5y8eg3n2i

January 4, 2025

[1]:
```
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, confusion_matrix,␣
 ↪classification_report, roc_auc_score, roc_curve
import matplotlib.pyplot as plt
```

[3]:
```
df = pd.read_csv('loan_detection.csv')
```

[5]:
```
df
```

[5]:

	age	campaign	pdays	previous	no_previous_contact	not_working	\
0	56	1	999	0	1	0	
1	57	1	999	0	1	0	
2	37	1	999	0	1	0	
3	40	1	999	0	1	0	
4	56	1	999	0	1	0	
…	…	…	…	…	…	…	
41183	73	1	999	0	1	1	
41184	46	1	999	0	1	0	
41185	56	2	999	0	1	1	
41186	44	1	999	0	1	0	
41187	74	3	999	1	1	1	

	job_admin.	job_blue-collar	job_entrepreneur	job_housemaid	…	\
0	0	0	0	1	…	
1	0	0	0	0	…	
2	0	0	0	0	…	
3	1	0	0	0	…	
4	0	0	0	0	…	
…	…	…	…	…	…	
41183	0	0	0	0	…	
41184	0	1	0	0	…	
41185	0	0	0	0	…	
41186	0	0	0	0	…	

```
41187           0                0                 0              0  …

       month_sep  day_of_week_fri  day_of_week_mon  day_of_week_thu  \
0              0                0                1                0
1              0                0                1                0
2              0                0                1                0
3              0                0                1                0
4              0                0                1                0
…            …                …                …                …
41183          0                1                0                0
41184          0                1                0                0
41185          0                1                0                0
41186          0                1                0                0
41187          0                1                0                0

       day_of_week_tue  day_of_week_wed  poutcome_failure  \
0                    0                0                 0
1                    0                0                 0
2                    0                0                 0
3                    0                0                 0
4                    0                0                 0
…                  …                …                 …
41183                0                0                 0
41184                0                0                 0
41185                0                0                 0
41186                0                0                 0
41187                0                0                 1

       poutcome_nonexistent  poutcome_success  Loan_Status_label
0                         1                 0                  0
1                         1                 0                  0
2                         1                 0                  0
3                         1                 0                  0
4                         1                 0                  0
…                       …                 …                  …
41183                     1                 0                  1
41184                     1                 0                  0
41185                     1                 0                  0
41186                     1                 0                  1
41187                     0                 0                  0

[41188 rows x 60 columns]
```

[7]:
```
df.head
```

[7]:
```
<bound method NDFrame.head of        age  campaign  pdays  previous
no_previous_contact  not_working  \
```

```
0       56          1    999         0                    1            0
1       57          1    999         0                    1            0
2       37          1    999         0                    1            0
3       40          1    999         0                    1            0
4       56          1    999         0                    1            0
…    …       …    …       …                  …           …
41183   73          1    999         0                    1            1
41184   46          1    999         0                    1            0
41185   56          2    999         0                    1            1
41186   44          1    999         0                    1            0
41187   74          3    999         1                    1            1

       job_admin.  job_blue-collar  job_entrepreneur  job_housemaid  …  \
0               0                0                 0              1  …
1               0                0                 0              0  …
2               0                0                 0              0  …
3               1                0                 0              0  …
4               0                0                 0              0  …
…           …               …                 …            …  …
41183           0                0                 0              0  …
41184           0                1                 0              0  …
41185           0                0                 0              0  …
41186           0                0                 0              0  …
41187           0                0                 0              0  …

       month_sep  day_of_week_fri  day_of_week_mon  day_of_week_thu  \
0              0                0                1                0
1              0                0                1                0
2              0                0                1                0
3              0                0                1                0
4              0                0                1                0
…          …               …                …              …
41183          0                1                0              0
41184          0                1                0              0
41185          0                1                0              0
41186          0                1                0              0
41187          0                1                0              0

       day_of_week_tue  day_of_week_wed  poutcome_failure  \
0                    0                0                 0
1                    0                0                 0
2                    0                0                 0
3                    0                0                 0
4                    0                0                 0
…                …               …                 …
41183                0                0                 0
41184                0                0                 0
```

```
41185                 0                 0                 0
41186                 0                 0                 0
41187                 0                 0                 1

       poutcome_nonexistent  poutcome_success  Loan_Status_label
0                         1                 0                 0
1                         1                 0                 0
2                         1                 0                 0
3                         1                 0                 0
4                         1                 0                 0
…                       …                 …                 …
41183                     1                 0                 1
41184                     1                 0                 0
41185                     1                 0                 0
41186                     1                 0                 1
41187                     0                 0                 0

[41188 rows x 60 columns]>
```

[9]:
```
df.tail
```

[9]:
```
<bound method NDFrame.tail of        age  campaign  pdays  previous
no_previous_contact  not_working  \
0       56         1    999         0                    1            0
1       57         1    999         0                    1            0
2       37         1    999         0                    1            0
3       40         1    999         0                    1            0
4       56         1    999         0                    1            0
…    …       …    …       …                    …          …
41183   73         1    999         0                    1            1
41184   46         1    999         0                    1            0
41185   56         2    999         0                    1            1
41186   44         1    999         0                    1            0
41187   74         3    999         1                    1            1

       job_admin.  job_blue-collar  job_entrepreneur  job_housemaid  …  \
0               0                0                 0              1  …
1               0                0                 0              0  …
2               0                0                 0              0  …
3               1                0                 0              0  …
4               0                0                 0              0  …
…             …                …                 …              …  …
41183           0                0                 0              0  …
41184           0                1                 0              0  …
41185           0                0                 0              0  …
41186           0                0                 0              0  …
41187           0                0                 0              0  …
```

```
       month_sep  day_of_week_fri  day_of_week_mon  day_of_week_thu  \
0              0                0                1                0
1              0                0                1                0
2              0                0                1                0
3              0                0                1                0
4              0                0                1                0
…            …                …                …                …
41183          0                1                0                0
41184          0                1                0                0
41185          0                1                0                0
41186          0                1                0                0
41187          0                1                0                0

       day_of_week_tue  day_of_week_wed  poutcome_failure  \
0                    0                0                 0
1                    0                0                 0
2                    0                0                 0
3                    0                0                 0
4                    0                0                 0
…                  …                …                 …
41183                0                0                 0
41184                0                0                 0
41185                0                0                 0
41186                0                0                 0
41187                0                0                 1

       poutcome_nonexistent  poutcome_success  Loan_Status_label
0                         1                 0                  0
1                         1                 0                  0
2                         1                 0                  0
3                         1                 0                  0
4                         1                 0                  0
…                       …                 …                  …
41183                     1                 0                  1
41184                     1                 0                  0
41185                     1                 0                  0
41186                     1                 0                  1
41187                     0                 0                  0

[41188 rows x 60 columns]>
```

[11]:
```
df.info
```

[11]:
```
<bound method DataFrame.info of        age  campaign  pdays  previous
no_previous_contact  not_working  \
0       56         1    999         0                    1            0
```

```
1       57         1    999         0                    1            0
2       37         1    999         0                    1            0
3       40         1    999         0                    1            0
4       56         1    999         0                    1            0
…    …       …    …       …                 …          …
41183   73         1    999         0                    1            1
41184   46         1    999         0                    1            0
41185   56         2    999         0                    1            1
41186   44         1    999         0                    1            0
41187   74         3    999         1                    1            1

       job_admin.  job_blue-collar  job_entrepreneur  job_housemaid  …  \
0               0                 0                 0              1  …
1               0                 0                 0              0  …
2               0                 0                 0              0  …
3               1                 0                 0              0  …
4               0                 0                 0              0  …
…           …               …               …             …  …
41183           0                 0                 0              0  …
41184           0                 1                 0              0  …
41185           0                 0                 0              0  …
41186           0                 0                 0              0  …
41187           0                 0                 0              0  …

       month_sep  day_of_week_fri  day_of_week_mon  day_of_week_thu  \
0              0                0                1                0
1              0                0                1                0
2              0                0                1                0
3              0                0                1                0
4              0                0                1                0
…          …               …               …             …
41183          0                1                0                0
41184          0                1                0                0
41185          0                1                0                0
41186          0                1                0                0
41187          0                1                0                0

       day_of_week_tue  day_of_week_wed  poutcome_failure  \
0                    0                0                 0
1                    0                0                 0
2                    0                0                 0
3                    0                0                 0
4                    0                0                 0
…                …               …              …
41183                0                0                 0
41184                0                0                 0
41185                0                0                 0
```

```
41186                0                0                0
41187                0                0                1

       poutcome_nonexistent  poutcome_success  Loan_Status_label
0                         1                 0                  0
1                         1                 0                  0
2                         1                 0                  0
3                         1                 0                  0
4                         1                 0                  0
…                       …                 …                  …
41183                     1                 0                  1
41184                     1                 0                  0
41185                     1                 0                  0
41186                     1                 0                  1
41187                     0                 0                  0

[41188 rows x 60 columns]>
```

[83]:
```
df.shape
```

[83]:
```
(41188, 61)
```

[146]:
```
df.isnull().sum
```

[146]:
```
<bound method DataFrame.sum of          age  campaign  pdays  previous
no_previous_contact  not_working  \
0      False     False  False     False                False        False
1      False     False  False     False                False        False
2      False     False  False     False                False        False
3      False     False  False     False                False        False
4      False     False  False     False                False        False
…      …       …    …       …                  …           …
41183  False     False  False     False                False        False
41184  False     False  False     False                False        False
41185  False     False  False     False                False        False
41186  False     False  False     False                False        False
41187  False     False  False     False                False        False

       job_admin.  job_blue-collar  job_entrepreneur  job_housemaid  …  \
0           False            False             False          False  …
1           False            False             False          False  …
2           False            False             False          False  …
3           False            False             False          False  …
4           False            False             False          False  …
…           …                …                 …              …  …
41183       False            False             False          False  …
41184       False            False             False          False  …
```

```
41185       False            False             False          False  …
41186       False            False             False          False  …
41187       False            False             False          False  …

       day_of_week_fri  day_of_week_mon  day_of_week_thu  day_of_week_tue  \
0                False            False            False            False
1                False            False            False            False
2                False            False            False            False
3                False            False            False            False
4                False            False            False            False
…                …                …                …                …
41183            False            False            False            False
41184            False            False            False            False
41185            False            False            False            False
41186            False            False            False            False
41187            False            False            False            False

       day_of_week_wed  poutcome_failure  poutcome_nonexistent  \
0                False             False                 False
1                False             False                 False
2                False             False                 False
3                False             False                 False
4                False             False                 False
…                …                 …                     …
41183            False             False                 False
41184            False             False                 False
41185            False             False                 False
41186            False             False                 False
41187            False             False                 False

       poutcome_success  Loan_Status_label  LoanPurpose
0                 False              False        False
1                 False              False        False
2                 False              False        False
3                 False              False        False
4                 False              False        False
…                 …                  …            …
41183             False              False        False
41184             False              False        False
41185             False              False        False
41186             False              False        False
41187             False              False        False

[41188 rows x 61 columns]>
```

[148]:
```
df.isnull().mean()*100
```

[148]:
```
age                     0.0
campaign                0.0
pdays                   0.0
previous                0.0
no_previous_contact     0.0
                        …
poutcome_failure        0.0
poutcome_nonexistent    0.0
poutcome_success        0.0
Loan_Status_label       0.0
LoanPurpose             0.0
Length: 61, dtype: float64
```

[ ]:
```
```

[13]:
```
X = df.drop(columns=["Loan_Status_label"])
y = df["Loan_Status_label"]
```

[15]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2,␣
↪random_state=42, stratify=y)
```

[88]:
```
logreg = LogisticRegression(max_iter=2000, random_state=42)
logreg.fit(X_train, y_train)
```

[88]:
```
LogisticRegression(max_iter=2000, random_state=42)
```

[ ]:
```
```

[90]:
```
y_pred_logreg = logreg.predict(X_test)
y_prob_logreg = logreg.predict_proba(X_test)[:, 1]
```

[92]:
```
accuracy_logreg = accuracy_score(y_test, y_pred_logreg)
conf_matrix_logreg = confusion_matrix(y_test, y_pred_logreg)
class_report_logreg = classification_report(y_test, y_pred_logreg)
roc_auc_logreg = roc_auc_score(y_test, y_prob_logreg)
```

[ ]:
```
```

[94]:
```
print("Logistic Regression Results:")
print(f"Accuracy: {accuracy_logreg:.2f}")
print("Confusion Matrix:")
print(conf_matrix_logreg)
print("Classification Report:")
print(class_report_logreg)
print(f"ROC-AUC: {roc_auc_logreg:.2f}")
```

```
Logistic Regression Results:
```

```
Accuracy: 0.90
Confusion Matrix:
[[7231   79]
 [ 762  166]]
Classification Report:
              precision    recall  f1-score   support

           0       0.90      0.99      0.95      7310
           1       0.68      0.18      0.28       928

    accuracy                           0.90      8238
   macro avg       0.79      0.58      0.61      8238
weighted avg       0.88      0.90      0.87      8238

ROC-AUC: 0.76
```

[96]:
```
rf = RandomForestClassifier(random_state=42)
rf.fit(X_train, y_train)

# Predictions and Evaluation
y_pred_rf = rf.predict(X_test)
y_prob_rf = rf.predict_proba(X_test)[:, 1]
```

[ ]:
```
```

[98]:
```
accuracy_rf = accuracy_score(y_test, y_pred_rf)
conf_matrix_rf = confusion_matrix(y_test, y_pred_rf)
class_report_rf = classification_report(y_test, y_pred_rf)
roc_auc_rf = roc_auc_score(y_test, y_prob_rf)
```

[ ]:
```
```

[138]:
```
print("Random Forest Results:")
print(f"Accuracy: {accuracy_rf:.2f}")
print("Confusion Matrix:")
print(conf_matrix_rf)
print("Classification Report:")
print(class_report_rf)
print(f"ROC-AUC: {roc_auc_rf:.2f}")
```

```
Random Forest Results:
Accuracy: 0.89
Confusion Matrix:
[[7111  199]
 [ 698  230]]
Classification Report:
              precision    recall  f1-score   support
```

```
              0       0.91      0.97      0.94      7310
              1       0.54      0.25      0.34       928

    accuracy                            0.89      8238
   macro avg       0.72      0.61      0.64      8238
weighted avg       0.87      0.89      0.87      8238

ROC-AUC: 0.75
```

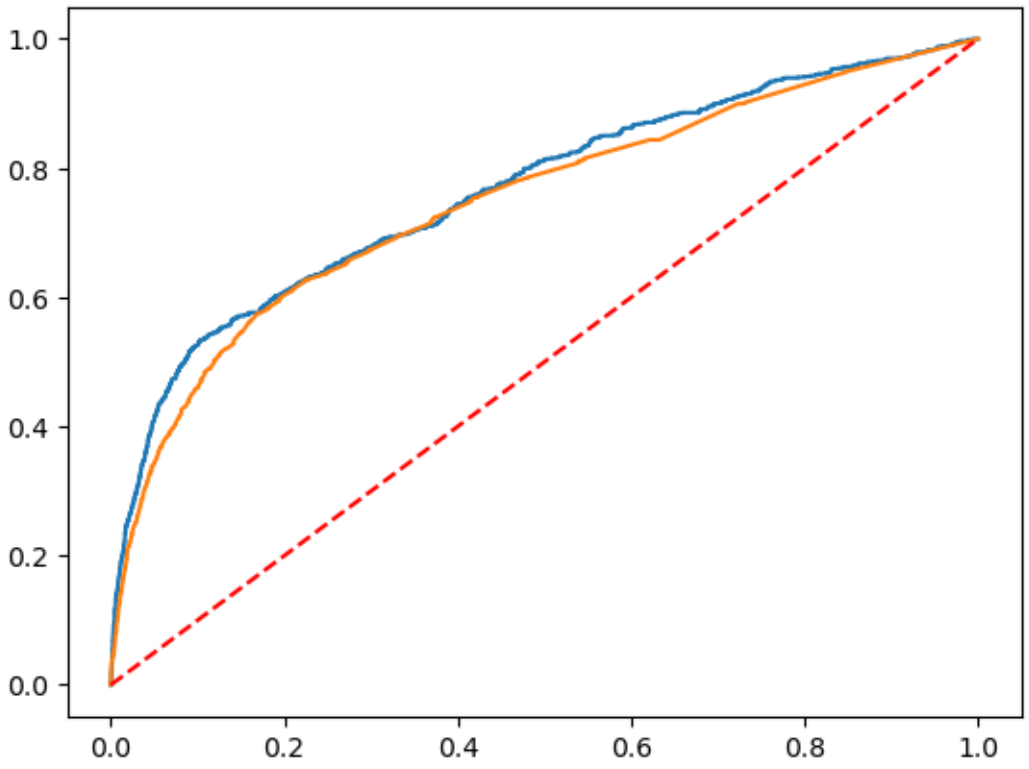
[ ]:

[105]:
```
plt.figure(figsize=(10, 6))
fpr_logreg, tpr_logreg, _ = roc_curve(y_test, y_prob_logreg)
fpr_rf, tpr_rf, _ = roc_curve(y_test, y_prob_rf)
```

```
<Figure size 1000x600 with 0 Axes>
```

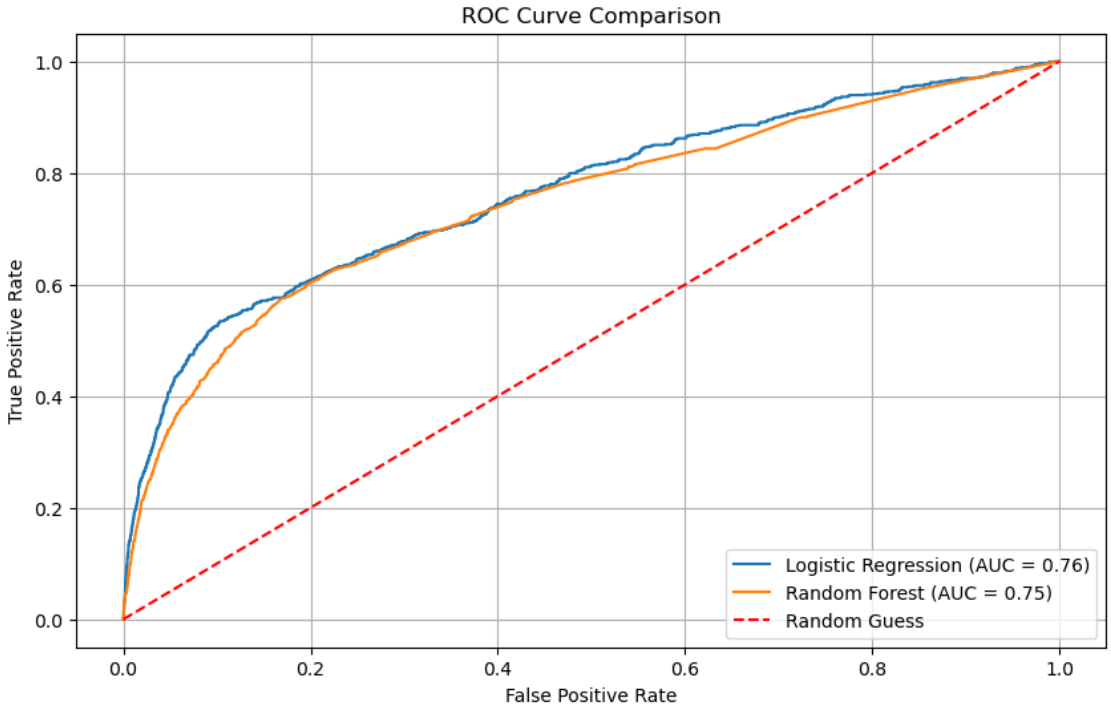
[ ]:

[108]:
```
plt.plot(fpr_logreg, tpr_logreg, label=f"Logistic Regression (AUC =␣
↪{roc_auc_logreg:.2f})")
plt.plot(fpr_rf, tpr_rf, label=f"Random Forest (AUC = {roc_auc_rf:.2f})")
plt.plot([0, 1], [0, 1], 'r--', label="Random Guess")
plt.show()
```

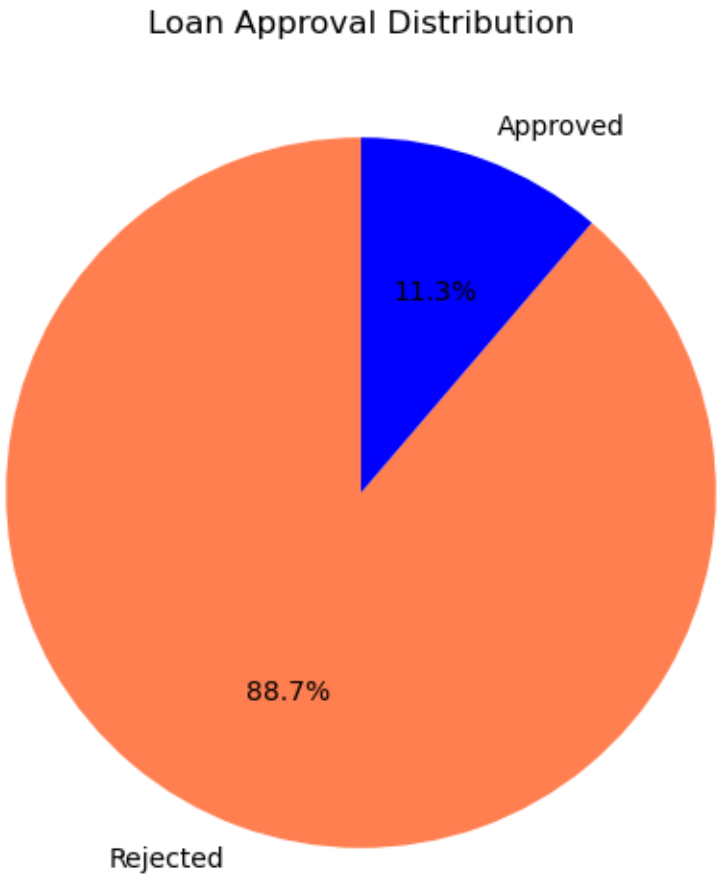


[ ]:

[130]:
```
plt.figure(figsize=(10, 6))


fpr_logreg, tpr_logreg, _ = roc_curve(y_test, y_prob_logreg)
plt.plot(fpr_logreg, tpr_logreg, label=f"Logistic Regression (AUC =␣
 ↪{roc_auc_logreg:.2f})")


fpr_rf, tpr_rf, _ = roc_curve(y_test, y_prob_rf)
plt.plot(fpr_rf, tpr_rf, label=f"Random Forest (AUC = {roc_auc_rf:.2f})")


plt.plot([0, 1], [0, 1], 'r--', label="Random Guess")


plt.xlabel("False Positive Rate")
plt.ylabel("True Positive Rate")
plt.title("ROC Curve Comparison")
plt.legend(loc="lower right")
plt.grid()
plt.show()
```



[193]:
```
labels = ['Rejected', 'Approved']
sizes = df['Loan_Status_label'].value_counts()
colors = ['coral', 'blue']

plt.figure(figsize=(8, 6))
plt.pie(sizes, labels=labels, colors=colors, autopct='%1.1f%%', startangle=90)
plt.title('Loan Approval Distribution')
plt.show()
```



[115]:
```
df.columns
```

[115]:
```
Index(['age', 'campaign', 'pdays', 'previous', 'no_previous_contact',
       'not_working', 'job_admin.', 'job_blue-collar', 'job_entrepreneur',
       'job_housemaid', 'job_management', 'job_retired', 'job_self-employed',
       'job_services', 'job_student', 'job_technician', 'job_unemployed',
```

```
       'job_unknown', 'marital_divorced', 'marital_married', 'marital_single',
       'marital_unknown', 'education_basic.4y', 'education_basic.6y',
       'education_basic.9y', 'education_high.school', 'education_illiterate',
       'education_professional.course', 'education_university.degree',
       'education_unknown', 'default_no', 'default_unknown', 'default_yes',
       'housing_no', 'housing_unknown', 'housing_yes', 'loan_no',
       'loan_unknown', 'loan_yes', 'contact_cellular', 'contact_telephone',
       'month_apr', 'month_aug', 'month_dec', 'month_jul', 'month_jun',
       'month_mar', 'month_may', 'month_nov', 'month_oct', 'month_sep',
       'day_of_week_fri', 'day_of_week_mon', 'day_of_week_thu',
       'day_of_week_tue', 'day_of_week_wed', 'poutcome_failure',
       'poutcome_nonexistent', 'poutcome_success', 'Loan_Status_label',
       'LoanPurpose'],
      dtype='object')
```

[150]:
```
df[df.duplicated()]
```

[150]:

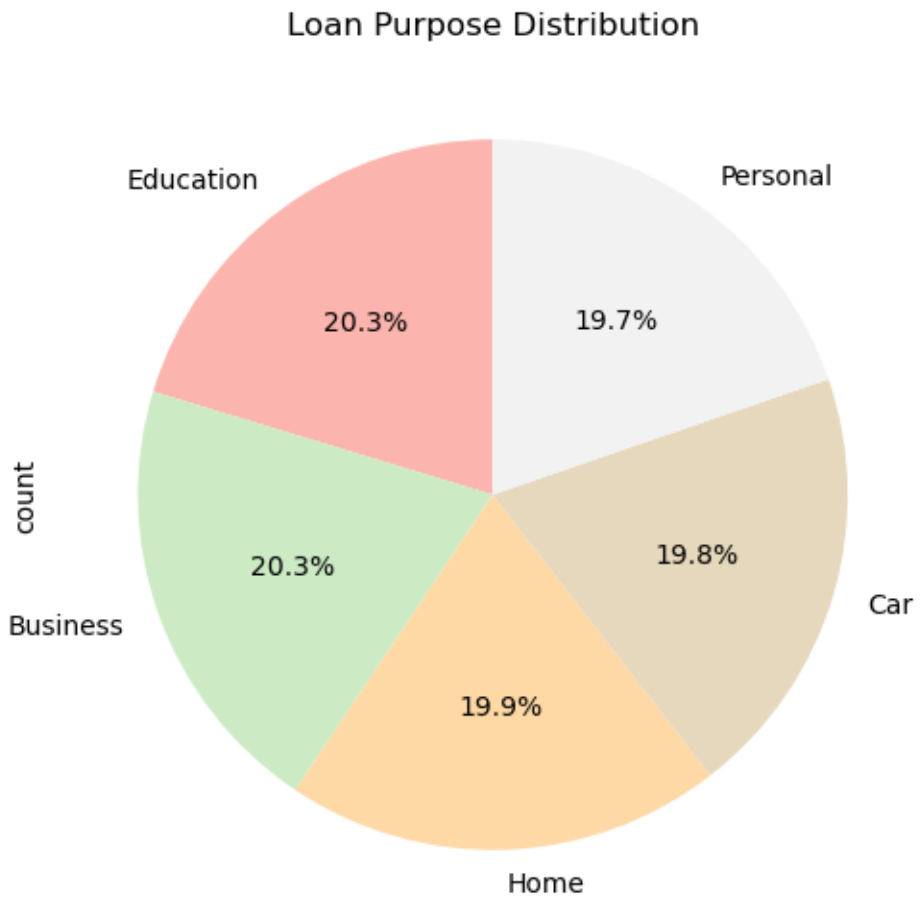
	age	campaign	pdays	previous	no_previous_contact	not_working	\
220	35	2	999	0	1	0	
226	42	2	999	0	1	0	
260	33	1	999	0	1	0	
338	55	2	999	0	1	0	
617	52	2	999	0	1	0	
…	…	…	…	…	…	…	
38875	32	1	999	0	1	0	
38919	58	1	999	0	1	0	
39266	30	3	999	0	1	0	
39839	28	1	999	0	1	0	
41167	32	3	999	0	1	0	

	job_admin.	job_blue-collar	job_entrepreneur	job_housemaid	…	\
220	1	0	0	0	…	
226	0	0	0	0	…	
260	1	0	0	0	…	
338	0	1	0	0	…	
617	0	1	0	0	…	
…	…	…	…	…	…	
38875	0	0	0	0	…	
38919	0	0	0	0	…	
39266	0	0	0	0	…	
39839	1	0	0	0	…	
41167	1	0	0	0	…	

	day_of_week_fri	day_of_week_mon	day_of_week_thu	day_of_week_tue	\
220	0	1	0	0	
226	0	1	0	0	
260	0	1	0	0	

```
338                   0                 1                 0                 0
617                   0                 0                 0                 1
…                   …                 …                 …                 …
38875                 0                 1                 0                 0
38919                 0                 0                 0                 0
39266                 0                 1                 0                 0
39839                 1                 0                 0                 0
41167                 0                 0                 0                 0

       day_of_week_wed  poutcome_failure  poutcome_nonexistent  \
220                  0                 0                     1
226                  0                 0                     1
260                  0                 0                     1
338                  0                 0                     1
617                  0                 0                     1
…                  …                 …                   …
38875                0                 0                     1
38919                1                 0                     1
39266                0                 0                     1
39839                0                 0                     1
41167                1                 0                     1

       poutcome_success  Loan_Status_label  LoanPurpose
220                   0                  0     Personal
226                   0                  0     Business
260                   0                  0     Business
338                   0                  0     Business
617                   0                  0     Business
…                   …                  …          …
38875                 0                  0     Business
38919                 0                  0          Car
39266                 0                  0          Car
39839                 0                  0          Car
41167                 0                  0     Business

[553 rows x 61 columns]
```

[117]:
```
import random

purposes = ['Education', 'Home', 'Car', 'Business', 'Personal']
df['LoanPurpose'] = random.choices(purposes, k=len(df))
df['LoanPurpose'].value_counts().plot.pie(
    autopct='%1.1f%%', startangle=90, figsize=(8, 6), colormap='Pastel1',␣
 ↪title='Loan Purpose Distribution'
)
plt.show()
```



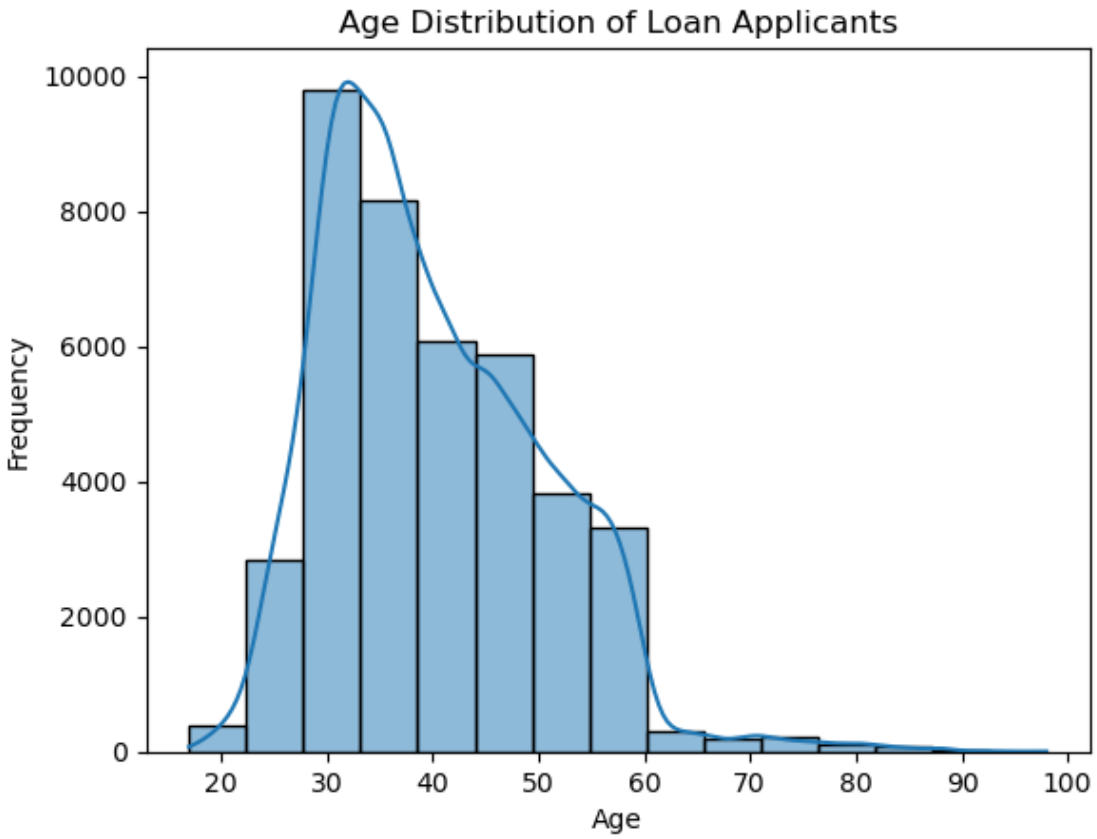
[ ]:

[126]:
```
average_age_by_status = df.groupby('Loan_Status_label')['age'].mean()
print("Average age by loan status:")
print(average_age_by_status)
```

```
Average age by loan status:
Loan_Status_label
0    39.911185
1    40.913147
Name: age, dtype: float64
```

[124]:
```
import seaborn as sns
import matplotlib.pyplot as plt

sns.histplot(df['age'], bins=15, kde=True)
plt.title("Age Distribution of Loan Applicants")
```

```
plt.xlabel("Age")
plt.ylabel("Frequency")
plt.show()
```



[ ]:

[157]:
```
df
```

[157]:

	age	campaign	pdays	previous	no_previous_contact	not_working	\
0	56	1	999	0	1	0	
1	57	1	999	0	1	0	
2	37	1	999	0	1	0	
3	40	1	999	0	1	0	
4	56	1	999	0	1	0	
…	…	…	…	…	…	…	
41183	73	1	999	0	1	1	
41184	46	1	999	0	1	0	
41185	56	2	999	0	1	1	
41186	44	1	999	0	1	0	
41187	74	3	999	1	1	1	

```
       job_admin.  job_blue-collar  job_entrepreneur  job_housemaid  …  \
0               0                0                 0              1  …
1               0                0                 0              0  …
2               0                0                 0              0  …
3               1                0                 0              0  …
4               0                0                 0              0  …
…             …                …                 …              …  …
41183           0                0                 0              0  …
41184           0                1                 0              0  …
41185           0                0                 0              0  …
41186           0                0                 0              0  …
41187           0                0                 0              0  …

       day_of_week_fri  day_of_week_mon  day_of_week_thu  day_of_week_tue  \
0                    0                1                0                0
1                    0                1                0                0
2                    0                1                0                0
3                    0                1                0                0
4                    0                1                0                0
…                  …                …                …                …
41183                1                0                0                0
41184                1                0                0                0
41185                1                0                0                0
41186                1                0                0                0
41187                1                0                0                0

       day_of_week_wed  poutcome_failure  poutcome_nonexistent  \
0                    0                 0                     1
1                    0                 0                     1
2                    0                 0                     1
3                    0                 0                     1
4                    0                 0                     1
…                  …                 …                     …
41183                0                 0                     1
41184                0                 0                     1
41185                0                 0                     1
41186                0                 0                     1
41187                0                 1                     0

       poutcome_success  Loan_Status_label  LoanPurpose
0                     0                  0     Personal
1                     0                  0         Home
2                     0                  0     Personal
3                     0                  0     Personal
4                     0                  0         Home
…                   …                  …           …
```

```
41183                 0                 1    Education
41184                 0                 0     Personal
41185                 0                 0    Education
41186                 0                 1         Home
41187                 0                 0     Personal

[41188 rows x 61 columns]
```

[169]:
```
df[['marital_divorced', 'marital_married', 'marital_single']].mean()*100
```

[169]:
```
marital_divorced    11.197436
marital_married     60.522482
marital_single      28.085850
dtype: float64
```

[173]:
```
df[['not_working', 'job_admin.', 'job_blue-collar', 'job_entrepreneur',
       'job_housemaid', 'job_management', 'job_retired', 'job_self-employed',
       'job_services', 'job_student', 'job_technician', 'job_unemployed',
       'job_unknown']].mean()*100
```

[173]:
```
not_working           8.762261
job_admin.           25.303486
job_blue-collar      22.467709
job_entrepreneur      3.535010
job_housemaid         2.573565
job_management        7.099155
job_retired           4.175974
job_self-employed     3.450034
job_services          9.636302
job_student           2.124405
job_technician       16.371273
job_unemployed        2.461882
job_unknown           0.801204
dtype: float64
```

[177]:
```
df[['month_apr', 'month_aug', 'month_dec', 'month_jul', 'month_jun',
       'month_mar', 'month_may', 'month_nov', 'month_oct', 'month_sep',
       'day_of_week_fri', 'day_of_week_mon', 'day_of_week_thu',
       'day_of_week_tue', 'day_of_week_wed']].mean()*100
```

[177]:
```
month_apr           6.390211
month_aug          14.999514
month_dec           0.441876
month_jul          17.417694
month_jun          12.911528
month_mar           1.325629
month_may          33.429640
```

```
month_nov           9.956784
month_oct           1.743226
month_sep           1.383898
day_of_week_fri    19.003108
day_of_week_mon    20.671069
day_of_week_thu    20.935709
day_of_week_tue    19.641643
day_of_week_wed    19.748470
dtype: float64
```

[209]:
```
df.LoanPurpose
```

[209]:
```
0          Personal
1              Home
2          Personal
3          Personal
4              Home
             …
41183     Education
41184      Personal
41185     Education
41186          Home
41187      Personal
Name: LoanPurpose, Length: 41188, dtype: object
```

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