In [301…

```python
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn import svm
```

In [303…

```python
df = pd.read_csv(r"C:\Users\10500\OneDrive\Desktop\loan.csv.csv")
```

In [305…

```python
df.head()
```

Out[305…

| | Loan_ID | Gender | Married | Dependents | Education | Self_Employed | ApplicantIncome |
|---|---|---|---|---|---|---|---|
| **0** | LP001002 | Male | No | 0 | Graduate | No | 5849 |
| **1** | LP001003 | Male | Yes | 1 | Graduate | No | 4583 |
| **2** | LP001005 | Male | Yes | 0 | Graduate | Yes | 3000 |
| **3** | LP001006 | Male | Yes | 0 | Not Graduate | No | 2583 |
| **4** | LP001008 | Male | No | 0 | Graduate | No | 6000 |

In [307…

```python
df.head(10)
```

Out[307…

| | Loan_ID | Gender | Married | Dependents | Education | Self_Employed | ApplicantIncome |
|---|---|---|---|---|---|---|---|
| **0** | LP001002 | Male | No | 0 | Graduate | No | 5849 |
| **1** | LP001003 | Male | Yes | 1 | Graduate | No | 4583 |
| **2** | LP001005 | Male | Yes | 0 | Graduate | Yes | 3000 |
| **3** | LP001006 | Male | Yes | 0 | Not Graduate | No | 2583 |
| **4** | LP001008 | Male | No | 0 | Graduate | No | 6000 |
| **5** | LP001011 | Male | Yes | 2 | Graduate | Yes | 5417 |
| **6** | LP001013 | Male | Yes | 0 | Not Graduate | No | 2333 |
| **7** | LP001014 | Male | Yes | 3+ | Graduate | No | 3036 |
| **8** | LP001018 | Male | Yes | 2 | Graduate | No | 4006 |
| **9** | LP001020 | Male | Yes | 1 | Graduate | No | 12841 |

In [309…

```python
df.tail()
```

Out[309…

| | Loan_ID | Gender | Married | Dependents | Education | Self_Employed | ApplicantInco |
|---|---|---|---|---|---|---|---|
| **609** | LP002978 | Female | No | 0 | Graduate | No | 2 |
| **610** | LP002979 | Male | Yes | 3+ | Graduate | No | 4 |
| **611** | LP002983 | Male | Yes | 1 | Graduate | No | 8 |
| **612** | LP002984 | Male | Yes | 2 | Graduate | No | 7 |
| **613** | LP002990 | Female | No | 0 | Graduate | Yes | 4 |

In [311…

```
df.info()
```

```
<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 
 3   Dependents         599 non-null    object 
 4   Education          614 non-null    object 
 5   Self_Employed      582 non-null    object 
 6   ApplicantIncome    614 non-null    int64  
 7   CoapplicantIncome  614 non-null    float64
 8   LoanAmount         592 non-null    float64
 9   Loan_Amount_Term   600 non-null    float64
 10  Credit_History     564 non-null    float64
 11  Property_Area      614 non-null    object 
 12  Loan_Status        614 non-null    object 
dtypes: float64(4), int64(1), object(8)
memory usage: 62.5+ KB
```

In [313…

```
df.shape
```

Out[313…

```
(614, 13)
```

In [315…

```
df.describe()
```

Out[315…

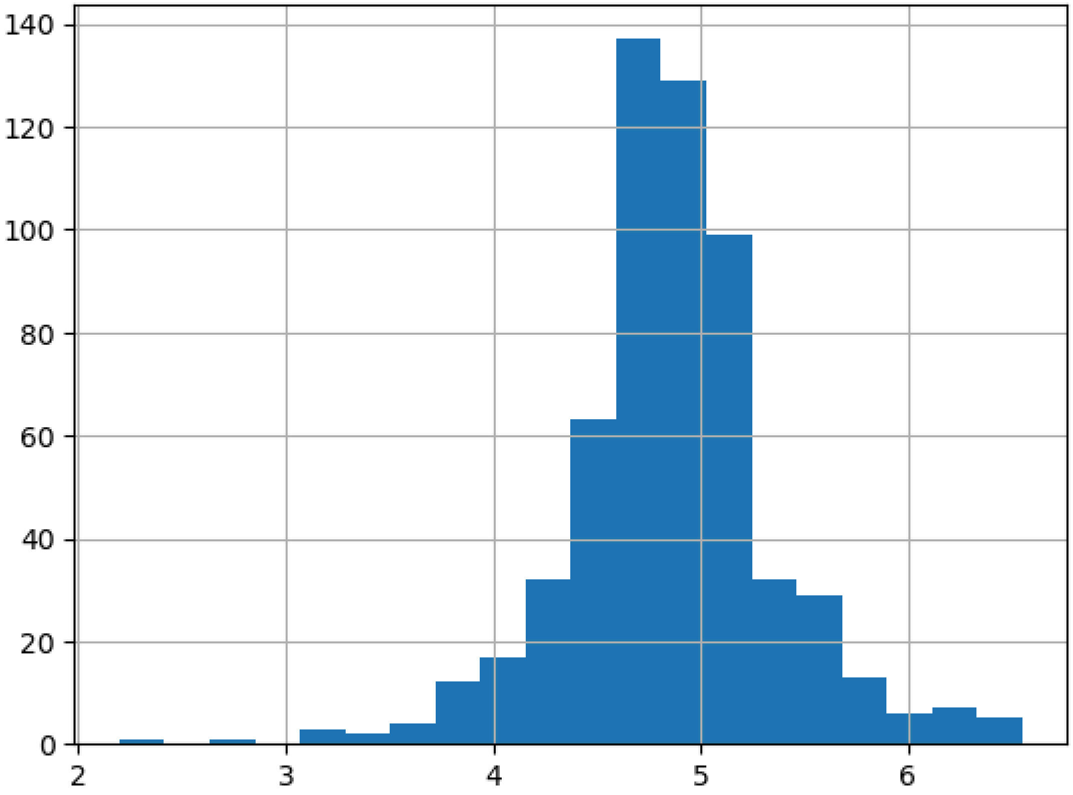
| | ApplicantIncome | CoapplicantIncome | LoanAmount | Loan_Amount_Term | Credit_H |
|---|---|---|---|---|---|
| **count** | 614.000000 | 614.000000 | 592.000000 | 600.00000 | 564. |
| **mean** | 5403.459283 | 1621.245798 | 146.412162 | 342.00000 | 0. |
| **std** | 6109.041673 | 2926.248369 | 85.587325 | 65.12041 | 0. |
| **min** | 150.000000 | 0.000000 | 9.000000 | 12.00000 | 0. |
| **25%** | 2877.500000 | 0.000000 | 100.000000 | 360.00000 | 1. |
| **50%** | 3812.500000 | 1188.500000 | 128.000000 | 360.00000 | 1. |
| **75%** | 5795.000000 | 2297.250000 | 168.000000 | 360.00000 | 1. |
| **max** | 81000.000000 | 41667.000000 | 700.000000 | 480.00000 | 1. |

In [317…

```
df['loanAmount_log']= np.log(df['LoanAmount'])
df['loanAmount_log'].hist(bins=20)
```

Out[317…

```
<Axes: >
```

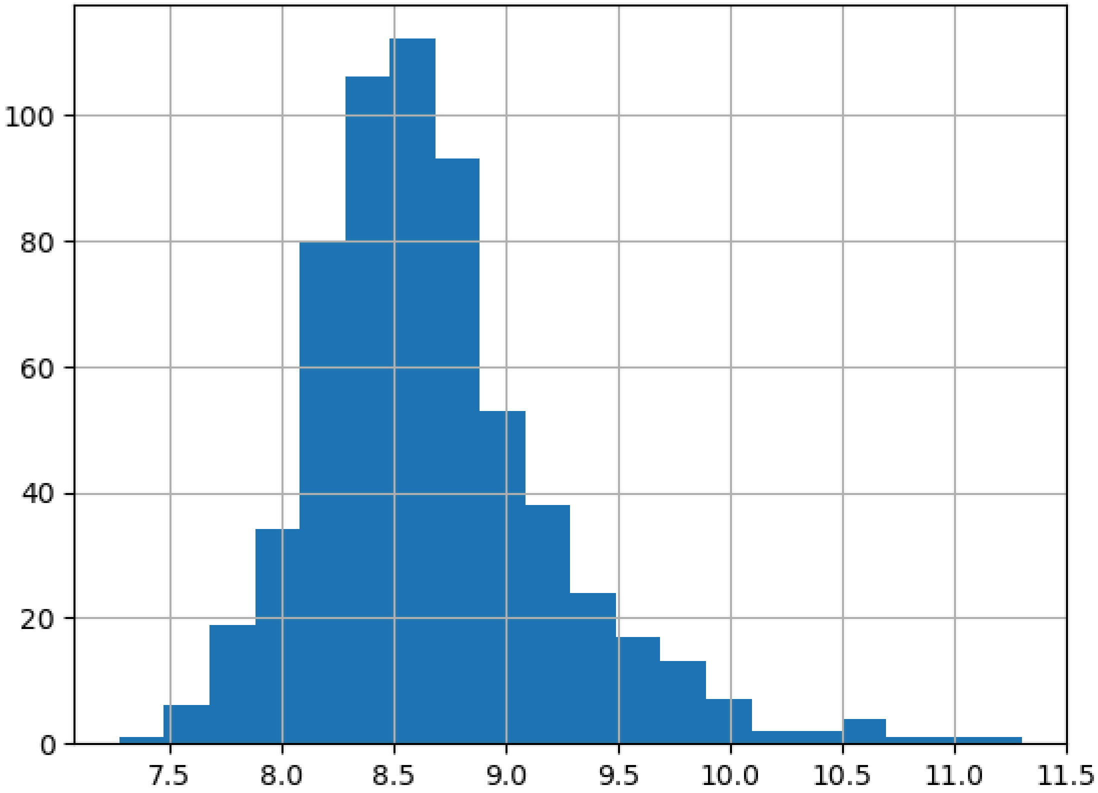


In [318…

```
df['TotalIncome']= df['ApplicantIncome']+ df['CoapplicantIncome']
df['TotalIncome_log']= np.log(df['TotalIncome'])
df['TotalIncome_log'].hist(bins=20)
```

Out[318…

```
<Axes: >
```



In [321…

```
# Fill missing values in categorical columns using mode
df['Gender'] = df['Gender'].fillna(df['Gender'].mode()[0])
df['Married'] = df['Married'].fillna(df['Married'].mode()[0])
df['Self_Employed'] = df['Self_Employed'].fillna(df['Self_Employed'].mode()[0])
df['Dependents'] = df['Dependents'].fillna(df['Dependents'].mode()[0])

# Fill missing values in numerical columns using mean
df['LoanAmount'] = df['LoanAmount'].fillna(df['LoanAmount'].mean())
df['loanAmount_log'] = df['loanAmount_log'].fillna(df['loanAmount_log'].mean())

# Fill missing values in other columns using mode
df['Loan_Amount_Term'] = df['Loan_Amount_Term'].fillna(df['Loan_Amount_Term'].mc
df['Credit_History'] = df['Credit_History'].fillna(df['Credit_History'].mode()[0

# Check for remaining missing values
missing_values = df.isnull().sum()
print(missing_values)
```

```
Loan_ID              0
Gender               0
Married              0
Dependents           0
Education            0
Self_Employed        0
ApplicantIncome      0
CoapplicantIncome    0
LoanAmount           0
Loan_Amount_Term     0
Credit_History       0
Property_Area        0
Loan_Status          0
loanAmount_log       0
TotalIncome          0
TotalIncome_log      0
dtype: int64
```

In [323…

```
x = df.iloc[:,np.r_[1:5,9:11,13:15]].values
y = df.iloc[:,12].values


x
```

Out[323…

```
array([['Male', 'No', '0', ..., 1.0, 4.857444178729352, 5849.0],
       ['Male', 'Yes', '1', ..., 1.0, 4.852030263919617, 6091.0],
       ['Male', 'Yes', '0', ..., 1.0, 4.189654742026425, 3000.0],
       ...,
       ['Male', 'Yes', '1', ..., 1.0, 5.53338948872752, 8312.0],
       ['Male', 'Yes', '2', ..., 1.0, 5.231108616854587, 7583.0],
       ['Female', 'No', '0', ..., 0.0, 4.890349128221754, 4583.0]],
      dtype=object)
```

In [325…

```
y
```

Out[325…

```
array(['Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'Y', 'Y', 'Y',
       'N', 'Y', 'Y', 'Y', 'N', 'N', 'Y', 'N', 'Y', 'N', 'N', 'N', 'Y',
       'Y', 'Y', 'N', 'Y', 'N', 'N', 'N', 'Y', 'N', 'Y', 'N', 'Y', 'Y',
       'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y',
       'N', 'N', 'N', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'N', 'N',
       'N', 'N', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'N', 'N',
       'N', 'Y', 'Y', 'Y', 'N', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y',
       'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y',
       'Y', 'Y', 'Y', 'N', 'N', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y',
       'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'N',
       'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'N', 'Y', 'N', 'N', 'N', 'Y', 'Y',
       'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'Y', 'N', 'N', 'Y', 'Y',
       'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'N', 'Y', 'Y', 'Y', 'N', 'Y', 'N',
       'Y', 'Y', 'Y', 'N', 'Y', 'N', 'Y', 'Y', 'N', 'Y', 'N', 'N', 'N',
       'Y', 'N', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'N', 'Y', 'Y',
       'N', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y',
       'Y', 'N', 'N', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'Y', 'N',
       'Y', 'Y', 'Y', 'Y', 'N', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y',
       'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'N', 'Y',
       'Y', 'Y', 'Y', 'N', 'N', 'Y', 'Y', 'N', 'Y', 'N', 'N', 'N', 'N',
       'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y',
       'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'N', 'Y',
       'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'N',
       'N', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'N', 'Y', 'Y', 'Y',
       'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y',
       'N', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y',
       'N', 'Y', 'N', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y',
       'N', 'Y', 'N', 'Y', 'Y', 'Y', 'N', 'N', 'Y', 'N', 'Y', 'Y', 'Y',
       'Y', 'N', 'N', 'N', 'Y', 'N', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y',
       'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'N', 'Y', 'Y',
       'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'N', 'N', 'N', 'Y',
       'Y', 'N', 'Y', 'Y', 'Y', 'N', 'N', 'N', 'Y', 'N', 'Y', 'N', 'Y',
       'N', 'N', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'Y', 'Y', 'N', 'Y', 'Y',
       'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y',
       'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'N', 'N', 'N', 'Y', 'N', 'Y', 'Y',
       'Y', 'Y', 'N', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'Y',
       'Y', 'N', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'Y',
       'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'N', 'Y', 'N', 'Y', 'Y', 'Y', 'Y',
       'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y',
       'N', 'Y', 'Y', 'N', 'Y', 'Y', 'N', 'N', 'Y', 'Y', 'N', 'N', 'N',
       'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'Y', 'N',
       'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y',
       'N', 'Y', 'N', 'Y', 'N', 'Y', 'Y', 'N', 'N', 'Y', 'Y', 'Y', 'Y',
       'Y', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'N', 'N', 'N', 'Y', 'N',
       'Y', 'N', 'N', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'N',
       'N', 'Y', 'Y', 'Y', 'N', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'N',
       'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'N', 'Y', 'Y', 'Y', 'Y', 'Y',
       'Y', 'Y', 'N'], dtype=object)
```

In [327…

```
print('per of missing Gender is %2f%%' %((df['Gender'].isnull().sum()/df.shape[0
```

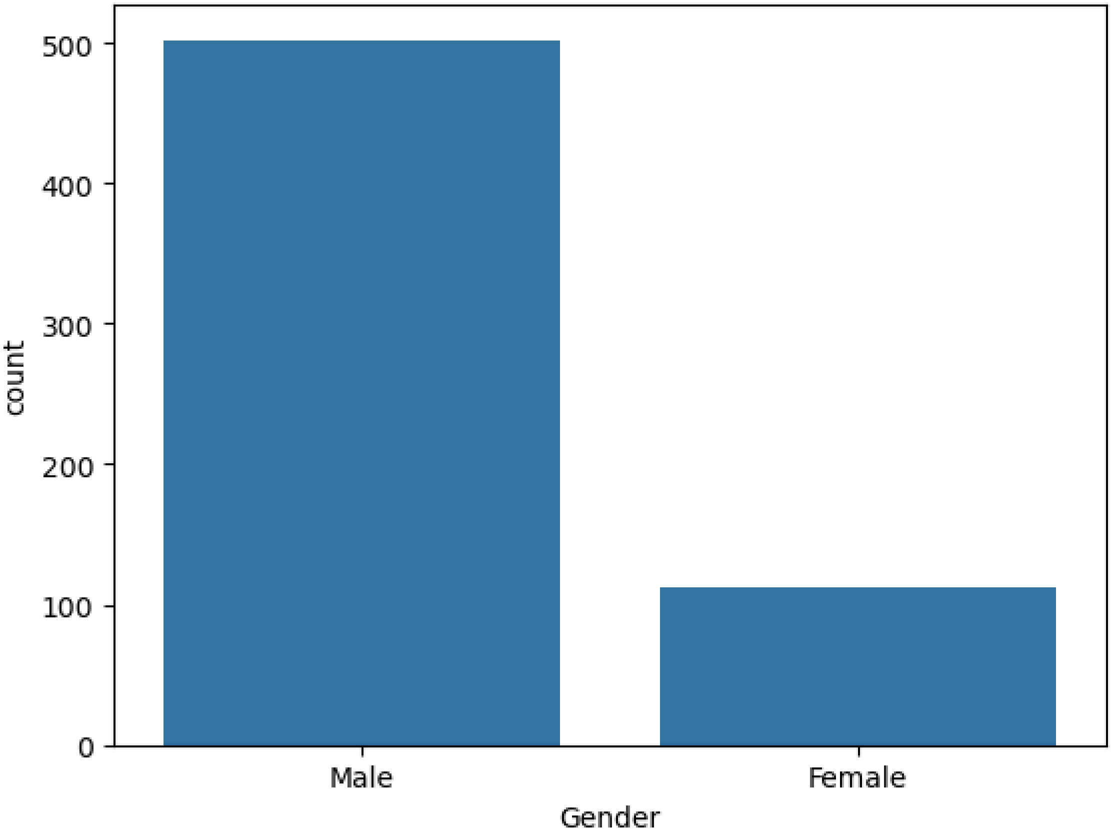
```
per of missing Gender is 0.000000%
```

In [329…

```
# Print the count of people who take loans grouped by gender
print('Number of people who take loans grouped by gender:')
print(df['Gender'].value_counts())

# Create a count plot for Gender
sns.countplot(x='Gender', data = df )
plt.show()
```

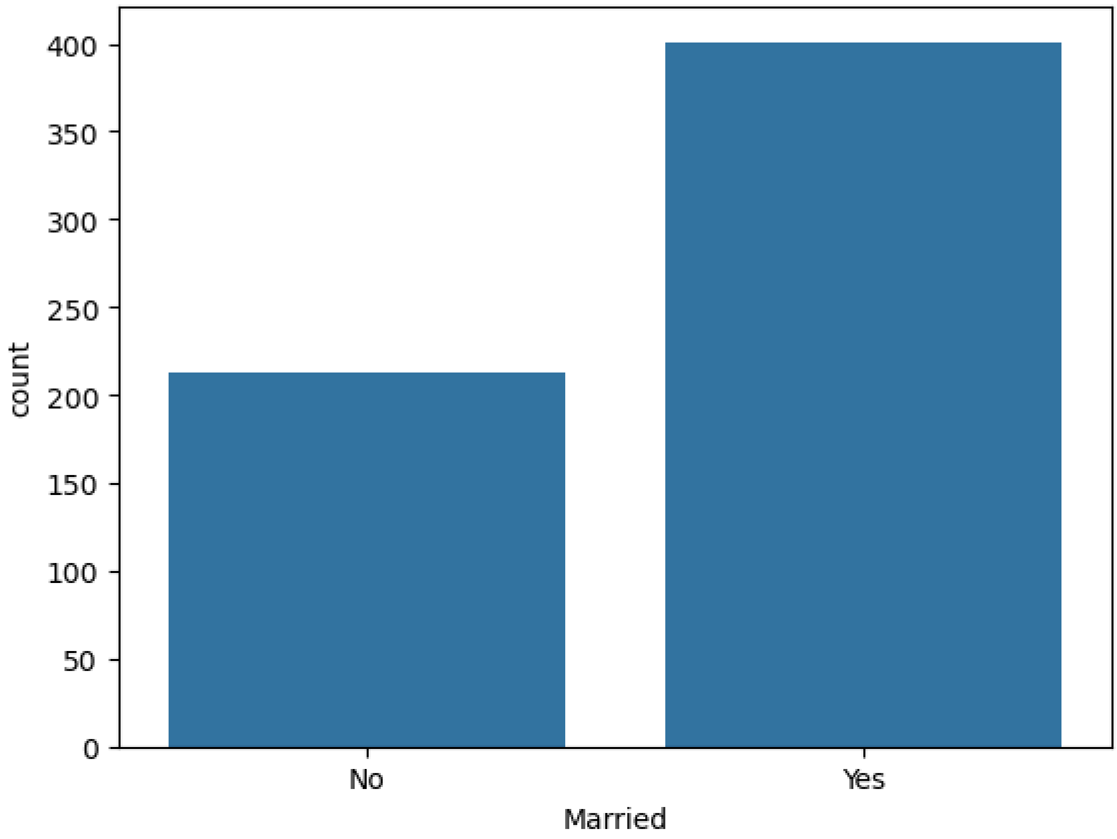
```
Number of people who take loans grouped by gender:
Gender
Male      502
Female    112
Name: count, dtype: int64
```



In [331…

```
print('Number of people who take loans grouped by Marital Status:')
print(df['Married'].value_counts())
sns.countplot(x='Married', data = df )
plt.show()
```

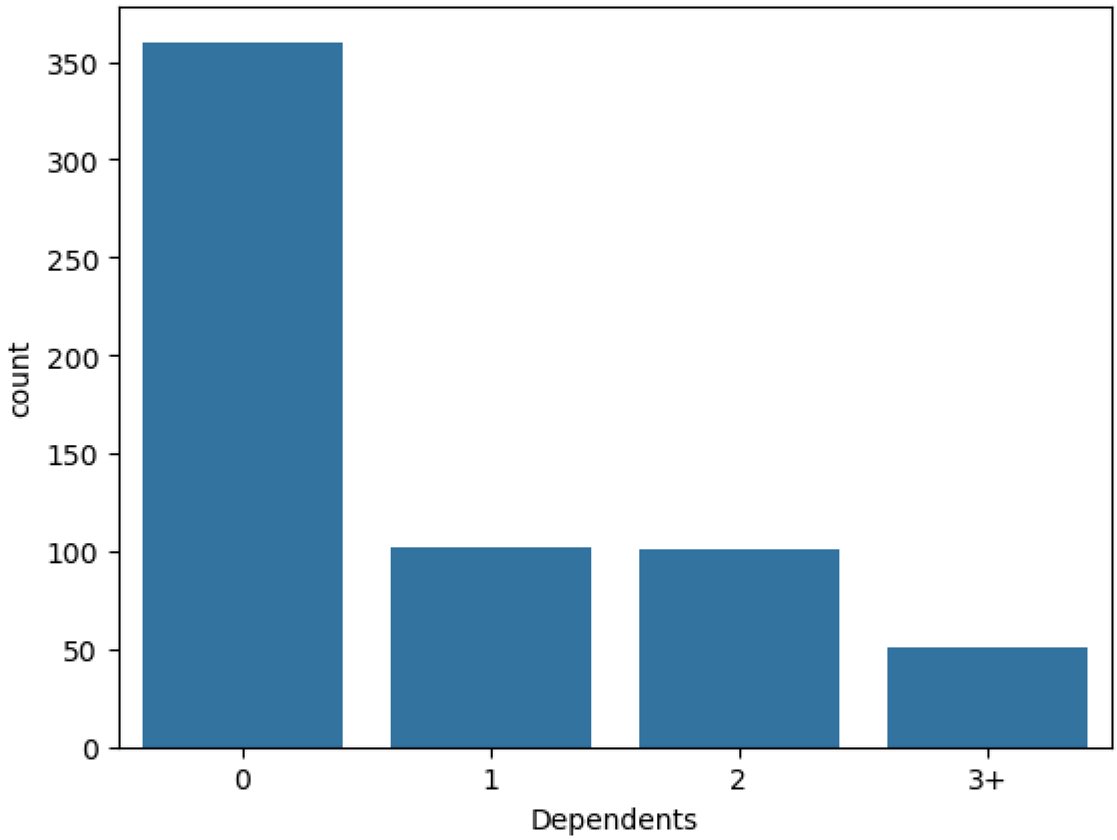
```
Number of people who take loans grouped by Marital Status:
Married
Yes    401
No     213
Name: count, dtype: int64
```



In [333…

```
print('Number of people who take loans grouped by Dependents')
print(df['Dependents'].value_counts())
sns.countplot(x='Dependents', data = df )
plt.show()
```

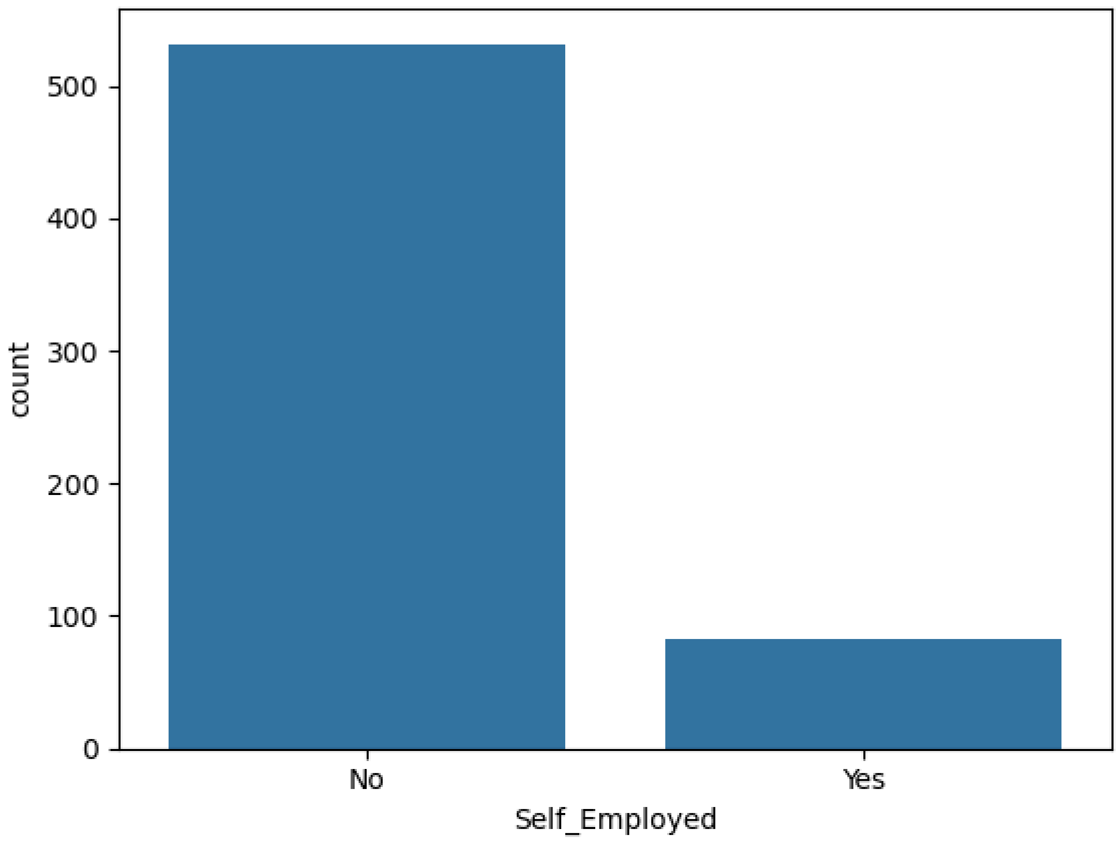
```
Number of people who take loans grouped by Dependents
Dependents
0     360
1     102
2     101
3+     51
Name: count, dtype: int64
```



In [335…

```
print('Number of people who take loans grouped by Self Employment')
print(df['Self_Employed'].value_counts())
sns.countplot(x='Self_Employed', data = df )
plt.show()
```

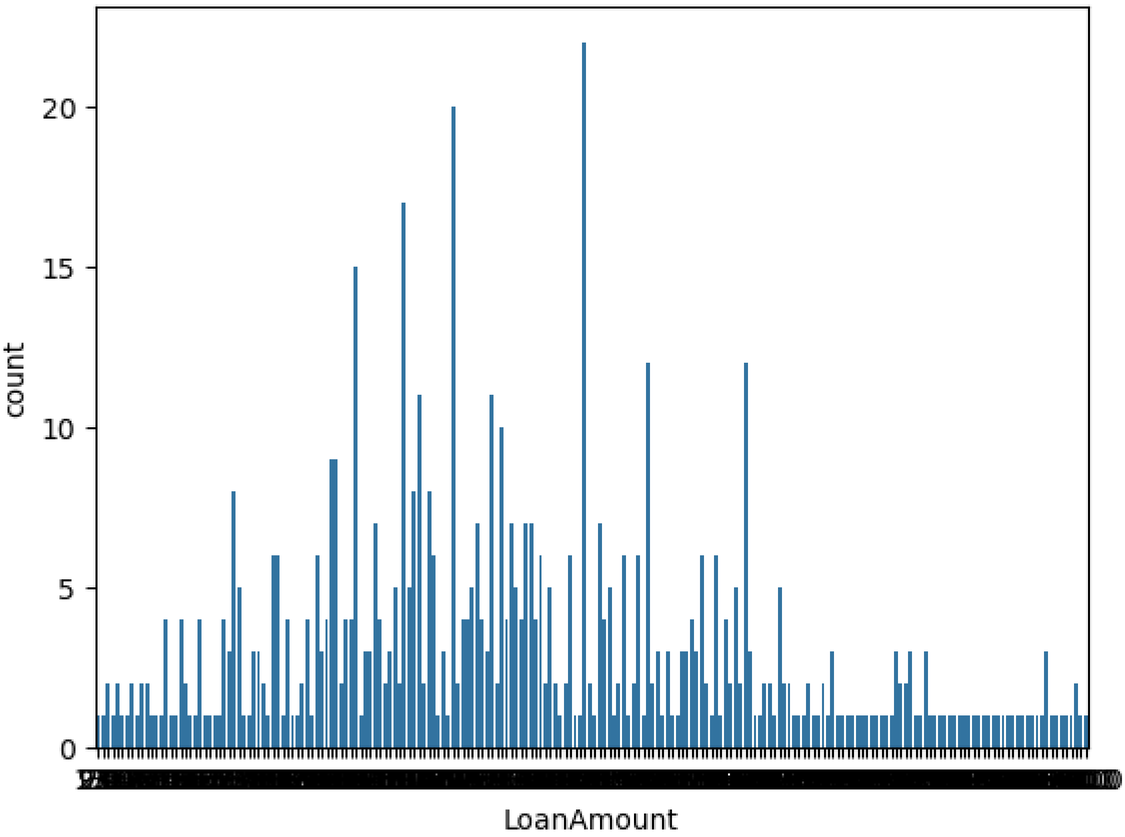
```
Number of people who take loans grouped by Self Employment
Self_Employed
No     532
Yes     82
Name: count, dtype: int64
```



In [337…

```python
print('Number of people who take loans grouped by Loan Amount')
print(df['LoanAmount'].value_counts())
sns.countplot(x='LoanAmount', data = df )
plt.show()
```

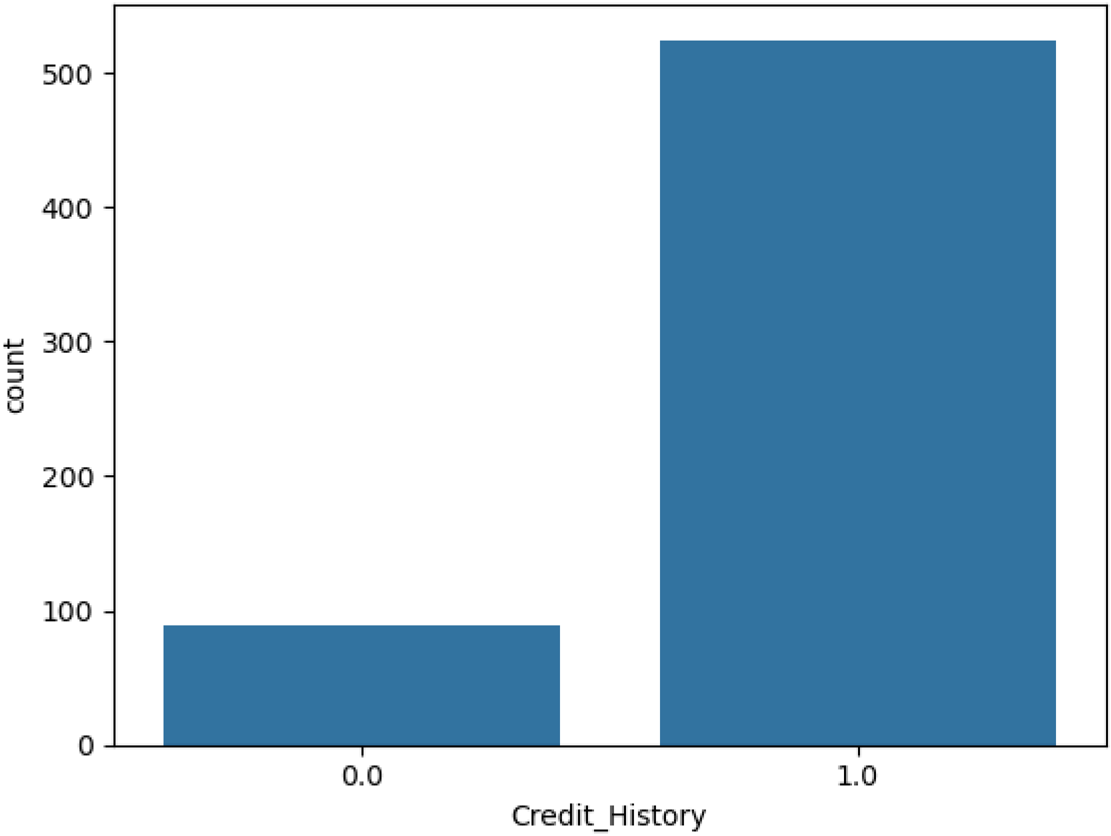
```
Number of people who take loans grouped by Loan Amount
LoanAmount
146.412162    22
120.000000    20
110.000000    17
100.000000    15
160.000000    12
              ..
240.000000     1
214.000000     1
59.000000      1
166.000000     1
253.000000     1
Name: count, Length: 204, dtype: int64
```



In [338…

```
print('Number of people who take loans grouped by Credit History')
print(df['Credit_History'].value_counts())
sns.countplot(x='Credit_History', data = df )
plt.show()
```

```
Number of people who take loans grouped by Credit History
Credit_History
1.0    525
0.0     89
Name: count, dtype: int64
```



In [339…

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split (x, y, test_size = 0.2, rand

from sklearn.preprocessing import LabelEncoder
Labelencoder_x = LabelEncoder()
```

In [341…

```
for i in range(0,5):
    X_train[:,i]=Labelencoder_x.fit_transform(X_train[:,i])
    X_train[:,7]= Labelencoder_x.fit_transform(X_train[:,7])

X_train
```

Out[341…

```
array([[1, 1, 0, ..., 1.0, 4.875197323201151, 267],
       [1, 0, 1, ..., 1.0, 5.278114659230517, 407],
       [1, 1, 0, ..., 0.0, 5.003946305945459, 249],
       ...,
       [1, 1, 3, ..., 1.0, 5.298317366548036, 363],
       [1, 1, 0, ..., 1.0, 5.075173815233827, 273],
       [0, 1, 0, ..., 1.0, 5.204006687076795, 301]], dtype=object)
```

In [345…

```
Labelencoder_y = LabelEncoder()
y_train= Labelencoder_y.fit_transform(y_train)

y_train
```

Out[345…

```
array([1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1,
       0, 1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1,
       1, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 0,
       1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1,
       1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 1, 1, 0, 0, 0,
       1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 1, 1, 1, 1, 0, 0, 0, 0, 1, 1,
       0, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0,
       0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1,
       0, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 1, 1,
       0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 0, 1, 0, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 0, 0, 1, 0, 1, 1, 1, 0, 1, 1, 0, 1, 0, 1, 0, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 0, 1, 1,
       1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 1, 1,
       1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1,
       1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0,
       1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1,
       1, 0, 1, 0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1,
       1, 1, 0, 1, 0, 1, 0, 1, 1, 0, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0,
       1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1,
       1, 1, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 1,
       1, 1, 1, 0, 1, 0, 1])
```

In [347…

```
for i in range(0,5):
    X_test[:,i]= Labelencoder_x.fit_transform(X_test[:,i])
    X_test[:,7] = Labelencoder_x.fit_transform(X_test[:,7])

X_test
```

```
Out[347…  array([[1, 0, 0, 0, 5, 1.0, 4.430816798843313, 85],
                 [0, 0, 0, 0, 5, 1.0, 4.718498871295094, 28],
                 [1, 1, 0, 0, 5, 1.0, 5.780743515792329, 104],
                 [1, 1, 0, 0, 5, 1.0, 4.700480365792417, 80],
                 [1, 1, 2, 0, 5, 1.0, 4.574710978503383, 22],
                 [1, 1, 0, 1, 3, 0.0, 5.10594547390058, 70],
                 [1, 1, 3, 0, 3, 1.0, 5.056245805348308, 77],
                 [1, 0, 0, 0, 5, 1.0, 6.003887067106539, 114],
                 [1, 0, 0, 0, 5, 0.0, 4.820281565605037, 53],
                 [1, 1, 0, 0, 5, 1.0, 4.852030263919617, 55],
                 [0, 0, 0, 0, 5, 1.0, 4.430816798843313, 4],
                 [1, 1, 1, 0, 5, 1.0, 4.553876891600541, 2],
                 [0, 0, 0, 0, 5, 1.0, 5.634789603169249, 96],
                 [1, 1, 2, 0, 5, 1.0, 5.4638318050256105, 97],
                 [1, 1, 0, 0, 5, 1.0, 4.564348191467836, 117],
                 [1, 1, 1, 0, 5, 1.0, 4.204692619390966, 22],
                 [1, 0, 1, 1, 5, 1.0, 5.247024072160486, 32],
                 [1, 0, 0, 1, 5, 1.0, 4.882801922586371, 25],
                 [0, 0, 0, 0, 5, 1.0, 4.532599493153256, 1],
                 [1, 1, 0, 1, 5, 0.0, 5.198497031265826, 44],
                 [0, 1, 0, 0, 5, 0.0, 4.787491742782046, 71],
                 [1, 1, 0, 0, 5, 1.0, 4.962844630259907, 43],
                 [1, 1, 2, 0, 5, 1.0, 4.68213122712422, 91],
                 [1, 1, 2, 0, 5, 1.0, 5.10594547390058, 111],
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                 [1, 1, 0, 0, 5, 1.0, 4.852030263919617, 75],
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                 [0, 0, 0, 0, 5, 1.0, 5.267858159063328, 89],
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                 [1, 1, 0, 0, 0, 1.0, 4.709530201312334, 90],
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                 [1, 0, 1, 0, 3, 1.0, 4.727387818712341, 17],
                 [1, 1, 1, 0, 5, 1.0, 4.6443908991413725, 36],
                 [0, 1, 0, 1, 5, 1.0, 4.605170185988092, 16],
                 [1, 0, 0, 0, 5, 1.0, 4.30406509320417, 7],
                 [1, 1, 1, 0, 1, 1.0, 5.147494476813453, 88],
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                 [0, 0, 0, 0, 5, 1.0, 4.2626798770413155, 3],
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                 [1, 1, 0, 0, 5, 1.0, 4.605170185988092, 15],
                 [1, 1, 2, 0, 5, 1.0, 4.787491742782046, 106],
                 [1, 0, 0, 0, 3, 1.0, 4.787491742782046, 105],
                 [1, 1, 3, 0, 5, 1.0, 4.852030263919617, 64],
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                 [1, 1, 3, 1, 3, 1.0, 4.394449154672439, 14],
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                 [1, 0, 0, 0, 6, 1.0, 4.727387818712341, 18],
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                 [1, 1, 3, 0, 5, 1.0, 4.867534450455582, 115],
                 [1, 1, 0, 0, 5, 1.0, 6.077642243349034, 116],
                 [1, 1, 3, 1, 3, 0.0, 4.248495242049359, 40],
                 [1, 1, 1, 0, 5, 1.0, 4.564348191467836, 12]], dtype=object)
```

In [349…

```
Labelencoder_y = LabelEncoder()

y_test= Labelencoder_y.fit_transform(y_test)

y_test
```

Out[349…

```
array([1, 0, 1, 0, 1, 0, 1, 1, 0, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 0, 1,
       1, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 1, 1,
       1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 1,
       1, 1, 1, 0, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0,
       1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 1])
```

In [351…

```
from sklearn.preprocessing import StandardScaler

ss = StandardScaler()
X_train = ss.fit_transform(X_train)
x_train = ss.fit_transform(X_test)
```

In [353…

```
from sklearn.ensemble import RandomForestClassifier

rf_clf = RandomForestClassifier()
rf_clf.fit(X_train, y_train)
```

Out[353…

▾ RandomForestClassifier ⓘ ?

RandomForestClassifier()

In [355…

```
from sklearn import metrics
y_pred = rf_clf.predict(X_test)

print ('acc of random forest clf is', metrics.accuracy_score(y_pred, y_test))

y_pred
```

```
acc of random forest clf is 0.7154471544715447
```

Out[355…

```
array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1])
```

In [357…

```
from sklearn.naive_bayes import GaussianNB
nb_clf = GaussianNB()
nb_clf.fit(X_train, y_train)
```

Out[357…

▾ GaussianNB ⓘ ?

GaussianNB()

In [363…

```
y_pred = nb_clf.predict(X_test)
print ('Acc of gaussianNB is %',metrics.accuracy_score(y_pred, y_test) )
```

```
Acc of gaussianNB is % 0.2764227642276423
```

In [365…

```python
y_pred
```

Out[365…

```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
```

In [369…

```python
from sklearn.tree import DecisionTreeClassifier
dt_clf = DecisionTreeClassifier()
dt_clf.fit(X_train, y_train)
```

Out[369…

```
▾ DecisionTreeClassifier

DecisionTreeClassifier()
```

In [371…

```python
y_pred = dt_clf.predict(X_test)
print('acc of DT is',metrics.accuracy_score(y_pred, y_test))
```

```
acc of DT is 0.7154471544715447
```

In [373…

```python
y_pred
```

Out[373…

```
array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1])
```

In [384…

```python
from sklearn.neighbors import KNeighborsClassifier
kn_clf = KNeighborsClassifier()
kn_clf.fit(X_train, y_train)
```

Out[384…

```
▾ KNeighborsClassifier

KNeighborsClassifier()
```

In [386…

```python
y_pred= kn_clf.predict(X_test)
print('acc of KN is', metrics.accuracy_score(y_pred, y_test))
```

```
acc of KN is 0.5528455284552846
```

In [ ]: