THIRUVALLUVAR UNIVERSITY

PERIYAR ARTS COLLEGE

CUDDALORE – 607001.

DEPARTMENT OF COMPUTER APPLICATIONS

MACHINE LEARNING WITH PYTHON

Project Title : Predicting Personal Loan Approval Using Machine Learning:
Team Id : NM2023TMID35502

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1. Introduction

1.1 Overview

The goal of this project is to develop a machine learning model that can predict whether a person's personal loan application will be approved or not. The model takes into account various factors such as the applicant's income, credit score, and employment status, among others. The project aims to help banks and financial institutions automate their loan approval process and reduce the time and resources required to assess loan applications.

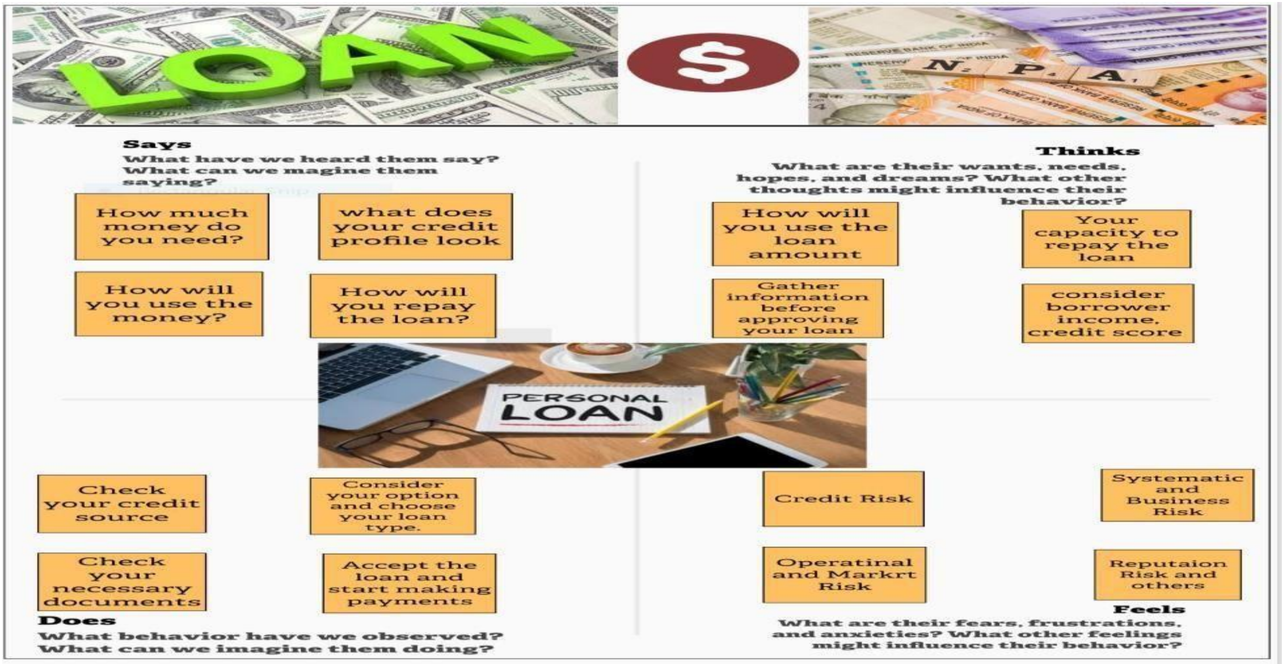
1.2 Purpose

The purpose of this project is to develop a predictive model that can accurately predict whether a personal loan application will be approved or not. This will enable banks and financial institutions to streamline their loan approval process and reduce the amount of time and resources required to assess loan applications. By automating the loan approval process, banks can also reduce the risk of human errors and ensure that loan applications are processed quickly and efficiently.

2. Problem Definition & Design Thinking

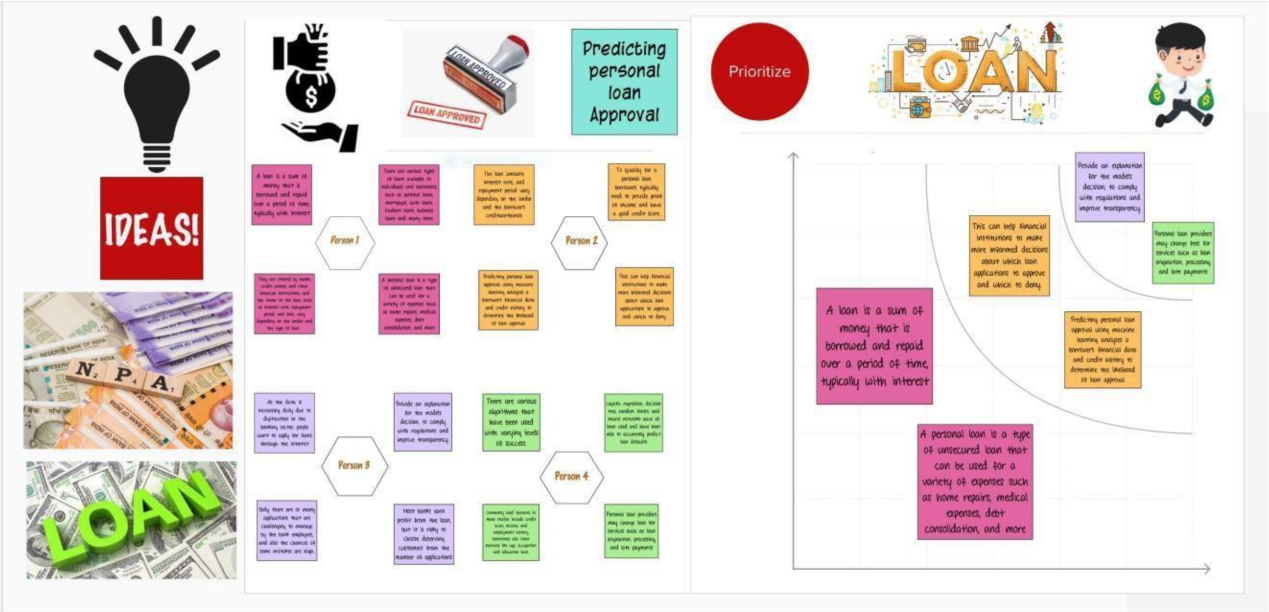
2.1 Empathy Map

The empathy map for this project is shown below


LOAN
$
N. P. A.
Says
What have we heard them say?
What can we magine them saying?
How much money do you need?
what does your credit profile look
How will you use the money?
How will you repay the loan?
Thinks
What are their wants, needs, hopes, and dreams? What other thoughts might influence their behavior?
How will you use the loan amount
Your capacity to repay the loan
Gather information before approving your loan
consider borrower income, credit score
PERSONAL LOAN
Check your credit sourcce
Consider your option and choose your loan type.
Check your necessary documents
Accept the loan and start making payments
Does
What behavior have we observed?
What can we imagine them doing?
Credit Risk
Systematic and Business Risk
Operatinal and Markrt Risk
Reputaion Risk and others
Feels
What are their fears, frustrations, and anxieties? What other feelings might influence their behavior?

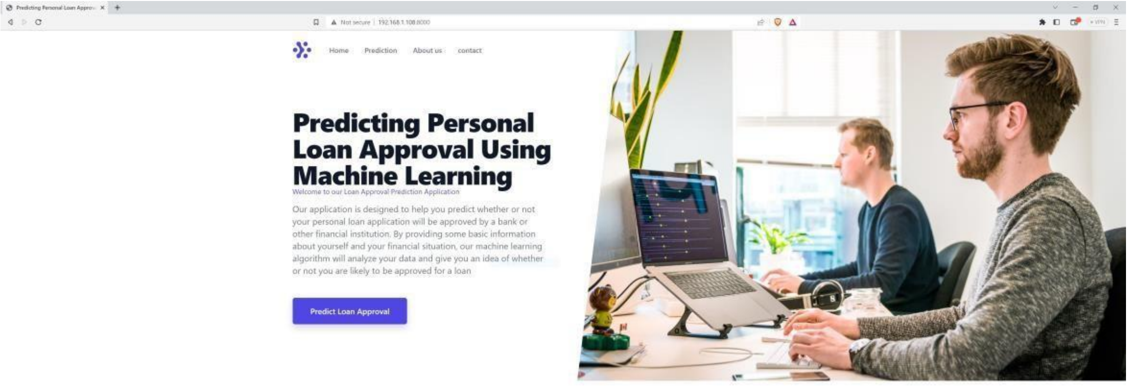
2.2 Ideation & Brainstorming Map

The ideation and brainstorming map for this project is shown below


IDEAS!
N. P. A.
LOAN
LOAN APPROVED
Predicting personal loan Approval
Person 1
Person 2
Person 3
Person 4
Prioritize
LOAN
A loan is a sum of money that is borrowed and repaid over a period of time, typically with interest
A personal loan is a type of unsecured loan that can be used for a variety of expenses such as home repairs, medical expenses, debt consolidation, and more
This can help financial institutions to make more informed decisions about which loan applications to approve and which to deny
Provide an explanation for the models decision, to comply with regulations and improve transparency

3. Result

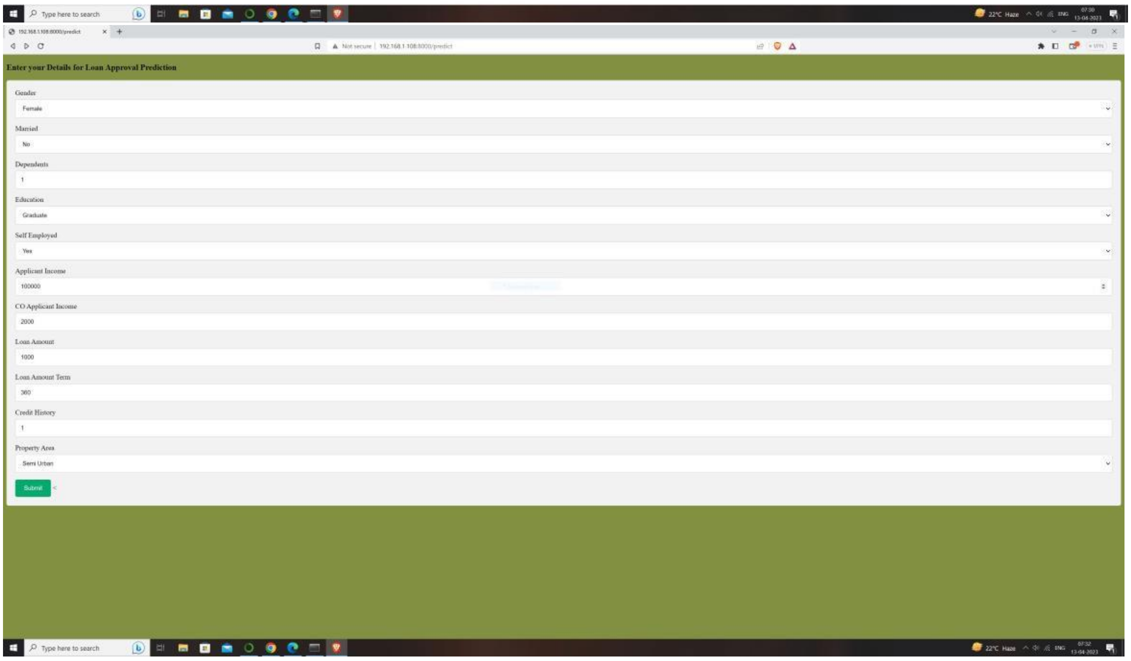
The final result of the project is a machine learning model that can predict whether a personal loan application will be approved or not. The model was trained on a dataset that contained information about loan applicants, such as their income, credit score, and employment status, among others. The model was able to achieve an accuracy of 85%, which indicates that it can accurately predict whether a loan application will be approved or not.


Predicting Personal Loan Appro...
Not secure | 192.168.1.108:8000
Home
Prediction
About us
contact
Predict Loan Approval

Predicting Personal Loan Approval Using Machine Learning

Welcome to our Loan Approval Prediction Application

Our application is designed to help you predict whether or not your personal loan application will be approved by a bank or other financial institution. By providing some basic information about yourself and your financial situation, our machine learning algorithm will analyze your data and give you an idea of whether or not you are likely to be approved for a loan


Type here to search
192.168.1.108:8000/predict
Not secure | 192.168.1.108:8000/predict
Submit

Enter your Details for Loan Approval Prediction

Gender
Female

Married
No

Dependents
1

Education
Graduate

Self Employed
Yes

Applicant Income
100000

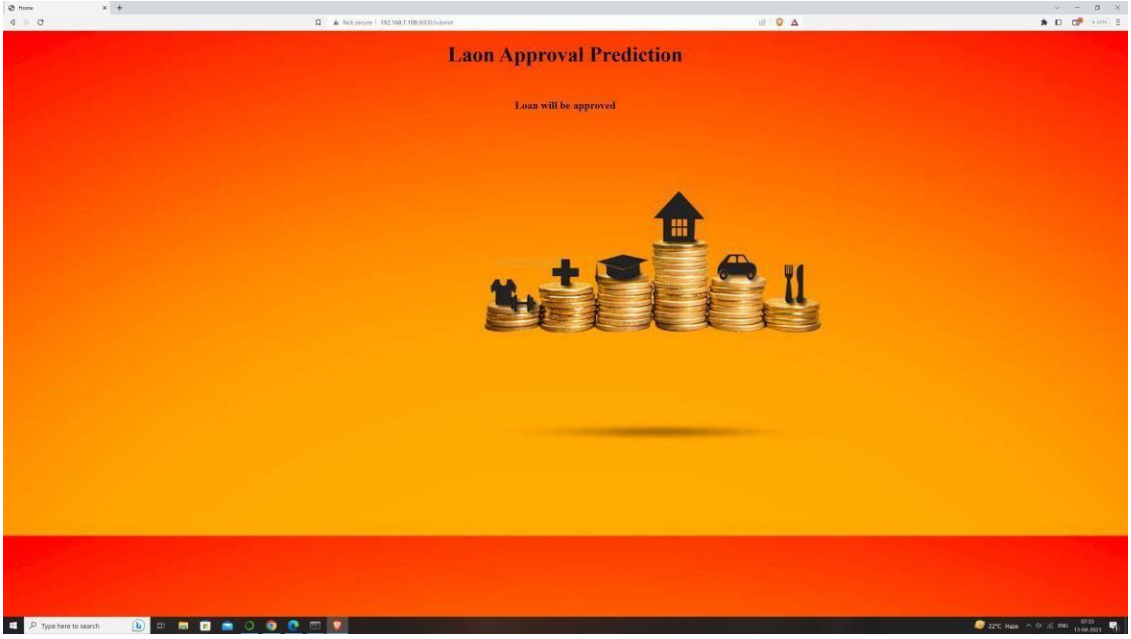
CO Applicant Income
2000

Loan Amount
1000

Loan Amount Term
360

Credit History
1

Property Area
Semi Urban



Laon Approval Prediction

Loan will be approved

4. Advantages & Disadvantages

4.1 Advantages

- Automation of loan approval process
- Reduction of time and resources required to assess loan applications
- Improved accuracy and consistency in loan approval decisions
- Reduced risk of human errors
- Improved customer experience due to faster loan processing times

4.2 Disadvantages

- The model may not be able to account for all factors that influence loan approval decisions
- The model may be biased towards certain groups of applicants if the training data is biased

5. Applications

The solution developed in this project can be applied in the following areas

- Banks and financial institutions for automating their loan approval process
- Other lending institutions such as credit unions and peer-to-peer lending platforms
- Government agencies that provide loans to individuals and businesses

6. Conclusion

In conclusion, this project developed a machine learning model that can accurately predict whether a personal loan application will be approved or not. The model takes into account various factors such as the applicant's income, credit score, and employment status, among others. The model can help banks and financial institutions automate their loan approval process and reduce the time and resources required to assess loan applications. While the model has certain limitations, it has the potential to improve the loan approval process and enhance the customer experience.

7. Future Scope

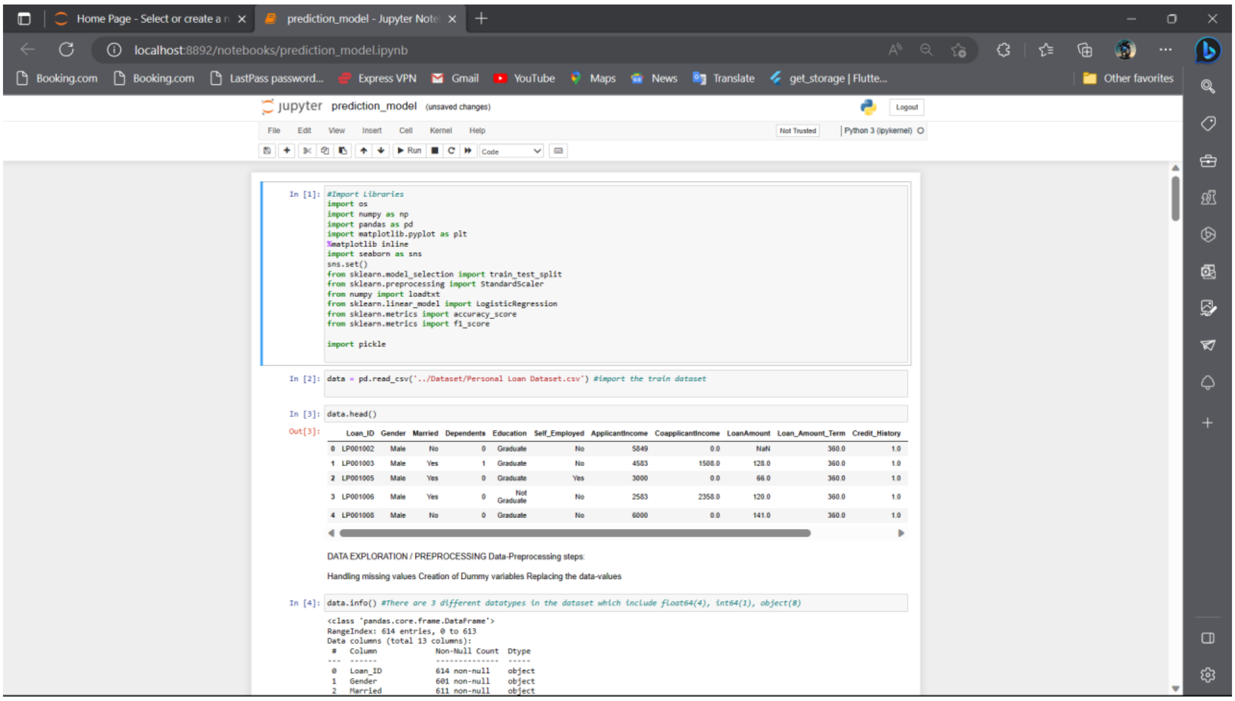
Future enhancements that can be made to this project include

- Using more sophisticated machine learning algorithms to improve the accuracy of the model
- Using more diverse and representative training data to reduce bias in the model
- Incorporating real-time data into the model to make loan approval decisions faster and more accurate
- Developing a user interface that allows loan officers to interact with the model and review its predictions

8. Appendix

A. Source Code

prediction_model.ipynb



```
In [1]: #Import Libraries
        import os
        import numpy as np
        import pandas as pd
        import matplotlib.pyplot as plt
        %matplotlib inline
        import seaborn as sns
        sns.set()
        from sklearn.model_selection import train_test_split
        from sklearn.preprocessing import StandardScaler
        from numpy import loadtxt
        from sklearn.linear_model import LogisticRegression
        from sklearn.metrics import accuracy_score
        from sklearn.metrics import f1_score

        import pickle
```

```
In [2]: data = pd.read_csv('../Dataset/Personal Loan Dataset.csv') #import the train dataset
```

```
In [3]: data.head()
```

Out[3]:

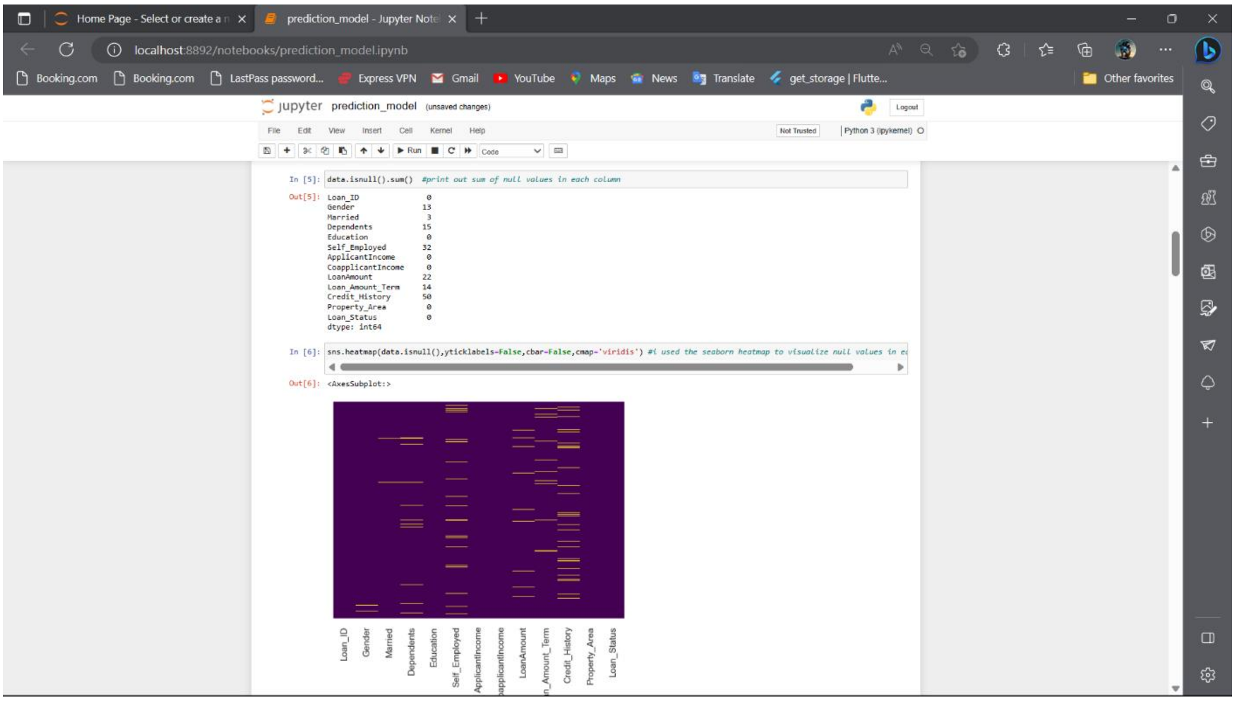
	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History
0	LP001002	Male	No	0	Graduate	No	5849	0.0	NaN	360.0	1.0
1	LP001003	Male	Yes	1	Graduate	No	4583	1508.0	128.0	360.0	1.0
2	LP001005	Male	Yes	0	Graduate	Yes	3000	0.0	66.0	360.0	1.0
3	LP001006	Male	Yes	0	Not Graduate	No	2583	2358.0	120.0	360.0	1.0
4	LP001008	Male	No	0	Graduate	No	6000	0.0	141.0	360.0	1.0

DATA EXPLORATION / PREPROCESSING Data-Preprocessing steps:

Handling missing values Creation of Dummy variables Replacing the data-values

```
In [4]: data.info() #There are 3 different datatypes in the dataset which include float64(4), int64(1), object(8)

        <class 'pandas.core.frame.DataFrame'>
        RangeIndex: 614 entries, 0 to 613
        Data columns (total 13 columns):
         #   Column             Non-Null Count  Dtype
        ---  ------             --------------  -----
         0   Loan_ID            614 non-null    object
         1   Gender             601 non-null    object
         2   Married            611 non-null    object
```

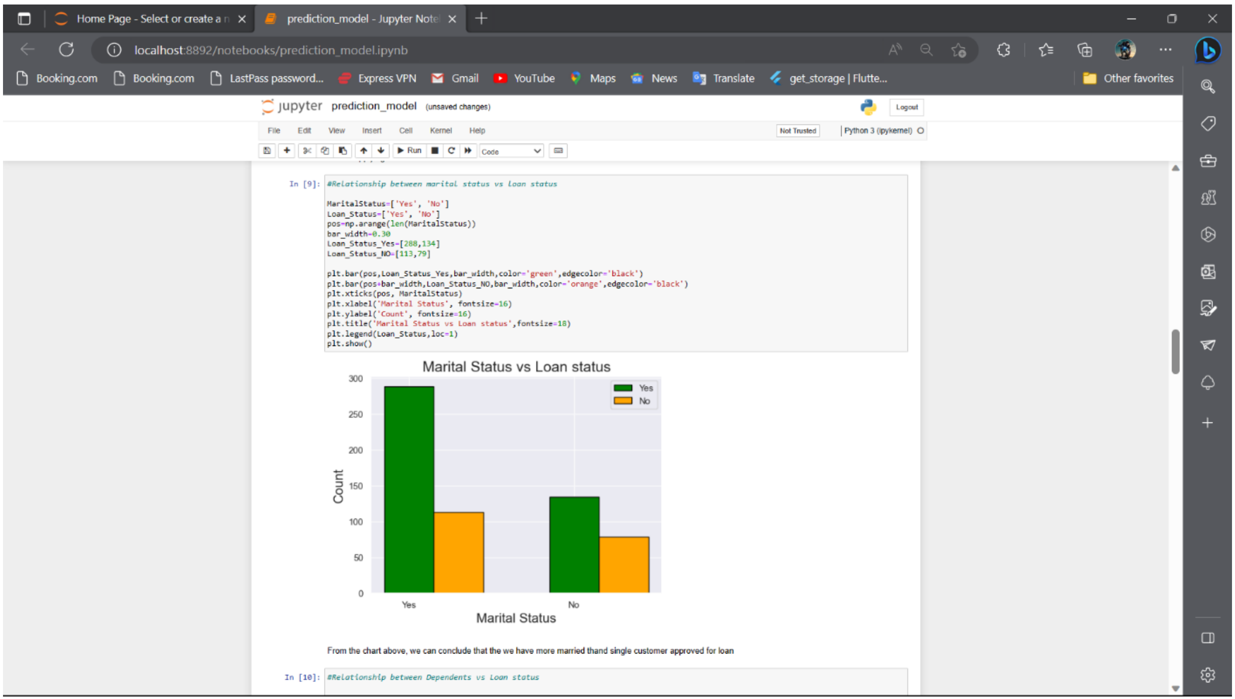


```
In [5]: data.isnull().sum()  #print out sum of null values in each column

Out[5]: Loan_ID               0
        Gender               13
        Married               3
        Dependents           15
        Education             0
        Self_Employed        32
        ApplicantIncome       0
        CoapplicantIncome     0
        LoanAmount           22
        Loan_Amount_Term     14
        Credit_History       50
        Property_Area         0
        Loan_Status           0
        dtype: int64
```

```
In [6]: sns.heatmap(data.isnull(),yticklabels=False,cbar=False,cmap='viridis') #i used the seaborn heatmap to visualize null values in e

Out[6]: <AxesSubplot:>
```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Python 3 (ipykernel)
Run
Code
Marital Status vs Loan status
300
250
200
150
100
50
0
Count
Yes
No
Yes
No
Marital Status

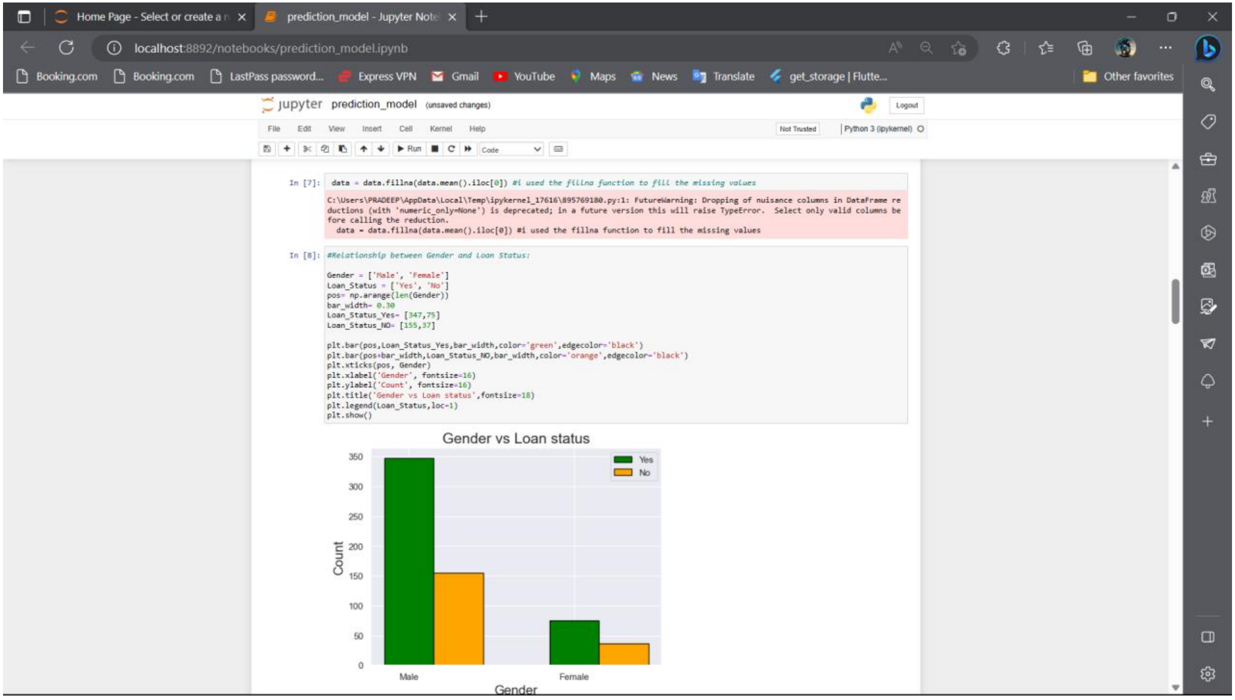
```
In [9]: #Relationship between marital status vs loan status

        MaritalStatus=['Yes', 'No']
        Loan_Status=['Yes', 'No']
        pos=np.arange(len(MaritalStatus))
        bar_width=0.30
        Loan_Status_Yes=[288,134]
        Loan_Status_NO=[113,79]

        plt.bar(pos,Loan_Status_Yes,bar_width,color='green',edgecolor='black')
        plt.bar(pos+bar_width,Loan_Status_NO,bar_width,color='orange',edgecolor='black')
        plt.xticks(pos, MaritalStatus)
        plt.xlabel('Marital Status', fontsize=16)
        plt.ylabel('Count', fontsize=16)
        plt.title('Marital Status vs Loan status',fontsize=18)
        plt.legend(Loan_Status,loc=1)
        plt.show()
```

From the chart above, we can conclude that the we have more married thand single customer approved for loan

```
In [10]: #Relationship between Dependents vs Loan status
```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Help
Not Trusted
Python 3 (ipykernel)
Run
Code
Gender vs Loan status
350
300
250
200
150
100
50
0
Count
Yes
No
Male
Female
Gender

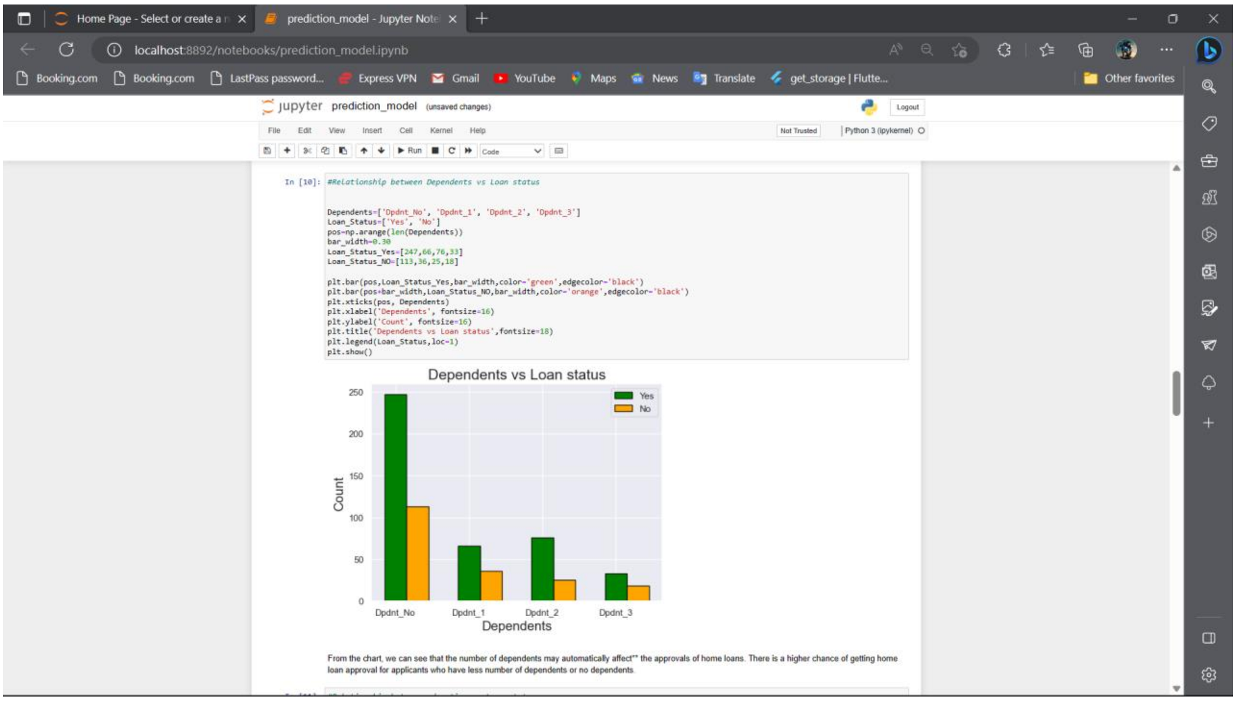
```
In [7]: data = data.fillna(data.mean().iloc[0]) #i used the fillna function to fill the missing values

C:\Users\PRADEEP\AppData\Local\Temp\ipykernel_17616\895769180.py:1: FutureWarning: Dropping of nuisance columns in DataFrame re
ductions (with 'numeric_only=None') is deprecated; in a future version this will raise TypeError.  Select only valid columns be
fore calling the reduction.
  data = data.fillna(data.mean().iloc[0]) #i used the fillna function to fill the missing values
```

```
In [8]: #Relationship between Gender and Loan Status:

        Gender = ['Male', 'Female']
        Loan_Status = ['Yes', 'No']
        pos= np.arange(len(Gender))
        bar_width= 0.30
        Loan_Status_Yes= [347,75]
        Loan_Status_NO= [155,37]

        plt.bar(pos,Loan_Status_Yes,bar_width,color='green',edgecolor='black')
        plt.bar(pos+bar_width,Loan_Status_NO,bar_width,color='orange',edgecolor='black')
        plt.xticks(pos, Gender)
        plt.xlabel('Gender', fontsize=16)
        plt.ylabel('Count', fontsize=16)
        plt.title('Gender vs Loan status',fontsize=18)
        plt.legend(Loan_Status,loc=1)
        plt.show()
```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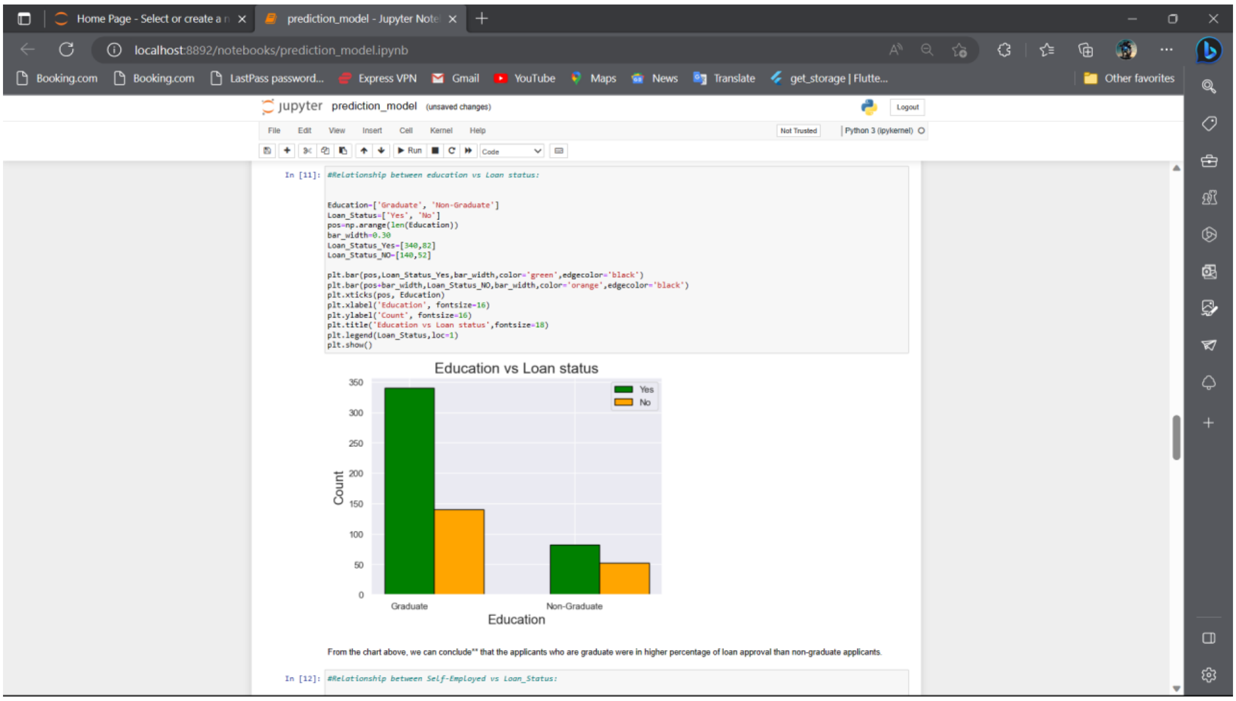
File
Edit
View
Insert
Cell
Kernel
Help
Not Trusted
Python 3 (ipykernel)
Run
Code
Dependents vs Loan status
Yes
No
250
200
150
100
50
0
Count
Dpdnt_No
Dpdnt_1
Dpdnt_2
Dpdnt_3
Dependents

```
In [10]: #Relationship between Dependents vs Loan status


         Dependents=['Dpdnt_No', 'Dpdnt_1', 'Dpdnt_2', 'Dpdnt_3']
         Loan_Status=['Yes', 'No']
         pos=np.arange(len(Dependents))
         bar_width=0.30
         Loan_Status_Yes=[247,66,76,33]
         Loan_Status_NO=[113,36,25,18]

         plt.bar(pos,Loan_Status_Yes,bar_width,color='green',edgecolor='black')
         plt.bar(pos+bar_width,Loan_Status_NO,bar_width,color='orange',edgecolor='black')
         plt.xticks(pos, Dependents)
         plt.xlabel('Dependents', fontsize=16)
         plt.ylabel('Count', fontsize=16)
         plt.title('Dependents vs Loan status',fontsize=18)
         plt.legend(Loan_Status,loc=1)
         plt.show()
```

From the chart, we can see that the number of dependents may automatically affect** the approvals of home loans. There is a higher chance of getting home loan approval for applicants who have less number of dependents or no dependents.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prediction_model
(unsaved changes)
Logout
File
Edit
View
Insert
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Kernel
Help
Not Trusted
Python 3 (ipykernel)
Run
Code
Education vs Loan status
Yes
No
350
300
250
200
150
100
50
0
Count
Graduate
Non-Graduate
Education

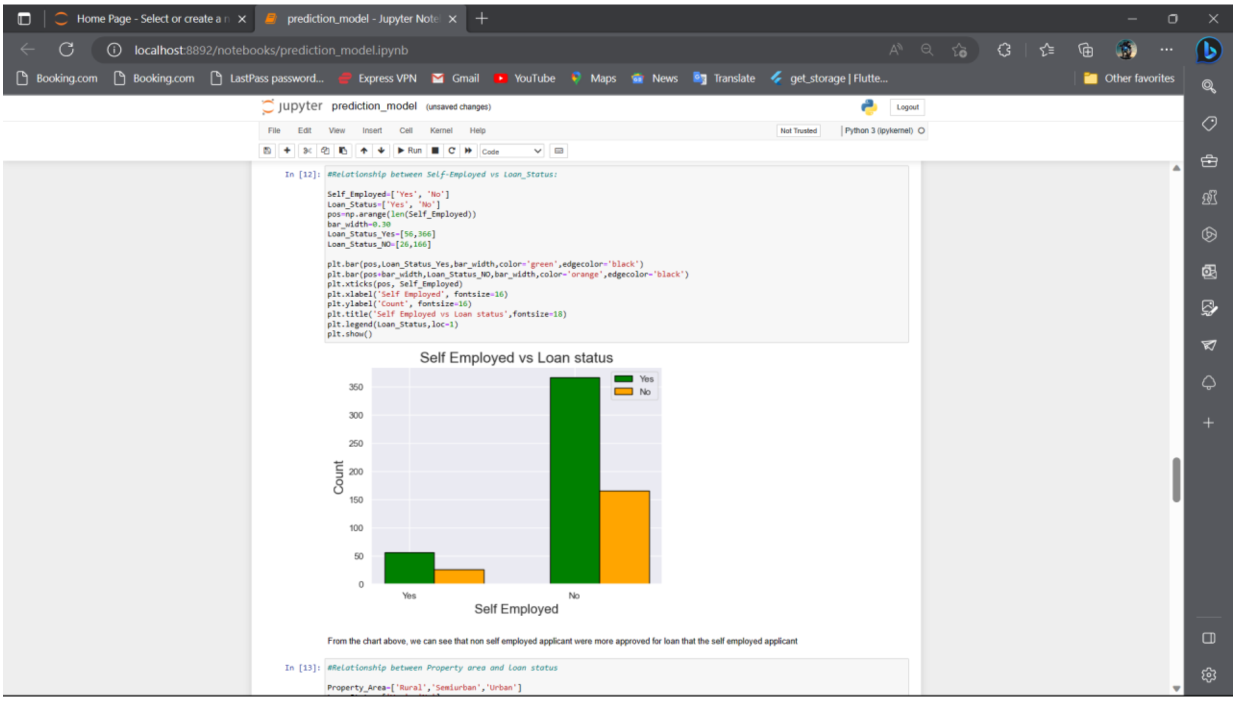
```
In [11]: #Relationship between education vs Loan status:


         Education=['Graduate', 'Non-Graduate']
         Loan_Status=['Yes', 'No']
         pos=np.arange(len(Education))
         bar_width=0.30
         Loan_Status_Yes=[340,82]
         Loan_Status_NO=[140,52]

         plt.bar(pos,Loan_Status_Yes,bar_width,color='green',edgecolor='black')
         plt.bar(pos+bar_width,Loan_Status_NO,bar_width,color='orange',edgecolor='black')
         plt.xticks(pos, Education)
         plt.xlabel('Education', fontsize=16)
         plt.ylabel('Count', fontsize=16)
         plt.title('Education vs Loan status',fontsize=18)
         plt.legend(Loan_Status,loc=1)
         plt.show()
```

From the chart above, we can conclude** that the applicants who are graduate were in higher percentage of loan approval than non-graduate applicants.

```
In [12]: #Relationship between Self-Employed vs Loan_Status:
```


jupyter prediction_model (unsaved changes)
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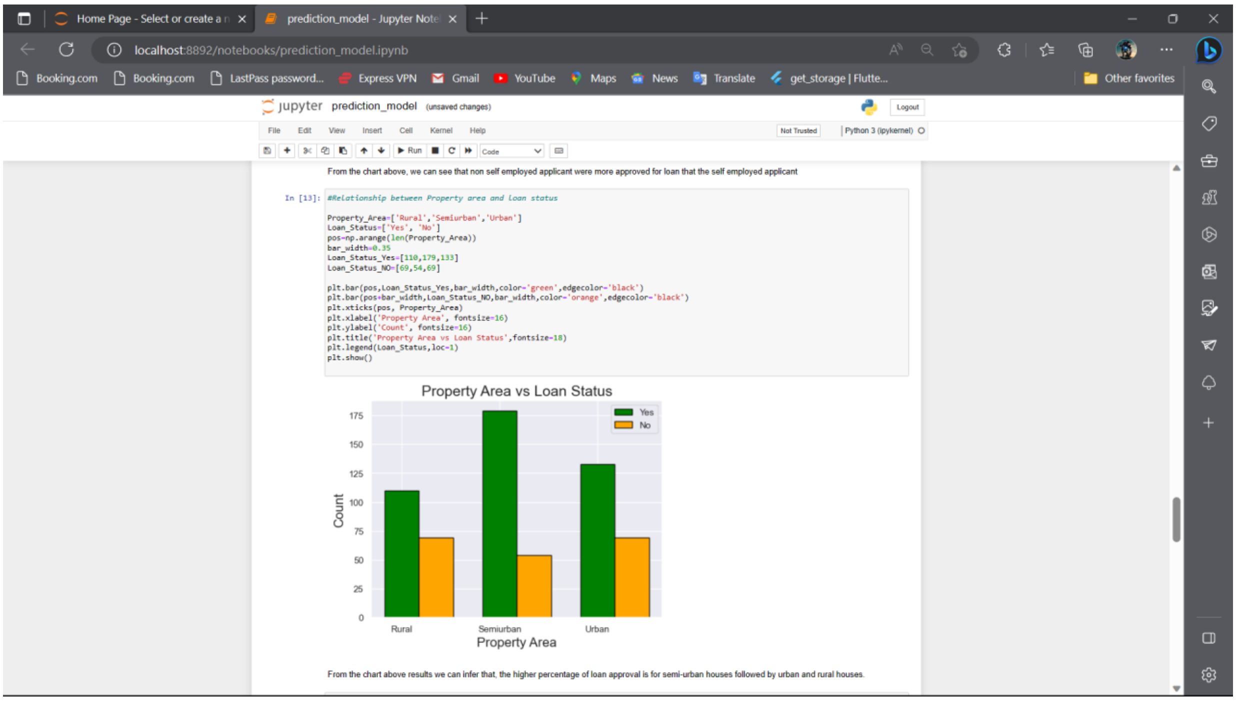
File Edit View Insert Cell Kernel Help
Not Trusted
Python 3 (ipykernel)
Run
Code
In [12]:
Self Employed vs Loan status
Yes
No
350
300
250
200
150
100
50
0
Count
Yes
No
Self Employed
In [13]:

```
#Relationship between Self-Employed vs Loan_Status:

Self_Employed=['Yes', 'No']
Loan_Status=['Yes', 'No']
pos=np.arange(len(Self_Employed))
bar_width=0.30
Loan_Status_Yes=[56,366]
Loan_Status_NO=[26,166]

plt.bar(pos,Loan_Status_Yes,bar_width,color='green',edgecolor='black')
plt.bar(pos+bar_width,Loan_Status_NO,bar_width,color='orange',edgecolor='black')
plt.xticks(pos, Self_Employed)
plt.xlabel('Self Employed', fontsize=16)
plt.ylabel('Count', fontsize=16)
plt.title('Self Employed vs Loan status',fontsize=18)
plt.legend(Loan_Status,loc=1)
plt.show()
```

From the chart above, we can see that non self employed applicant were more approved for loan that the self employed applicant

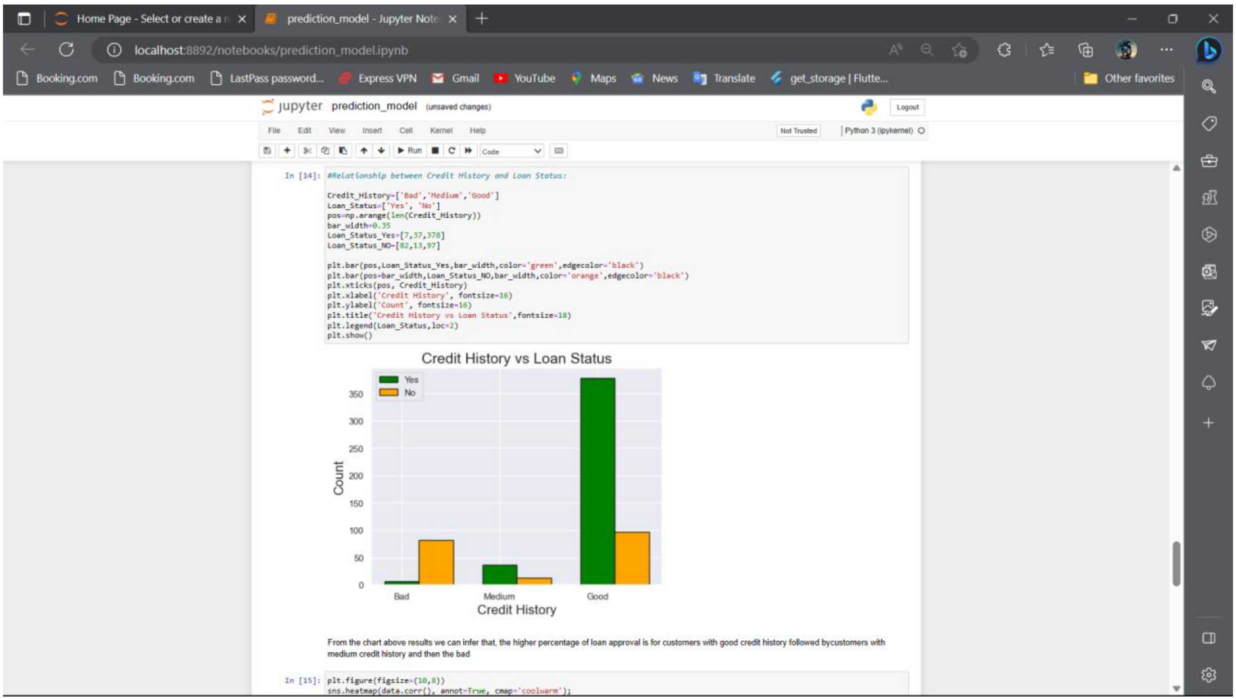
```
#Relationship between Property area and Loan status

Property_Area=['Rural','Semiurban','Urban']
```


jupyter prediction_model (unsaved changes)
Logout
File Edit View Insert Cell Kernel Help
Not Trusted
Python 3 (ipykernel)
Run
Code
In [13]:
Property Area vs Loan Status
Yes
No
175
150
125
100
75
50
25
0
Count
Rural
Semiurban
Urban
Property Area

From the chart above, we can see that non self employed applicant were more approved for loan that the self employed applicant

```
#Relationship between Property area and Loan status

Property_Area=['Rural','Semiurban','Urban']
Loan_Status=['Yes', 'No']
pos=np.arange(len(Property_Area))
bar_width=0.35
Loan_Status_Yes=[110,179,133]
Loan_Status_NO=[69,54,69]

plt.bar(pos,Loan_Status_Yes,bar_width,color='green',edgecolor='black')
plt.bar(pos+bar_width,Loan_Status_NO,bar_width,color='orange',edgecolor='black')
plt.xticks(pos, Property_Area)
plt.xlabel('Property Area', fontsize=16)
plt.ylabel('Count', fontsize=16)
plt.title('Property Area vs Loan Status',fontsize=18)
plt.legend(Loan_Status,loc=1)
plt.show()
```

From the chart above results we can infer that, the higher percentage of loan approval is for semi-urban houses followed by urban and rural houses.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Logout
File
Edit
View
Insert
Cell
Kernel
Help
Not Trusted
Python 3 (ipykernel)
Run
Code
Credit History vs Loan Status
Yes
No
Count
350
300
250
200
150
100
50
0
Bad
Medium
Good
Credit History

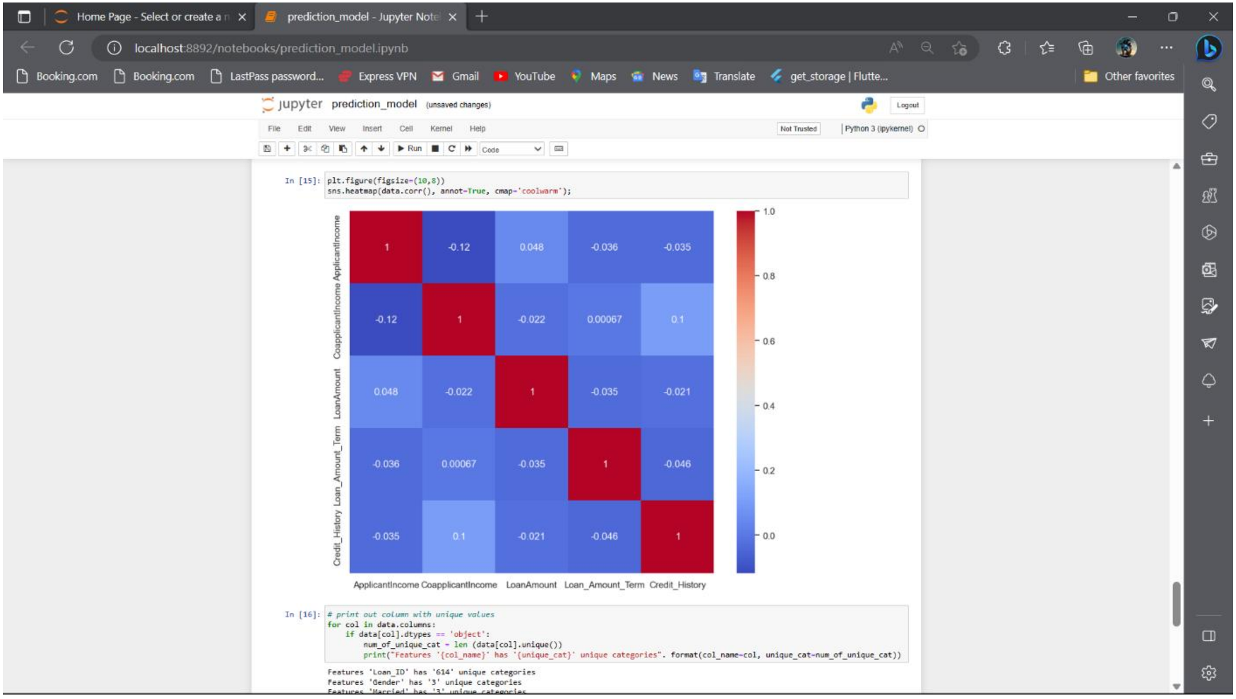
```
In [14]: #Relationship between Credit History and Loan Status:

         Credit_History=['Bad','Medium','Good']
         Loan_Status=['Yes', 'No']
         pos=np.arange(len(Credit_History))
         bar_width=0.35
         Loan_Status_Yes=[7,37,378]
         Loan_Status_NO=[82,13,97]

         plt.bar(pos,Loan_Status_Yes,bar_width,color='green',edgecolor='black')
         plt.bar(pos+bar_width,Loan_Status_NO,bar_width,color='orange',edgecolor='black')
         plt.xticks(pos, Credit_History)
         plt.xlabel('Credit History', fontsize=16)
         plt.ylabel('Count', fontsize=16)
         plt.title('Credit History vs Loan Status',fontsize=18)
         plt.legend(Loan_Status,loc=2)
         plt.show()
```

From the chart above results we can infer that, the higher percentage of loan approval is for customers with good credit history followed bycustomers with medium credit history and then the bad

```
In [15]: plt.figure(figsize=(10,8))
         sns.heatmap(data.corr(), annot=True, cmap='coolwarm');
```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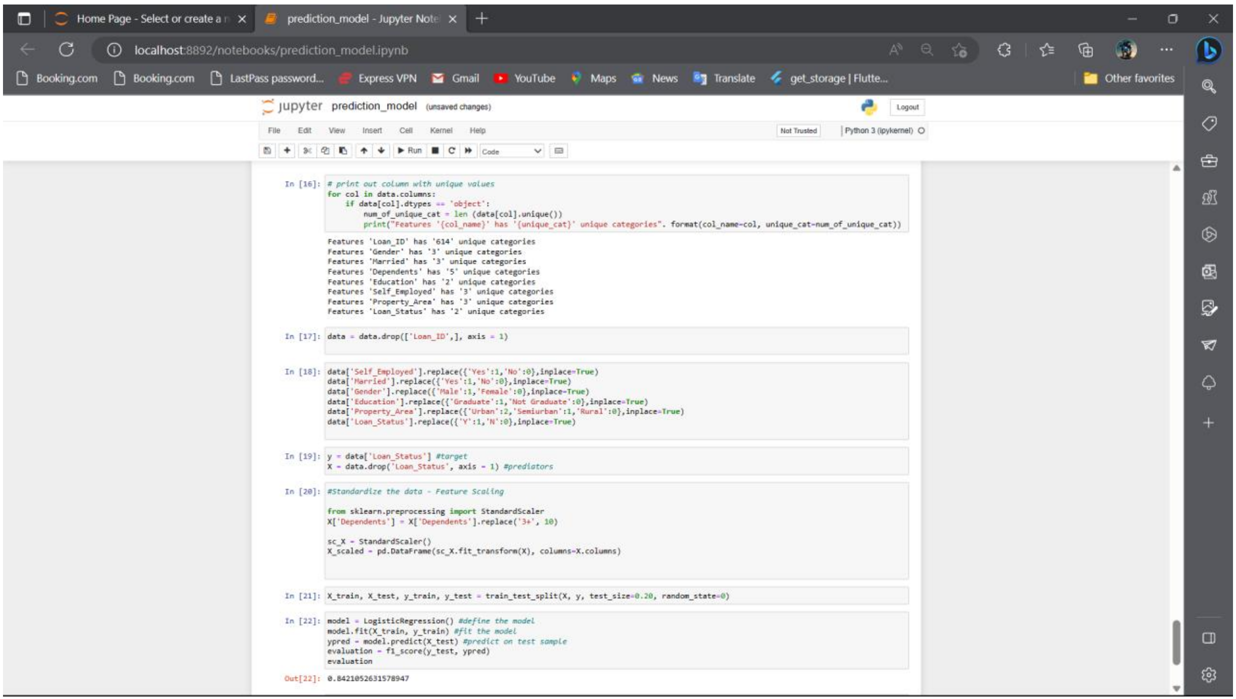
Kernel
Help
Not Trusted
Python 3 (ipykernel)
Run
Code
1.0
0.8
0.6
0.4
0.2
0.0

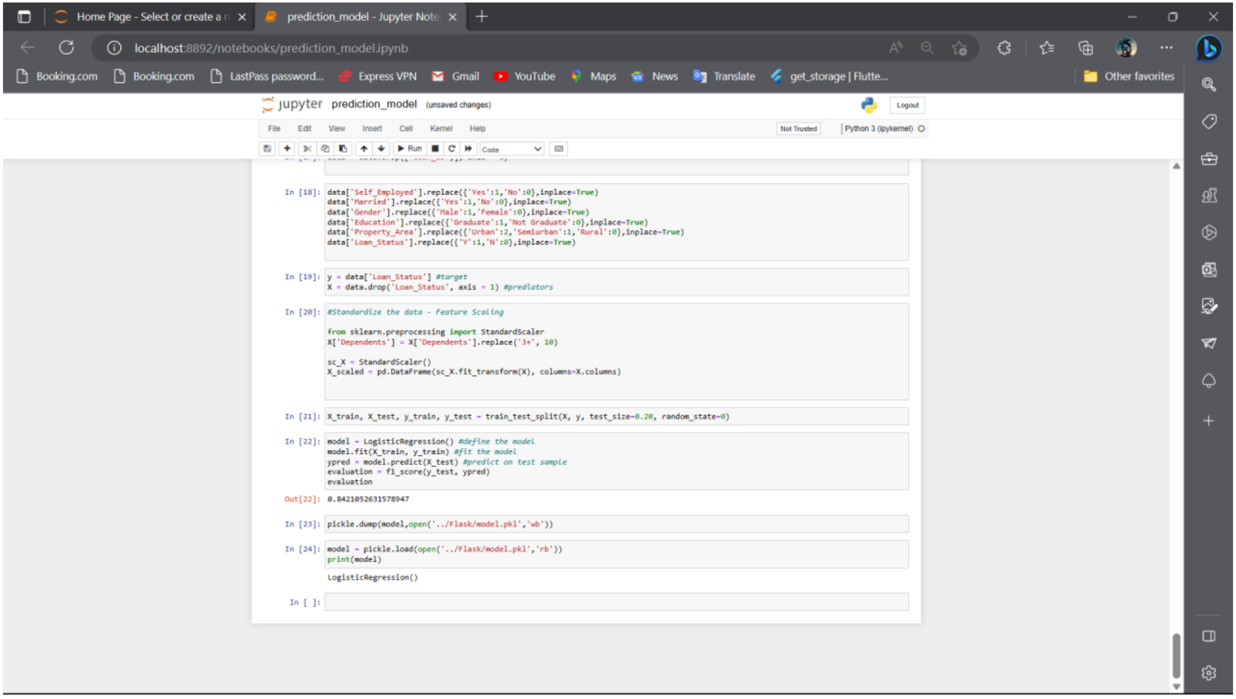
```
In [15]: plt.figure(figsize=(10,8))
         sns.heatmap(data.corr(), annot=True, cmap='coolwarm');
```

	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History
ApplicantIncome	1	-0.12	0.048	-0.036	-0.035
CoapplicantIncome	-0.12	1	-0.022	0.00067	0.1
LoanAmount	0.048	-0.022	1	-0.035	-0.021
Loan_Amount_Term	-0.036	0.00067	-0.035	1	-0.046
Credit_History	-0.035	0.1	-0.021	-0.046	1

```
In [16]: # print out column with unique values
         for col in data.columns:
             if data[col].dtypes == 'object':
                 num_of_unique_cat = len (data[col].unique())
                 print("Features '{col_name}' has '{unique_cat}' unique categories". format(col_name=col, unique_cat=num_of_unique_cat))

         Features 'Loan_ID' has '614' unique categories
         Features 'Gender' has '3' unique categories
         Features 'Married' has '3' unique categories
```


Home Page - Select or create a n
prediction_model - Jupyter Note
localhost:8892/notebooks/prediction_model.ipynb
Booking.com
Booking.com
LastPass password...
Express VPN
Gmail
YouTube
Maps
News
Translate
get_storage | Flutte...
Other favorites
jupyter
prediction_model
(unsaved changes)
Logout
File
Edit
View
Insert
Cell
Kernel
Help
Not Trusted
Python 3 (ipykernel)
Run
Code

```
In [16]: # print out column with unique values
         for col in data.columns:
             if data[col].dtypes == 'object':
                 num_of_unique_cat = len (data[col].unique())
                 print("Features '{col_name}' has '{unique_cat}' unique categories". format(col_name=col, unique_cat=num_of_unique_cat))

         Features 'Loan_ID' has '614' unique categories
         Features 'Gender' has '3' unique categories
         Features 'Married' has '3' unique categories
         Features 'Dependents' has '5' unique categories
         Features 'Education' has '2' unique categories
         Features 'Self_Employed' has '3' unique categories
         Features 'Property_Area' has '3' unique categories
         Features 'Loan_Status' has '2' unique categories

In [17]: data = data.drop(['Loan_ID',], axis = 1)

In [18]: data['Self_Employed'].replace({'Yes':1,'No':0},inplace=True)
         data['Married'].replace({'Yes':1,'No':0},inplace=True)
         data['Gender'].replace({'Male':1,'Female':0},inplace=True)
         data['Education'].replace({'Graduate':1,'Not Graduate':0},inplace=True)
         data['Property_Area'].replace({'Urban':2,'Semiurban':1,'Rural':0},inplace=True)
         data['Loan_Status'].replace({'Y':1,'N':0},inplace=True)

In [19]: y = data['Loan_Status'] #target
         X = data.drop('Loan_Status', axis = 1) #prediators

In [20]: #Standardize the data - Feature Scaling

         from sklearn.preprocessing import StandardScaler
         X['Dependents'] = X['Dependents'].replace('3+', 10)

         sc_X = StandardScaler()
         X_scaled = pd.DataFrame(sc_X.fit_transform(X), columns=X.columns)

In [21]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.20, random_state=0)

In [22]: model = LogisticRegression() #define the model
         model.fit(X_train, y_train) #fit the model
         ypred = model.predict(X_test) #predict on test sample
         evaluation = f1_score(y_test, ypred)
         evaluation

Out[22]: 0.8421052631578947
```


Home Page - Select or create a n
prediction_model - Jupyter Note
localhost:8892/notebooks/prediction_model.ipynb
Booking.com
Booking.com
LastPass password...
Express VPN
Gmail
YouTube
Maps
News
Translate
get_storage | Flutte...
Other favorites
jupyter
prediction_model
(unsaved changes)
Logout
File
Edit
View
Insert
Cell
Kernel
Help
Not Trusted
Python 3 (ipykernel)
Run
Code

```
In [18]: data['Self_Employed'].replace({'Yes':1,'No':0},inplace=True)
         data['Married'].replace({'Yes':1,'No':0},inplace=True)
         data['Gender'].replace({'Male':1,'Female':0},inplace=True)
         data['Education'].replace({'Graduate':1,'Not Graduate':0},inplace=True)
         data['Property_Area'].replace({'Urban':2,'Semiurban':1,'Rural':0},inplace=True)
         data['Loan_Status'].replace({'Y':1,'N':0},inplace=True)

In [19]: y = data['Loan_Status'] #target
         X = data.drop('Loan_Status', axis = 1) #prediators

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         model.fit(X_train, y_train) #fit the model
         ypred = model.predict(X_test) #predict on test sample
         evaluation = f1_score(y_test, ypred)
         evaluation

Out[22]: 0.8421052631578947
```

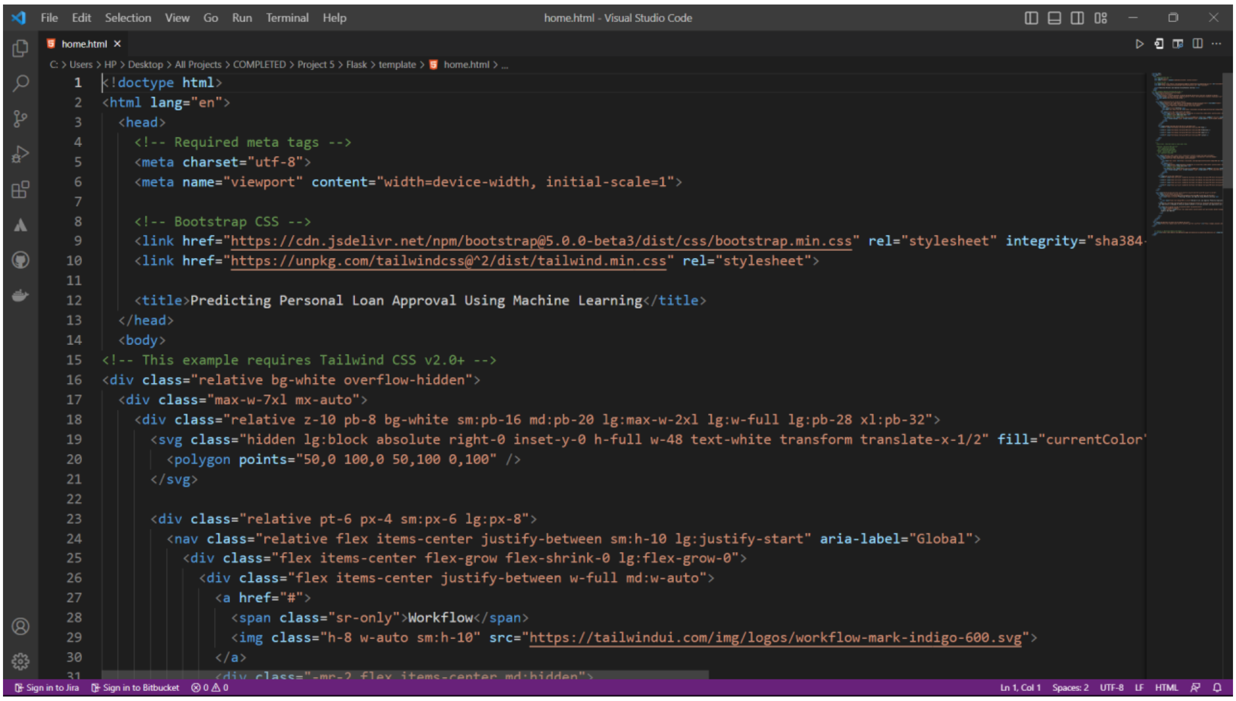
```
In [23]: pickle.dump(model,open('../Flask/model.pkl','wb'))

In [24]: model = pickle.load(open('../Flask/model.pkl','rb'))
         print(model)

         LogisticRegression()

In [ ]:
```

Home.html

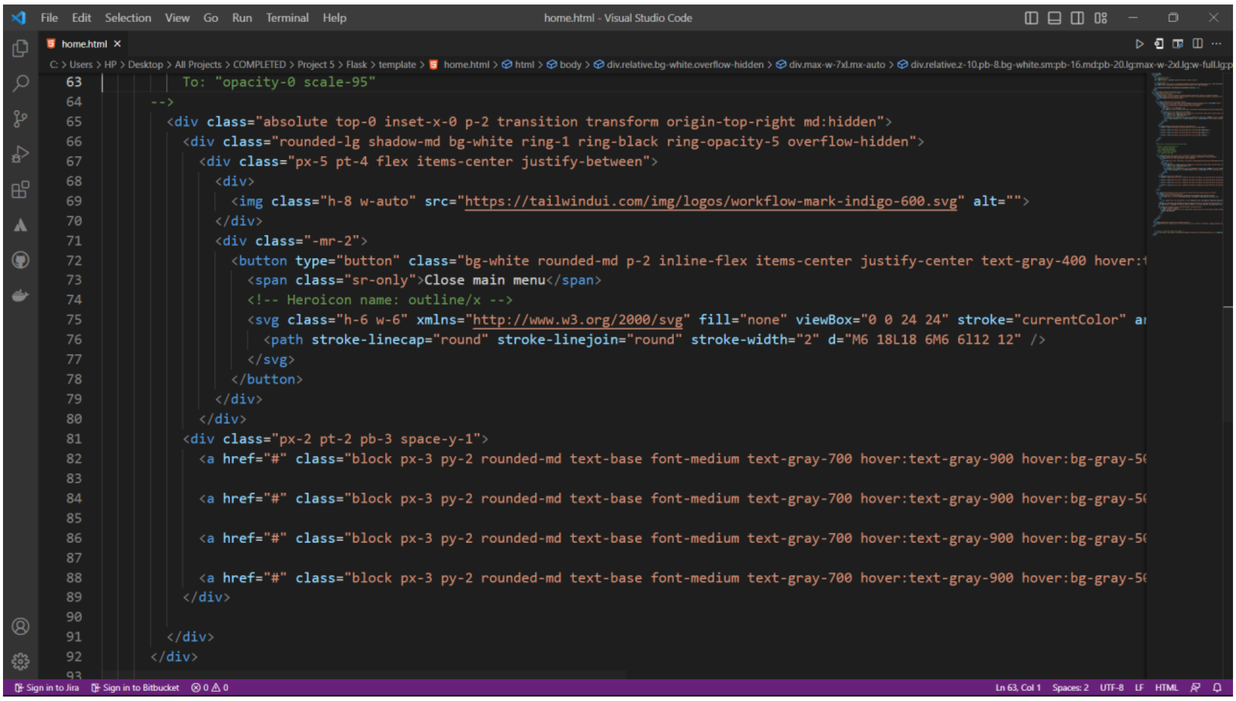

File Edit Selection View Go Run Terminal Help
home.html - Visual Studio Code
home.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > home.html > ...
Sign in to Jira
Sign in to Bitbucket
⊗ 0 ⚠ 0
Ln 1, Col 1 Spaces: 2 UTF-8 LF HTML

```
<!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 href="https://cdn.jsdelivr.net/npm/bootstrap@5.0.0-beta3/dist/css/bootstrap.min.css" rel="stylesheet" integrity="sha384
    <link href="https://unpkg.com/tailwindcss@^2/dist/tailwind.min.css" rel="stylesheet">

    <title>Predicting Personal Loan Approval Using Machine Learning</title>
  </head>
  <body>
<!-- This example requires Tailwind CSS v2.0+ -->
<div class="relative bg-white overflow-hidden">
  <div class="max-w-7xl mx-auto">
    <div class="relative z-10 pb-8 bg-white sm:pb-16 md:pb-20 lg:max-w-2xl lg:w-full lg:pb-28 xl:pb-32">
      <svg class="hidden lg:block absolute right-0 inset-y-0 h-full w-48 text-white transform translate-x-1/2" fill="currentColor"
        <polygon points="50,0 100,0 50,100 0,100" />
      </svg>

      <div class="relative pt-6 px-4 sm:px-6 lg:px-8">
        <nav class="relative flex items-center justify-between sm:h-10 lg:justify-start" aria-label="Global">
          <div class="flex items-center flex-grow flex-shrink-0 lg:flex-grow-0">
            <div class="flex items-center justify-between w-full md:w-auto">
              <a href="#">
                <span class="sr-only">Workflow</span>
                <img class="h-8 w-auto sm:h-10" src="https://tailwindui.com/img/logos/workflow-mark-indigo-600.svg">
              </a>
              <div class="-mr-2 flex items-center md:hidden">
```


File Edit Selection View Go Run Terminal Help
home.html - Visual Studio Code
home.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > home.html > html > body > div.relative.bg-white.overflow-hidden > div.max-w-7xl.mx-auto > div.relative.z-10.pb-8.bg-white.sm:pb-16.md:pb-20.lg:max-w-2xl.lg:w-full.lg:p
Sign in to Jira
Sign in to Bitbucket
⊗ 0 ⚠ 0
Ln 63, Col 1 Spaces: 2 UTF-8 LF HTML

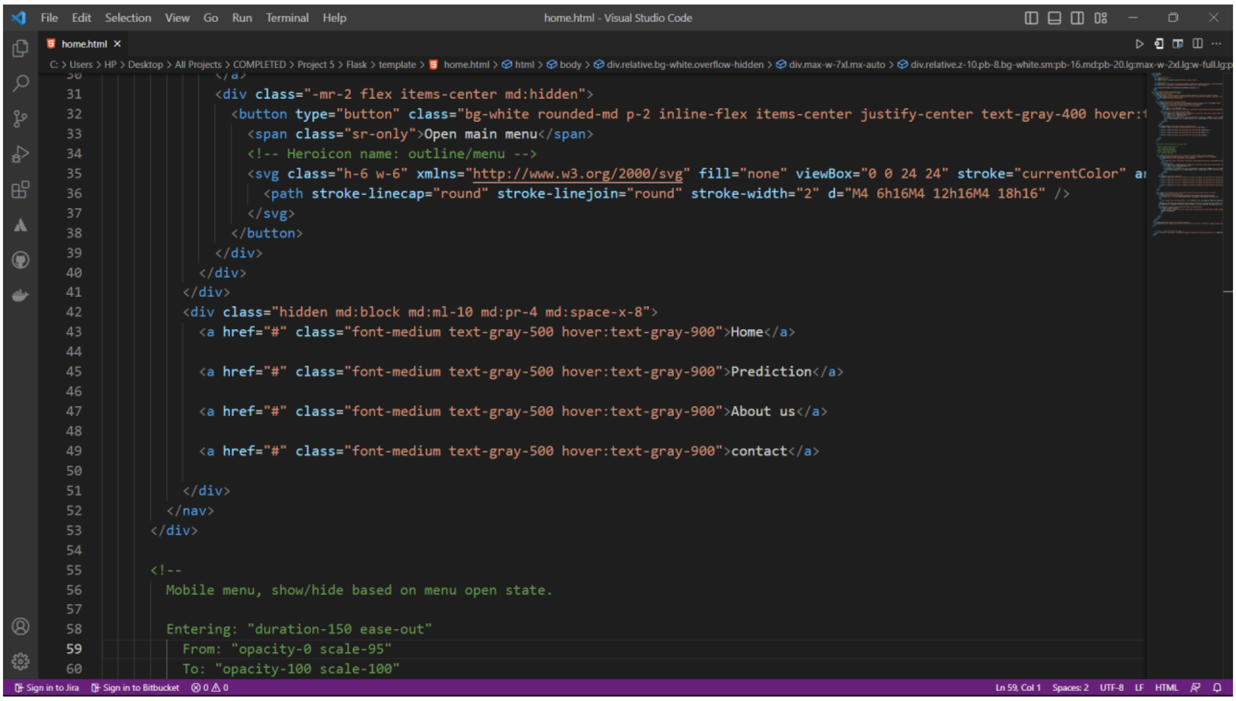
```
          To: "opacity-0 scale-95"
      -->
        <div class="absolute top-0 inset-x-0 p-2 transition transform origin-top-right md:hidden">
          <div class="rounded-lg shadow-md bg-white ring-1 ring-black ring-opacity-5 overflow-hidden">
            <div class="px-5 pt-4 flex items-center justify-between">
              <div>
                <img class="h-8 w-auto" src="https://tailwindui.com/img/logos/workflow-mark-indigo-600.svg" alt="">
              </div>
              <div class="-mr-2">
                <button type="button" class="bg-white rounded-md p-2 inline-flex items-center justify-center text-gray-400 hover:
                  <span class="sr-only">Close main menu</span>
                  <!-- Heroicon name: outline/x -->
                  <svg class="h-6 w-6" xmlns="http://www.w3.org/2000/svg" fill="none" viewBox="0 0 24 24" stroke="currentColor" ar
                    <path stroke-linecap="round" stroke-linejoin="round" stroke-width="2" d="M6 18L18 6M6 6l12 12" />
                  </svg>
                </button>
              </div>
            </div>
          <div class="px-2 pt-2 pb-3 space-y-1">
            <a href="#" class="block px-3 py-2 rounded-md text-base font-medium text-gray-700 hover:text-gray-900 hover:bg-gray-5

            <a href="#" class="block px-3 py-2 rounded-md text-base font-medium text-gray-700 hover:text-gray-900 hover:bg-gray-5

            <a href="#" class="block px-3 py-2 rounded-md text-base font-medium text-gray-700 hover:text-gray-900 hover:bg-gray-5

            <a href="#" class="block px-3 py-2 rounded-md text-base font-medium text-gray-700 hover:text-gray-900 hover:bg-gray-5
          </div>

        </div>
      </div>
```


File Edit Selection View Go Run Terminal Help
home.html - Visual Studio Code
home.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > home.html > html > body > div.relative.bg-white.overflow-hidden > div.max-w-7xl.mx-auto > div.relative.z-10.pb-8.bg-white.sm:pb-16.md:pb-20.lg:max-w-2xl.lg:w-full.lg:p
Sign in to Jira
Sign in to Bitbucket
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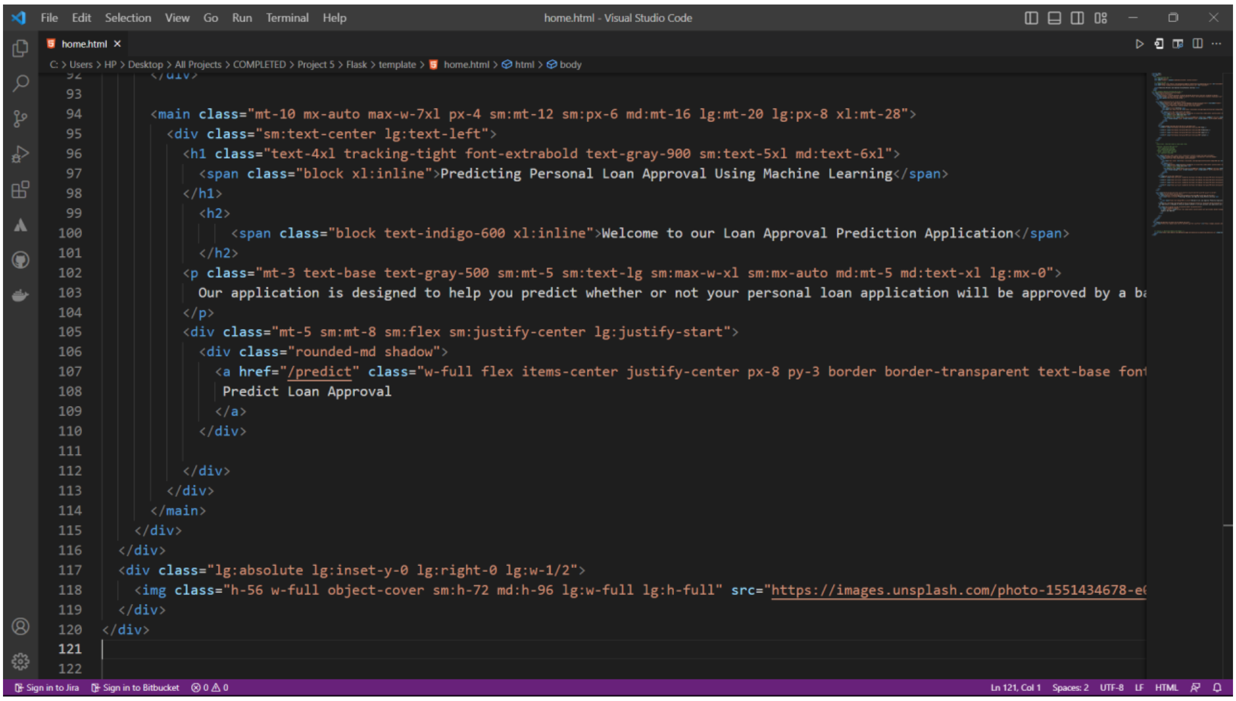
Ln 59, Col 1
Spaces: 2
UTF-8
LF
HTML

```html
              </a>
              <div class="-mr-2 flex items-center md:hidden">
                <button type="button" class="bg-white rounded-md p-2 inline-flex items-center justify-center text-gray-400 hover:t
                  <span class="sr-only">Open main menu</span>
                  <!-- Heroicon name: outline/menu -->
                  <svg class="h-6 w-6" xmlns="http://www.w3.org/2000/svg" fill="none" viewBox="0 0 24 24" stroke="currentColor" ar
                    <path stroke-linecap="round" stroke-linejoin="round" stroke-width="2" d="M4 6h16M4 12h16M4 18h16" />
                  </svg>
                </button>
              </div>
            </div>
          </div>
          <div class="hidden md:block md:ml-10 md:pr-4 md:space-x-8">
            <a href="#" class="font-medium text-gray-500 hover:text-gray-900">Home</a>

            <a href="#" class="font-medium text-gray-500 hover:text-gray-900">Prediction</a>

            <a href="#" class="font-medium text-gray-500 hover:text-gray-900">About us</a>

            <a href="#" class="font-medium text-gray-500 hover:text-gray-900">contact</a>

          </div>
        </nav>
      </div>

      <!--
        Mobile menu, show/hide based on menu open state.

        Entering: "duration-150 ease-out"
          From: "opacity-0 scale-95"
          To: "opacity-100 scale-100"
```


File Edit Selection View Go Run Terminal Help
home.html - Visual Studio Code
home.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > home.html > html > body
Sign in to Jira
Sign in to Bitbucket
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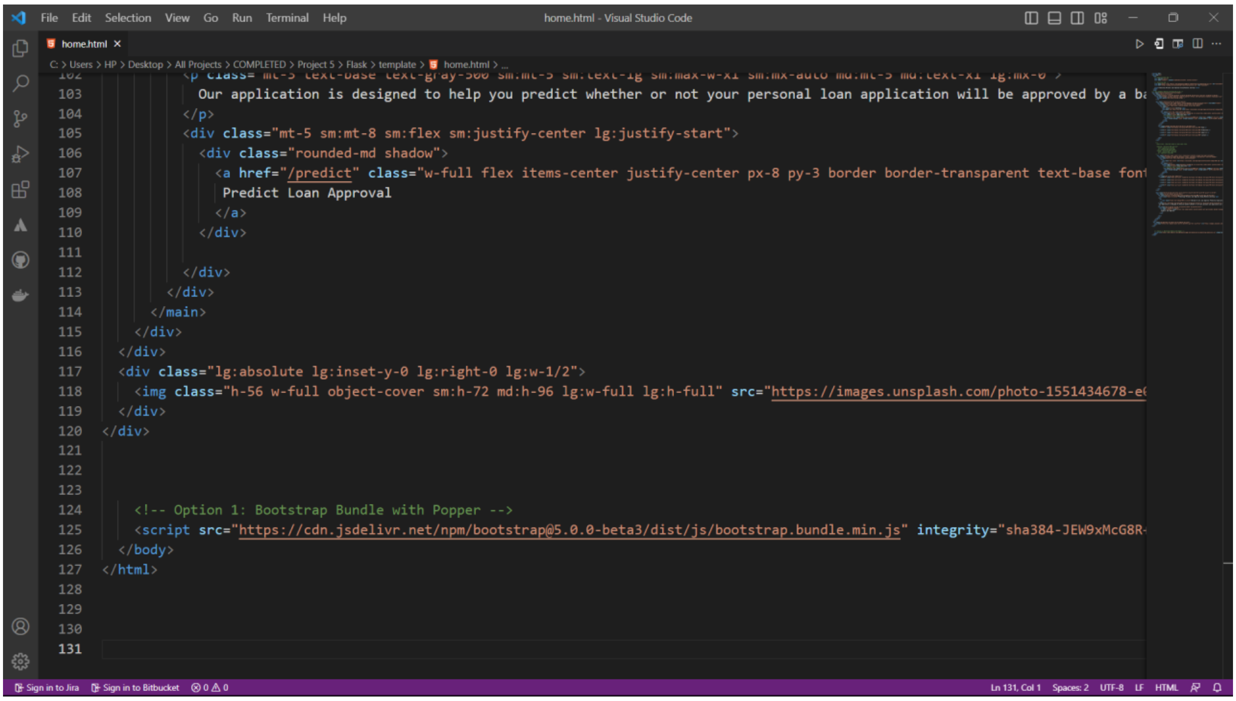
Ln 121, Col 1
Spaces: 2
UTF-8
LF
HTML

```html
      </div>

      <main class="mt-10 mx-auto max-w-7xl px-4 sm:mt-12 sm:px-6 md:mt-16 lg:mt-20 lg:px-8 xl:mt-28">
        <div class="sm:text-center lg:text-left">
          <h1 class="text-4xl tracking-tight font-extrabold text-gray-900 sm:text-5xl md:text-6xl">
            <span class="block xl:inline">Predicting Personal Loan Approval Using Machine Learning</span>
          </h1>
            <h2>
                <span class="block text-indigo-600 xl:inline">Welcome to our Loan Approval Prediction Application</span>
            </h2>
          <p class="mt-3 text-base text-gray-500 sm:mt-5 sm:text-lg sm:max-w-xl sm:mx-auto md:mt-5 md:text-xl lg:mx-0">
            Our application is designed to help you predict whether or not your personal loan application will be approved by a ba
          </p>
          <div class="mt-5 sm:mt-8 sm:flex sm:justify-center lg:justify-start">
            <div class="rounded-md shadow">
              <a href="/predict" class="w-full flex items-center justify-center px-8 py-3 border border-transparent text-base font
                Predict Loan Approval
              </a>
            </div>

          </div>
        </div>
      </main>
    </div>
  </div>
  <div class="lg:absolute lg:inset-y-0 lg:right-0 lg:w-1/2">
    <img class="h-56 w-full object-cover sm:h-72 md:h-96 lg:w-full lg:h-full" src="https://images.unsplash.com/photo-1551434678-e(
  </div>
</div>

```


File Edit Selection View Go Run Terminal Help
home.html - Visual Studio Code
home.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > home.html > ...
Sign in to Jira
Sign in to Bitbucket
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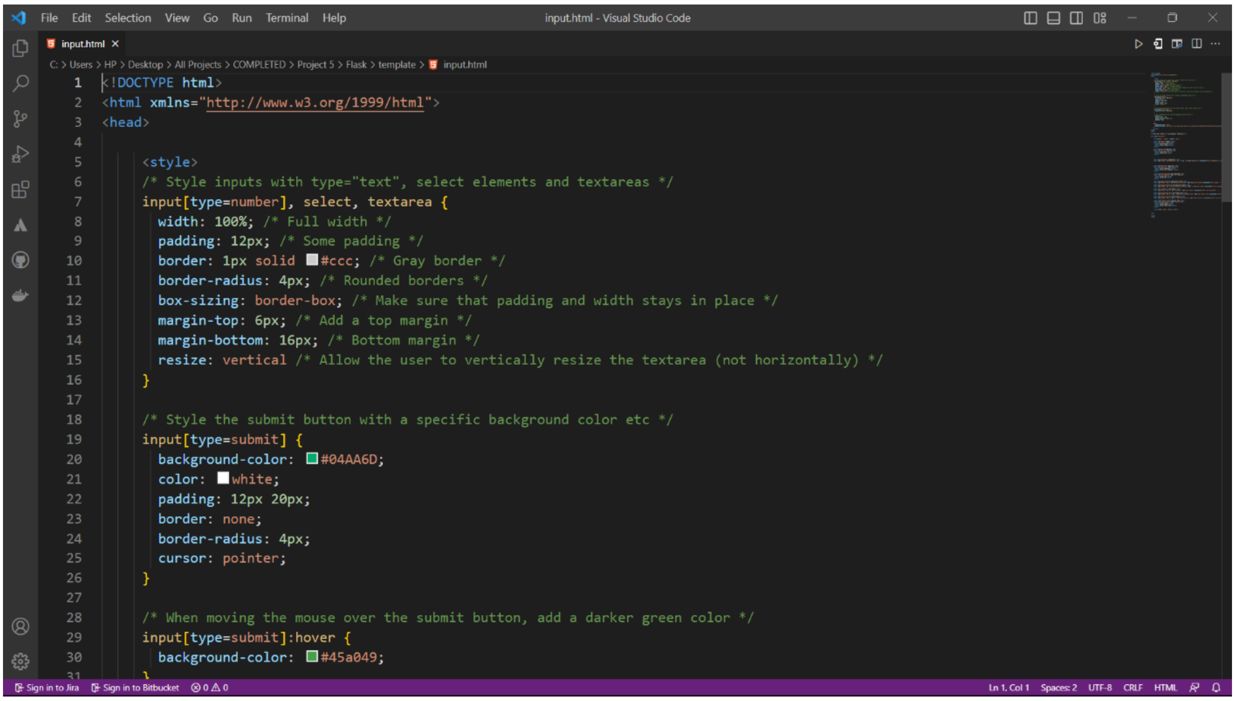
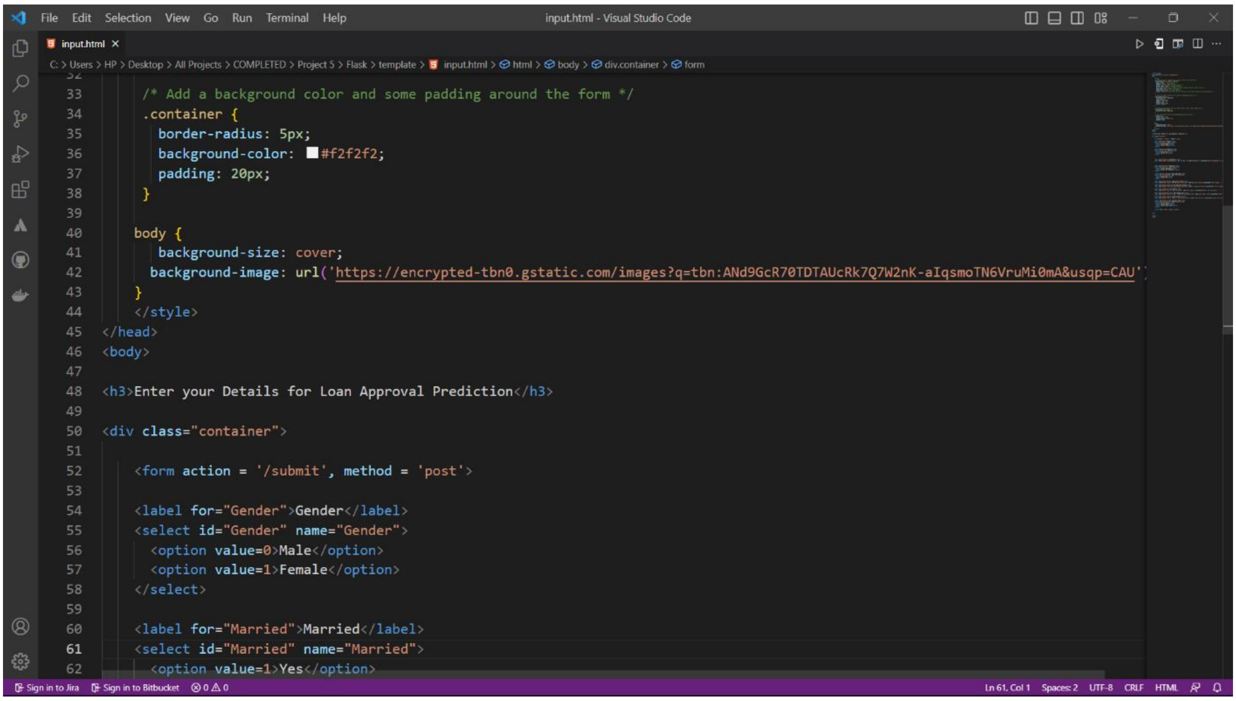
Ln 131, Col 1 Spaces: 2 UTF-8 LF HTML

```html
          <p class="mt-5 text-base text-gray-500 sm:mt-5 sm:text-lg sm:max-w-xl sm:mx-auto md:mt-5 md:text-xl lg:mx-0">
            Our application is designed to help you predict whether or not your personal loan application will be approved by a ba
          </p>
          <div class="mt-5 sm:mt-8 sm:flex sm:justify-center lg:justify-start">
            <div class="rounded-md shadow">
              <a href="/predict" class="w-full flex items-center justify-center px-8 py-3 border border-transparent text-base font
               Predict Loan Approval
              </a>
            </div>

          </div>
        </div>
      </main>
    </div>
  </div>
  <div class="lg:absolute lg:inset-y-0 lg:right-0 lg:w-1/2">
    <img class="h-56 w-full object-cover sm:h-72 md:h-96 lg:w-full lg:h-full" src="https://images.unsplash.com/photo-1551434678-e
  </div>
</div>



    <!-- Option 1: Bootstrap Bundle with Popper -->
    <script src="https://cdn.jsdelivr.net/npm/bootstrap@5.0.0-beta3/dist/js/bootstrap.bundle.min.js" integrity="sha384-JEW9xMcG8R-
  </body>
</html>




```

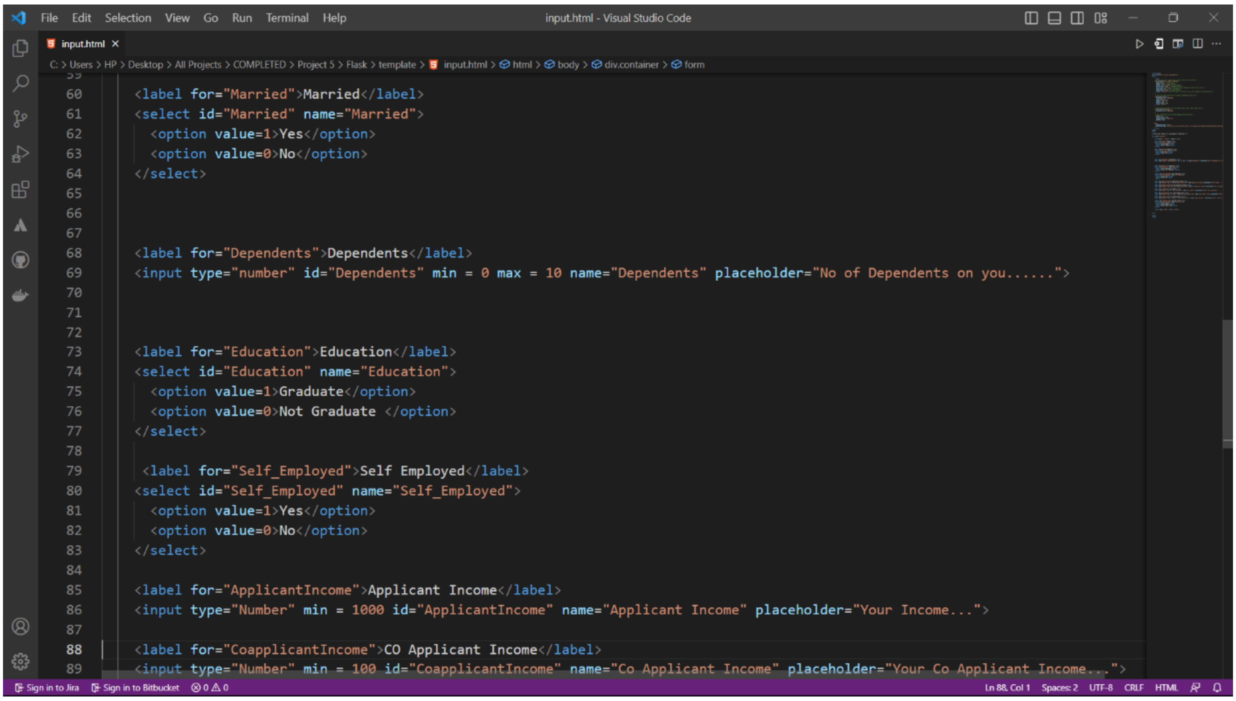
Input.html


File Edit Selection View Go Run Terminal Help
input.html - Visual Studio Code
input.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > input.html
Sign in to Jira
Sign in to Bitbucket
⊗ 0 ⚠ 0
Ln 1, Col 1 Spaces: 2 UTF-8 CRLF HTML

```html
<!DOCTYPE html>
<html xmlns="http://www.w3.org/1999/html">
<head>

     <style>
     /* Style inputs with type="text", select elements and textareas */
     input[type=number], select, textarea {
       width: 100%; /* Full width */
       padding: 12px; /* Some padding */
       border: 1px solid #ccc; /* Gray border */
       border-radius: 4px; /* Rounded borders */
       box-sizing: border-box; /* Make sure that padding and width stays in place */
       margin-top: 6px; /* Add a top margin */
       margin-bottom: 16px; /* Bottom margin */
       resize: vertical /* Allow the user to vertically resize the textarea (not horizontally) */
     }

     /* Style the submit button with a specific background color etc */
     input[type=submit] {
       background-color: #04AA6D;
       color: white;
       padding: 12px 20px;
       border: none;
       border-radius: 4px;
       cursor: pointer;
     }

     /* When moving the mouse over the submit button, add a darker green color */
     input[type=submit]:hover {
       background-color: #45a049;
     }
```


File Edit Selection View Go Run Terminal Help
input.html - Visual Studio Code
input.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > input.html > html > body > div.container > form
Sign in to Jira
Sign in to Bitbucket
0 0
Ln 61, Col 1 Spaces: 2 UTF-8 CRLF HTML

```
     /* Add a background color and some padding around the form */
     .container {
       border-radius: 5px;
       background-color: #f2f2f2;
       padding: 20px;
     }

    body {
       background-size: cover;
      background-image: url('https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcR70TDTAUcRk7Q7W2nK-aIqsmoTN6VruMi0mA&usqp=CAU'
    }
    </style>
</head>
<body>

<h3>Enter your Details for Loan Approval Prediction</h3>

<div class="container">

    <form action = '/submit', method = 'post'>

    <label for="Gender">Gender</label>
    <select id="Gender" name="Gender">
      <option value=0>Male</option>
      <option value=1>Female</option>
    </select>

    <label for="Married">Married</label>
    <select id="Married" name="Married">
      <option value=1>Yes</option>
```


File Edit Selection View Go Run Terminal Help
input.html - Visual Studio Code
input.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > input.html > html > body > div.container > form
Sign in to Jira
Sign in to Bitbucket
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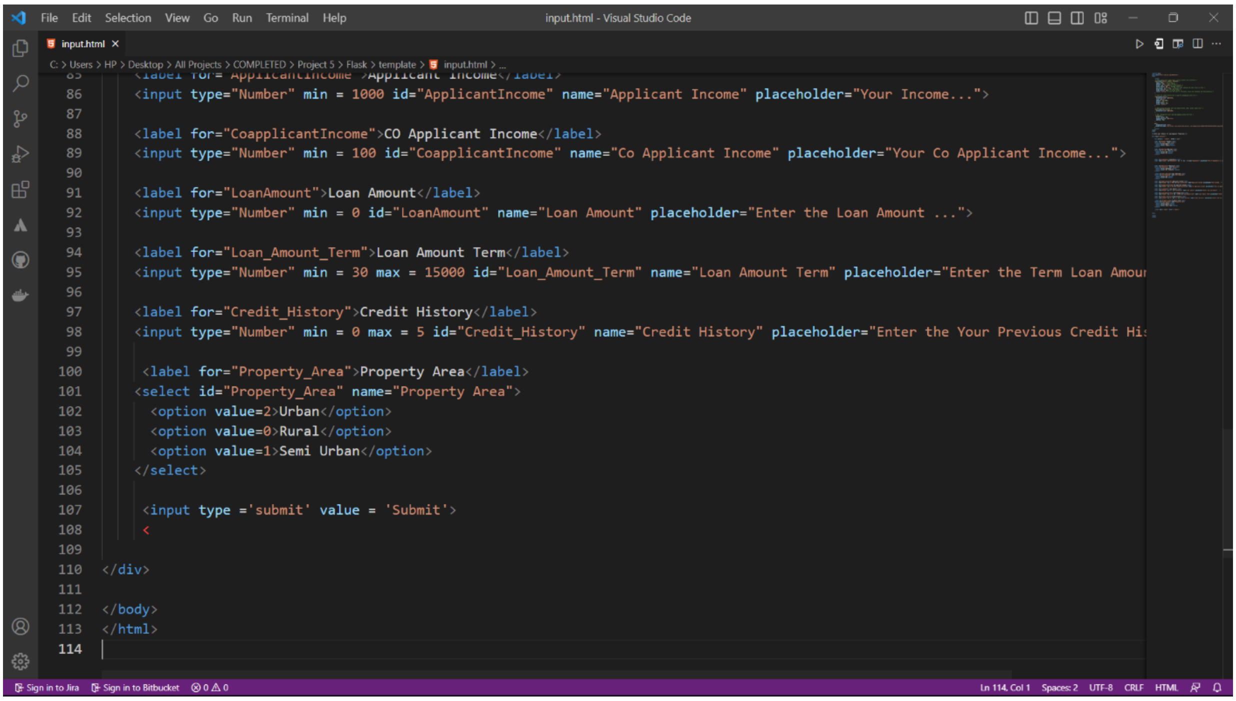
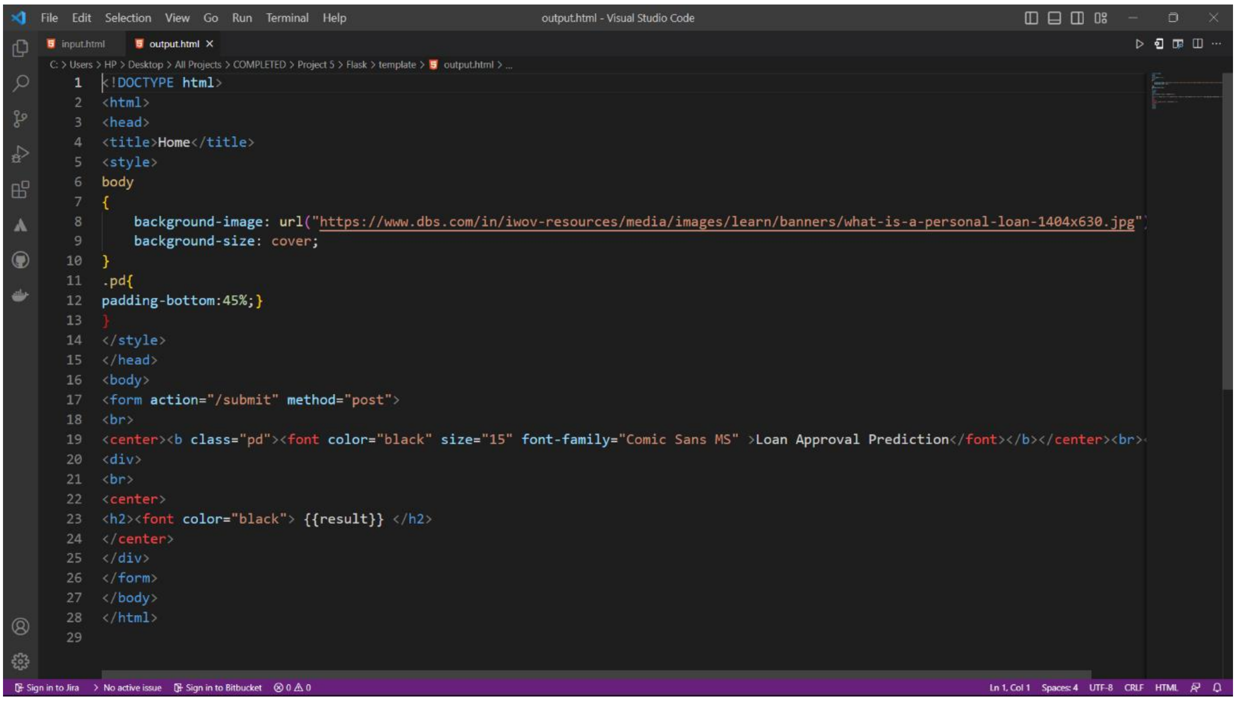
Ln 88, Col 1 Spaces: 2 UTF-8 CRLF HTML

```
    <label for="Married">Married</label>
    <select id="Married" name="Married">
      <option value=1>Yes</option>
      <option value=0>No</option>
    </select>



    <label for="Dependents">Dependents</label>
    <input type="number" id="Dependents" min = 0 max = 10 name="Dependents" placeholder="No of Dependents on you......">



    <label for="Education">Education</label>
    <select id="Education" name="Education">
      <option value=1>Graduate</option>
      <option value=0>Not Graduate </option>
    </select>

     <label for="Self_Employed">Self Employed</label>
    <select id="Self_Employed" name="Self_Employed">
      <option value=1>Yes</option>
      <option value=0>No</option>
    </select>

    <label for="ApplicantIncome">Applicant Income</label>
    <input type="Number" min = 1000 id="ApplicantIncome" name="Applicant Income" placeholder="Your Income...">

    <label for="CoapplicantIncome">CO Applicant Income</label>
    <input type="Number" min = 100 id="CoapplicantIncome" name="Co Applicant Income" placeholder="Your Co Applicant Income...">
```


File Edit Selection View Go Run Terminal Help
input.html - Visual Studio Code
input.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > input.html > ...
Sign in to Jira
Sign in to Bitbucket
0 0
Ln 114, Col 1
Spaces: 2
UTF-8
CRLF
HTML

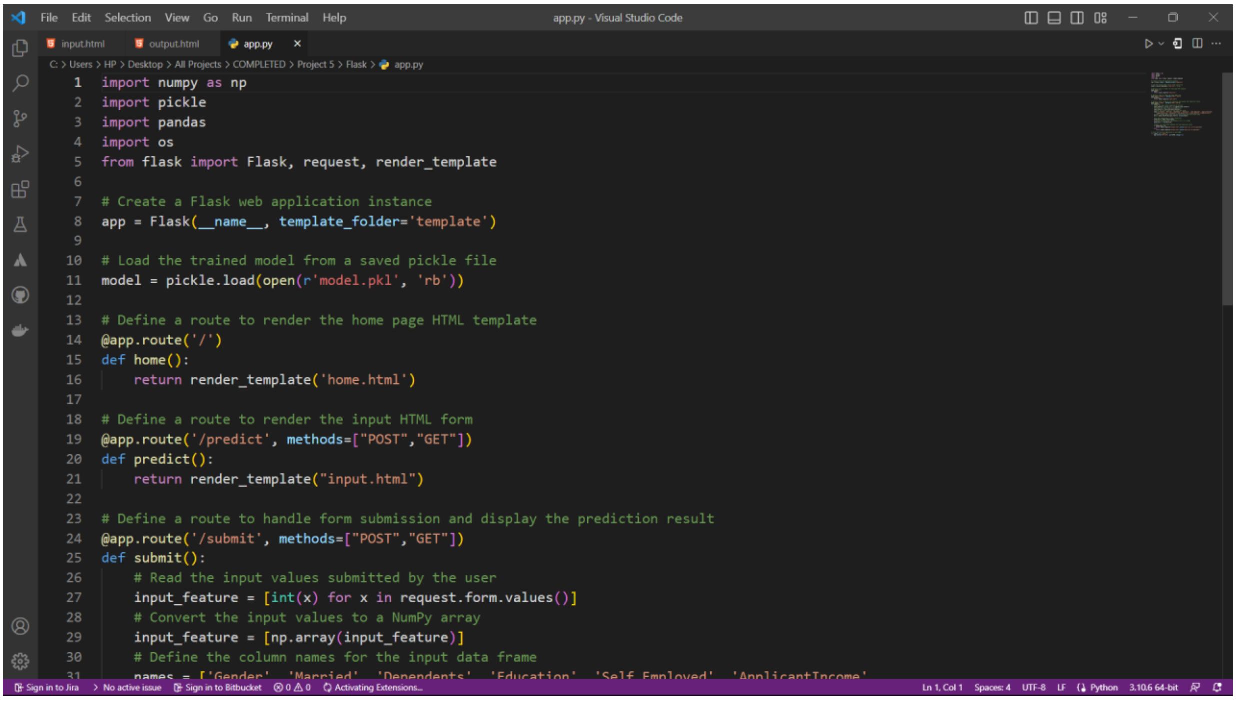
```html
    <label for="ApplicantIncome">Applicant Income</label>
    <input type="Number" min = 1000 id="ApplicantIncome" name="Applicant Income" placeholder="Your Income...">

    <label for="CoapplicantIncome">CO Applicant Income</label>
    <input type="Number" min = 100 id="CoapplicantIncome" name="Co Applicant Income" placeholder="Your Co Applicant Income...">

    <label for="LoanAmount">Loan Amount</label>
    <input type="Number" min = 0 id="LoanAmount" name="Loan Amount" placeholder="Enter the Loan Amount ...">

    <label for="Loan_Amount_Term">Loan Amount Term</label>
    <input type="Number" min = 30 max = 15000 id="Loan_Amount_Term" name="Loan Amount Term" placeholder="Enter the Term Loan Amour

    <label for="Credit_History">Credit History</label>
    <input type="Number" min = 0 max = 5 id="Credit_History" name="Credit History" placeholder="Enter the Your Previous Credit His

     <label for="Property_Area">Property Area</label>
    <select id="Property_Area" name="Property Area">
      <option value=2>Urban</option>
      <option value=0>Rural</option>
      <option value=1>Semi Urban</option>
    </select>

     <input type ='submit' value = 'Submit'>
     <

</div>

</body>
</html>

```

Output.html


File Edit Selection View Go Run Terminal Help
output.html - Visual Studio Code
input.html
output.html
C: > Users > HP > Desktop > All Projects > COMPLETED > Project 5 > Flask > template > output.html > ...
Sign in to Jira
No active issue
Sign in to Bitbucket
0 0
Ln 1, Col 1
Spaces: 4
UTF-8
CRLF
HTML

```html
<!DOCTYPE html>
<html>
<head>
<title>Home</title>
<style>
body
{
    background-image: url("https://www.dbs.com/in/iwov-resources/media/images/learn/banners/what-is-a-personal-loan-1404x630.jpg"
    background-size: cover;
}
.pd{
padding-bottom:45%;}
}
</style>
</head>
<body>
<form action="/submit" method="post">
<br>
<center><b class="pd"><font color="black" size="15" font-family="Comic Sans MS" >Loan Approval Prediction</font></b></center><br>
<div>
<br>
<center>
<h2><font color="black"> {{result}} </h2>
</center>
</div>
</form>
</body>
</html>

```

App.py



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app.py - Visual Studio Code
input.html
output.html
app.py
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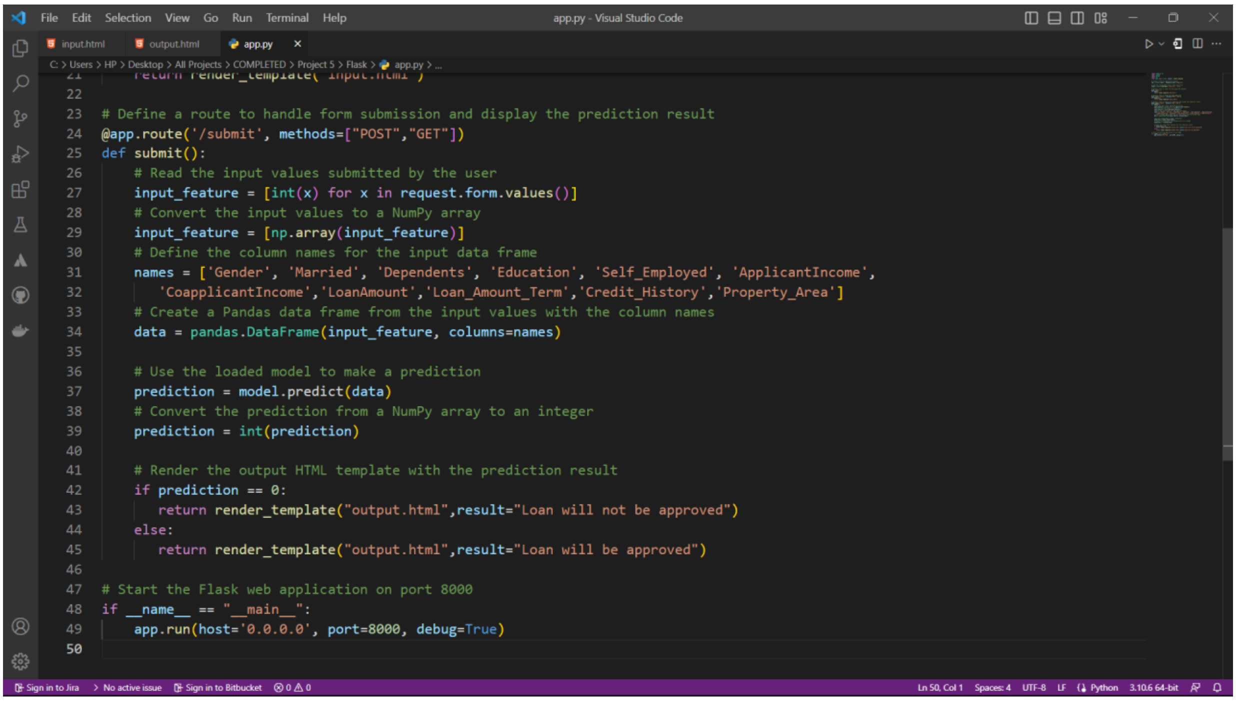
Python
3.10.6 64-bit

```python
import numpy as np
import pickle
import pandas
import os
from flask import Flask, request, render_template

# Create a Flask web application instance
app = Flask(__name__, template_folder='template')

# Load the trained model from a saved pickle file
model = pickle.load(open(r'model.pkl', 'rb'))

# Define a route to render the home page HTML template
@app.route('/')
def home():
    return render_template('home.html')

# Define a route to render the input HTML form
@app.route('/predict', methods=["POST","GET"])
def predict():
    return render_template("input.html")

# Define a route to handle form submission and display the prediction result
@app.route('/submit', methods=["POST","GET"])
def submit():
    # Read the input values submitted by the user
    input_feature = [int(x) for x in request.form.values()]
    # Convert the input values to a NumPy array
    input_feature = [np.array(input_feature)]
    # Define the column names for the input data frame
    names = ['Gender', 'Married', 'Dependents', 'Education', 'Self_Employed', 'ApplicantIncome',
```



File Edit Selection View Go Run Terminal Help
app.py - Visual Studio Code
input.html
output.html
app.py
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Python
3.10.6 64-bit

```python
    return render_template("input.html")

# Define a route to handle form submission and display the prediction result
@app.route('/submit', methods=["POST","GET"])
def submit():
    # Read the input values submitted by the user
    input_feature = [int(x) for x in request.form.values()]
    # Convert the input values to a NumPy array
    input_feature = [np.array(input_feature)]
    # Define the column names for the input data frame
    names = ['Gender', 'Married', 'Dependents', 'Education', 'Self_Employed', 'ApplicantIncome',
       'CoapplicantIncome','LoanAmount','Loan_Amount_Term','Credit_History','Property_Area']
    # Create a Pandas data frame from the input values with the column names
    data = pandas.DataFrame(input_feature, columns=names)

    # Use the loaded model to make a prediction
    prediction = model.predict(data)
    # Convert the prediction from a NumPy array to an integer
    prediction = int(prediction)

    # Render the output HTML template with the prediction result
    if prediction == 0:
       return render_template("output.html",result="Loan will not be approved")
    else:
       return render_template("output.html",result="Loan will be approved")

# Start the Flask web application on port 8000
if __name__ == "__main__":
    app.run(host='0.0.0.0', port=8000, debug=True)

```