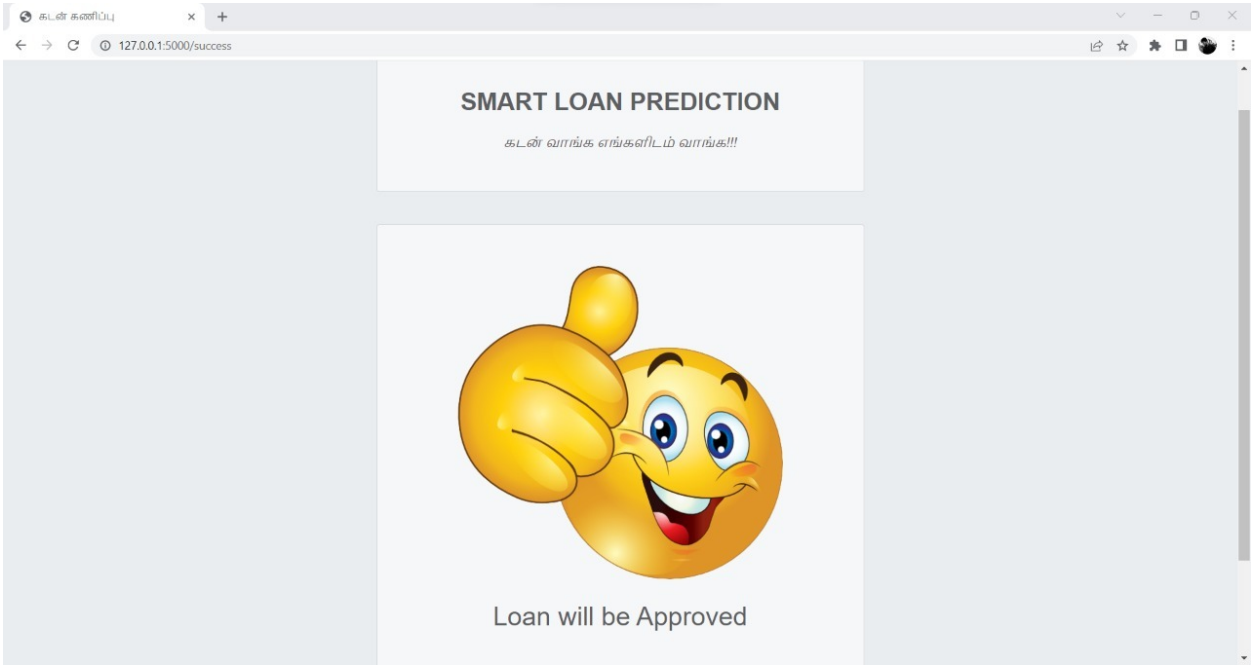
```
    </div>
    <div class="form-row">
      <label for="Property Area">Property Area</label>
      <select id="Property Area" name="Property Area" required>
        <option value="0">Urban</option>
        <option value="1">Semiurban</option>
        <option value="2">Rural</option>
      </select>
    </div>
    <!-- <div class="form-row">
      <label for="abstract">Abstract</label>
      <textarea id="abstract" name="abstract"></textarea>
      <div class="instructions">Describe your talk in 500 words or less</div>
    </div>
    <div class="form-row">
      <label class="checkbox-label" for="available">
        <input
          id="available"
          name="available"
          type="checkbox"
          value="is-available"
        />
        <span>I’m actually available the date of the talk</span>
      </label>
    </div> -->
    <div class="form-row">
      <button>Submit</button>
    </div>
  </form>
 </body>
</html>
```

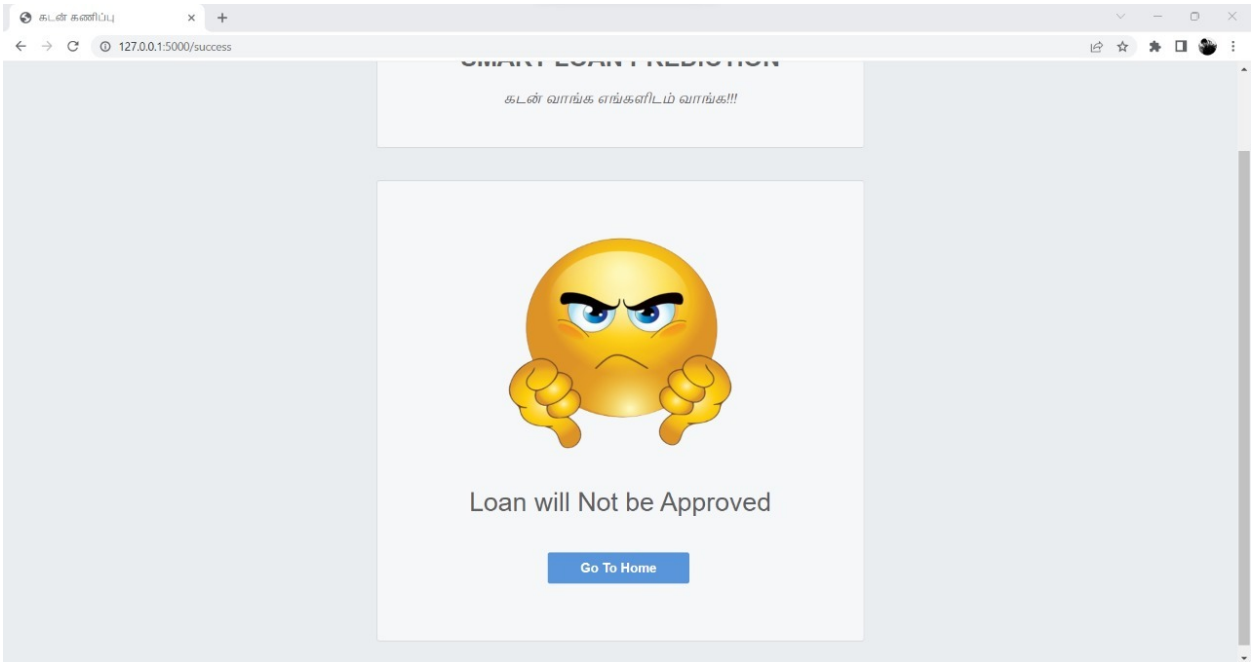


success.html

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="UTF-8" />
    <title>கடன் கணிப்பு</title>
    <link rel="stylesheet" href="{{ url_for('static',     filename='css/styles.css') }}" />
  </head>
  <body>
    <header class="speaker-form-header">
      <h1>SMART LOAN PREDICTION</h1>
      <p><em>கடன் வாங்க எங்களிடம் வாங்க!!!</em></p>
    </header>
    {% block content %}
    <form action="{{ url_for('home') }}" method="post" class="speaker-form">
      <div >
        <!-- <label > -->
            {% if loan == 0 %}
            <center>
                <img style="width: 450px;height:300px" src="{{url_for('static', filename='css/0.png')}}"/>
                <p style="text-align: center;font-size: xx-large;;margin-top: 20px;">{{result}}</p>
              </center>
            {% endif %}
            {% if loan == 1 %}
```

```
        <center>
           <img style="width: 400px;height:386px" src="{{url_for('static', filename='css/1.png')}}"/>
           <p style="text-align: center;font-size: xx-large;margin-top: 20px;">{{result}}</p>
        </center>
        {% endif %}

      <!-- </label> -->
    </div>
    <br><br>
    <div class="form-row">

      <button style="text-align: center;margin-left: 160px;">Go To Home</button>
    </div>
  </form>
  {% endblock %}
 </body>
</html>
```




கடன் கணிப்பு
127.0.0.1:5000/success
கடன் வாங்க எங்களிடம் வாங்க!!!
Loan will Not be Approved
Go To Home

7.2 Flask Application Code with endpoints

main.py

```
from flask import Flask, render_template,request
import numpy as np
# import pickle
import requests

API_KEY = "q3P7ZbT4fGZALq9E6p2WnN8A673uSOz3MREKcwiy4H_V"
token_response = requests.post('https://iam.cloud.ibm.com/identity/token', data={"apikey":
 API_KEY, "grant_type": 'urn:ibm:params:oauth:grant-type:apikey'})
mltoken = token_response.json()["access_token"]
header = {'Content-Type': 'application/json', 'Authorization': 'Bearer ' + mltoken}

app = Flask(_name_)

# model = pickle.load(open(r'rdf.pkl','rb'))

@app.route("/", methods=['GET', 'POST'])
def home():
    return render_template("home.html")

@app.route("/predict",methods=['POST','GET'])
def predict():
    if request.method == 'POST':
        project_name=request.form['full-name']
        print(project_name)
    return render_template("predict.html",project_name=project_name)

@app.route("/success",methods=['POST','GET'])
def evaluate():
    input_feature = [int(x) for x in request.form.values()]
    print(input_feature)
    # input_feature=[np.array(input_feature)]
    print(input_feature)
    names = ['Gender', 'Married', 'Dependents', 'Education', 'Self Employed', 'Applicant Income',
'Coapplicant Income', 'Loan Amount', 'Loan_Amount_Term', 'Credit_History', 'Property_Area']
    payload_scoring = {"input_data": [{"fields": [names],
```

```
                                "values": [input_feature]}]}
    response_scoring = requests.post(
        'https://us-south.ml.cloud.ibm.com/ml/v4/deployments/cfb7dd73-4afb-4559-b3d2-
b5087422dba4/predictions?version=2022-11-15',
        json=payload_scoring,
        headers={'Authorization': 'Bearer ' + mltoken})
    predictions = response_scoring.json()
    prediction = predictions['predictions'][0]['values'][0][0]
    print("Predictions are ",predictions)
    if (prediction == 0):
        return render_template("success.html",result = "Loan will Not be Approved",loan=0)
    else:
        return render_template("success.html",result = "Loan will be Approved",loan=1)

if _name_ == "_main_":
    app.run(debug=True)
```

8. TESTING

8.1 Test Case

For checking the loan application, We have two testcase

- Eligible
- Not Eligible

This is based on the training and testing the model we used in our application. This eligibility can be checked by using the details entered by the users.

This includes the details like

- ➤ Gender
- ➤ Status
- ➤ Dependants
- ➤ Education
- ➤ Employ
- ➤ Income
- ➤ Co-income(additional income)
- ➤ Loan amount
- ➤ Loan amount term(in days)
- ➤ Credit history
- ➤ Property area(type of location)

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 project - Smart Lender - Applicant Credibility Prediction for Loan Approval at the time of the release to User Acceptance Testing (UAT).

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

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	6	0	0	6
Client Application	16	0	0	16
Security	2	0	0	2
Exception Reporting	3	0	0	3
Final Report Output	4	0	0	4
Version Control	1	0	0	1

9. RESULTS

9.1 Performance Metrics

In our project we used Random Forest for prediction

S.No	Parameter	Values	Screenshot
1.	Metrics	**Classification Model:** Confusion Matrix , Accuray Score- & Classification Report	Fig 1
2.	Tune the Model	Hyperparameter Tuning Validation Method	Fig 2

Random Forest Classifier

```
In [64]: randomForest(x_train, x_test, y_train, y_test)
```

```
**RandomForestClassifier**
Confusion matrix
[[ 73  25]
 [ 17 108]]
Classification report
              precision    recall  f1-score   support

           0       0.81      0.74      0.78        98
           1       0.81      0.86      0.84       125

    accuracy                           0.81       223
   macro avg       0.81      0.80      0.81       223
weighted avg       0.81      0.81      0.81       223
```

Evaluating Performance Of The Model And Saving The Model

In [68]:
```
rf = RandomForestClassifier()
rf.fit(x_train, y_train)
yPred = rf.predict(x_test)
```

In [73]:
```
f1_score(yPred, y_test, average='weighted')
```

Out[73]:
```
0.8042001876805869
```

In [74]:
```
cv = cross_val_score(rf, x, y, cv=5)
```

In [75]:
```
np.mean(cv)
```

Out[75]:
```
0.7817406370785018
```

In [76]:
```
pickle.dump(rf, open('rdf.pkl','wb'))
```

From the four model, Random forest is performing well. Random Forest is giving the accuracy of 81%.So, we considering Random forest and deploying this model.

10. ADVANTAGES & DISADVANTAGES

ADVANTAGES:

Fast and highly accurate result

Easy handling of the problem

Less risk and more convenient to use

Reliablity is pretty high Better choice for responsive result

Better user interface

DISADVANTAGES:

Machine Learning model in general is little complex

Prediction sometime not reliable because the model is build on the old data.

The prediction result is more depend on the model.

11. CONCLUSION

We determined the most important features that influence the loan approval status. These most important features are then used on some selected algorithms and their performance accuracy is compared with the instance of using all the features. The model can help the banks in figuring out which factors are important for the loan approval procedure. The comparative study makes us clear about which algorithm will be the best and ignores the rest, based on their accuracy. We have developed a model which can easily predict that the person will repay its loan or not. we can see our model has reduced the efforts of bankers. Machine learning has helped a lot in developing this model which gives precise results

12. FUTURE SCOPE

Future enhancement of this research work on training bots to predict the loan eligibility areas by using machine learning techniques. Since, machine learning is similar to data mining advanced concept of machine learning can be used for better prediction. The data privacy, reliability, accuracy can be improved for enhanced prediction. From the encouraging results, we believe that crime data mining has a promising future for increasing the effectiveness and efficiency of criminal and intelligence analysis.

Visual and intuitive criminal and intelligence investigation techniques can be developed for loan credibility pattern. As we have applied machine learning technique of data mining for loan prediction we can also perform other techniques of data mining such as classification. Also we can perform analysis on various dataset such as enterprise survey dataset, poverty dataset, aid effectiveness dataset, etc.

13. APPENDIX

GitHub Link:

https://github.com/IBM-EPBL/IBM-Project-18629-1659687889

Demonstration Video Link:

https://drive.google.com/file/d/1e8R32iAB5dacwVKkxbe9BPQELz5Xg2cy/view?usp=share_link

Drive Link:

https://drive.google.com/drive/folders/1Nqb3BfrkdnVWoUs0Pm68WVxLnlRYRd2F?usp=sharing