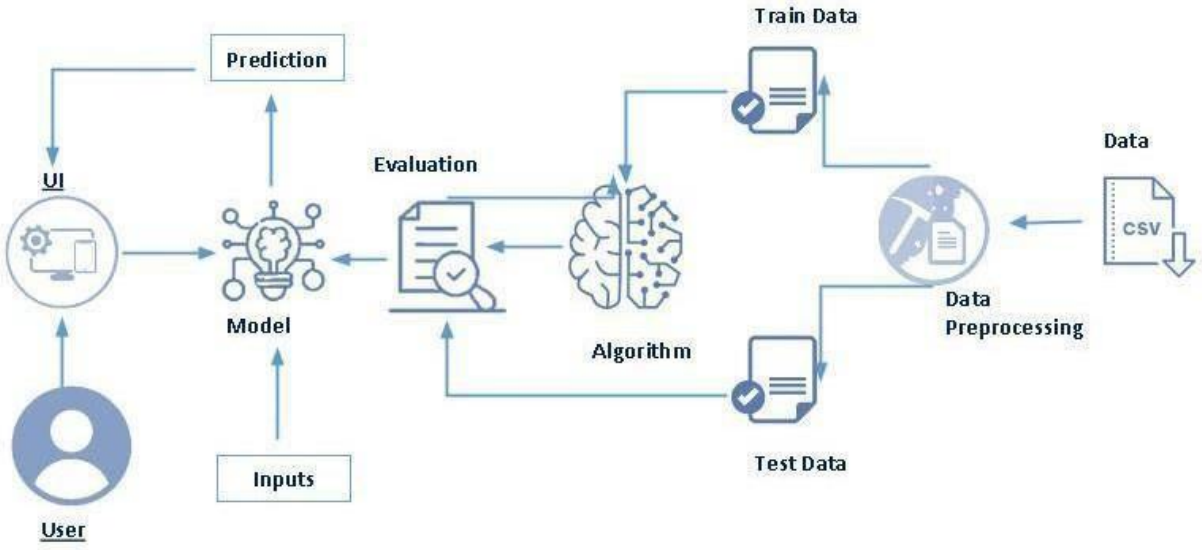
Predicting Personal Loan ApprovalUsing Machine Learning

Overview:

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. The loan amount, interest rate, and repayment period vary depending on the lender and the borrower's credit worthiness. To qualify for a personal loan, borrowers typically need to provide proof of income and have a good credit score. Predicting personal loan approval using machine learning analyses a borrower's financial data and credit history to determine the likelihood of loan approval. This can help financial institutions to make more informed decisions about which loan applications to approve and which to deny.

Technical Architecture:



A PROJECT DESCRIPTION:

A Personal Loan is an can help you meet your current financial needs. The loan does not require you to pledge any security or collateral and is available with minimum documentation. The lump sum from the as home renovations, marriage expenses, medical emergencies, funeral costs, etc.

You can also use a Personal Loan to consolidate different debts or seal. Unlike a credit card, a Personal Loan gives you a lump sum amount to use at once. You pay back the amount plus interest in pre-agreed monthly in over the loan tenure. Most people prefer **personal loans as an alternative to credit cards** because often Personal Loans have lower interest rates than credit cards.
Also, you can use a Personal Loan amount to nearly any kind of expense that is personal in nature, such as some of your goals, needs, emergencies, etc.

Moreover, owing to the ease of online Personal Loans and the increasing competition, availing of a Personal Loan is cheaper and more accessible than ever before. In contrast to credit cards, Personal Loans are available at a fixed rate of interest for any amount you want to borrow. However, credit cards are revolving debts, where you can borrow the balance of the funds after spending per the credit card limit.

Project Flow:

- User interacts with the UI to enter the input.
- Entered input is by the model which is integrated.
- One model analyses the input the prediction is showcased on the UI

To accomplish this, we have to complete all the activities listed below,

- Define Problem / Problem Understanding

- Specify the business problem
- Business requirements
- Literature Survey
- Social & Business Impact

● Data Collection & Preparation
- Collect the dataset
- Data Preparation

● Exploratory Data Analysis
- Descriptive statistical
- Visual Analysis

● Model Building
- Training the model in multiple algorithms
- Testing the model

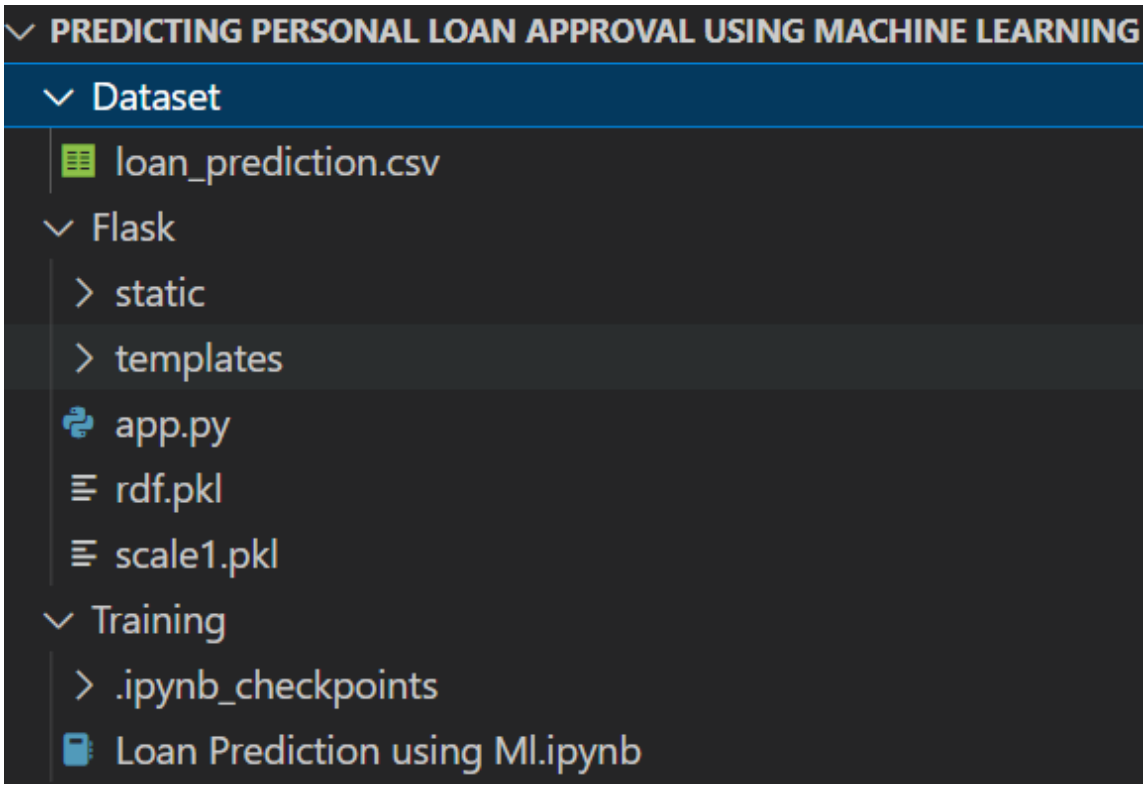
● Performance Testing & Hyper-parameter Tuning
- Testing model with multiple evaluation metrics
- Comparing model accuracy before & after applying hyper-parametertuning

● Model Deployment
- Save the best model
- Integrate with Web Framework

● Project Demonstration & Documentation
- Record explanation Video for project end to end solution
- Project Documentation-Step by step project development procedure

Project Structure:

Create the Project folder which contains files as shown below

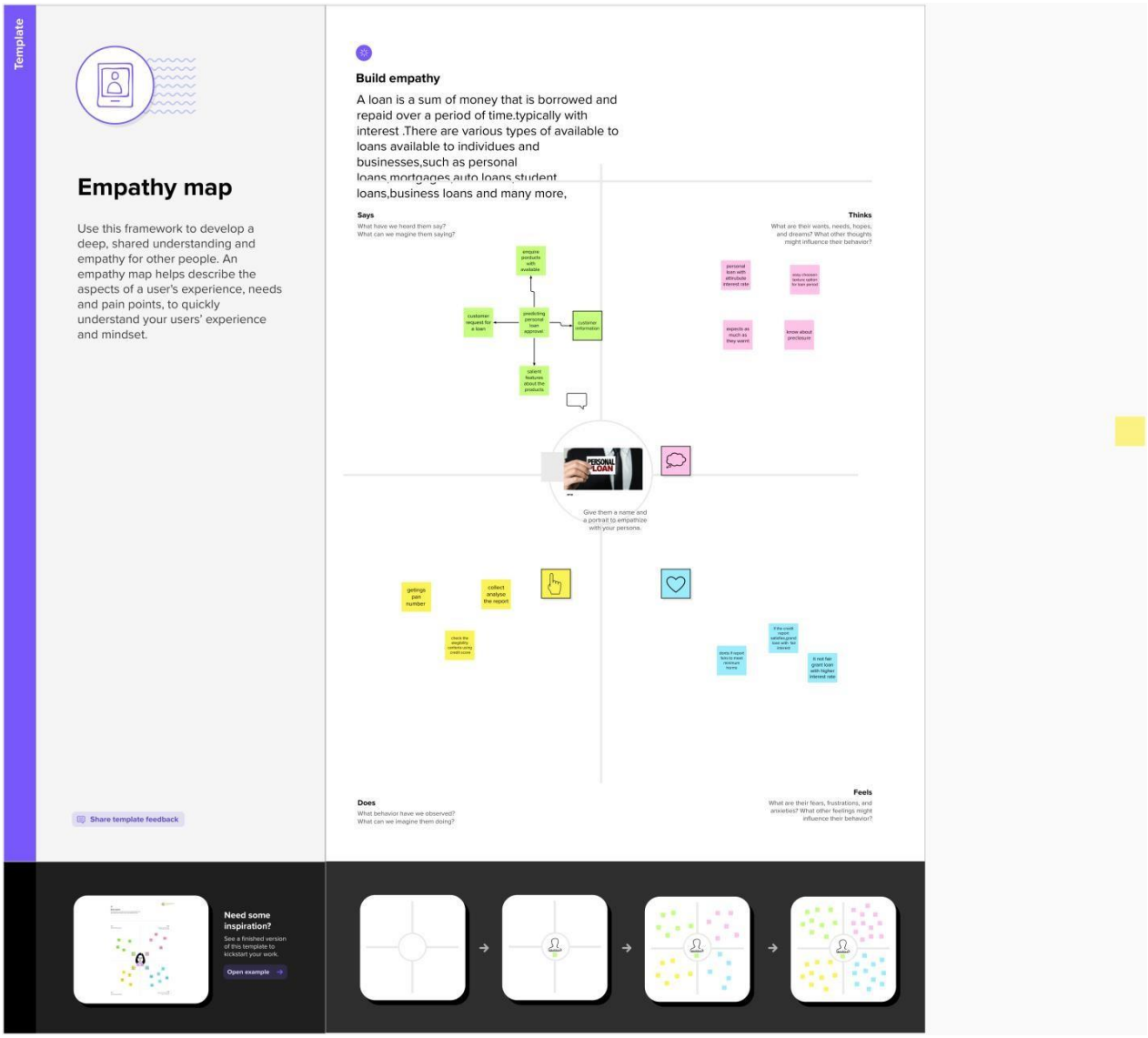


●We are building a flask application which needs HTML pages stored in the templates folder and a
Python script app.py for scripting.
●rdf.pkl is our saved model. Further we will use this model for flask integration.
● Training folder contains a model training file.

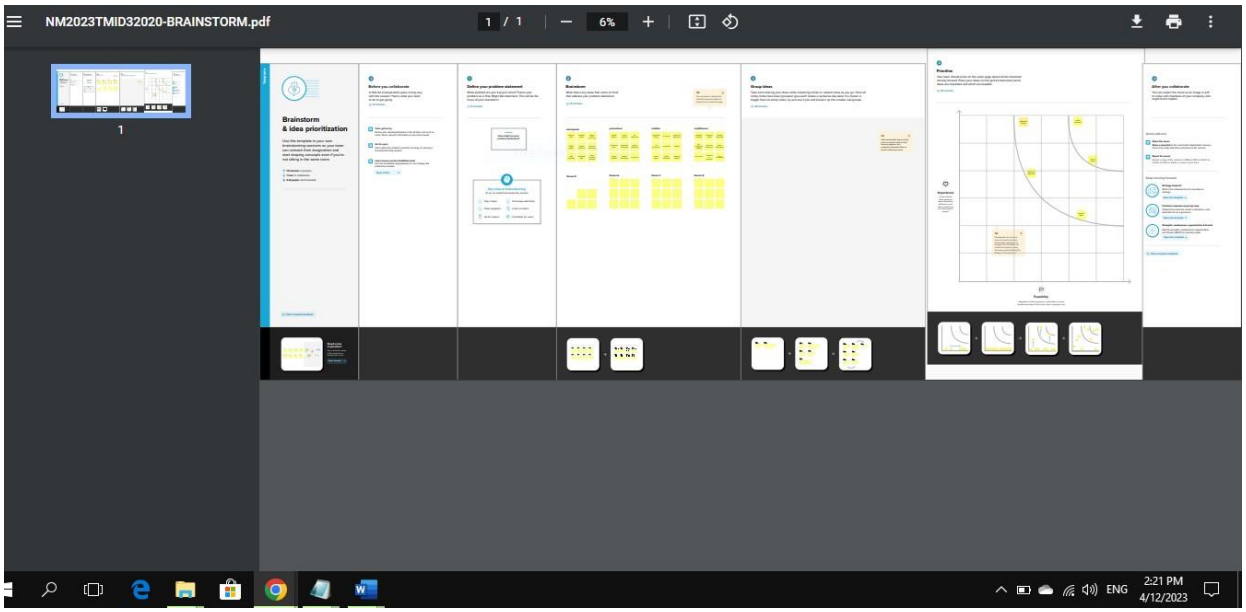
1.2PURPOSE:

Apart from these reasons, you can use a personal loan to cover funeral costs, moving expenses, pay credit card dues, buy a vehicle or an expensive gadget, etc. There is no restriction on the usage of personal loan money, so you have complete freedom to use the lump sum as you deem fit. You could even use the money for two or more two purposes, as per your financial requirement.

EMPATHY MAP:



Ideation and Brainstorming Map:



2. PROBLEM DEFINITION AND DESIGN THINKING:

The bank or lending financial institution assess your personal loan application and sanction the loan amount. The amount of personal loan you can avail of depends on your income level, profession and lender's assessment of your loan application. If you are a business owner or self-employed person, the personal loan amount will depend on your profit and loss statement. However, if you are a salaried individual, the lender will assess your monthly salary and credit history before sanctioning the personal loan. Apart from restricting the amount per your financial assessment, the lender also limits the maximum and minimum funding available. Hence, it is advisable to always check for the maximum and minimum personal loan funding available.

ADVANTAGE AND DISADVANTAGE:

Advantage:

One lump sum:

Because you get the loan payment all at once, it can be easier to make a large purchase, consolidate debt or otherwise use the loan all at once. Plus, you'll get a fixed interest rate and predictable monthly payment, making the loan easier to manage. Why this mat**ters:** Receiving a lump-sum payment with a fixed interest rate can be easier to manage and help you avoid late payments.

Fast funding times:

Personal loans generally have fast approval times and payment times, making them useful for emergencies or other situations where you need money quickly. Some personal loan lenders can deposit the loan proceeds to your bank account as soon as the next business day. Why this matters: If you need money fast, a personal loan can be a good financing option.

No collateral requirement:

Unsecured personal loans don't require collateral for you to get approved. This means you don't have to put your car, home or another asset up as a guarantee that you'll repay the funds. If you cannot repay the loan based on the agreed-upon terms with your lender, you'll face significant financial and credit consequences. But unlike a secured personal loan, you don't have to worry about losing a home or a car as a direct result.

Disadvantage:

Interest rates can be higher than alternatives:

Interest rates for personal loans are not always the lowest option. This is especially true for borrowers with poor credit, who might pay higher interest rates than credit cards or a secured loan requiring collateral. Why this matters: The lower your credit, the more likely a lender will charge you a high interest rate. As a result, you could end up paying thousands of dollars more in interest than someone with good credit.

More eligibility requirements:

Personal loans can have more strict requirements than other types of funding options. If you have poor credit or a short financial history, fewer lenders will be available to you. Furthermore, some lenders don't allow co-signers, which can be used to strengthen your approval odds if you have minimal credit history or your credit score is low. Why this matters: Qualifying for a personal loan may be more difficult if you have bad credit.

Fees and penalties can be high:

Personal loans may come with fees and penalties that can drive up the cost of borrowing. Some loans come with origination fees of 1 percent to 6 percent of the loan amount. The fees, which cover loan processing, can either be rolled into the loan or subtracted from the amount disbursed to the borrower. Some lenders charge prepayment penalties if you pay the balance off before the end of your loan term. Before applying, review all fees and penalties of any personal loans you are considering.

Additional monthly payment:

With a personal loan, you add another monthly payment. If you are not careful, a personal loan can lead to loan term issues with your budget if it's not accounted for when you take out the loan and making the monthly payment causes you to overdraw your account and send your budget into the red.

Application:

If the personal loan applicant has an existing relationship with the financial lender, he/she can apply for a personal loan via his/her net banking account and could possibly be eligible for a pre-approval. For other customers, they can apply for a personal loan online by following the steps mentioned below:

- Visit the website of the financial lender.
- Under the loan section, choose personal loans.
- Click on the 'apply now' option.
- Enter the details in the personal loan application form and submit it to the bank.
- The bank will assess the eligibility of the applicant and request for the submission of the required KYC documents and income documents.
- If the applicant is found eligible, the bank will disburse the loan amount to the bank account of the applicant, as mentioned in the application form.

2. Personal loan application offline

Listed below is the process of applying for a personal loan at the branch of the financial lender:

- Visit the branch of the financial lender.
- Procure the personal loan application form and enter all the required details.
- Submit relevant documents that prove one's income, age, address and identity.
- The lender will then verify the documents and check the eligibility of the applicant.
- The loan amount will be transferred to the bank account of the applicant if he/she is found eligible.

3. Email and phone banking requests:

You can leave a request for personal loan with the bank through an email or at the customer service centre of the bank. The bank will review your eligibility and contact you to take the process further.

4. Request through ATM machine:

Nowadays you can apply for personal loan via ATM kiosks as well. Once you raise a request the bank personnel will contact you.

How Personal Loan Applications are processed

The process of sanctioning of a personal loan is simpler than property loans such as home loan and car loan. This is because, in case of property loans, the bank has to verify not just your financial information, but also the credibility and eligibility of the asset that you are purchasing with the loan amount. For personal loan, you are the collateral security yourself, so the bank has to do background verification only on you.

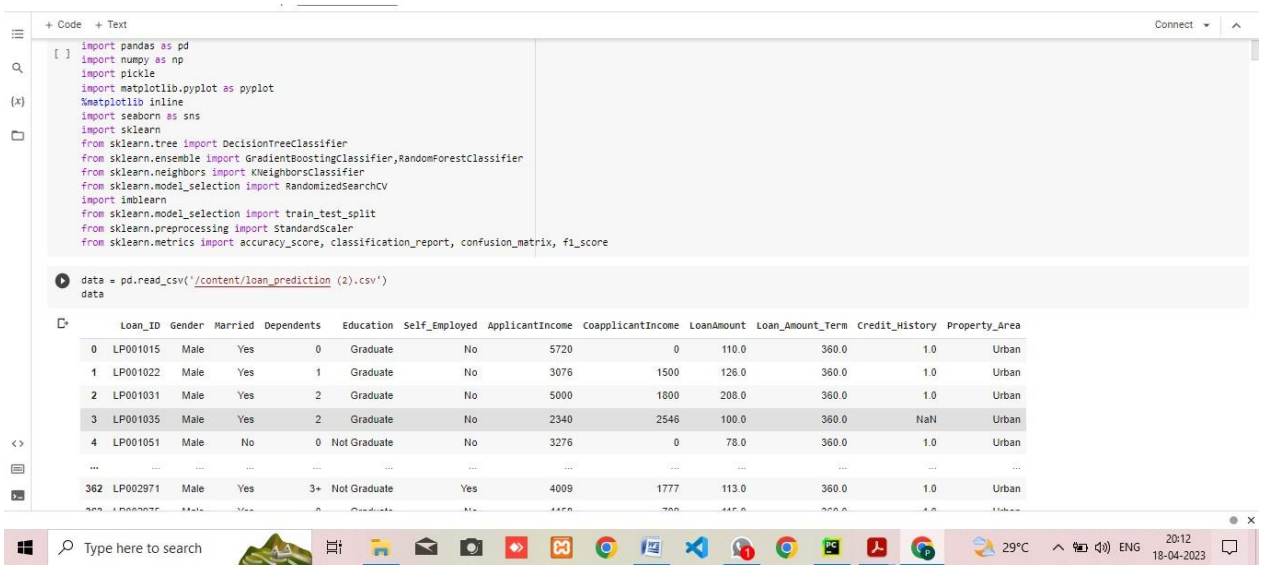
FUTURE SCOPE:

Most personal loans have fixed interest rates, which means that your payments will stay the same every month. Personal loans are also typically unsecured, meaning there's no collateral behind the loan. If you don't qualify for an unsecured personal loan, you may have to use collateral to be approved, like a savings account or certificate of deposit. You can also ask a friend or family member to co-sign on your personal loan to help you get approved.

Whatever your loan purpose, you'll likely have several options available to you. Financing is available through credit cards, home equity loans and more. However, in many cases, personal loans are an ideal solution for consumers. Personal loans are often less expensive than credit cards, and funding is faster than with home equity loans or HELOCs.

Additionally, because there's usually no collateral tied to a personal loan, it's a less risky form of financing than secured loans like home equity products — meaning your home, vehicle or savings account is not immediately at risk if you default.

Source Code:



```
[ ] import pandas as pd
    import numpy as np
    import pickle
    import matplotlib.pyplot as pyplot
    %matplotlib inline
    import seaborn as sns
    import sklearn
    from sklearn.tree import DecisionTreeClassifier
    from sklearn.ensemble import GradientBoostingClassifier,RandomForestClassifier
    from sklearn.neighbors import KNeighborsClassifier
    from sklearn.model_selection import RandomizedSearchCV
    import imblearn
    from sklearn.model_selection import train_test_split
    from sklearn.preprocessing import StandardScaler
    from sklearn.metrics import accuracy_score, classification_report, confusion_matrix, f1_score
```

```
data = pd.read_csv('/content/loan_prediction (2).csv')
data
```

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History	Property_Area
0	LP001015	Male	Yes	0	Graduate	No	5720	0	110.0	360.0	1.0	Urban
1	LP001022	Male	Yes	1	Graduate	No	3076	1500	126.0	360.0	1.0	Urban
2	LP001031	Male	Yes	2	Graduate	No	5000	1800	208.0	360.0	1.0	Urban
3	LP001035	Male	Yes	2	Graduate	No	2340	2546	100.0	360.0	NaN	Urban
4	LP001051	Male	No	0	Not Graduate	No	3276	0	78.0	360.0	1.0	Urban
...	...	...	...	...	...	...	...	...	...	...	...	...
362	LP002971	Male	Yes	3+	Not Graduate	Yes	4009	1777	113.0	360.0	1.0	Urban

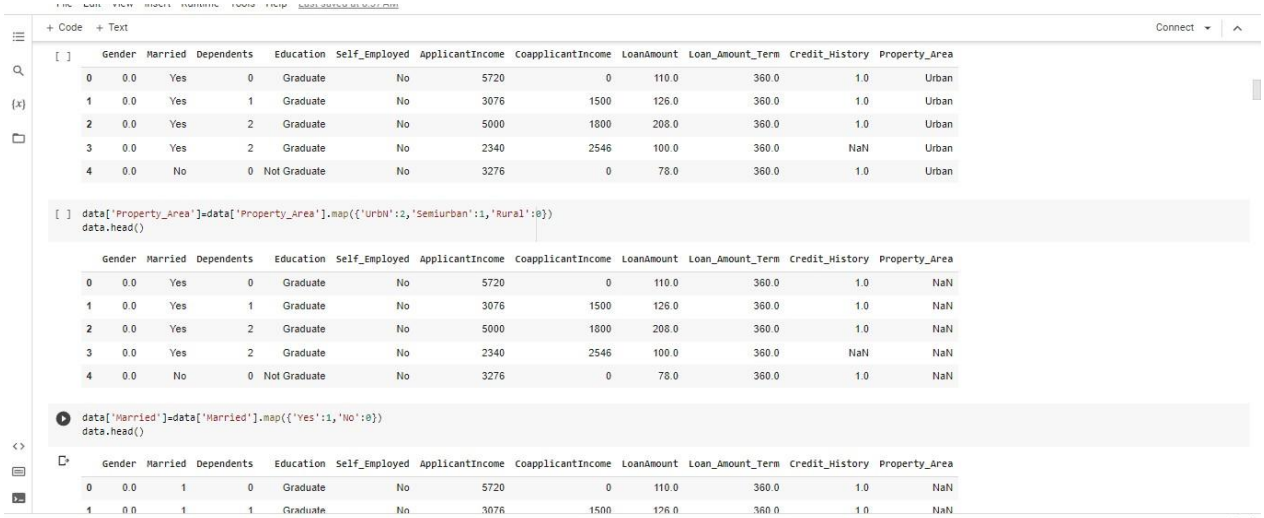

```
[ ] data.drop(['Loan_ID'],axis=1,inplace=True)
```

```
data
```

	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History	Property_Area
0	Male	Yes	0	Graduate	No	5720	0	110.0	360.0	1.0	Urban
1	Male	Yes	1	Graduate	No	3076	1500	126.0	360.0	1.0	Urban
2	Male	Yes	2	Graduate	No	5000	1800	208.0	360.0	1.0	Urban
3	Male	Yes	2	Graduate	No	2340	2546	100.0	360.0	NaN	Urban
4	Male	No	0	Not Graduate	No	3276	0	78.0	360.0	1.0	Urban
...	...	...	...	...	...	...	...	...	...	...	...
362	Male	Yes	3+	Not Graduate	Yes	4009	1777	113.0	360.0	1.0	Urban
363	Male	Yes	0	Graduate	No	4158	709	115.0	360.0	1.0	Urban
364	Male	No	0	Graduate	No	3250	1993	126.0	360.0	NaN	Semiurban
365	Male	Yes	0	Graduate	No	5000	2393	158.0	360.0	1.0	Rural
366	Male	No	0	Graduate	Yes	9200	0	98.0	180.0	1.0	Rural

367 rows × 11 columns

```
[ ] data['Gender']=data['Gender'].map({'Female':1,'Male':0})
    data.head()
```



+ Code + Text

Connect

```
[ ]
```

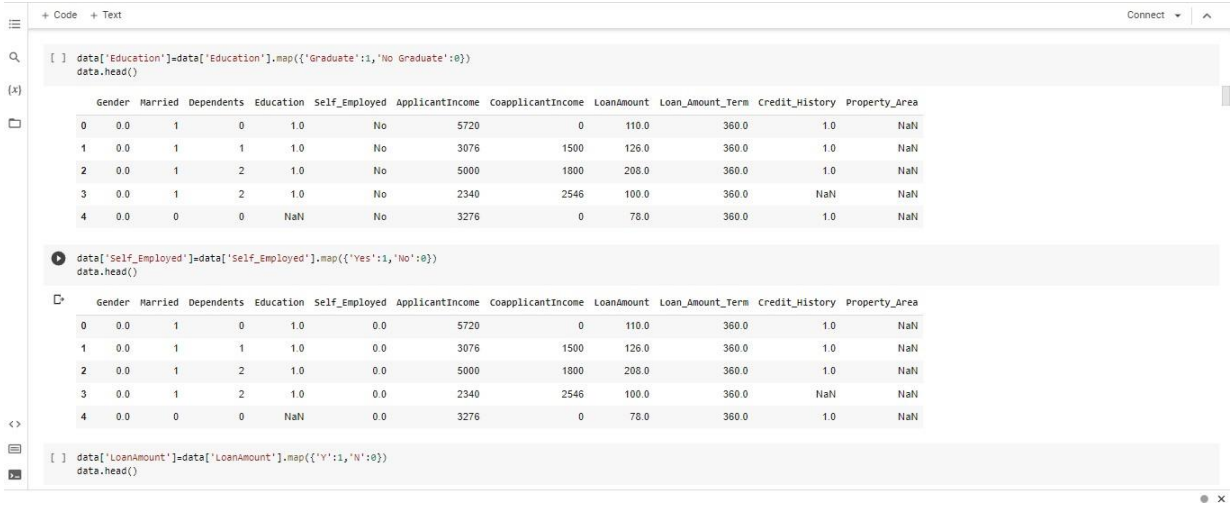
	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History	Property_Area
0	0.0	Yes	0	Graduate	No	5720	0	110.0	360.0	1.0	Urban
1	0.0	Yes	1	Graduate	No	3076	1500	126.0	360.0	1.0	Urban
2	0.0	Yes	2	Graduate	No	5000	1800	208.0	360.0	1.0	Urban
3	0.0	Yes	2	Graduate	No	2340	2546	100.0	360.0	NaN	Urban
4	0.0	No	0	Not Graduate	No	3276	0	78.0	360.0	1.0	Urban

```
[ ] data['Property_Area']=data['Property_Area'].map({'UrbN':2,'Semiurban':1,'Rural':0})
    data.head()
```

	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History	Property_Area
0	0.0	Yes	0	Graduate	No	5720	0	110.0	360.0	1.0	NaN
1	0.0	Yes	1	Graduate	No	3076	1500	126.0	360.0	1.0	NaN
2	0.0	Yes	2	Graduate	No	5000	1800	208.0	360.0	1.0	NaN
3	0.0	Yes	2	Graduate	No	2340	2546	100.0	360.0	NaN	NaN
4	0.0	No	0	Not Graduate	No	3276	0	78.0	360.0	1.0	NaN

```
data['Married']=data['Married'].map({'Yes':1,'No':0})
data.head()
```

	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History	Property_Area
0	0.0	1	0	Graduate	No	5720	0	110.0	360.0	1.0	NaN
1	0.0	1	1	Graduate	No	3076	1500	126.0	360.0	1.0	NaN



+ Code + Text

Connect

```
[ ] data['Education']=data['Education'].map({'Graduate':1,'No Graduate':0})
    data.head()
```

	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History	Property_Area
0	0.0	1	0	1.0	No	5720	0	110.0	360.0	1.0	NaN
1	0.0	1	1	1.0	No	3076	1500	126.0	360.0	1.0	NaN
2	0.0	1	2	1.0	No	5000	1800	208.0	360.0	1.0	NaN
3	0.0	1	2	1.0	No	2340	2546	100.0	360.0	NaN	NaN
4	0.0	0	0	NaN	No	3276	0	78.0	360.0	1.0	NaN

```
data['Self_Employed']=data['Self_Employed'].map({'Yes':1,'No':0})
data.head()
```

	Gender	Married	Dependents	Education	Self_Employed	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	Credit_History	Property_Area
0	0.0	1	0	1.0	0.0	5720	0	110.0	360.0	1.0	NaN
1	0.0	1	1	1.0	0.0	3076	1500	126.0	360.0	1.0	NaN
2	0.0	1	2	1.0	0.0	5000	1800	208.0	360.0	1.0	NaN
3	0.0	1	2	1.0	0.0	2340	2546	100.0	360.0	NaN	NaN
4	0.0	0	0	NaN	0.0	3276	0	78.0	360.0	1.0	NaN

```
[ ] data['LoanAmount']=data['LoanAmount'].map({'Y':1,'N':0})
    data.head()
```

```
+ Code + Text                                                                    Connect

data.isnull().sum()

Gender               11
Married               0
Dependents           10
Education            84
Self_Employed        23
ApplicantIncome       0
CoapplicantIncome     0
LoanAmount          367
Loan_Amount_Term      6
Credit_History       29
Property_Area       140
dtype: int64

[ ] data['Gender'] = data['Gender'].fillna(data['Gender'].mode()[0])

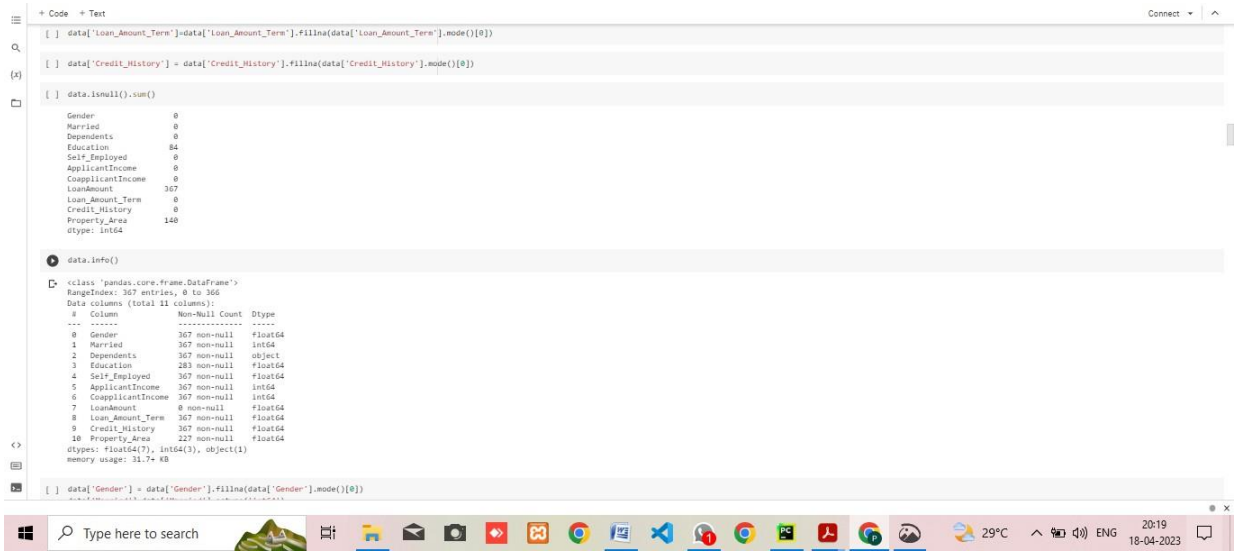
[ ] data['Married'] = data['Married'].fillna(data['Married'].mode()[0])

data['Dependents']=data['Dependents'].str.replace('+','')

<ipython-input-14-d550c6f6dfffc>:1: FutureWarning: The default value of regex will change from True to False in a future version. In addition, single character regular expressions will *not* be treated as li
  data['Dependents']=data['Dependents'].str.replace('+','')

[ ] data['Dependents']=data['Dependents'].fillna(data['Dependents'].mode()[0])

[ ] data['Self_Employed']=data['Self_Employed'].fillna(data['Self_Employed'].mode()[0])
```



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[ ] data['Loan_Amount_Term']=data['Loan_Amount_Term'].fillna(data['Loan_Amount_Term'].mode()[0])

[ ] data['Credit_History'] = data['Credit_History'].fillna(data['Credit_History'].mode()[0])

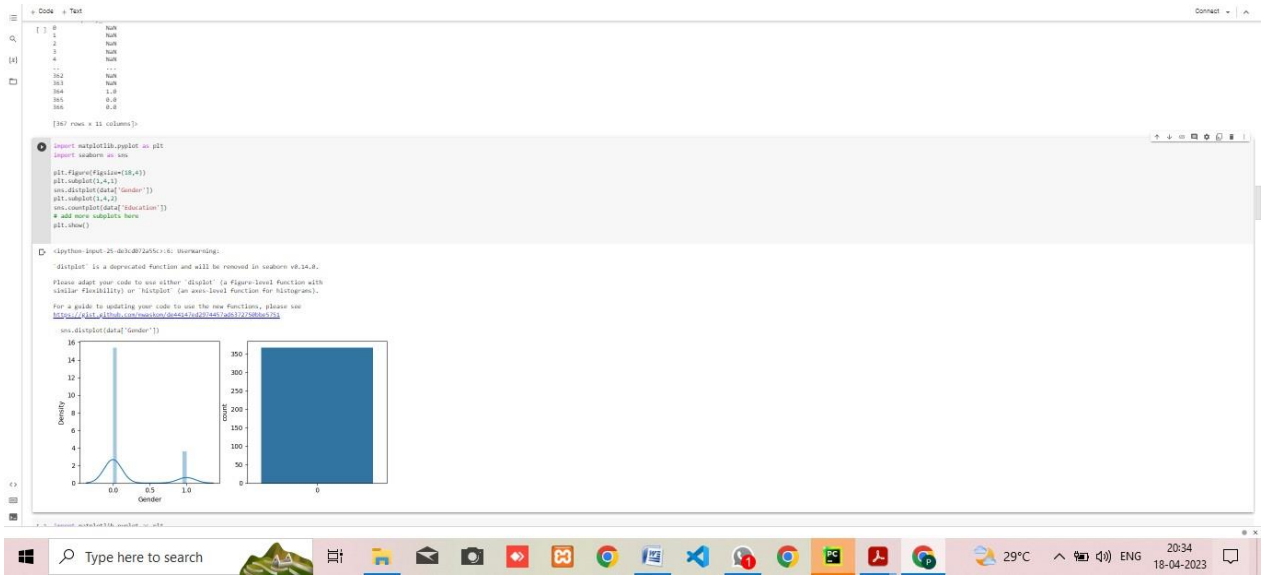
[ ] data.isnull().sum()

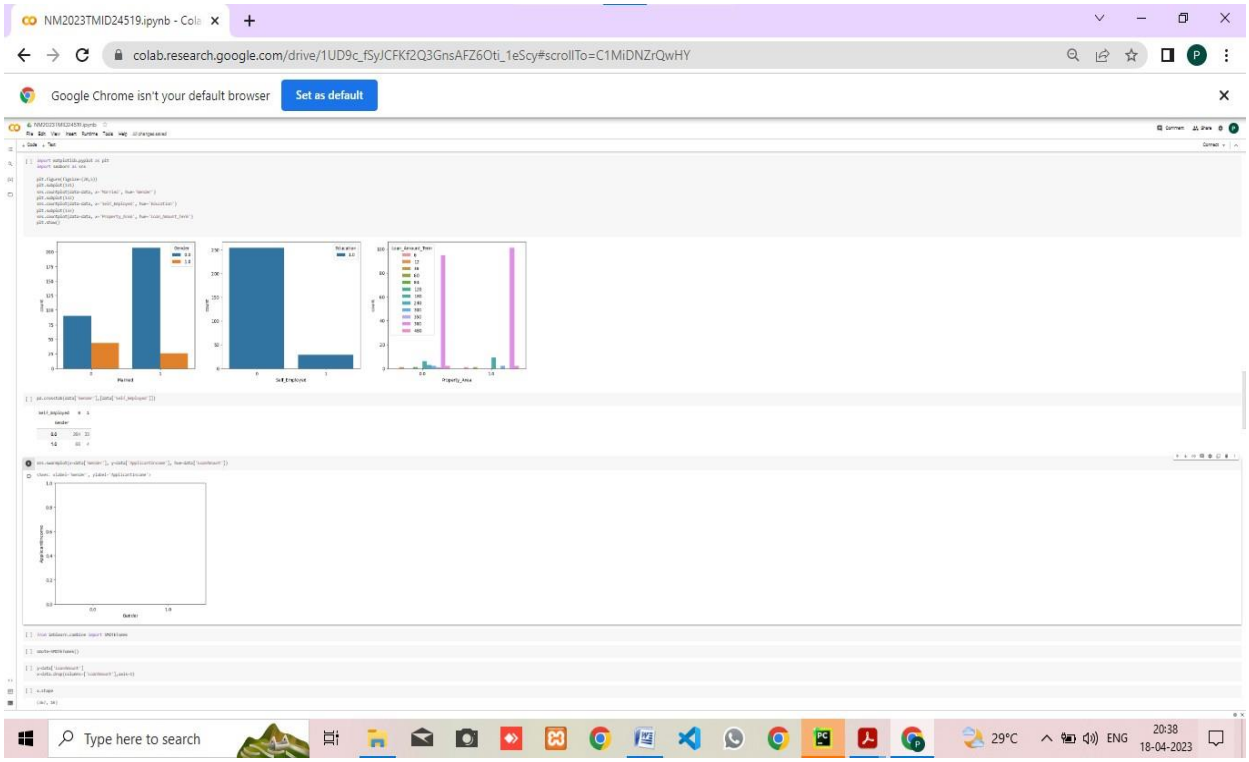
Gender               0
Married              0
Dependents           0
Education           84
Self_Employed        0
ApplicantIncome      0
CoapplicantIncome    0
LoanAmount         367
Loan_Amount_Term     0
Credit_History       0
Property_Area      140
dtype: int64

data.info()

<class 'pandas.core.frame.DataFrame'>
RangeIndex: 367 entries, 0 to 366
Data columns (total 11 columns):
 #   Column             Non-Null Count  Dtype
---  ------             --------------  -----
 0   Gender             367 non-null    float64
 1   Married            367 non-null    int64
 2   Dependents         367 non-null    object
 3   Education          283 non-null    float64
 4   Self_Employed      367 non-null    float64
 5   ApplicantIncome    367 non-null    int64
 6   CoapplicantIncome  367 non-null    int64
 7   LoanAmount         0 non-null      float64
 8   Loan_Amount_Term   367 non-null    float64
 9   Credit_History     367 non-null    float64
 10  Property_Area      227 non-null    float64
dtypes: float64(7), int64(3), object(1)
memory usage: 31.7+ KB

[ ] data['Gender'] = data['Gender'].fillna(data['Gender'].mode()[0])
```


Type here to search
29°C
ENG
20:34
18-04-2023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Google Chrome isn't your default browser
Set as default
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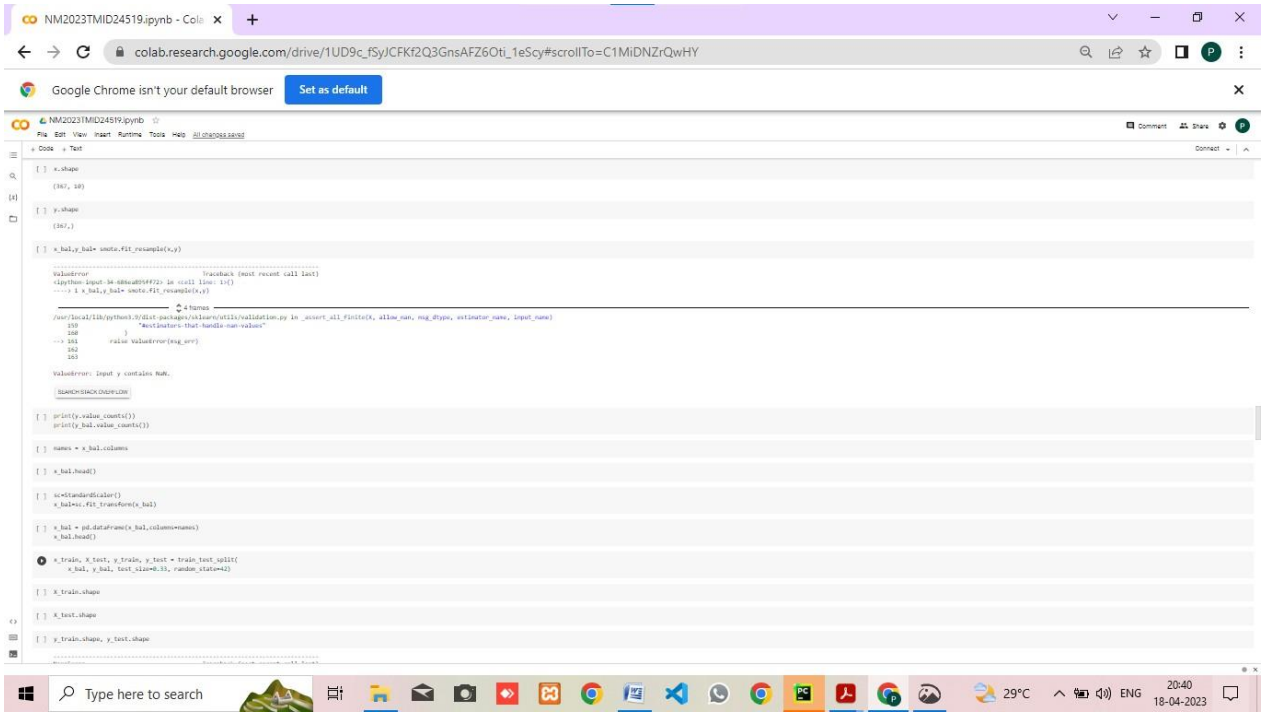
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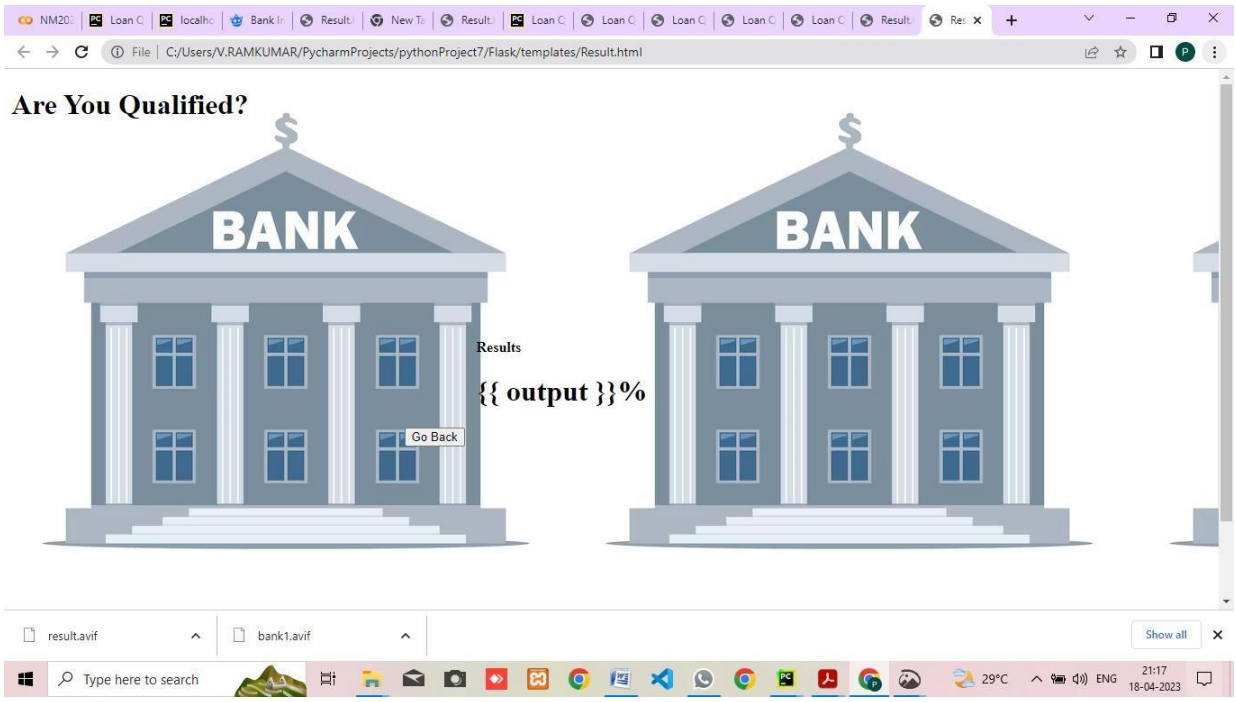
colab.research.google.com/drive/1UD9c_fSyJCFKf2Q3GnsAFZ6Oti_1eScy#scrollTo=C1MiDNZrQwHY
Google Chrome isn't your default browser
Set as default
NM2023TMID24519.ipynb
x.shape
(367, 10)
y.shape
(367,)
x_bal,y_bal= smote.fit_resample(x,y)
ValueError
Traceback (most recent call last)
<ipython-input-34-686ad05ff72> in <cell line: 1>()
----> 1 x_bal,y_bal= smote.fit_resample(x,y)
4 frames
/usr/local/lib/python3.9/dist-packages/sklearn/utils/validation.py in _assert_all_finite(X, allow_nan, msg_dtype, estimator_name, input_name)
ValueError: Input y contains NaN.
SEARCH STACK OVERFLOW
print(y.value_counts())
print(y_bal.value_counts())
names = x_bal.columns
x_bal.head()
sc=StandardScaler()
x_bal=sc.fit_transform(x_bal)
x_bal = pd.DataFrame(x_bal,columns=names)
x_bal.head()
x_train, X_test, y_train, y_test = train_test_split(
x_bal, y_bal, test_size=0.33, random_state=42)
X_train.shape
X_test.shape
y_train.shape, y_test.shape
Type here to search
29°C
ENG
20:40
18-04-2023

Result:


File | C:/Users/V.RAMKUMAR/PycharmProjects/pythonProject7/Flask/templates/index.html
Personal Loan Approval Forecasting
Use the interactive chart below to explore your qualifications.
Marital Status. Enter: 1 for "Yes", 0 for "No"
Enter Number of Dependents: 1/2/3/4...
Are you Self Employed? Enter: 1 for "Yes", 0 for "No"
Enter Applicant Monthly Income: Exp: 5000
Enter Coapplicant Monthly Income: Exp: 3000
Enter Loan Amount: Exp: 100
Enter Loan Amount Term in Days: Exp: 360
Predict
BANK
BANK
bank1.avif
Show all
Type here to search
29°C
ENG
21:13
18-04-2023


File | C:/Users/V.RAMKUMAR/PycharmProjects/pythonProject7/Flask/templates/Result.html
Are You Qualified?
BANK
BANK
Results
{{ output }}%
Go Back
result.avif
bank1.avif
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