```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.preprocessing import OneHotEncoder
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score
from sklearn import metrics
from sklearn.impute import SimpleImputer


train_df = pd.read_csv('train.csv')
test_df = pd.read_csv('test.csv')


train_df.head()
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare
0	1	0	3	Braund, Mr. Owen Harris	male	22.0	1	0	A/5 21171	7.2500
1	2	1	1	Cumings, Mrs. John Bradley (Florence	female	38.0	1	0	PC 17599	71.2833

Data Preprocessing

- get rid of nulls
- encoding categorical data

```
train_df.isna().any()
```

```
PassengerId    False
Survived       False
Pclass         False
Name           False
Sex            False
Age             True
SibSp          False
Parch          False
Ticket         False
Fare           False
Cabin           True
Embarked        True
dtype: bool
```

```
# any one without a cabin just place None
train_df['Cabin'] = train_df['Cabin'].apply(lambda x: 'None' if pd.isna(x) else x)
test_df['Cabin'] = test_df['Cabin'].apply(lambda x: 'None' if pd.isna(x) else x)


train_df.isna().any()
```

```
PassengerId    False
Survived       False
Pclass         False
Name           False
Sex            False
Age             True
SibSp          False
Parch          False
Ticket         False
Fare           False
Cabin          False
Embarked        True
dtype: bool
```

```
# find the most common location embarked
train_df['Embarked'] = train_df['Embarked'].fillna(train_df['Embarked'].mode()[0])
test_df['Embarked'] = test_df['Embarked'].fillna(test_df['Embarked'].mode()[0])


train_df.isna().any()
```

```
PassengerId    False
Survived       False
Pclass         False
Name           False
Sex            False
Age             True
SibSp          False
Parch          False
Ticket         False
Fare           False
Cabin          False
Embarked       False
dtype: bool
```

```
# Age is usually correlated with the amount of money they make and sex.
# find the average age based on sex and passenger class (1st 2nd or 3rd)
corr_df = train_df.groupby(['Pclass', 'Sex']).Age.mean().reset_index()

def update_age(params):
    pclass = params.iloc[0]
    sex = params.iloc[1]
    age = params.iloc[2]
    if pd.isnull(age):
        age = float(corr_df[(corr_df['Pclass'] == pclass) & (corr_df['Sex'] == sex)]['Age'].iloc[0])
    return age

train_df['Age'] = train_df[['Pclass', 'Sex', 'Age']].apply(lambda x : update_age(x), axis = 1)


corr_df = test_df.groupby(['Pclass', 'Sex']).Age.mean().reset_index()

test_df['Age'] = test_df[['Pclass', 'Sex', 'Age']].apply(lambda x : update_age(x), axis = 1)


train_df.isna().any()
```

```
PassengerId    False
Survived       False
Pclass         False
Name           False
Sex            False
Age            False
SibSp          False
Parch          False
Ticket         False
Fare           False
Cabin          False
Embarked       False
dtype: bool
```

```
test_df.isna().any()
```

```
PassengerId    False
Pclass         False
Name           False
Sex            False
Age            False
SibSp          False
Parch          False
Ticket         False
Fare            True
Cabin          False
Embarked       False
dtype: bool
```

```
corr_df = train_df.groupby(['Pclass']).Fare.mean().reset_index()

def update_fare(params):
    pclass = params.iloc[0]
    fare = params.iloc[1]
    if pd.isna(fare):
        fare = float(corr_df[(corr_df['Pclass'] == pclass)]['Fare'].iloc[0])
    return fare

test_df['Fare'] = test_df[['Pclass', 'Fare']].apply(lambda x : update_fare(x), axis = 1)
```

```
test_df.isna().any()
```

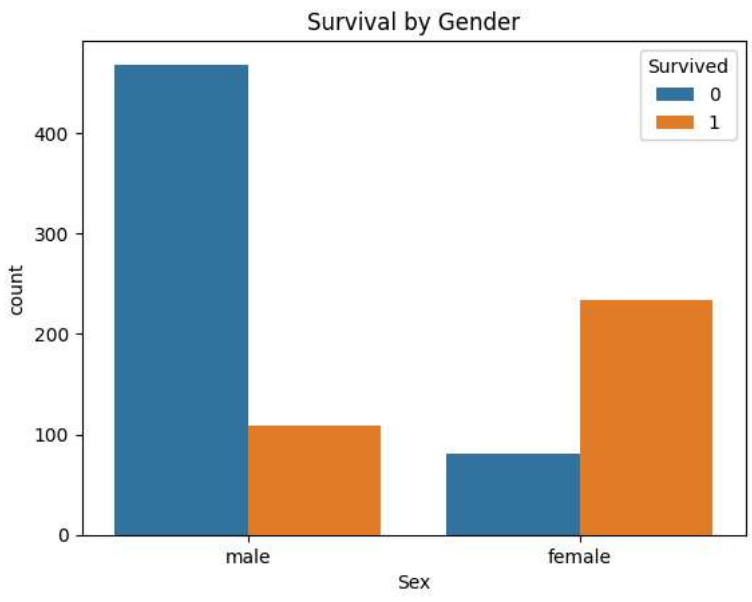
```
PassengerId    False
Pclass         False
Name           False
Sex            False
Age            False
SibSp          False
Parch          False
Ticket         False
Fare           False
Cabin          False
Embarked       False
dtype: bool
```

```
# get rid of uneeded columns
train_df = train_df.drop(columns=['Name', 'Ticket', 'Cabin'])
test_df = test_df.drop(columns=['Name', 'Ticket', 'Cabin'])
train_df.head()
```

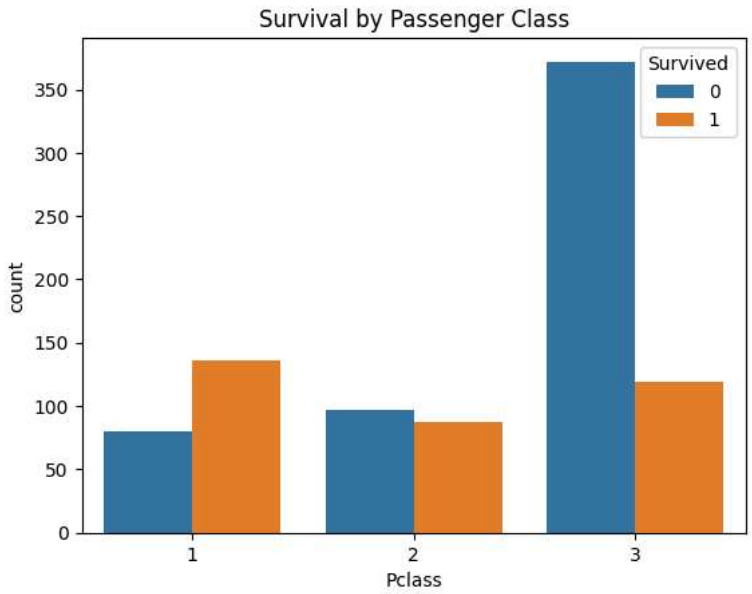
	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked
0	1	0	3	male	22.0	1	0	7.2500	S
1	2	1	1	female	38.0	1	0	71.2833	C
2	3	1	3	female	26.0	0	0	7.9250	S
3	4	1	1	female	35.0	1	0	53.1000	S
4	5	0	3	male	35.0	0	0	8.0500	S

Data Analysis

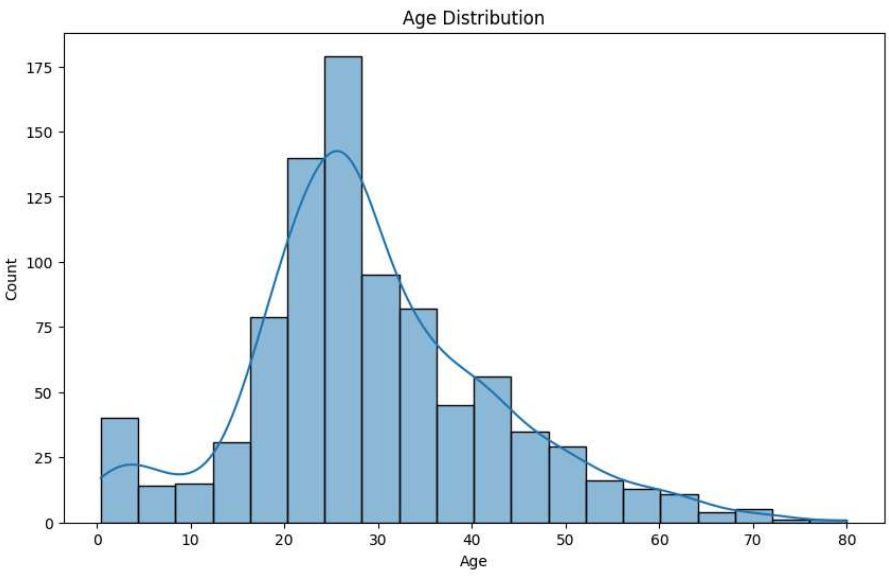
```
sns.countplot(x='Sex', hue='Survived', data=train_df)
plt.title('Survival by Gender')
plt.show()
```



```
sns.countplot(x='Pclass', hue='Survived', data=train_df)
plt.title('Survival by Passenger Class')
plt.show()
```




```
plt.figure(figsize=(10, 6))
sns.histplot(data=train_df, x='Age', bins=20, kde=True)
plt.title('Age Distribution')
plt.xlabel('Age')
plt.ylabel('Count')
plt.show()
```




```
train_df.describe()
```

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
count	891.000000	891.000000	891.000000	891.000000	891.000000	891.000000	891.000000
mean	446.000000	0.383838	2.308642	29.318643	0.523008	0.381594	32.204208
std	257.353842	0.486592	0.836071	13.281103	1.102743	0.806057	49.693429
min	1.000000	0.000000	1.000000	0.420000	0.000000	0.000000	0.000000
25%	223.500000	0.000000	2.000000	21.750000	0.000000	0.000000	7.910400
50%	446.000000	0.000000	3.000000	26.507589	0.000000	0.000000	14.454200
75%	668.500000	1.000000	3.000000	36.000000	1.000000	0.000000	31.000000

```
train_df[['Age', 'Pclass']].groupby(['Pclass'], as_index=False).mean().sort_values(by='Age', ascending=False)
```

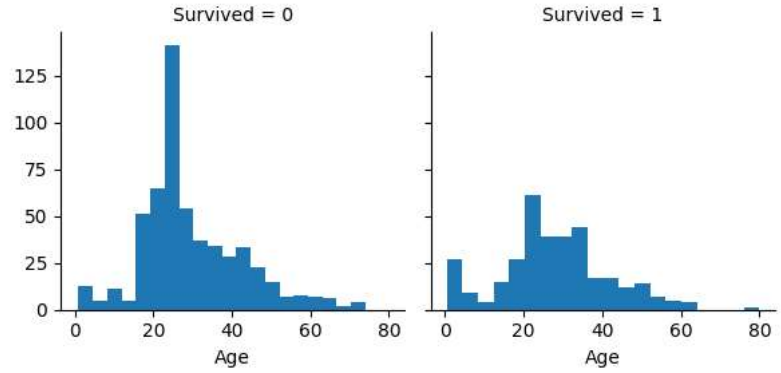
	Pclass	Age
0	1	38.378866
1	2	29.907295
2	3	25.112288

```
train_df[['Pclass', 'Survived']].groupby(['Pclass'], as_index=False).mean().sort_values(by='Survived', ascending=False)
```

	Pclass	Survived
0	1	0.629630
1	2	0.472826
2	3	0.242363

```
g = sns.FacetGrid(train_df, col='Survived')
g.map(plt.hist, 'Age', bins=20)
```

```
<seaborn.axisgrid.FacetGrid at 0x1708ca62d20>
```



One hot encode categorical data

- take text data like Sex and Embarked and split them into binary columns of different cateories
- aka one hot encoding

```
# one hot encode sex and embarked columns
encoder = OneHotEncoder()
sex_arr = encoder.fit_transform(train_df[['Sex']]).toarray()

# split sex column into male and female columns
categories = ['female', 'male']
for i in range(len(sex_arr.T)):
    train_df[categories[i]] = sex_arr.T[i]

sex_arr = encoder.fit_transform(test_df[['Sex']]).toarray()

# split sex column into male and female columns
categories = ['female', 'male']
for i in range(len(sex_arr.T)):
    test_df[categories[i]] = sex_arr.T[i]
```

```
train_df.head()
```

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	female	m
0	1	0	3	male	22.0	1	0	7.2500	S	0.0	
1	2	1	1	female	38.0	1	0	71.2833	C	1.0	
2	3	1	3	female	26.0	0	0	7.9250	S	1.0	
3	4	1	1	female	35.0	1	0	53.1000	S	1.0	

```
emb_arr = encoder.fit_transform(train_df[['Embarked']]).toarray()

# split sex column into male and female columns
categories = ['C','S','Q','N']
for i in range(len(emb_arr.T)):
    train_df[categories[i]] = emb_arr.T[i]

emb_arr = encoder.fit_transform(test_df[['Embarked']]).toarray()

# split sex column into male and female columns
categories = ['C','S','Q','N']
for i in range(len(emb_arr.T)):
    test_df[categories[i]] = emb_arr.T[i]
```

```
train_df.head()
```

	PassengerId	Survived	Pclass	Sex	Age	SibSp	Parch	Fare	Embarked	female	m
0	1	0	3	male	22.0	1	0	7.2500	S	0.0	
1	2	1	1	female	38.0	1	0	71.2833	C	1.0	
2	3	1	3	female	26.0	0	0	7.9250	S	1.0	
3	4	1	1	female	35.0	1	0	53.1000	S	1.0	

```
# remove uneeded columns
train_df = train_df.drop(columns=['Sex', 'Embarked'])
test_df = test_df.drop(columns=['Sex', 'Embarked'])
train_df.head()
```

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare	female	male	C	S	Q
0	1	0	3	22.0	1	0	7.2500	0.0	1.0	0.0	0.0	1.0
1	2	1	1	38.0	1	0	71.2833	1.0	0.0	1.0	0.0	0.0
2	3	1	3	26.0	0	0	7.9250	1.0	0.0	0.0	0.0	1.0
3	4	1	1	35.0	1	0	53.1000	1.0	0.0	0.0	0.0	1.0
4	5	0	3	35.0	0	0	8.0500	0.0	1.0	0.0	0.0	1.0

```
test_df
```

	PassengerId	Pclass	Age	SibSp	Parch	Fare	female	male	C	S	Q
0	892	3	34.500000	0	0	7.8292	0.0	1.0	0.0	1.0	0.0
1	893	3	47.000000	1	0	7.0000	1.0	0.0	0.0	0.0	1.0
2	894	2	62.000000	0	0	9.6875	0.0	1.0	0.0	1.0	0.0
3	895	3	27.000000	0	0	8.6625	0.0	1.0	0.0	0.0	1.0
4	896	3	22.000000	1	1	12.2875	1.0	0.0	0.0	0.0	1.0
...	...	...	...	...	...	...	...	...	...	...	...
413	1305	3	24.525104	0	0	8.0500	0.0	1.0	0.0	0.0	1.0
414	1306	1	39.000000	0	0	108.9000	1.0	0.0	1.0	0.0	0.0
415	1307	3	38.500000	0	0	7.2500	0.0	1.0	0.0	0.0	1.0
416	1308	3	24.525104	0	0	8.0500	0.0	1.0	0.0	0.0	1.0
417	1309	3	24.525104	1	1	22.3583	0.0	1.0	1.0	0.0	0.0

418 rows × 11 columns

Normalize Data Points

- use standard scaler to make 0 the mean and 1 the standard deviation

```
def normalize_data(df):
    numeric_data = df[['Pclass', 'Age', 'SibSp', 'Parch', 'Fare']]
    scaler = StandardScaler()
    norm_data = scaler.fit_transform(numeric_data)
    norm_df = pd.DataFrame(norm_data, columns=numeric_data.columns)
    df[['Pclass', 'Age', 'SibSp', 'Parch', 'Fare']] = norm_df

normalize_data(train_df)
normalize_data(test_df)
```

```
train_df.head()
```

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare	female	male
0	1	0	0.827377	-0.551366	0.432793	-0.473674	-0.502445	0.0	1.0
1	2	1	-1.566107	0.654030	0.432793	-0.473674	0.786845	1.0	0.0
2	3	1	0.827377	-0.250017	-0.474545	-0.473674	-0.488854	1.0	0.0
3	4	1	-1.566107	0.428018	0.432793	-0.473674	0.420730	1.0	0.0

```
test_df.head()
```

	PassengerId	Pclass	Age	SibSp	Parch	Fare	female	male	C	S
0	892	0.873482	0.392121	-0.499470	-0.400248	-0.497374	0.0	1.0	0.0	1.0
1	893	0.873482	1.357557	0.616992	-0.400248	-0.512238	1.0	0.0	0.0	0.0
2	894	-0.315819	2.516080	-0.499470	-0.400248	-0.464061	0.0	1.0	0.0	1.0
3	895	0.873482	-0.187140	-0.499470	-0.400248	-0.482436	0.0	1.0	0.0	0.0

Logistic Regression Model

```
# setup data
X = train_df.iloc[:, 2:]
Y = train_df.iloc[:, 1]

x_train, x_test, y_train, y_test = train_test_split(X, Y, train_size = 0.8)

x_eval = test_df.iloc[:, 1:]


log_mod = LogisticRegression()

log_mod.fit(x_train, y_train)

y_pred = log_mod.predict(x_test)


print(f"accuracy of training set: {100*log_mod.score(x_train,y_train):.2f}%")
print(f"accuracy of training set: {100*log_mod.score(x_test,y_test):.2f}%")
```

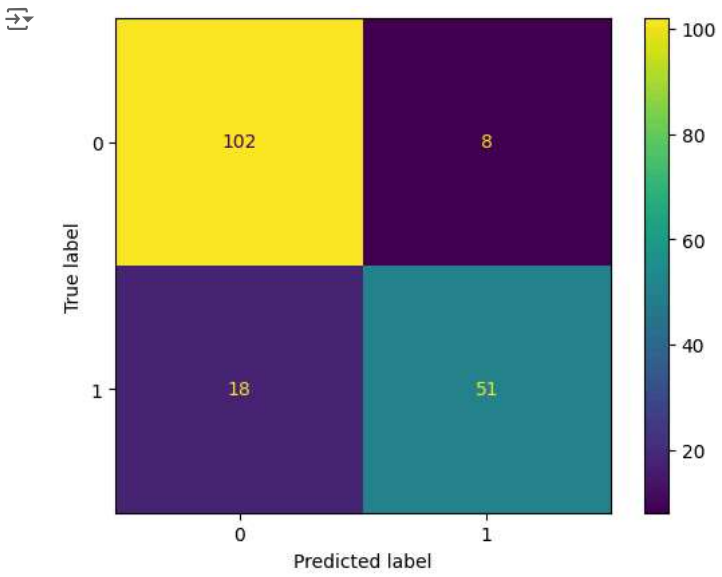
```
accuracy of training set: 80.76%
accuracy of training set: 85.47%
```

```
actual = y_test
predicted = y_pred

confusion_matrix = metrics.confusion_matrix(actual, predicted)

cm_display = metrics.ConfusionMatrixDisplay(confusion_matrix = confusion_matrix, display_labels = [0, 1])

cm_display.plot()
plt.show()
```



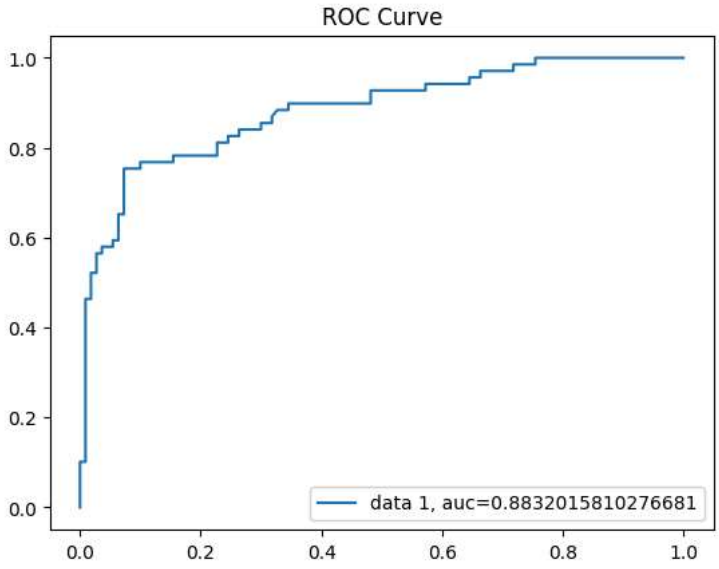

```
print(metrics.classification_report(y_test, y_pred, target_names={'Did not Survive', 'Survived'}))
```

```
                  precision    recall  f1-score   support

           Survived       0.85      0.93      0.89       110
     Did not Survive       0.86      0.74      0.80        69

           accuracy                           0.85       179
          macro avg       0.86      0.83      0.84       179
       weighted avg       0.86      0.85      0.85       179
```

```
y_pred_proba = log_mod.predict_proba(x_test)[::,1]
fpr, tpr, _ = metrics.roc_curve(y_test,  y_pred_proba)
auc = metrics.roc_auc_score(y_test, y_pred_proba)
plt.title("ROC Curve")
plt.plot(fpr,tpr,label="data 1, auc="+str(auc))
plt.legend(loc=4)
plt.show()
```




```
def print_prediction(pred):
    if pred[0] == 1:
        print("This person probably survived")
    else:
        print("This person probably did not survive")

# P_class:3 Age: 27.0 sibsp:0 parch:0 Fare: 8.6625 Sex: Male Embarked to: Q
prediction_eval = log_mod.predict(x_eval.iloc[[3]])
print_prediction(prediction_eval)
```

```
This person probably did not survive
```

```
# P_class:1 Age: 39.0 sibsp:0 parch:0 Fare: 108.90 Sex: Female Embarked to: C
prediction_eval = log_mod.predict(x_eval.iloc[[414]])
print_prediction(prediction_eval)
```

```
This person probably survived
```

Get Evaluation data results into csv file

```
prediction_eval = log_mod.predict(x_eval)
```

```
result_data = pd.DataFrame(test_df['PassengerId'], columns=['PassengerId'])
result_data = result_data.assign(Survived=prediction_eval)
result_data.head()
```

	PassengerId	Survived
0	892	0
1	893	0
2	894	0
3	895	0
4	896	0

```
result_data.to_csv("titanic_submission.csv", index=False)
!cat titanic_submission.csv
```

```
PassengerId,Survived
892,0
893,0
894,0
895,0
896,0
897,0
898,1
```

```
899,0
900,1
901,0
902,0
903,0
904,1
905,0
906,1
907,1
908,0
909,0
910,0
911,0
912,0
913,0
914,1
915,1
916,1
917,0
918,1
919,0
920,0
921,0
922,0
923,0
924,0
925,0
926,0
927,0
928,1
929,1
930,0
931,0
```