A

Mini Project

On

CUSTOMER LOAN PREDICTION ANALYSIS

(Submitted in partial fulfillment of the requirements for the award of Degree)

BACHELOR OF TECHNOLOGY

In

COMPUTER SCIENCE AND ENGINEERING

By

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CMR TECHNICAL CAMPUS

UGC AUTONOMOUS

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2020-2024

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

CERTIFICATE

This is to certify that the project entitled **"CUSTOMER LOAN PREDICTION ANALYSIS"** being submitted by **B SRIHITHA (217R5A0502), P SAI KIRAN (207R1A0546), K SUNIL (207R1A0533)** in partial fulfillment of the requirements for the award of the degree of B. Tech in Computer Science and Engineering to the CMR Technical Campus, is a record of bonafide work carried out by them under our guidance and supervision during the year 2023-2024.

The results embodied in this thesis have not been submitted to any other University or Institute for the award of any degree or diploma.

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HOD

EXTERNAL EXAMINER

Submitted for viva voice Examination held on _____

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ABSTRACT

With the enhancement in the banking sector lots of people are applying for bank loans but the bank has its limited assets which it has to grant to limited people only, so finding out to whom the loan can be granted which will be a safer option for the bank is a typical process. So, in this paper we try to reduce this risk factor behind selecting the safe person so as to save lots of bank efforts and assets. This is done by mining the Big Data of the previous records of the people to whom the loan was granted before and on the basis of these records/experiences the machine was trained using the machine learning model which give the most accurate result. The main objective of this paper is to predict whether assigning the loan to particular person will be safe or not. This paper is divided into four sections (i)Data Collection (ii) Comparison of machine learning models on collected data (iii) Training of system on most promising model (iv) Testing.

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1. INTRODUCTION

1.INTRODUCTION

1.1 PROJECT SCOPE

This project titled “CUSTOMER LOAN PREDICTION ANALYSIS, focuses on developing a predictive model using the Random Forest machine learning algorithm to determine loan approval for customers based on financial features. This involves gathering and preprocessing a comprehensive dataset, encompassing critical financial parameters. Exploratory data analysis and feature engineering will enhance the model's predictive power, aiding in informed loan approval predictions. The project scope also includes model development using Random Forest, performance evaluation, hyperparameter tuning for optimization, and deploying the model to provide real-time predictions for loan approvals.

1.2 PROJECT PURPOSE

The primary objective of this project is to assist financial institutions in automating and optimizing their loan approval processes. By leveraging machine learning, specifically the Random Forest algorithm, the model predicts loan approvals based on historical data and various financial features. This automation speeds up decision-making, improves efficiency, and ensures a fair and consistent approach to loan approvals. Furthermore, it enhances risk assessment, enabling financial institutions to make more informed lending decisions.

1.3 PROJECT FEATURES

The project offers robust data handling and preprocessing capabilities, ensuring data quality and consistency. Exploratory Data Analysis (EDA) facilitates the visualization of data patterns and correlations, crucial for feature engineering. Leveraging the Random Forest algorithm, known for its accuracy, the project builds a predictive model. It also encompasses model evaluation, hyperparameter tuning for enhanced performance, and deploying the trained model for efficient real-time loan approval predictions.

2.SYSTEM ANALYSIS

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SYSTEM ANALYSIS

System Analysis is the important phase in the system development process. The System is studied to the minute details and analyzed. The system analyst plays an important role of an interrogator and dwells deep into the working of the present system.In analysis, a detailed study of these operations performed by the system and their relationships within and outside the system is done. A key question considered here is, “what must be done to solve the problem?” The system is viewed as a whole and the inputs to the system are identified. Once analysis is completed the analyst hasa firm understanding of what is to be done.

2.1 PROBLEM DEFINITION

The general statement of CUSTOMER LOAN PREDICTION ANALYSIS is to introduce a technology to deal with the issue of loan to a customer in a particular bank which in result ensures security of bank assets and fair distribution of them.

2.2 EXISTING SYSTEM

Machine Learning implementation is a very complex part in terms of Data analytics. Working on the data which deals with prediction and making the code to predict the future outcomes from customer is the challenging part.

2.2.1 LIMITATIONS OF EXISTING SYSTEM

Following are the disadvantages of existing system:

- Complexity in analyzing the data.
- Prediction is a challenging task working in the model.
- Coding is complex maintaining multiple methods.
- The libraries' support was not that familiar.

2.3 PROPOSED SYSTEM

Python has a is a good area for data analysis which helps us in analyzing the data with better models in data science. The library in python makes the predication for loan data and results with multiple terms considering all properties of the customer in terms of prediction.

2.3.1 ADVANTAGES OF THE PROPOSED SYSTEM

- Libraries help to analyze the data.
- Statistical and prediction is very easy compared to existing technologies.
- Results will be accurate compared to other methodologies.

2.4 FEASIBILITY STUDY

The feasibility of the project is analyzed in this phase and a business proposal is put forth with a very general plan for the project and some cost estimates. During system analysis the feasibility study of the proposed system is to be carried out. This isto ensure that the proposed system is not a burden to the company. Three key considerations involved in the feasibility analysis:

- Economic Feasibility
- Technical Feasibility
- Social Feasibility

2.4.1 ECONOMIC FEASIBILITY

The developing system must be justified by cost and benefit. Criteria to ensure that effort is concentrated on a project, which will give best, return at the earliest. One of the factors which affect the development of a new system, is the cost it would require.

The following are some of the important financial questions asked during preliminary investigation:

- The costs conduct a full system investigation.
- The cost of the hardware and software.
- The benefits come in the form of reduced costs or fewer costly errors.

Since the system is developed as part of project work, there is no manual cost to spend for the proposed system. Also, all the resources are already available, it give an indication that the system is economically possible for development.

2.4.2 TECHNICAL FEASIBILITY

This study is carried out to check the technical feasibility, that is, the technical requirements of the system. Any system developed must not have a high demand on theavailable technical resources. The developed system must have a modest requirement, as only minimal or null changes are required for implementing this system.

2.4.3 SOCIAL FEASIBILITY

This includes the following questions:

- Is there sufficient support for the users?
- Will the proposed system cause harm?

The project would be beneficial because it satisfies the objectives when developed and installed. All behavioral aspects are considered carefully and conclude that the project is behaviorally feasible.

2.5 HARDWARE & SOFTWARE REQUIREMENTS

2.5.1 HARDWARE REQUIREMENTS:

Hardware interfaces specify the logical characteristics of each interface betweenthe software product and the hardware components of the system. The following are some hardware requirements.

- Processor : Intel core I3 or above.
- Hard disk : 516GB SSD or above.
- Memory : 8GB or above.

2.5.2 SOFTWARE REQUIREMENTS:

Software Requirements specifies the logical characteristics of each interfaceand software components of the system.

The following are some software requirements.

- Operating system : Windows 8 or above.
- Code language : Python
- Agent : Any compatible browser
- Security and Integration tools

3.ARCHITECTURE

3.ARCHITECTURE

3.1 PROJECT ARCHITECTURE

The figure below shows the architecture of the project.

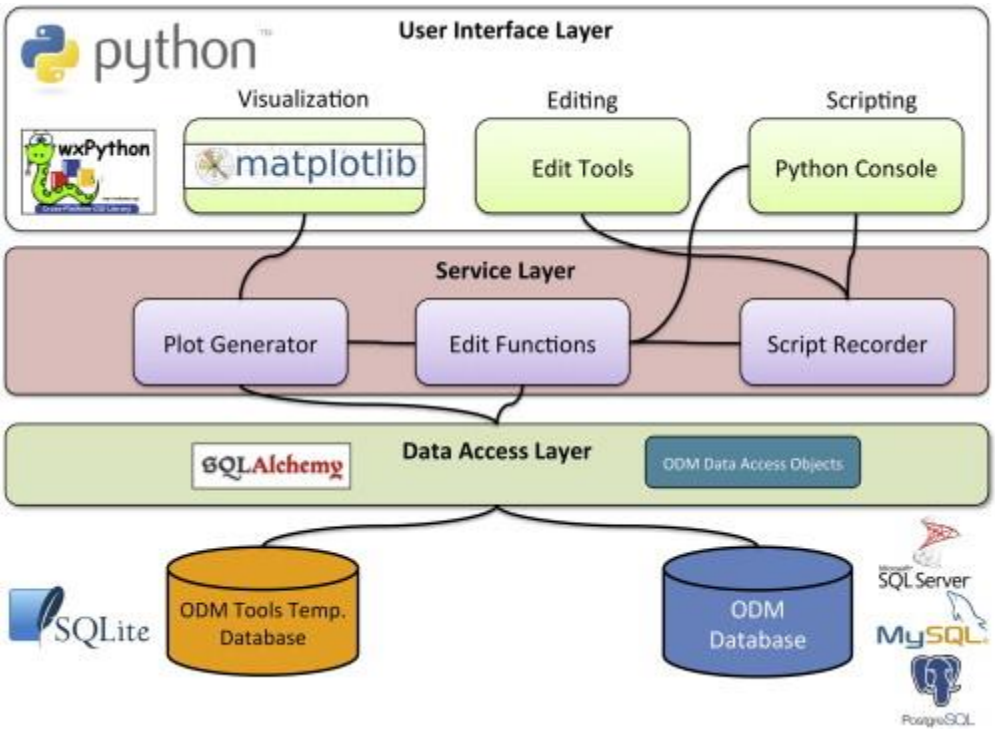

Figure 3.1: Architecture of Customer loan analysis

3.2DESCRIPTION

The project "Customer Loan Prediction Analysis using Random Forest Machine Learning Algorithm with Python" aims to revolutionize the loan approval process within the financial sector. By harnessing the power of historical loan application data and cutting-edge machine learning techniques, specifically the Random Forest algorithm, the project endeavors to predict loan approval outcomes based on a customer's financial background. This predictive model is positioned to significantly enhance the efficiency and consistency of loan decision-making, benefiting both financial institutions and prospective borrowers.

The endeavor commences with meticulous data collection & preprocessing, ensuring that the dataset is well-structured and amenable to model training. Exploratory data analysis and feature engineering follow suit, allowing for the extraction of crucial insights and the creation of significant features that will fortify the predictive capability of the model. The Random Forest algorithm, chosen for its reputation of high accuracy and adaptability, becomes the linchpin of the predictive model. Through rigorous evaluation and fine-tuning of model hyperparameters, the system is optimized to deliver precise predictions.

However, the project's impact doesn't conclude with the development of a robust model. It extends to the user interface, where customers can seamlessly input their financial details, and the model, in turn, provides prompt predictions regarding their loan approval prospects. This blend of machine learning prowess and user-centric design strives to make the loan approval process more transparent, unbiased, and expeditious. Ultimately, the "Customer Loan Prediction Analysis using Random Forest Machine Learning Algorithm with Python" project aspires to be a game-changer in the financial domain, simplifying decision-making for both financial institutions and customers, and fostering a future where lending is efficient, equitable, and insightful.

Moreover, the significance of this project lies in its potential to democratize financial opportunities. By providing a data-driven mechanism to predict loan approvals, it can empower individuals with insights into their financial journey. Customers gain a clearer understanding of their eligibility for loans, allowing them to plan and work towards fulfilling their financial goals. Simultaneously, financial institutions benefit from a streamlined and automated process, reducing the workload associated with manual evaluation while maintaining a fair and unbiased approach to loan approvals. Through this venture, the aim is to create a win-win situation, fostering a symbiotic relationship where financial institutions operate more efficiently, and customers are equipped with the knowledge to make informed financial decisions, ultimately contributing to a more inclusive and equitable financial landscape.

BIG DATA

Big data is a propelling term that depicts any voluminous measure of sorted out, semi composed and unstructured data that can be burrowed for information. Though huge data doesn't suggest a specific sum, the term is much of the time used when discussing Petabytes and Exabyte's of data.

Bigdata is a term for informational collections that are so extensive or complex that customary information handling application programming is lacking to manage them. Gigantic data is used to depict a tremendous volume of data that is expansive to the point that it's difficult to process. The data is excessively colossal that outperforms current getting ready cutoff. Gigantic Data is an articulation used to mean an enormous volume of both sorted out and unstructured data that is so sweeping it is difficult to process using traditional database and programming frameworks. In most undertaking situations the volume of information is too enormous, or it moves too quick, surpasses current

handling limit. Huge Data operations and make speedier, more keen choices. This information, when caught, can possibly enable organizations to enhance organized, controlled put away, and investigated can enable an organization to increase helpful understanding to expand incomes, to get or hold clients, and enhance operations.

ABOUT PYTHON

Python is a programming language, which means it's a language both people and computers can understand. Python was developed by a Dutch software engineer named Guido van Rossum, who created the language to solve some problems he saw in computer languages of the time.

Python is an interpreted high-level programming language for general-purpose programming. Created by Guido van Rossum and first released in 1991, Python has a design philosophy that emphasizes code readability, and a syntax that allows programmers to express concepts in fewer lines of code, notably using significant whitespace. It provides constructs that enable clear programming on both small and large scales.

Python features a dynamic type system and automatic memory management. It supports multiple programming paradigms, including object-oriented, imperative, functional and procedural, and has a large and comprehensive standard library.

Python interpreters are available for many operating systems. C Python, the reference implementation of Python, is an open-source software and has a community-based development model, as do nearly all of its variant implementations. C Python is managed by the non-profit Python Software Foundation.

You Can Use Python for Pretty Much Anything

One significant advantage of learning Python is that it is general-purpose language that can be applied in a large variety of projects. Below are just some of the most common fields where Python has found its use:

- Data science
- Scientific and mathematical computing
- Web development
- Computer graphics
- Basic game development
- Mapping and geography (GIS software)

Python Is Widely Used in Data Science

Python's ecosystem has been growing over the years and it's more and more capable of statistical analysis.

It's the best compromise between scale and sophistication (in terms of data processing). Python emphasizes productivity and readability. Python is used by programmers that want to delve into data analysis or apply statistical techniques (and by Devs that turn to data science).

There are plenty of Python scientific packages for data visualization, machine learning, natural language processing, complex data analysis and more. All of these factors make Python a great tool for scientific computing and a solid alternative for commercial packages such as MATLAB.

Python

Python features a dynamic type of system and automatic memory management. It supports multiple programming paradigms, including object-oriented, imperative, functional, and procedural, and has a large and comprehensive standard library.

Python interpreters are available for many operating systems. Python, the reference implementation of Python, is open-source software and has a community-based development model, as do nearly all of its variant implementations. C Python is managed by the non-profit Python Software Foundation.

3.3 USE CASE DIAGRAM

A use case diagram is a graphical depiction of a user's possible interactions witha system. A use case diagram shows various use cases and different types of users the system has. The use cases are represented by either circles or ellipses. The actors are often shown as stick figures.

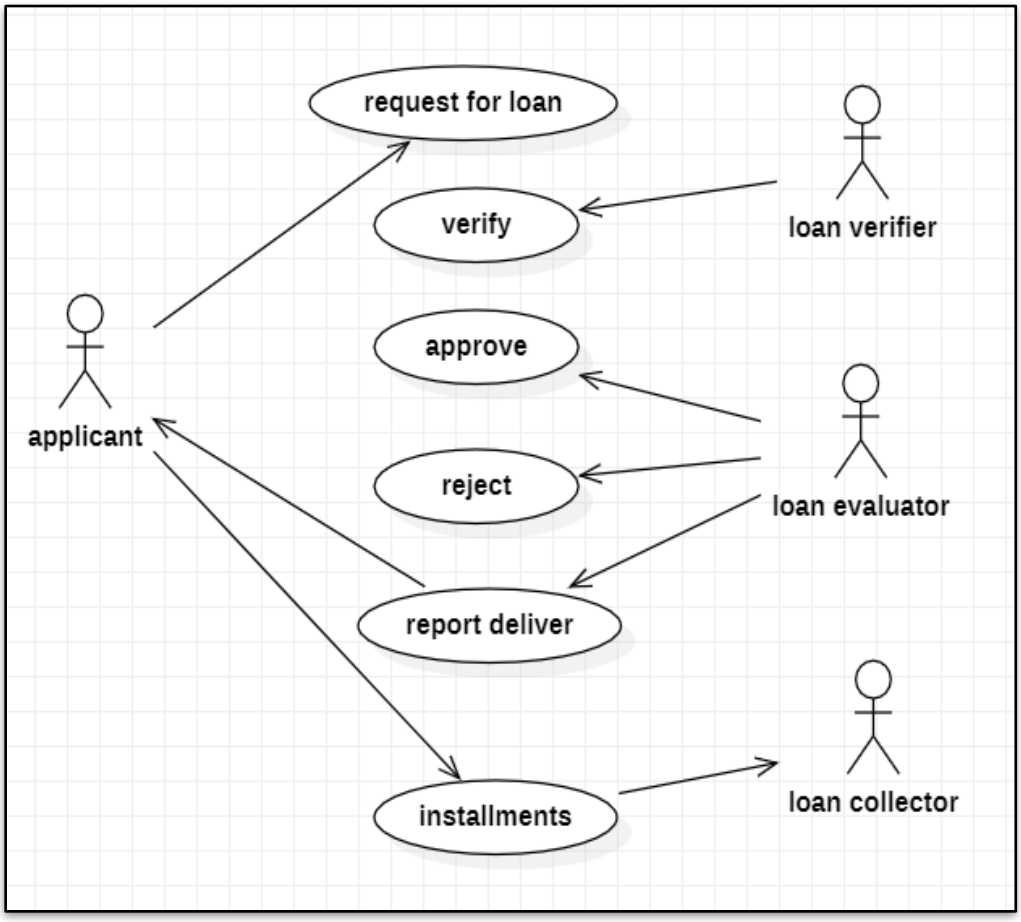

Figure 3.3: Use Case Diagram of Customer loan Prediction analysis

3.4 CLASS DIAGRAM

Class diagram is a type of static structure diagram that describes the structure of a system by showing the system's classes, their attributes, operations (or methods), and the relationships among objects.

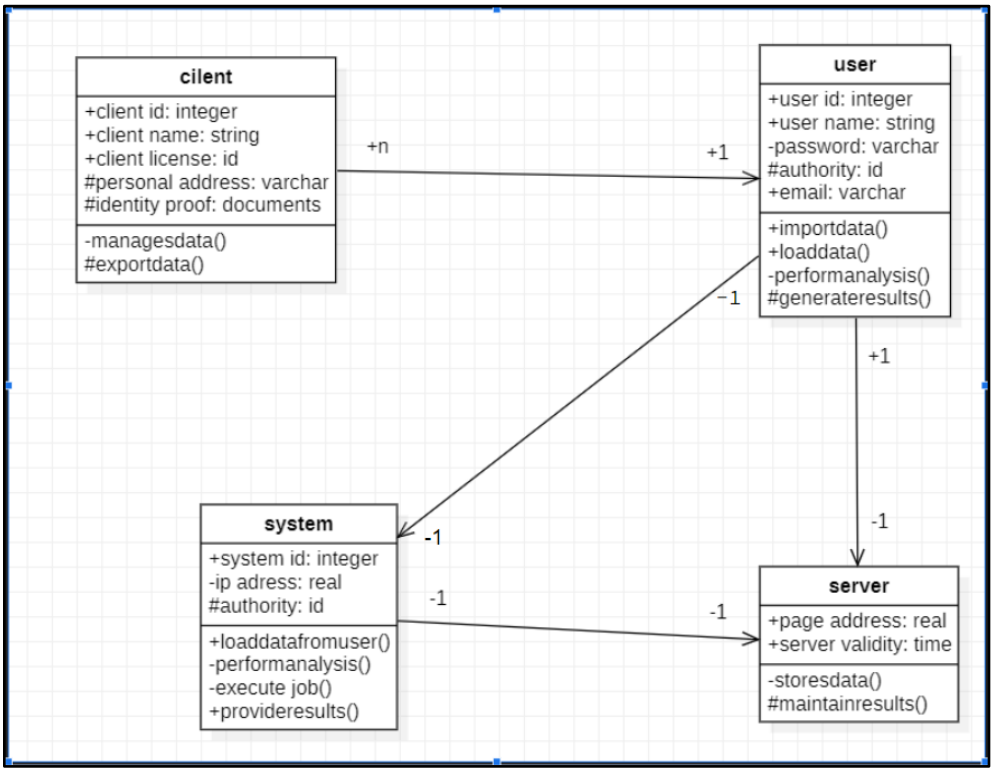

Figure 3.4: Class Diagram of Customer Loan Prediction Analysis

3.5 SEQUENCE DIAGRAM

A sequence diagram shows object interactions arranged in time sequence. It depicts the objects involved in the scenario and the sequence of messages exchanged between the objects needed to carry out the functionality of the scenario. Sequence diagrams are typically associated with use case realizations in the logical view of the system under development.

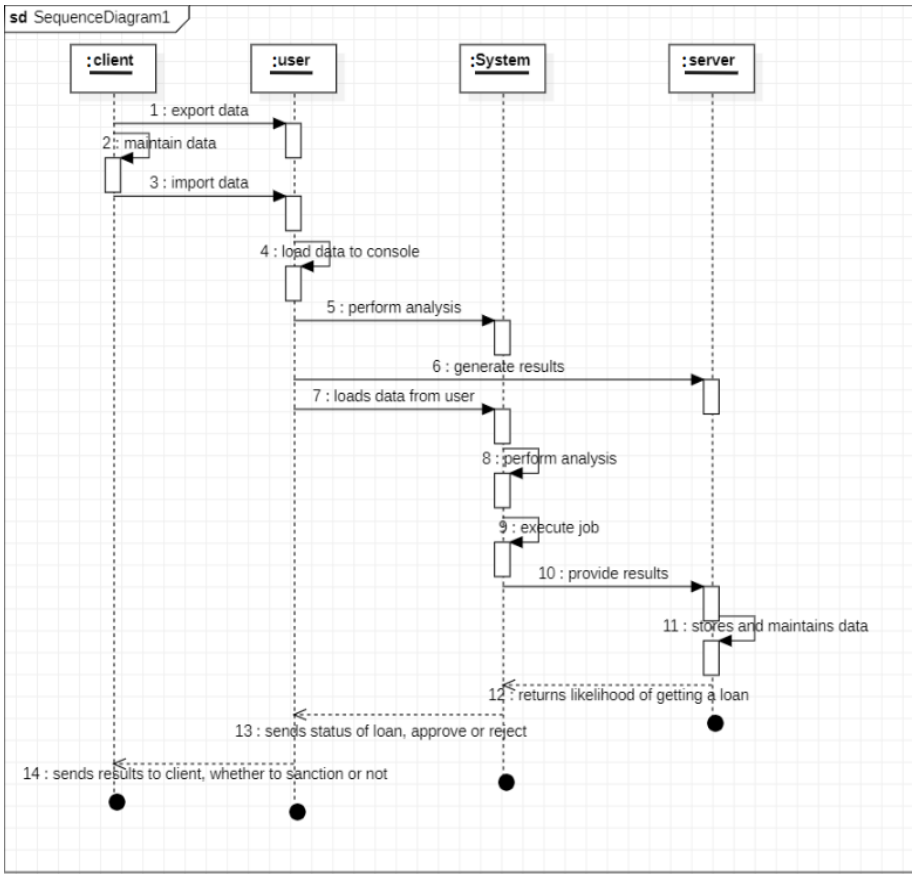

Figure 3.5: Sequence Diagram of Customer Loan Prediction Analysis

3.6 ACTIVITY DIAGRAM

Activity diagrams are graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency. They can also include elements showing the flow of data between activities through one or more datastores.

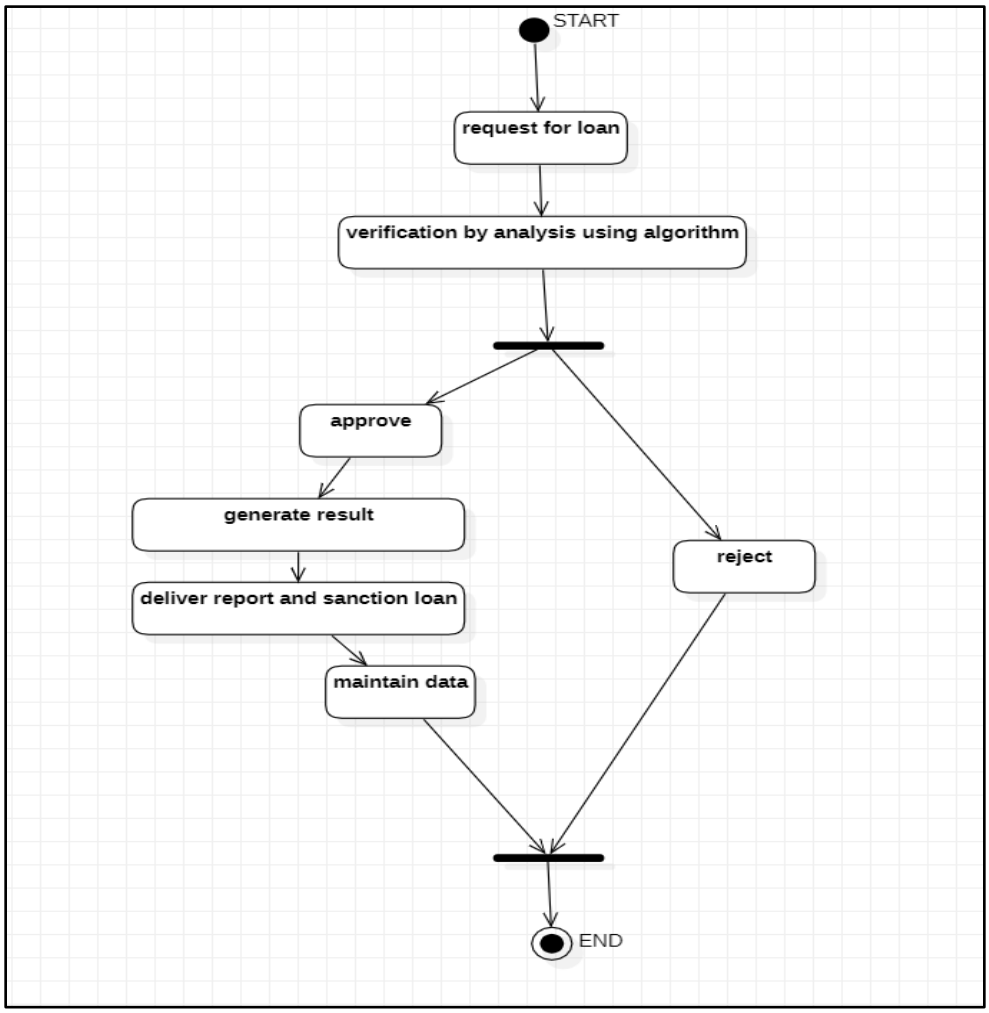

Figure 3.6: Activity Diagram of Customer Loan Prediction Analysis

4.IMPLEMENTATION

SAMPLE CODE

clp.py

```
import pandas as pd
import numpy as np
import matplotlib as plt

df = pd.read_csv(r"D:\MINI PROJECT\A19_CUSTOMER LOAN PREDICTION
ANALYSIS\Project14 clp\data.csv")
df.head(10)
df.tail(10)
df.describe()
df['Property_Area'].value_counts()
import matplotlib.pyplot as plt
df['ApplicantIncome'].hist(bins=50)
plt.show()
df.boxplot(column='ApplicantIncome')
plt.show()
df.boxplot(column='ApplicantIncome', by = 'Education')
plt.show()
df['LoanAmount'].hist(bins=50)
plt.show()
df.boxplot(column='LoanAmount')
plt.show()
temp1 = df['Credit_History'].value_counts(ascending=True)
temp2 = df.pivot_table(values='Loan_Status',index=['Credit_History'],aggfunc=lambda
x: x.map({'Y':1,'N':0}).mean())
print('Frequency Table for Credit History:')
print(temp1)
print('\nProbility of getting loan for each Credit History class:' )
print(temp2)


import matplotlib.pyplot as plt
fig = plt.figure(figsize=(8,4))
ax1 = fig.add_subplot(121)
ax1.set_xlabel('Credit_History')
ax1.set_ylabel('Count of Applicants')
ax1.set_title("Applicants by Credit_History")
temp1.plot(kind='bar')
plt.show()
```

```
ax2 = fig.add_subplot(122)
temp2.plot(kind = 'bar')
ax2.set_xlabel('Credit_History')
ax2.set_ylabel('Probability of getting loan')
ax2.set_title("Probability of getting loan by credit history/data.csv")
df.head(10)
df.describe()
df['Property_Area'].value_counts()
temp1 = df['Credit_History'].value_counts(ascending=True)
temp2 = df.pivot_table(values='Loan_Status',index=['Credit_History'],aggfunc=lambda
x: x.map({'Y':1,'N':0}).mean())
print('Frequency Table for Credit History:')
print(temp1)

print('\nProbility of getting loan for each Credit History class:' )
print(temp2)
```

coll.py

```
import pandas as pd
import numpy as np
import matplotlib as plt

df = pd.read_csv(r"D:\MINI PROJECT\A19_CUSTOMER LOAN PREDICTION
ANALYSIS\Project14 clp\data.csv")
print(df.head(10))
print(df.tail(10))
df.describe()
df['Property_Area'].value_counts()
import matplotlib.pyplot as plt
df['ApplicantIncome'].hist(bins=50)
plt.show()
df.boxplot(column='ApplicantIncome')
plt.show()
df.boxplot(column='ApplicantIncome', by = 'Education')
plt.show()
df['LoanAmount'].hist(bins=50)
plt.show()
df.boxplot(column='LoanAmount')
plt.show()

temp1 = df['Credit_History'].value_counts(ascending=True)
temp2 = df.pivot_table(values='Loan_Status',index=['Credit_History'],aggfunc=lambda
x: x.map({'Y':1,'N':0}).mean())
print('Frequency Table for Credit History:')
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print('\nProbility of getting loan for each Credit History class:' )
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import matplotlib.pyplot as plt
fig = plt.figure(figsize=(8,4))
ax1 = fig.add_subplot(121)
ax1.set_xlabel('Credit_History')
ax1.set_ylabel('Count of Applicants')
ax1.set_title("Applicants by Credit_History")
temp1.plot(kind='bar')
plt.show()

ax2 = fig.add_subplot(122)
```
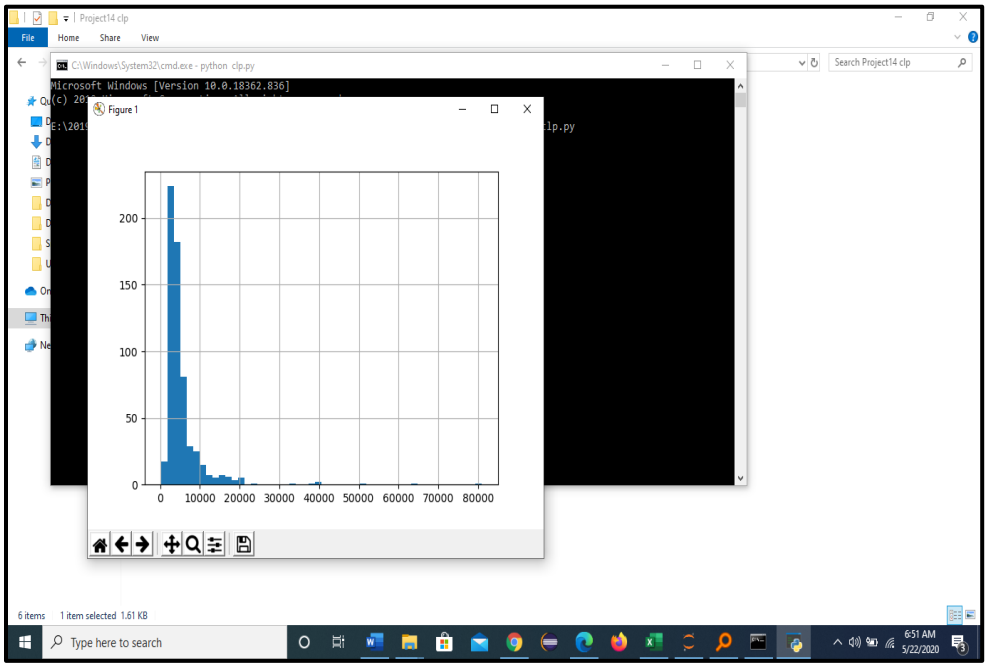
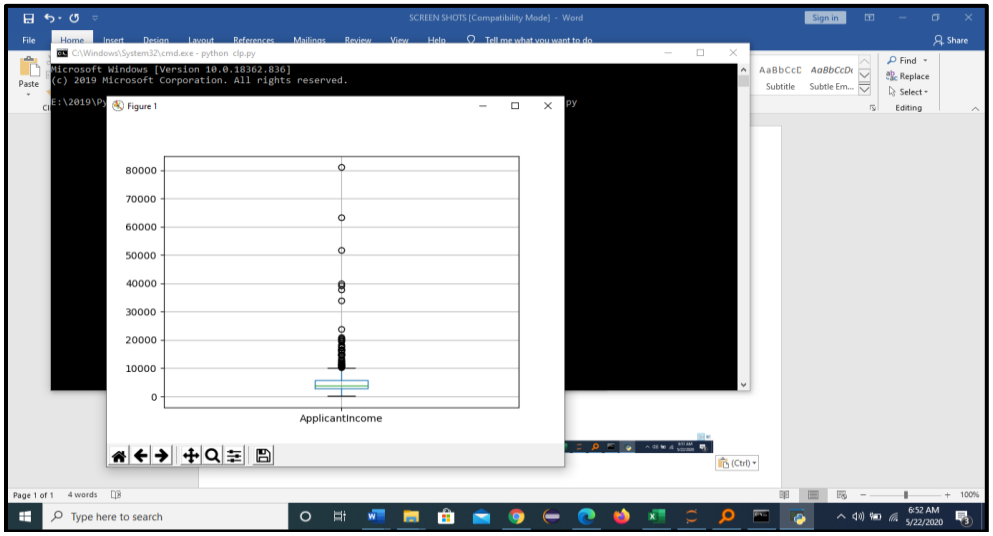

```
temp2.plot(kind = 'bar')
ax2.set_xlabel('Credit_History')
ax2.set_ylabel('Probability of getting loan')
ax2.set_title("Probability of getting loan by credit history/data.csv")
df.head(10)
df.describe()
df['Property_Area'].value_counts()
import matplotlib.pyplot as plt
df['ApplicantIncome'].hist(bins=50)
plt.show()
df.boxplot(column='ApplicantIncome')
plt.show()
df.boxplot(column='ApplicantIncome', by = 'Education')
plt.show()
df['LoanAmount'].hist(bins=50)
plt.show()
df.boxplot(column='LoanAmount')
plt.show()

temp1 = df['Credit_History'].value_counts(ascending=True)
temp2 = df.pivot_table(values='Loan_Status',index=['Credit_History'],aggfunc=lambda
x: x.map({'Y':1,'N':0}).mean())
print('Frequency Table for Credit History:')
print(temp1)

print('\nProbility of getting loan for each Credit History class:' )
print(temp2)


import matplotlib.pyplot as plt
fig = plt.figure(figsize=(8,4))
ax1 = fig.add_subplot(121)
ax1.set_xlabel('Credit_History')
ax1.set_ylabel('Count of Applicants')
ax1.set_title("Applicants by Credit_History")
temp1.plot(kind='bar')
plt.show()

ax2 = fig.add_subplot(122)
temp2.plot(kind = 'bar')
ax2.set_xlabel('Credit_History')
ax2.set_ylabel('Probability of getting loan')
ax2.set_title("Probability of getting loan by credit history")
```

5.RESULTS

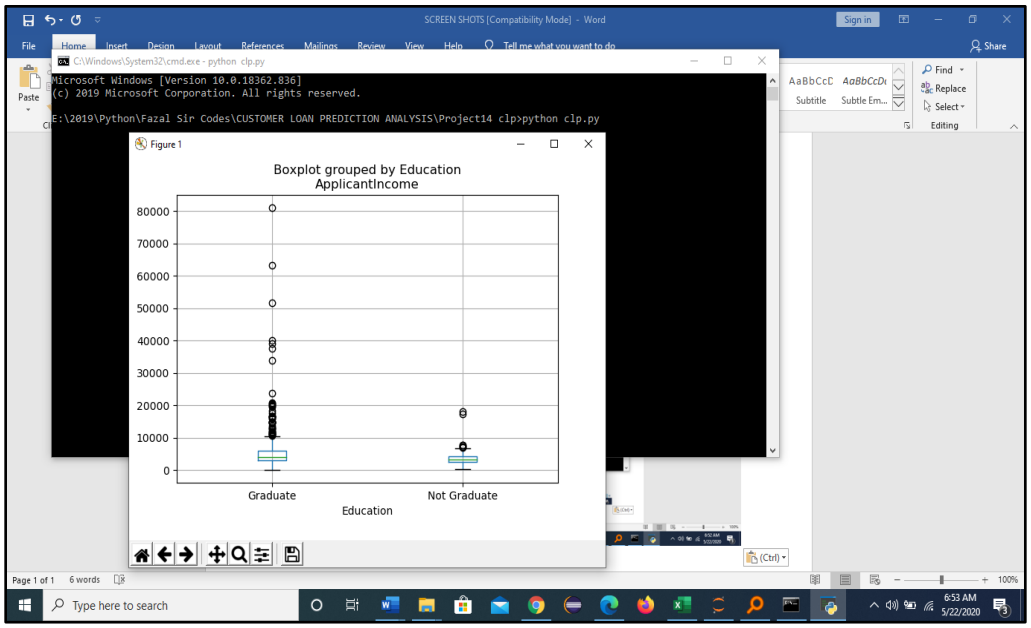
SCREENSHOTS



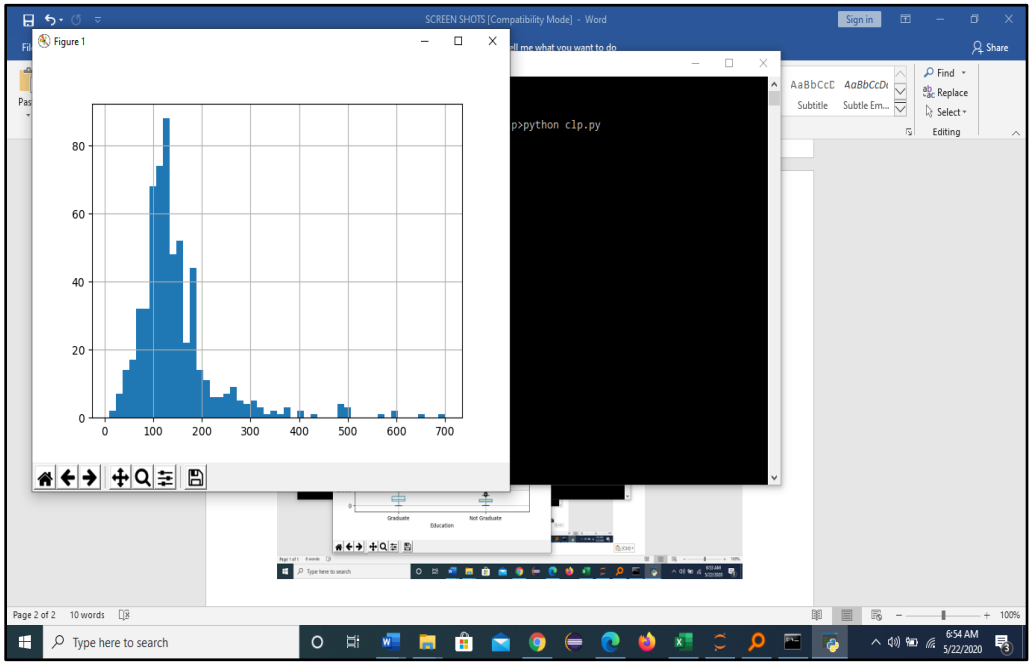
Screenshot 5.1: Customer based on salary.



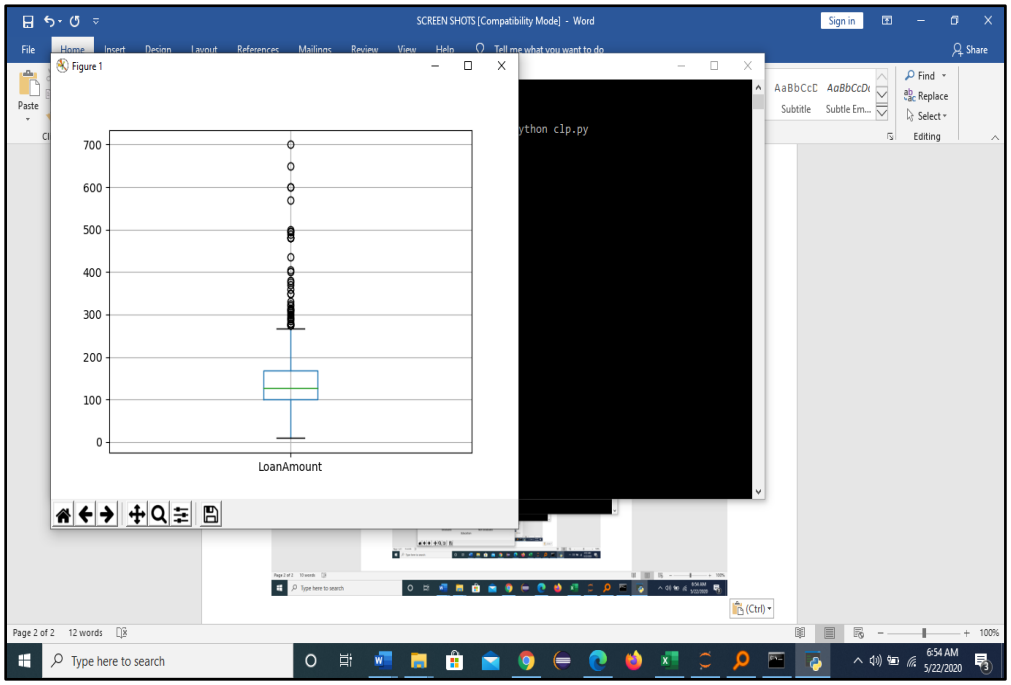
Screenshot 5.2: Customer Income



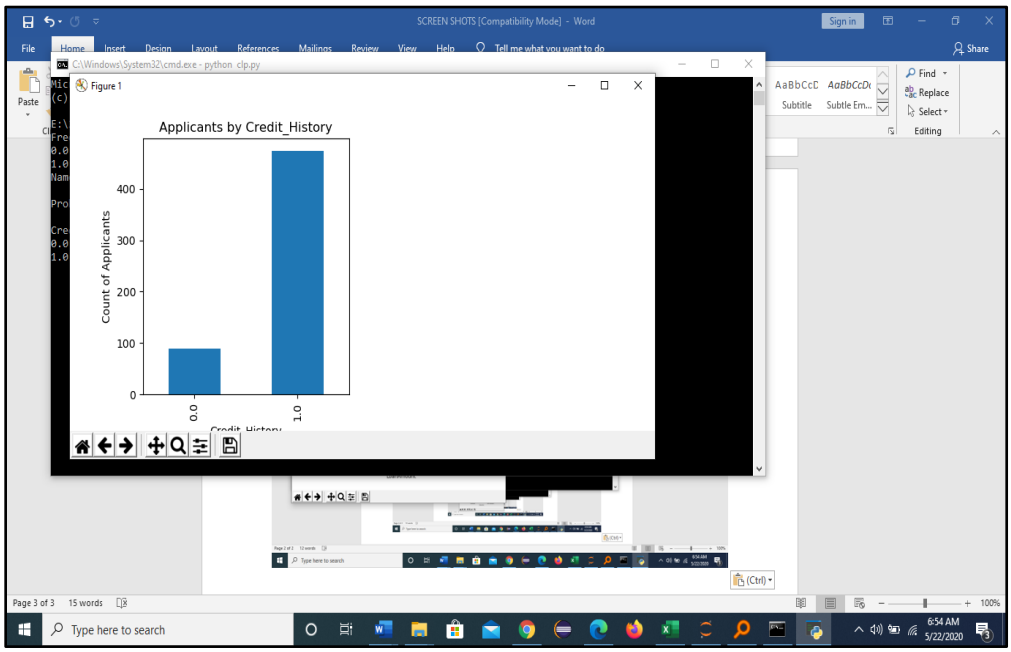
Screenshot 5.3: Customer Income by Education



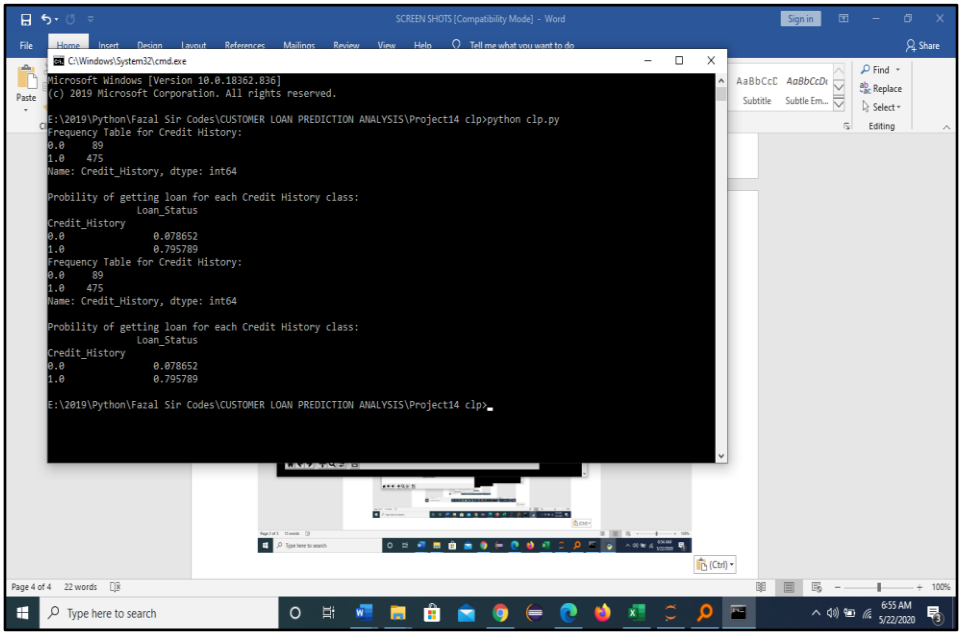
Screenshot 5.4: Customer Score



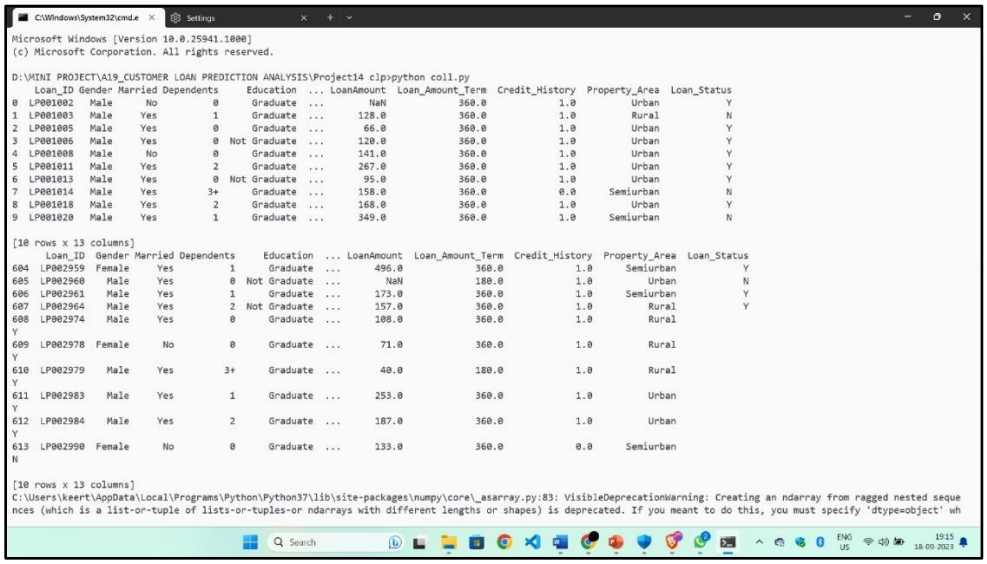
Screenshot 5.5: Customer Loan Amount



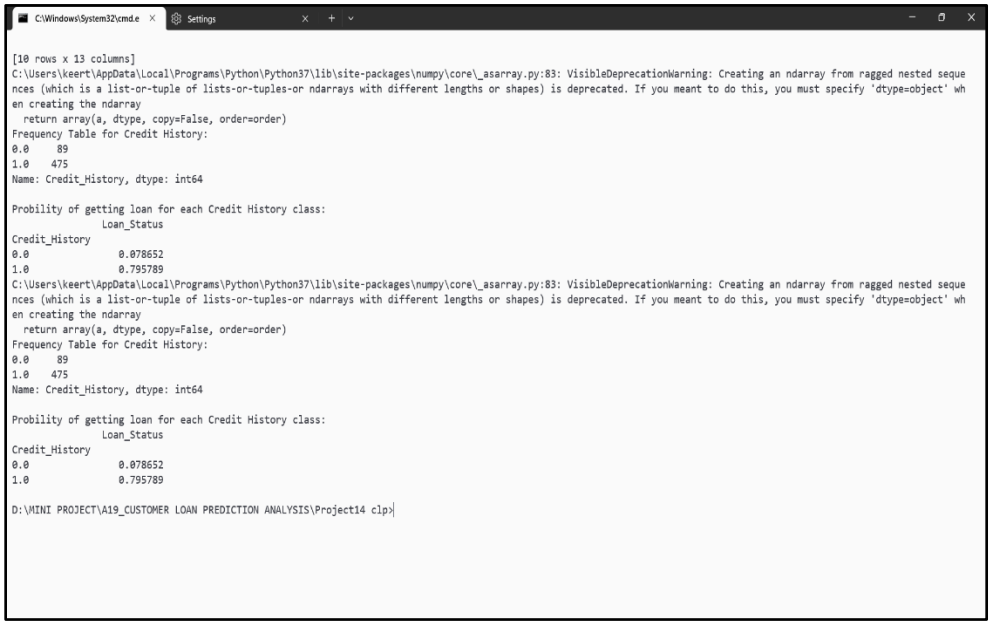
Screenshot 5.6: Customer Credit History



Screenshot 5.7: Credit History of Loan



Screenshot 5.8: coll.py data



Screenshot 5.9: coll.py probability and credit history

6.TESTING

6.TESTING

6.1 INTRODUCTION TO TESTING

The purpose of testing is to discover errors. Testing is the process of trying to discover every conceivable fault or weakness in a work product. It provides a way to check the functionality of components, subassemblies, assemblies and/or a finished product. It is the process of exercising software with the intent of ensuring that the Software system meets its requirements and user expectations and does not fail in an unacceptable manner. There are various types of tests. Each test type addresses a specific testing requirement.

6.2 TYPES OF TESTING

6.2.1 UNIT TESTING

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .It is done after the completion of an individual unit before integration. This is a structural testing that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component leveland test a specific business process, application and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

6.2.2 INTEGRATION TESTING

Integration tests are designed to test integrated software components to determine if they actually run as one program. Integration tests demonstrate that although the components were individually satisfactory, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

6.2.3 FUNCTIONAL TESTING

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.
Functional testing is centered on the following items:

Valid Input	: identified classes of valid input must be accepted.
Invalid Input	: identified classes of invalid input must be rejected.
Functions	: identified functions must be exercised.
Output	: identified classes of application outputs must be exercised.

Systems/Procedures: interfacing systems or procedures must be invoked. Organization and preparation of functional tests is focused on requirements, key functions, or special test cases.

6.3 TEST CASES

Experiments include an arrangement of steps, conditions and sources of info that can be utilized while performing testing undertakings. The principal expectation of this action is to guarantee whether a product passes or bombs as far as usefulness and different perspectives. The way toward creating experiments can likewise help discover issues in the prerequisites or plan of an application. Experiment goes about as the beginning stage for the test execution, and in the wake of applying an arrangement of information esteems, the application has a conclusive result and leaves the framework at some end point or otherwise called execution post condition.

6.3.1 CLASSIFICATION

ID	Test cases	Input values	Error	Error resolution
1	Starting python shell	python shell	No	None
2	Install libraries	libraries	yes	Load dependency libraries first
3	Load data from local system	Path of the data to be loaded	Yes	Check the path of data

4	Perform statistics	Data parameters analysis like job, education	No	None
5	Divide the data to training and testing	Data	No	None
6	Perform prediction	Kable method	No	None

7.CONCLUSION

7.CONCLUSION & FUTURE SCOPE

7.1 PROJECT CONCLUSION

The project "Customer Loan Prediction Analysis using Random Forest Machine Learning Algorithm with Python" holds immense potential in transforming the loan approval process. Through the successful implementation of the Random Forest algorithm and a user-friendly interface, the project streamlines decision-making for both financial institutions and loan applicants. The predictive model, built upon comprehensive data analysis and feature engineering, has showcased promising accuracy in determining loan approval probabilities. The integration of machine learning not only enhances efficiency but also fosters transparency and objectivity, ensuring a fair assessment for loan seekers. By presenting this solution, we envision a future where data-driven lending decisions are the norm, contributing to a more accessible and equitable financial landscape.

7.2 FUTURE SCOPE

The project's future trajectory encompasses several exciting prospects. Firstly, enhancing the model's accuracy by incorporating more diverse and up-to-date datasets is paramount. Additionally, incorporating advanced machine learning techniques and experimenting with ensemble methods could potentially yield even better predictive performance. Introducing real-time data integration and monitoring for constantly updating the model would ensure its relevance in dynamic financial scenarios. Moreover, collaborating with financial institutions to integrate this predictive tool directly into their systems would provide a seamless and efficient experience for both financial analysts and customers.

8.BIBLIOGRAPHY

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8.2 GITHUB LINK

https://github.com/Saikiran-287/Customer_loan_predictionanalysis