Loan_Status_Prediction

August 17, 2025

1 Importing the Dependencies

[45]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn import svm
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix, classification_report
```

2 Data Collection and Processing

[2]:
```
# loading the dataset to pandas DataFrame
loan_dataset = pd.read_csv('/content/dataset.csv')
```

[3]:
```
type(loan_dataset)
```

[3]:
```
pandas.core.frame.DataFrame
```

[4]:
```
# printing the first 5 rows of the dataframe
loan_dataset.head()
```

[4]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	\
0	LP001002	Male	No	0	Graduate	No	
1	LP001003	Male	Yes	1	Graduate	No	
2	LP001005	Male	Yes	0	Graduate	Yes	
3	LP001006	Male	Yes	0	Not Graduate	No	
4	LP001008	Male	No	0	Graduate	No	

	ApplicantIncome	CoapplicantIncome	LoanAmount	Loan_Amount_Term	\
0	5849	0.0	NaN	360.0	
1	4583	1508.0	128.0	360.0	
2	3000	0.0	66.0	360.0	
3	2583	2358.0	120.0	360.0	
4	6000	0.0	141.0	360.0	

```
   Credit_History Property_Area Loan_Status
0             1.0         Urban           Y
1             1.0         Rural           N
2             1.0         Urban           Y
3             1.0         Urban           Y
4             1.0         Urban           Y
```

[5]:
```
# number of rows and columns
loan_dataset.shape
```

[5]:
```
(614, 13)
```

[6]:
```
# statistical measures
loan_dataset.describe()
```

[6]:
```
       ApplicantIncome  CoapplicantIncome  LoanAmount  Loan_Amount_Term  \
count       614.000000         614.000000  592.000000         600.00000
mean       5403.459283        1621.245798  146.412162         342.00000
std        6109.041673        2926.248369   85.587325          65.12041
min         150.000000           0.000000    9.000000          12.00000
25%        2877.500000           0.000000  100.000000         360.00000
50%        3812.500000        1188.500000  128.000000         360.00000
75%        5795.000000        2297.250000  168.000000         360.00000
max       81000.000000       41667.000000  700.000000         480.00000

       Credit_History
count      564.000000
mean         0.842199
std          0.364878
min          0.000000
25%          1.000000
50%          1.000000
75%          1.000000
max          1.000000
```

[7]:
```
# number of missing values in each column
loan_dataset.isnull().sum()
```

[7]:
```
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
```

[8]:
```
# dropping the missing values
loan_dataset = loan_dataset.dropna()
```

[9]:
```
# number of missing values in each column
loan_dataset.isnull().sum()
```

[9]:
```
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
dtype: int64
```

[10]:
```
# label encoding
loan_dataset.replace({"Loan_Status":{'N':0,'Y':1}},inplace=True)
```

```
/tmp/ipython-input-474101102.py:2: FutureWarning: Downcasting behavior in
`replace` is deprecated and will be removed in a future version. To retain the
old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to
the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`
  loan_dataset.replace({"Loan_Status":{'N':0,'Y':1}},inplace=True)
```

[11]:
```
# printing the first 5 rows of the dataframe
loan_dataset.head()
```

[11]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	\
1	LP001003	Male	Yes	1	Graduate	No	
2	LP001005	Male	Yes	0	Graduate	Yes	
3	LP001006	Male	Yes	0	Not Graduate	No	
4	LP001008	Male	No	0	Graduate	No	
5	LP001011	Male	Yes	2	Graduate	Yes	

```
   ApplicantIncome  CoapplicantIncome  LoanAmount  Loan_Amount_Term  \
1             4583             1508.0       128.0             360.0
2             3000                0.0        66.0             360.0
3             2583             2358.0       120.0             360.0
4             6000                0.0       141.0             360.0
5             5417             4196.0       267.0             360.0

   Credit_History Property_Area  Loan_Status
1             1.0         Rural            0
2             1.0         Urban            1
3             1.0         Urban            1
4             1.0         Urban            1
5             1.0         Urban            1
```

[12]:
```
# Dependent column values
loan_dataset['Dependents'].value_counts()
```

[12]:
```
Dependents
0     274
2      85
1      80
3+     41
Name: count, dtype: int64
```

[13]:
```
# replacing the value of 3+ to 4
loan_dataset = loan_dataset.replace(to_replace='3+', value=4)
```

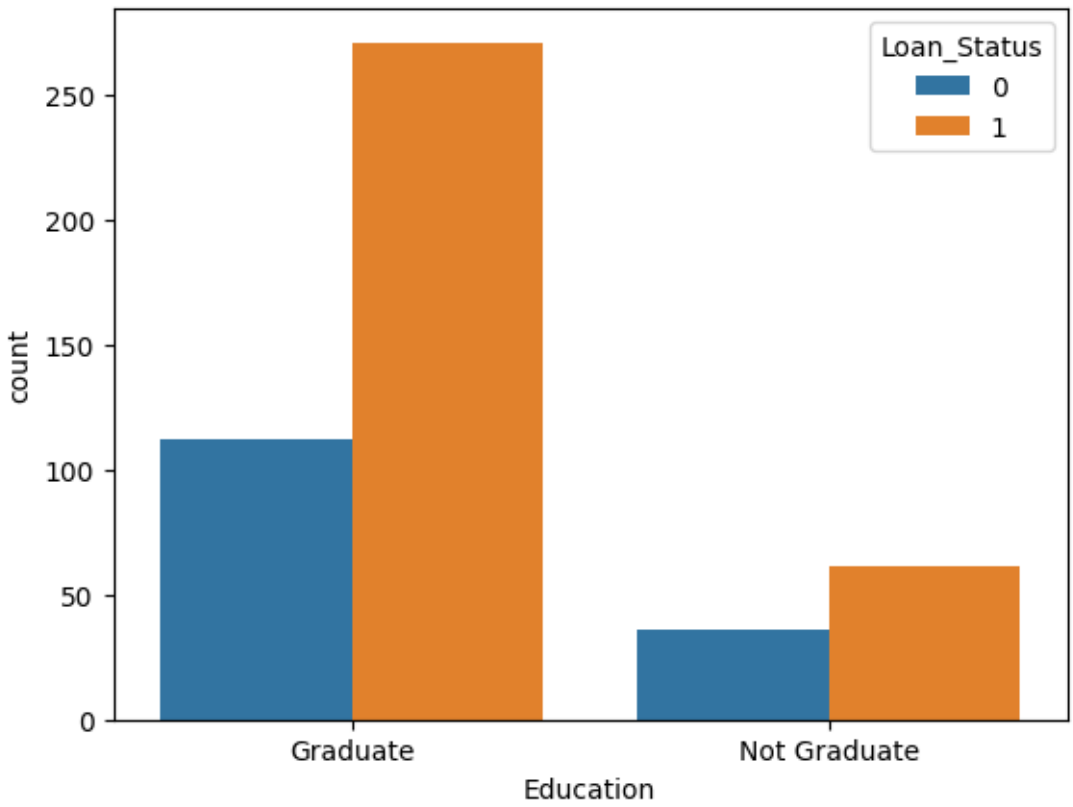
[14]:
```
# Dependent column values
loan_dataset['Dependents'].value_counts()
```

[14]:
```
Dependents
0    274
2     85
1     80
4     41
Name: count, dtype: int64
```

3 Data Visualiztion

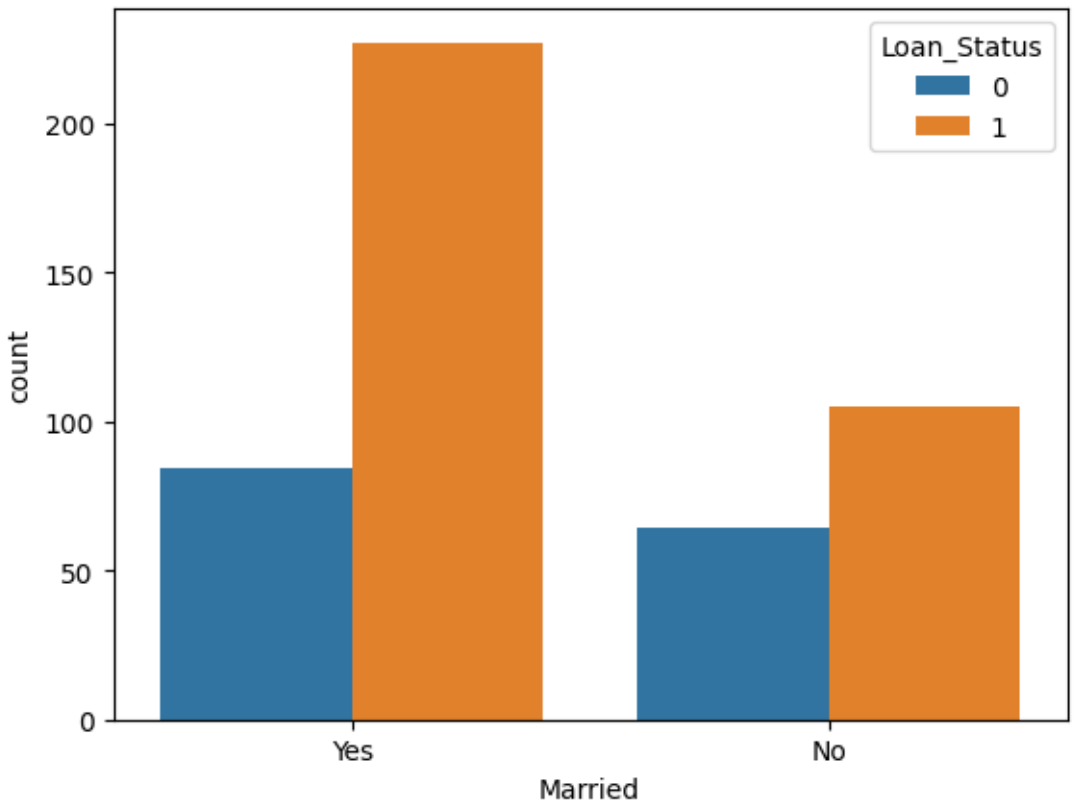
[15]:
```
# education and loan status
sns.countplot(x='Education',hue='Loan_Status',data=loan_dataset)
```

[15]:
```
<Axes: xlabel='Education', ylabel='count'>
```



[16]:
```
# marital status and loan status
sns.countplot(x='Married',hue='Loan_Status',data=loan_dataset)
```

[16]: <Axes: xlabel='Married', ylabel='count'>



[24]:
```
# convert categorical columns to numerical values
loan_dataset.replace({'Married':{'No':0,'Yes':1},'Gender':{'Male':1,'Female':
↪0},'Self_Employed':{'No':0,'Yes':1},
                      'Property_Area':{'Rural':0,'Semiurban':1, 'Urban':2},␣
↪'Education':{'Graduate':1, 'Not Graduate':0}}, inplace=True)
```

```
/tmp/ipython-input-1446719479.py:2: FutureWarning: Downcasting behavior in
`replace` is deprecated and will be removed in a future version. To retain the
old behavior, explicitly call `result.infer_objects(copy=False)`. To opt-in to
the future behavior, set `pd.set_option('future.no_silent_downcasting', True)`
  loan_dataset.replace({'Married':{'No':0,'Yes':1},'Gender':{'Male':1,'Female':0
},'Self_Employed':{'No':0,'Yes':1},
```

[25]:
```
loan_dataset.head()
```

[25]:

	Loan_ID	Gender	Married	Dependents	Education	Self_Employed	\
1	LP001003	1	1	1	1	0	
2	LP001005	1	1	0	1	1	
3	LP001006	1	1	0	0	0	
4	LP001008	1	0	0	1	0	
5	LP001011	1	1	2	1	1	

```
   ApplicantIncome  CoapplicantIncome  LoanAmount  Loan_Amount_Term  \
1             4583             1508.0       128.0             360.0
2             3000                0.0        66.0             360.0
3             2583             2358.0       120.0             360.0
4             6000                0.0       141.0             360.0
5             5417             4196.0       267.0             360.0

   Credit_History  Property_Area  Loan_Status
1             1.0              0            0
2             1.0              2            1
3             1.0              2            1
4             1.0              2            1
5             1.0              2            1
```

[27]:
```
# separating the data and lable
X = loan_dataset.drop(columns=['Loan_ID', 'Loan_Status'],axis=1)
Y = loan_dataset['Loan_Status']
```

[28]:
```
print(X)
print(Y)
```

```
     Gender  Married Dependents  Education  Self_Employed  ApplicantIncome  \
1         1        1          1          1              0             4583
2         1        1          0          1              1             3000
3         1        1          0          0              0             2583
4         1        0          0          1              0             6000
5         1        1          2          1              1             5417
..      ...      ...        ...        ...            ...              ...
609       0        0          0          1              0             2900
610       1        1          4          1              0             4106
611       1        1          1          1              0             8072
612       1        1          2          1              0             7583
613       0        0          0          1              1             4583

     CoapplicantIncome  LoanAmount  Loan_Amount_Term  Credit_History  \
1               1508.0       128.0             360.0             1.0
2                  0.0        66.0             360.0             1.0
3               2358.0       120.0             360.0             1.0
4                  0.0       141.0             360.0             1.0
5               4196.0       267.0             360.0             1.0
..                 ...         ...               ...             ...
609                0.0        71.0             360.0             1.0
610                0.0        40.0             180.0             1.0
611              240.0       253.0             360.0             1.0
612                0.0       187.0             360.0             1.0
613                0.0       133.0             360.0             0.0
```

```
     Property_Area
1                0
2                2
3                2
4                2
5                2
..             ...
609              0
610              0
611              2
612              2
613              1

[480 rows x 11 columns]
1      0
2      1
3      1
4      1
5      1
      ..
609    1
610    1
611    1
612    1
613    0
Name: Loan_Status, Length: 480, dtype: int64
```

4 Train Test Split

[29]:
```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.1,␣
↪stratify=Y, random_state=2)
```

[30]:
```
print(X.shape, X_train.shape, X_test.shape)
```

```
(480, 11) (432, 11) (48, 11)
```

5 Training the model: Support Vector Machine (SVM)

[31]:
```
classifier = svm.SVC(kernel='linear')
```

[32]:
```
# training the support vector machine model
classifier.fit(X_train, Y_train)
```

[32]:
```
SVC(kernel='linear')
```

6 Model Evaluation

[33]:
```
# accuracy score on training data
X_train_prediction = classifier.predict(X_train)
training_data_accuracy = accuracy_score(X_train_prediction, Y_train)
```

[34]:
```
print('Accuracy score of the training data : ', training_data_accuracy)
```

```
Accuracy score of the training data :  0.7986111111111112
```

[35]:
```
# accuracy score on tes data
X_test_prediction = classifier.predict(X_test)
test_data_accuracy = accuracy_score(X_test_prediction, Y_test)
```

[37]:
```
print('Accuracy score of the test data : ', test_data_accuracy)
```

```
Accuracy score of the test data :  0.8333333333333334
```

7 Making Prediction

[40]:
```
y_pred = classifier.predict(X_test)
print(y_pred[:10])   # first 10 predictions
```

```
[1 1 1 1 1 1 1 1 1 1]
```

[53]:
```
# Example: first row of test set
single_pred = classifier.predict(X_test.iloc[[0]])[0]
print("Prediction:", "Approved" if single_pred==1 else "Not Approved")
```

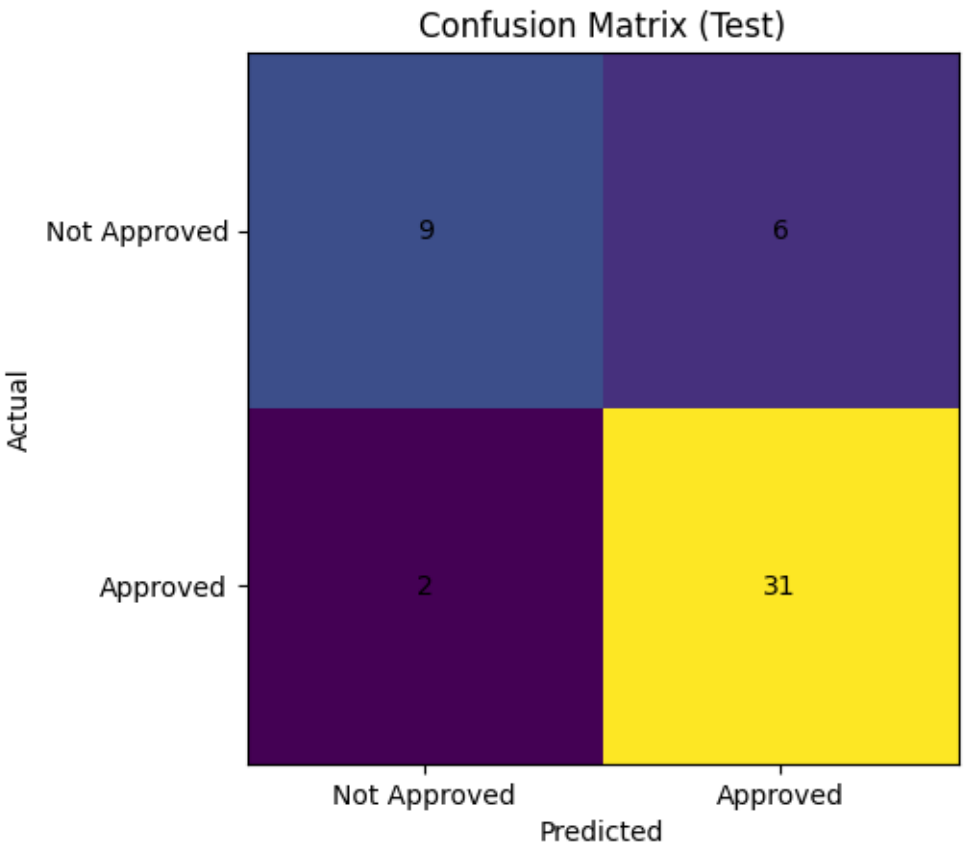
```
Prediction: Approved
```

8 Confusion Matrix + Classification Report (+ nice plot)

[47]:
```
aitcm = confusion_matrix(Y_test, X_test_prediction)
print("Classification report:\n",
      classification_report(Y_test, X_test_prediction, digits=3))

# Simple confusion-matrix heatmap
fig, ax = plt.subplots()
im = ax.imshow(cm)
ax.set_title("Confusion Matrix (Test)")
ax.set_xlabel("Predicted")
ax.set_ylabel("Actual")
ax.set_xticks([0,1]); ax.set_yticks([0,1])
ax.set_xticklabels(["Not Approved","Approved"])
ax.set_yticklabels(["Not Approved","Approved"])
```

```
# label each cell
for i in range(cm.shape[0]):
    for j in range(cm.shape[1]):
        ax.text(j, i, cm[i, j], ha="center", va="center")
plt.show()
```

```
Classification report:
              precision    recall  f1-score   support

           0      0.818     0.600     0.692        15
           1      0.838     0.939     0.886        33

    accuracy                          0.833        48
   macro avg      0.828     0.770     0.789        48
weighted avg      0.832     0.833     0.825        48
```



[49]:
```
# Predicton for New applicant
import pandas as pd
```

```
new_applicant = {
    "Gender":1,
    "Married":1,
    "Dependents":0,
    "Education":1,
    "Self_Employed":0,
    "ApplicantIncome":4000,
    "CoapplicantIncome":1500,
    "LoanAmount":120,
    "Loan_Amount_Term":360,
    "Credit_History":1,
    "Property_Area":2
}

new_df = pd.DataFrame([new_applicant])
new_df = new_df.reindex(columns=X_train.columns, fill_value=0)  # keep column␣
 ↪order same

pred = classifier.predict(new_df)[0]
print("New applicant loan status:", "Approved" if pred==1 else "Not Approved")
```

```
New applicant loan status: Approved
```

[51]:
```
print("Model features:", list(X_train.columns))
```

```
Model features: ['Gender', 'Married', 'Dependents', 'Education',
'Self_Employed', 'ApplicantIncome', 'CoapplicantIncome', 'LoanAmount',
'Loan_Amount_Term', 'Credit_History', 'Property_Area']
```