```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
import sklearn
from pandas import Series, DataFrame
from pylab import rcParams
from sklearn import preprocessing
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.metrics import classification_report
from sklearn import tree
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix
```

```
Url = "https://raw.githubusercontent.com/BigDataGal/Python-for-Data-Science/master/titanic-train.csv"
titanic = pd.read_csv(Url)
titanic.columns =['PassengerId','Survived','Pclass','Name','Sex','Age','SibSp','Parch','Ticket','Fare','Cabin','Embarked']
titanic.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

```
titanic.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
```

```
titanic.corr()
```

```
<ipython-input-4-c1c691e9860d>:1: FutureWarning: The default value of numeric_only in Da
  titanic.corr()
```

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

```
titanic.groupby('Pclass').mean()
```

```
<ipython-input-5-288bab41a485>:1: FutureWarning: The default value of numeric_only in Da
  titanic.groupby('Pclass').mean()
        PassengerId  Survived       Age     SibSp     Parch       Fare

Pclass
```

```
titanic[titanic['Cabin'].isnull()]['Pclass'].value_counts()
```

```
3    479
2    168
1     40
Name: Pclass, dtype: int64
```

```
titanic[titanic['Pclass']==1]['Survived'].value_counts()
```

```
1    136
0     80
Name: Survived, dtype: int64
```

```
titanic[titanic['Pclass']==2]['Survived'].value_counts()
```

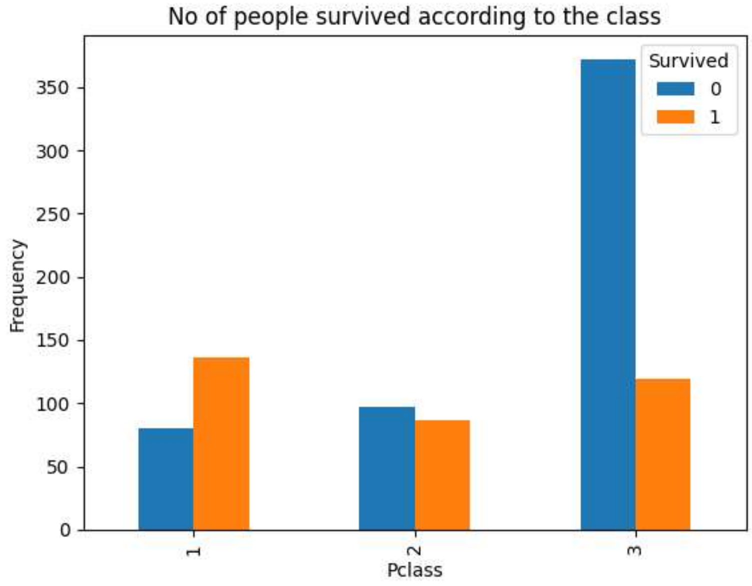
```
0    97
1    87
Name: Survived, dtype: int64
```

```
titanic[titanic['Pclass']==3]['Survived'].value_counts()
```

```
0    372
1    119
Name: Survived, dtype: int64
```

```
pd.crosstab(titanic.Pclass, titanic.Survived).plot(kind='bar')
plt.ylabel('Frequency')
plt.title('No of people survived according to the class')
```

```
Text(0.5, 1.0, 'No of people survived according to the class')
```



```
titanic[titanic['Fare']==0]
```

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare
179	180	0	3	Leonard, Mr. Lionel	male	36.0	0	0	LINE	0.0
263	264	0	1	Harrison, Mr. William	male	40.0	0	0	112059	0.0
271	272	1	3	Tornquist, Mr. William Henry	male	25.0	0	0	LINE	0.0
277	278	0	2	Parkes, Mr. Francis "Frank"	male	NaN	0	0	239853	0.0
				Johnson, Mr						

```
titanic['Fare'] = titanic['Fare'].replace(0,titanic['Fare'].mean())
```

```
titanic.drop('Cabin',axis=1,inplace=True) #The survival is not depend on the cabin
titanic['Age'].fillna(titanic['Age'].median(), inplace=True) #The survival may be depend on the Age because old think that, grandspa's and pa
```

```
titanic.isnull().sum()
```

```
PassengerId    0
Survived       0
Pclass         0
Name           0
Sex            0
Age            0
SibSp          0
Parch          0
Ticket         0
Fare           0
Embarked       2
dtype: int64
```

```
titanic['Embarked'].fillna(titanic['Embarked'].mode()[0], inplace=True)
```

```
titanic.isnull().sum()
```

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

```
titanic['GenderClass'] = titanic.apply(lambda x: 'child' if x['Age'] < 15 else x['Sex'],axis=1)
```

```
titanic.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

```
titanic.drop(['Name','Sex','Ticket'],axis=1,inplace=True)
```

```
titanic.Embarked.unique()
```

```
array(['S', 'C', 'Q'], dtype=object)
```

```
titanic.GenderClass.unique()
```

```
array(['male', 'female', 'child'], dtype=object)
```

```
Embarked_category = {'S':1,'C':2,'Q':3}
GenderClass_category = {'male':1,'female':2,'child':3}
```

```
titanic['Embarked'] = titanic['Embarked'].replace(Embarked_category)
titanic['GenderClass'] = titanic['GenderClass'].replace(GenderClass_category)
```

```
titanic.head()
```

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare	Embarked	GenderClass
0	1	0	3	22.0	1	0	7.2500	1	1
1	2	1	1	38.0	1	0	71.2833	2	2
2	3	1	3	26.0	0	0	7.9250	1	2
3	4	1	1	35.0	1	0	53.1000	1	2
4	5	0	3	35.0	0	0	8.0500	1	1

```
titanic['Family'] = titanic['SibSp'] + titanic['Parch'] + 1
```

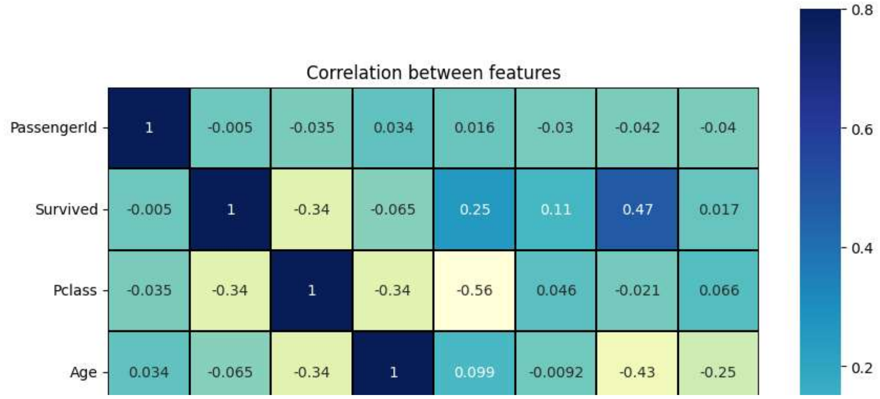
```
titanic.drop(['SibSp','Parch'],axis=1,inplace=True)
```

```
titanic.head()
```

	PassengerId	Survived	Pclass	Age	Fare	Embarked	GenderClass	Family
0	1	0	3	22.0	7.2500	1	1	2
1	2	1	1	38.0	71.2833	2	2	2
2	3	1	3	26.0	7.9250	1	2	1
3	4	1	1	35.0	53.1000	1	2	2
4	5	0	3	35.0	8.0500	1	1	1

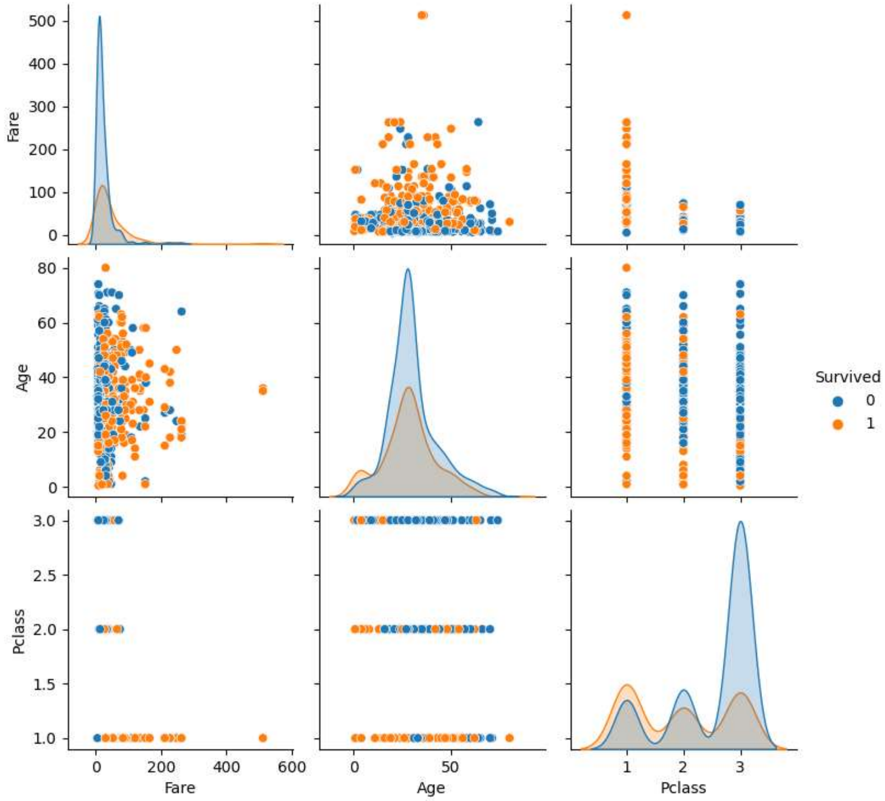
```
corr = titanic.corr()
plt.figure(figsize=(10,10))
sns.heatmap(corr,vmax=.8,linewidth=.01, square = True, annot = True,cmap='YlGnBu',linecolor ='black')
plt.title('Correlation between features')
```

```
Text(0.5, 1.0, 'Correlation between features')
```



```
sns.pairplot(titanic[["Fare","Age","Pclass","Survived"]],vars = ["Fare","Age","Pclass"],hue="Survived",dropna=True)
```

```
<seaborn.axisgrid.PairGrid at 0x7f99c1772b90>
```



```
X = titanic.loc[:,titanic.columns != 'Survived']
X.head()
```

	PassengerId	Pclass	Age	Fare	Embarked	GenderClass	Family
0	1	3	22.0	7.2500	1	1	2
1	2	1	38.0	71.2833	2	2	2
2	3	3	26.0	7.9250	1	2	1
3	4	1	35.0	53.1000	1	2	2
4	5	3	35.0	8.0500	1	1	1

```
y = titanic.Survived
y.head()
```

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

```
X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.3,random_state=40)
print(X_train.shape)
print(X_test.shape)
```

```
(623, 7)
(268, 7)
```

```
model = tree.DecisionTreeClassifier()
model.fit(X_train,y_train)
```

```
▾ DecisionTreeClassifier
DecisionTreeClassifier()
```

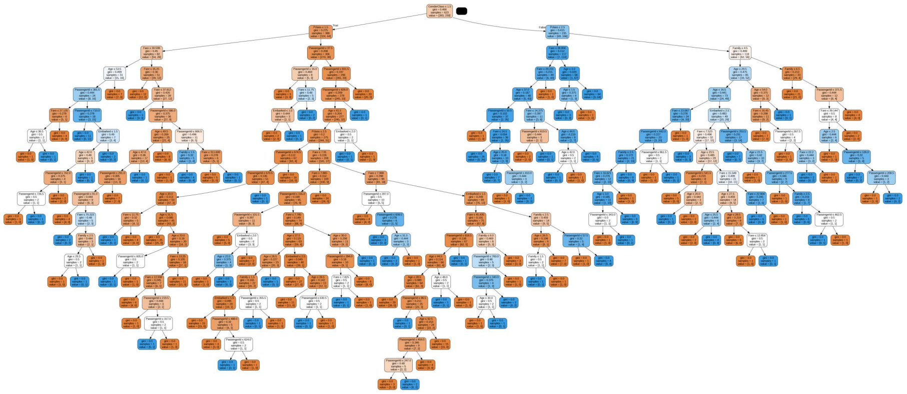
```
import sys
!{sys.executable} -m pip install graphviz
!{sys.executable} -m pip install pydotplus
!{sys.executable} -m pip install Ipython
```

```
Requirement already satisfied: graphviz in /usr/local/lib/python3.10/dist-packages (0.20.1)
Requirement already satisfied: pydotplus in /usr/local/lib/python3.10/dist-packages (2.0.2)
Requirement already satisfied: pyparsing>=2.0.1 in /usr/local/lib/python3.10/dist-packages (from pydotplus) (3.1.1)
Requirement already satisfied: Ipython in /usr/local/lib/python3.10/dist-packages (7.34.0)
Requirement already satisfied: setuptools>=18.5 in /usr/local/lib/python3.10/dist-packages (from Ipython) (67.7.2)
Collecting jedi>=0.16 (from Ipython)
  Downloading jedi-0.19.0-py2.py3-none-any.whl (1.6 MB)
     ━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━━ 1.6/1.6 MB 9.9 MB/s eta 0:00:00
Requirement already satisfied: decorator in /usr/local/lib/python3.10/dist-packages (from Ipython) (4.4.2)
Requirement already satisfied: pickleshare in /usr/local/lib/python3.10/dist-packages (from Ipython) (0.7.5)
Requirement already satisfied: traitlets>=4.2 in /usr/local/lib/python3.10/dist-packages (from Ipython) (5.7.1)
Requirement already satisfied: prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0 in /usr/local/lib/python3.10/dist-packages (from Ipython) (3
Requirement already satisfied: pygments in /usr/local/lib/python3.10/dist-packages (from Ipython) (2.16.1)
Requirement already satisfied: backcall in /usr/local/lib/python3.10/dist-packages (from Ipython) (0.2.0)
Requirement already satisfied: matplotlib-inline in /usr/local/lib/python3.10/dist-packages (from Ipython) (0.1.6)
Requirement already satisfied: pexpect>4.3 in /usr/local/lib/python3.10/dist-packages (from Ipython) (4.8.0)
Requirement already satisfied: parso<0.9.0,>=0.8.3 in /usr/local/lib/python3.10/dist-packages (from jedi>=0.16->Ipython) (0.8.3)
Requirement already satisfied: ptyprocess>=0.5 in /usr/local/lib/python3.10/dist-packages (from pexpect>4.3->Ipython) (0.7.0)
Requirement already satisfied: wcwidth in /usr/local/lib/python3.10/dist-packages (from prompt-toolkit!=3.0.0,!=3.0.1,<3.1.0,>=2.0.0->Ip
Installing collected packages: jedi
Successfully installed jedi-0.19.0
```

```
import pydotplus
from IPython.display import Image

dot_tree = tree.export_graphviz(model, out_file=None,filled=True, rounded=True,
                                special_characters=True, feature_names=X.columns)
graph = pydotplus.graph_from_dot_data(dot_tree)

Image(graph.create_png())
```



```
y_pred_train = model.predict(X_train)
y_pred_test = model.predict(X_test)


print('Accuracy of the Train Set',accuracy_score(y_train,y_pred_train))
print('Accuracy of the Test Set',accuracy_score(y_test,y_pred_test))
```

```
Accuracy of the Train Set 1.0
Accuracy of the Test Set 0.7350746268656716
```

```
import pandas as pd
from sklearn.metrics import confusion_matrix
confusion_matrix = pd.DataFrame(confusion_matrix(y_test, y_pred_test))

confusion_matrix.index = ['Actual Died','Actual Survived']
confusion_matrix.columns = ['Predicted Died','Predicted Survived']
print(confusion_matrix)
```

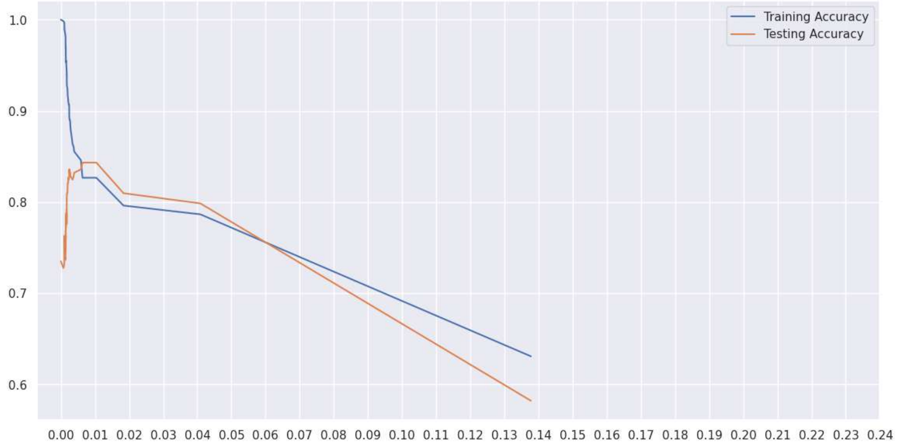
```
                 Predicted Died  Predicted Survived
Actual Died                 122                  34
Actual Survived              37                  75
```

```
from sklearn import tree
path = tree.DecisionTreeClassifier(random_state=0).cost_complexity_pruning_path(X_train,y_train)
alphas = path['ccp_alphas']
alphas
```

```
array([0.        , 0.00075798, 0.00101659, 0.00103442, 0.00104334,
       0.00107009, 0.00107009, 0.00120385, 0.00120385, 0.00133761,
       0.00133761, 0.00139355, 0.00139577, 0.00140449, 0.00140449,
       0.00140449, 0.00140449, 0.00142679, 0.00144462, 0.00144462,
       0.00144462, 0.00145889, 0.00146094, 0.00151074, 0.00156055,
       0.00158153, 0.00160514, 0.00160514, 0.001651  , 0.00170742,
       0.00171215, 0.00173355, 0.00174295, 0.00176139, 0.00192616,
       0.00200571, 0.00200642, 0.00214018, 0.00216693, 0.00216693,
       0.00232628, 0.00243032, 0.00248147, 0.00252236, 0.00256822,
       0.00267523, 0.00272387, 0.00275166, 0.00281969, 0.00344244,
       0.00375107, 0.00389482, 0.00587045, 0.00634481, 0.0103999 ,
       0.01836386, 0.04088443, 0.13773534])
```

```
from sklearn.tree import DecisionTreeClassifier
accuracy_train,accuracy_test = [],[]
for i in alphas:
  model = DecisionTreeClassifier(ccp_alpha = i)
  model.fit(X_train,y_train)
  y_train_pred=model.predict(X_train)
  y_test_pred = model.predict(X_test)

  accuracy_train.append(accuracy_score(y_train,y_train_pred))
  accuracy_test.append(accuracy_score(y_test,y_test_pred))
sns.set()
plt.figure(figsize=(14,7))
sns.lineplot(y=accuracy_train,x=alphas,label="Training Accuracy")
sns.lineplot(y=accuracy_test,x=alphas,label="Testing Accuracy")
plt.xticks(ticks=np.arange(0.00,0.25,0.01))
plt.show()
```



```
# Model creation using grid search CV and parameter tuning
from sklearn.model_selection import GridSearchCV

decision_tree_classifier = tree.DecisionTreeClassifier(ccp_alpha = 0.005)


tree_para = [{'criterion':['gini','entropy'],'max_depth': range(2,60),
                             'max_features': ['sqrt', 'log2', None] }]



grid_search = GridSearchCV(decision_tree_classifier,tree_para, cv=10, refit='AUC')
grid_search.fit(X_train, y_train)
```

```
▸           GridSearchCV
▸ estimator: DecisionTreeClassifier
      ▸ DecisionTreeClassifier
```

```
y_pred_test1 = grid_search.predict(X_test)
from sklearn.metrics import accuracy_score
print('Accuracy score for test data is:', accuracy_score(y_test,y_pred_test1))
# Accuracy score for test data is: 0.832089552238806 for ccp_alpha = 0.005
# Accuracy score for test data is: 0.8097014925373134 for ccp_alpha = 0.06
```

```
Accuracy score for test data is: 0.832089552238806
```

```
from sklearn.metrics import confusion_matrix

confusion_matrix = pd.DataFrame(confusion_matrix(y_test, y_pred_test1))

confusion_matrix.index = ['Actual Died','Actual Survived']
confusion_matrix.columns = ['Predicted Died','Predicted Survived']
print(confusion_matrix)
```

```
                 Predicted Died  Predicted Survived
Actual Died                 138                  18
Actual Survived              27                  85
```