21bce7877-assignment-3

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1 1. IMPORT THE LIBRARIES

[ ]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from scipy import stats
from sklearn.preprocessing import LabelEncoder
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
```

2 2. IMPORT THE DATASET

[ ]:

[ ]:
```
df=pd.read_csv("Titanic-Dataset.csv")
```

```

```

df

[ ]:
```
    PassengerId Survived Pclass \
0             1        0      3
1             2        1      1
2             3        1      3
3             4        1      1
4             5        0      3
..          ...      ...    ...
886         887        0      2
887         888        1      1
888         889        0      3
889         890        1      1
890         891        0      3

                                                Name  Sex   Age  SibSp \0 Braund, Mr. Owen Harris                             male  22.0      2
1 Cumings, Mrs. John Bradley (Florence Briggs Th…  female  38.0      2
3 Futrelle, Mrs. Jacques Heath (Lily May Peel)  female  35.0      2

2                            Heikkinen, Miss. Laina  female  26.0      0
```

```
4                          Allen, Mr. William Henry  male 35.0     0
..                                                  …    …   …    …
886                              Montvila, Rev. Juozas    male 27.0  0
887                              Graham, Miss. Margaret Edith female
                                 19.0     0
888                              Johnston, Miss. Catherine Helen
                                 "Carrie" female     NaN   1
889                              Behr, Mr. Karl Howell    male 26.0  0
890                              Dooley, Mr. Patrick male 32.0  0

     Parch          Ticket   Fare Cabin Embarked
0        0   A/5 21171  7.2500     NaN   S
1        0   PC 17599 71.2833 C85   C
2        0 STON/O2. 3101282   7.9250     NaN   S
3        0   113803 53.1000 C123   S
4        0   373450     8.0500     NaN   S
..     …              …      …   …      …
886      0   211536 13.0000   NaN   S
887      0   112053 30.0000   B42   S
888      2   W./C. 6607 23.4500    NaN   S
889      0   111369 30.0000 C148   C
890      0   370376     7.7500     NaN   Q

[891 rows x 12 columns]
```

[ ]:
```
df.head()
```

[ ]:
```
   PassengerId Survived Pclass \
0           1        0      3
1           2        1      1
2           3        1      3
3           4        1      1
4           5        0      3

                                                 Name     Sex   Age SibSp \
0                            Braund, Mr. Owen Harris   male 22.0     1
 1 Cumings, Mrs. John Bradley (Florence Briggs Th…  female 38.0   1
2                             Heikkinen, Miss. Laina female 26.0    0
3    Futrelle, Mrs. Jacques Heath (Lily May Peel)  female 35.0   1
4                           Allen, Mr. William Henry   male 35.0     0

   Parch          Ticket   Fare Cabin Embarked
0      0     A/5 21171  7.2500     NaN   S
1      0     PC 17599 71.2833 C85   C
2      0 STON/O2. 3101282     7.9250     NaN   S
3      0     113803 53.1000 C123   S
```

```
4      0      373450      8.0500      NaN   S
```

[ ]:
```
df.tail()
```

[ ]:
```
    PassengerId Survived Pclass                                      Name \
886         887        0      2                     Montvila, Rev. Juozas
887         888        1      1                     Graham, Miss. Margaret Edith
888         889        0      3 Johnston, Miss. Catherine Helen "Carrie"
889         890        1      1                     Behr, Mr. Karl Howell
890         891        0      3                     Dooley, Mr. Patrick

        Sex   Age SibSp Parch     Ticket Fare Cabin Embarked
886    male 27.0   0     0     211536 13.00     NaN   S
887    female 19.0 0     0     112053 30.00     B42   S
888    female      NaN   1     2 W./C. 6607 23.45     NaN   S
889    male 26.0   0     0     111369 30.00 C148      C
890    male 32.0   0     0     370376      7.75  NaN   Q
```

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

[ ]:
```
(891, 12)
```

[ ]:
```
df.info()
```

```
<class
'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to
890 Data columns (total 12
columns):
 # Column Non-Null Count Dtype --- -
----- -------------- -----
 0   PassengerId 891 non-null int64
 1   Survived    891 non-null  int64
 2   Pclass      891 non-null  int64
 3   Name        891 non-null  object
 4   Sex         891 non-null  object
 5   Age         714 non-null  float64
 6   SibSp       891 non-null  int64
 7   Parch       891 non-null  int64
 8   Ticket      891 non-null  object
 9   Fare        891 non-null  float64
 10 Cabin        204 non-null  object
 11 Embarked     889 non-null  object
dtypes: float64(2), int64(5), object(5)
memory usage: 83.7+ KB
```

[ ]:
```
df.describe()
```

[ ]:
```
       PassengerId   Survived     Pclass         Age      SibSp \
count 891.000000 891.000000 891.000000 714.000000 891.000000
```

```
mean   446.000000   0.383838   2.308642  29.699118   0.523008
std    257.353842   0.486592   0.836071  14.526497   1.102743
min      1.000000   0.000000   1.000000   0.420000   0.000000
25%    223.500000   0.000000   2.000000  20.125000   0.000000
50%    446.000000   0.000000   3.000000  28.000000   0.000000
75%    668.500000   1.000000   3.000000  38.000000   1.000000
max    891.000000   1.000000   3.000000  80.000000   8.000000

            Parch       Fare
count          891.000000
891.000000  mean  0.381594
32.204208   std   0.806057
49.693429   min   0.000000
0.000000    25%   0.000000
7.910400
50%     0.000000   14.454200
75%     0.000000   31.000000
max     6.000000 512.329200
```

[ ]:
```
corr=df.corr()
corr
```

```
<ipython-input-13-7d5195e2bf4d>:1: FutureWarning: The default value
of numeric_only in DataFrame.corr is deprecated. In a future version,
it will default to False. Select only valid columns or specify the
value of numeric_only to silence this warning. corr=df.corr()
```

[ ]:
```
             PassengerId Survived  Pclass      Age    SibSp    Parch \
PassengerId     1.000000 -0.005007 -0.035144 0.036847 -0.057527 -
                                                      0.001652
Survived       -0.005007 1.000000 -0.338481 -0.077221 -0.035322
               0.081629
Pclass         -0.035144 -0.338481 1.000000 -0.369226 0.083081
               0.018443
Age              0.036847 -0.077221 -0.369226 1.000000 -0.308247 -
                                                      0.189119
SibSp          -0.057527 -0.035322 0.083081 -0.308247 1.000000
               0.414838
Parch          -0.001652 0.081629 0.018443 -0.189119 0.414838
               1.000000
Fare           0.012658 0.257307 -0.549500 0.096067 0.159651 0.216225

                 Fare
PassengerId 0.012658
Survived   0.257307
Pclass    -
          0.549500
Age        0.096067
SibSp      0.159651
```

```
Parch       0.216225
Fare        1.000000
```

```
[ ]: plt.subplots(figsize=(15,10))
     sns.heatmap(corr,annot=True)
```

```
[ ]: <Axes: >
```


```
[ ]: df.Survived.value_counts()
```

```
[ ]: 0   549
     1   342
Name: Survived, dtype: int64
```

```
[ ]: df.Sex.value_counts()
```

```
[ ]: male  577 female
      314
   Name: Sex, dtype: int64
```

```
[ ]: df.Embarked.value_counts()
```

```
[ ]: S   644
     C   168
```

```
Q     77
Name: Embarked, dtype: int64
```

#3. CHECK FOR NULL VALUES

[ ]:

```
df.isnull().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
```

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

[ ]:
```
PassengerId    0
Survived       0
Pclass         0
Name           0
Sex            0
Age          177
SibSp          0
Parch          0
Ticket         0
Fare           0
Cabin        687
Embarked       2
dtype:
int64
```

Fill null values in the 'Age' column with the mean age

[ ]:
```
mean_age = df['Age'].mean()
df['Age'].fillna(mean_age, inplace=True)
```

Fill null values in the 'Embarked' column with the most common value

[ ]:
```
most_common_embarked = df['Embarked'].mode()[0]
df['Embarked'].fillna(most_common_embarked, inplace=True)
```

[ ]:
```
df.drop(['Cabin'],axis=1, inplace=True)
```

[ ]:
```
df.drop(['Ticket'],axis=1, inplace=True)
```

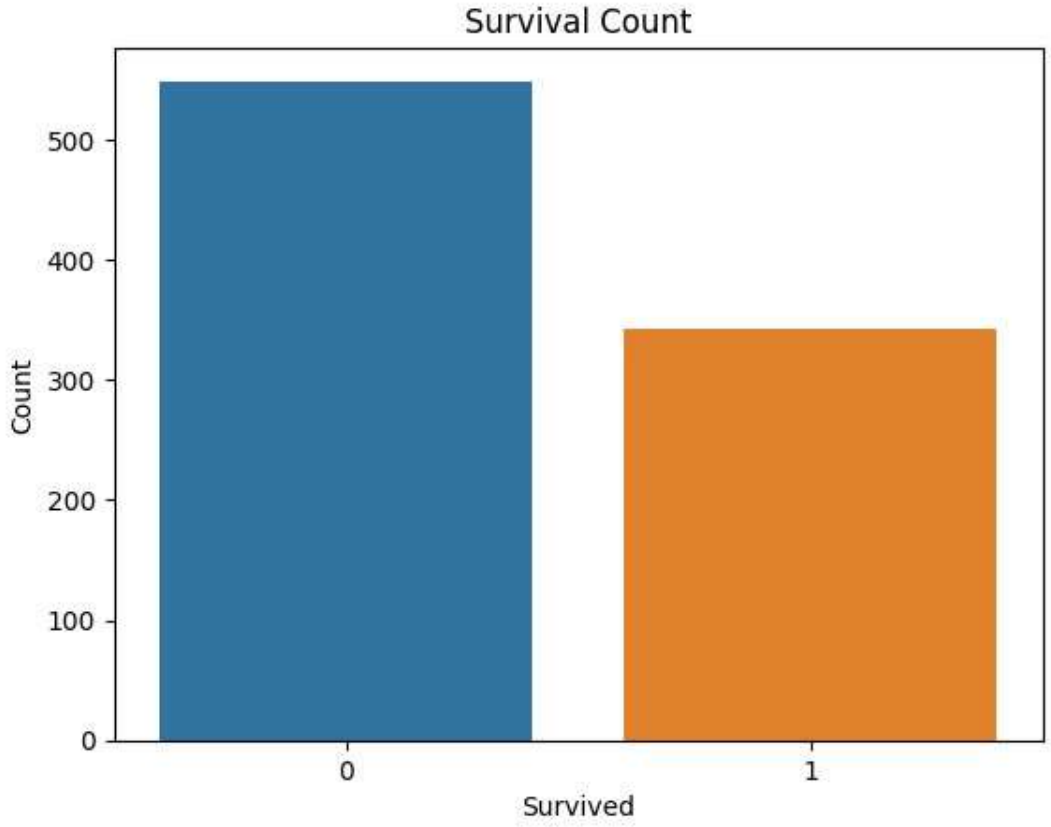
[ ]:
```
df.drop(['Name'],axis=1,inplace=True)
```

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

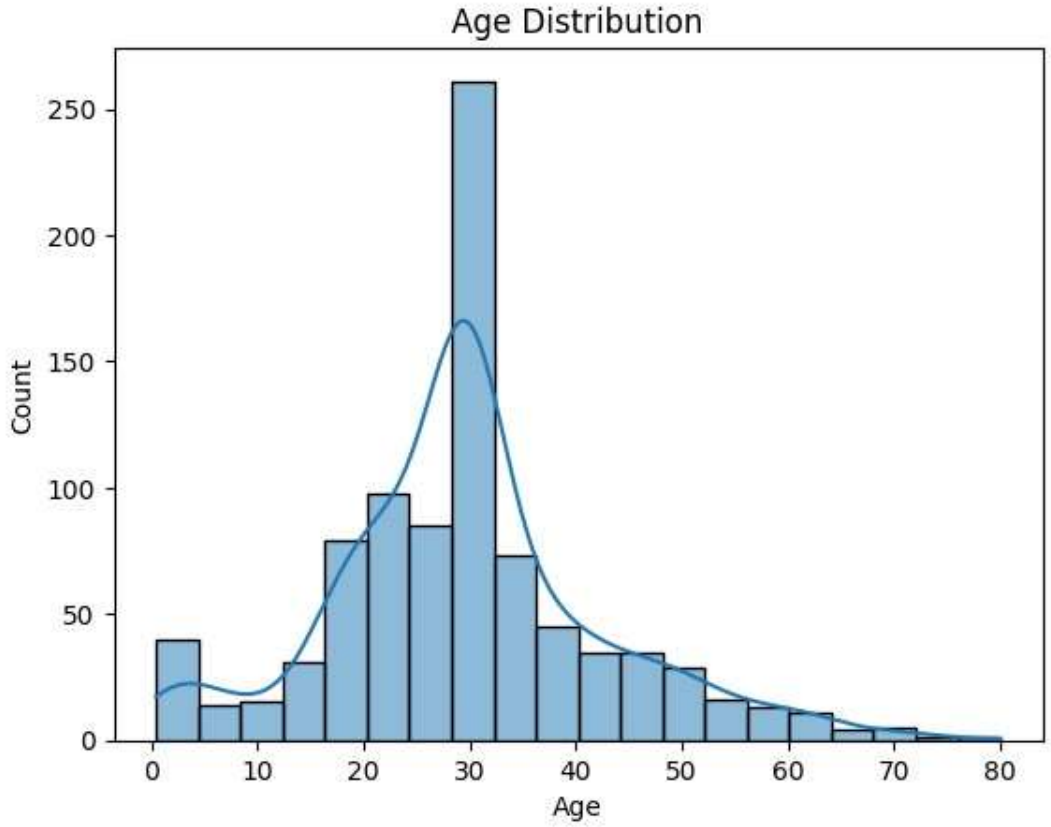
```
PassengerId    0
Survived       0
Pclass         0
Sex            0
Age            0
SibSp          0
Parch          0
Fare           0
Embarked       0
dtype: int64
```

#4. Data Visualization

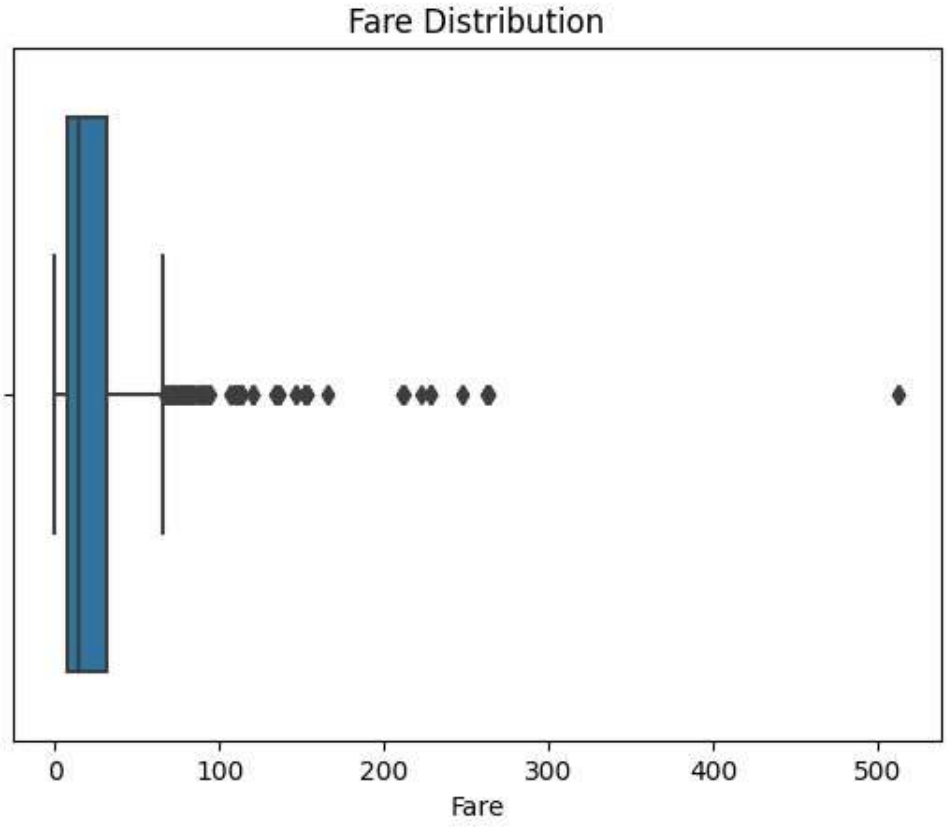
[ ]:
```
# Visualize the distribution of the 'Survived' column (0 = Not Survived, 1 =
↪Survived)
sns.countplot(data=df, x='Survived')
plt.title('Survival Count')
plt.xlabel('Survived')
plt.ylabel('Count')
plt.show()
```



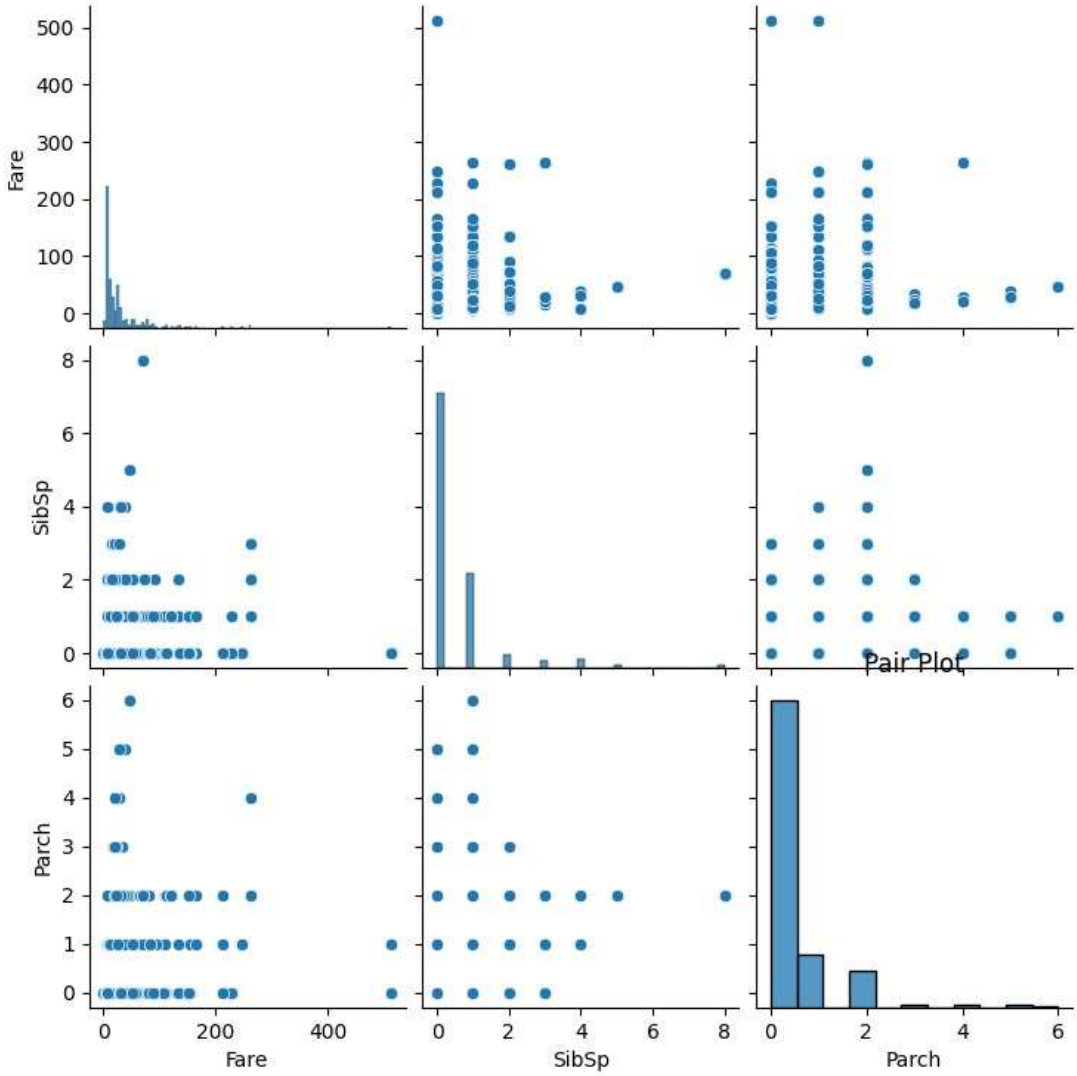
[ ]:
```
#Visualize the distribution of the 'Age' column
sns.histplot(data=df, x='Age', bins=20, kde=True)
plt.title('Age Distribution')
plt.xlabel('Age')
plt.ylabel('Count')
plt.show()
```



[ ]:
```
#Visualize the distribution of the 'Fare' column and detect outliers we will
 ↪handle outliers in the next step
sns.boxplot(data=df, x='Fare')
plt.title('Fare Distribution')
plt.xlabel('Fare')
plt.show()
```

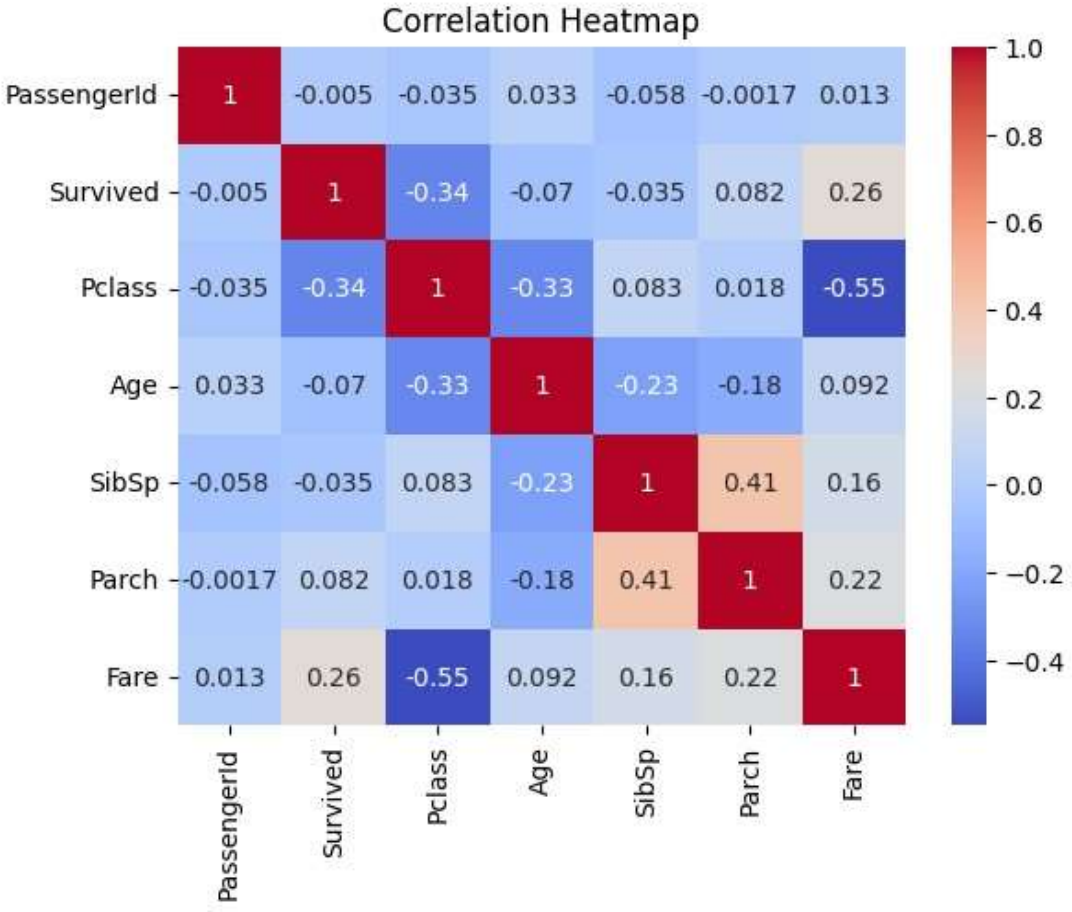


[ ]:
```
#Pair plot for selected numerical columns
sns.pairplot(data=df[['Fare', 'SibSp', 'Parch']])
plt.title('Pair Plot')
plt.show()
```



[ ]:
```
corr_matrix = df.corr()
sns.heatmap(corr_matrix, annot=True,cmap='coolwarm')
plt.title('Correlation Heatmap')
plt.show()
```

```
<ipython-input-30-8dcbd071fff3>:1: FutureWarning: The default value
of numeric_only in DataFrame.corr is deprecated. In a future version,
it will default to False. Select only valid columns or specify the
value of numeric_only to silence this warning. corr_matrix =
df.corr()
```



3 5. Detect and Handle Outliers

[ ]:
```
z_scores = np.abs(stats.zscore(df['Age']))
max_threshold=3
outliers = df['Age'][z_scores > max_threshold]

# Print and visualize the outliers
print("Outliers detected using Z-Score:")
print(outliers)
```

```
Outliers detected using Z-Score:
96    71.0
116   70.5
493   71.0
630   80.0
672   70.0
745   70.0
```

```
851    74.0
Name: Age, dtype: float64
```

[ ]:
```
z_scores = np.abs(stats.zscore(df['Fare']))
max_threshold=3
outliers = df['Fare'][z_scores > max_threshold]

# Print and visualize the outliers
print("Outliers detected using Z-Score:")
print(outliers)
```

```
Outliers detected using Z-Score:
27    263.0000
88    263.0000
118   247.5208
258   512.3292
299   247.5208
311   262.3750
341   263.0000
377   211.5000
380   227.5250
438   263.0000
527   221.7792
557   227.5250
679   512.3292
689   211.3375
700   227.5250
716   227.5250
730   211.3375
737   512.3292
742   262.3750
779   211.3375
```

```
Name: Fare, dtype: float64
```

[ ]:
```
column_name = 'Fare'

# Calculate the first quartile (Q1) and third quartile (Q3)
Q1 = df[column_name].quantile(0.25)
Q3 = df[column_name].quantile(0.75)

# Calculate the IQR
IQR = Q3 - Q1

# Define the lower and upper bounds for outliers
lower_bound = Q1 - 1.5 * IQR
upper_bound = Q3 + 1.5 * IQR
```

```
# Filter rows with values outside the IQR bounds
df_cleaned = df[(df[column_name] > lower_bound) &
(df[column_name]␣ ↪<upper_bound)]

# Display the original and cleaned DataFrame sizes
print(f"Original DataFrame size: {df.shape}")
print(f"Cleaned DataFrame size: {df_cleaned.shape}")
df_cleaned
```

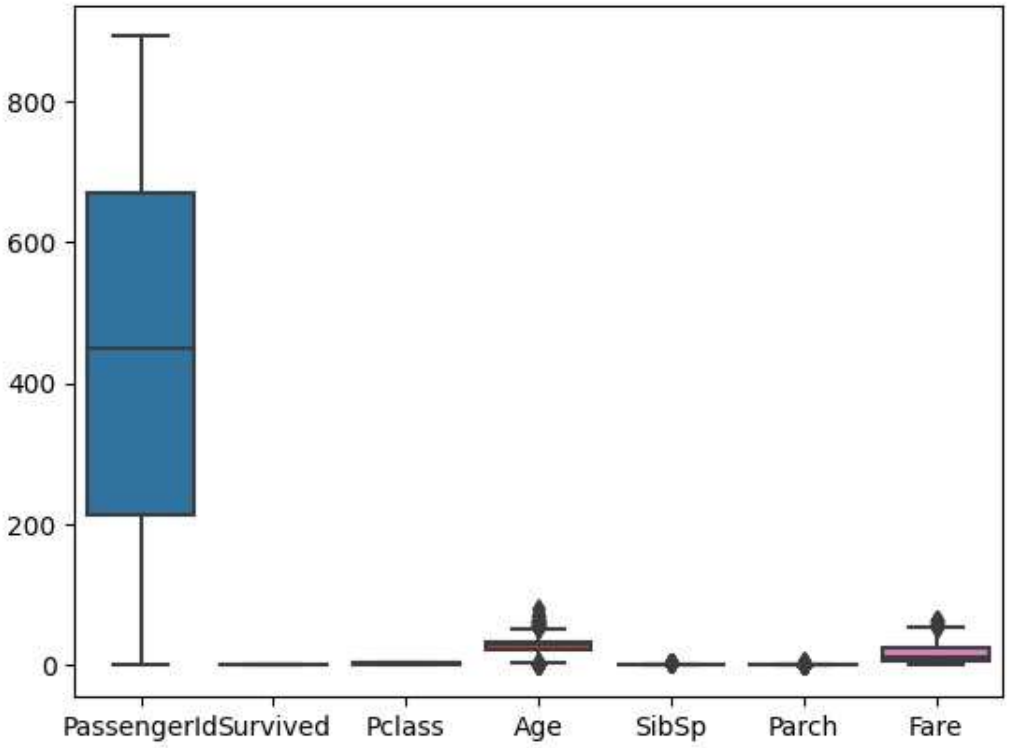
```
Original DataFrame size: (891, 9)
Cleaned DataFrame size: (775, 9)
```

[ ]:
```
     PassengerId Survived Pclass   Sex       Age SibSp Parch     Fare \
0              1        0      3   male 22.000000     1     0 7.2500
2              3        1      3 female 26.000000     0     0 7.9250
3              4        1      1 female 35.000000     1     0 53.1000
4              5        0      3   male 35.000000     0     0 8.0500
5              6        0      3   male 29.699118     0     0 8.4583
..           …       …     …      …         …    …    …      …
886          887        0      2   male 27.000000     0     0 13.0000
887          888        1      1 female 19.000000     0     0 30.0000
888          889        0      3 female 29.699118     1     2 23.4500
889          890        1      1   male 26.000000     0     0 30.0000
890          891        0      3   male 32.000000     0     0 7.7500

    Embarked
0          S
```

```
2          S
3          S
4          S
5          Q
..       ...
886        S
887        S
888        S
889        C
890        Q

[775 rows x 9 columns]
```

[ ]:
```
sns.boxplot(df_cleaned)
```

[ ]: <Axes: >



```
[ ]: df=df_cleaned
```

```
[ ]: x=df.drop('Survived', axis=1)
     y=df['Survived']
```

```
[ ]: x.head()
```

```
[ ]:    PassengerId  Pclass     Sex        Age  SibSp  Parch     Fare Embarked
     0            1       3    male 22.000000      1      0 7.2500        S
     2            3       3  female 26.000000      0      0 7.9250        S
     3            4       1  female 35.000000      1      0 53.1000       S
     4            5       3    male 35.000000      0      0 8.0500        S
     5            6       3    male 29.699118      0      0 8.4583        Q
```

```
[ ]: y.head()
```

```
[ ]: 0    0
     2    1
     3    1
     4    0
     5    0
     Name: Survived, dtype: int64
```

#7. Perform Encoding

```
[ ]: en = LabelEncoder()
     x['Sex'] = en.fit_transform(x['Sex'])
```

```
[ ]: x.head()
```

```
[ ]:    PassengerId  Pclass  Sex        Age  SibSp  Parch     Fare Embarked
     0            1       3    1 22.000000      1      0 7.2500        S
     2            3       3    0 26.000000      0      0 7.9250        S
     3            4       1    0 35.000000      1      0 53.1000       S
     4            5       3    1 35.000000      0      0 8.0500        S
     5            6       3    1 29.699118      0      0 8.4583        Q
```

```
[ ]: x = pd.get_dummies(x,columns=['Embarked'])
```

```
[ ]: x.head()
```

```
[ ]:   PassengerId Pclass Sex       Age SibSp Parch     Fare Embarked_C \
     0            1       3    1 22.000000      1      0 7.2500          0
     2            3       3    0 26.000000      0      0 7.9250    0
```

```
3           4      1     0 35.000000      1     0 53.1000   0
4           5      3     1 35.000000      0     0 8.0500    0
5           6      3     1 29.699118      0     0 8.4583    0

   Embarked_Q Embarked_S
0          0          1
2          0 1
3          0 1
4          0 1
5          1 0
```

#8. Feature Scaling

[ ]:
```
scale = StandardScaler()
x[['Age', 'Fare']] = scale.fit_transform(x[['Age', 'Fare']])
```

[ ]:
```
x.head()
```

[ ]:
```
   PassengerId  Pclass  Sex       Age  SibSp  Parch      Fare  Embarked_C  \
0           1       3   1 -0.556219      1      0 -0.779117           0
2           3       3      0 -0.243027       0      0 -0.729373       0
3           4       1      0 0.461654 1      0 2.599828 0
4           5       3      1 0.461654 0      0 -0.720161       0
5           6       3      1 0.046606 0      0 -0.690071       0

   Embarked_Q Embarked_S
0          0          1
2          0      1

3          0      1

4          0      1

5          1      0
```

#9. Splitting the data into Train and Test

[ ]:
```
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=0.2,␣
↪random_state=42)
```

[ ]:
```
print(x_train.shape)
print(x_test.shape)
print(y_train.shape)
print(y_test.shape)
```

```
(620, 10)
(155, 10)
(620,)
(155,)
```