Data Science Masters :Assignment 23

Problem:

Predicting Survival in the Titanic Data Set. We will be using a decision tree to make predictions about the Titanic data set from Kaggle. This data set provides information on the Titanic passengers and can be used to predict whether a passenger survived or not.

Solution:

Importing Libraries...

In [1]:

```
%matplotlib inline
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sb
from IPython.display import Image, display
import pydotplus
import sklearn
from pandas import Series, DataFrame
from pylab import rcParams
from sklearn import preprocessing
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.metrics import accuracy_score,classification_report
```

Data Pre-processing Steps

In [2]:

```
# Load dataset
# Load Dataset and Convert it into Datafarme
df=pd.read_csv("https://raw.githubusercontent.com/BigDataGal/Python-for-Data-Science/master
df.head()
```

Out[2]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	C
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 Briggs Th...	female	38.0	1	0	PC 17599	71.2833	
2	3	1	3	Heikkinen, Miss. Laina	female	26.0	0	0	STON/O2. 3101282	7.9250	
3	4	1	1	Futrelle, Mrs. Jacques Heath (Lily May Peel)	female	35.0	1	0	113803	53.1000	
4	5	0	3	Allen, Mr. William Henry	male	35.0	0	0	373450	8.0500	

Exploring Data - Analysis

In [3]:

```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
PassengerId    891 non-null int64
Survived       891 non-null int64
Pclass         891 non-null int64
Name           891 non-null object
Sex            891 non-null object
Age            714 non-null float64
SibSp          891 non-null int64
Parch          891 non-null int64
Ticket         891 non-null object
Fare           891 non-null float64
Cabin          204 non-null object
Embarked       889 non-null object
dtypes: float64(2), int64(5), object(5)
memory usage: 83.6+ KB
```

In [4]:

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

Out[4]:

```
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
```

Looks like, there are some null values in the given dataset

In [5]:

```
print("The No. of rows in titanic data : {0}\nThe No. of columns in titanic data : {1}" .fo
```

```
The No. of rows in titanic data : 891
The No. of columns in titanic data : 12
```

In [6]:

```
# Statictical observation
df.describe()
```

Out[6]:

	PassengerId	Survived	Pclass	Age	SibSp	Parch	Fare
count	891.000000	891.000000	891.000000	714.000000	891.000000	891.000000	891.000000
mean	446.000000	0.383838	2.308642	29.699118	0.523008	0.381594	32.204208
std	257.353842	0.486592	0.836071	14.526497	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	20.125000	0.000000	0.000000	7.910400
50%	446.000000	0.000000	3.000000	28.000000	0.000000	0.000000	14.454200
75%	668.500000	1.000000	3.000000	38.000000	1.000000	0.000000	31.000000
max	891.000000	1.000000	3.000000	80.000000	8.000000	6.000000	512.329200

In [7]:

```
# Fill null values with Mean for numerical datatatype features
df=df.fillna(df.mean())
```

In [8]:

```
df.Survived.value_counts(normalize=True)
```

Out[8]:

```
0    0.616162
1    0.383838
Name: Survived, dtype: float64
```

61.6 % of passengers had not survived and 38.3 % had survived.

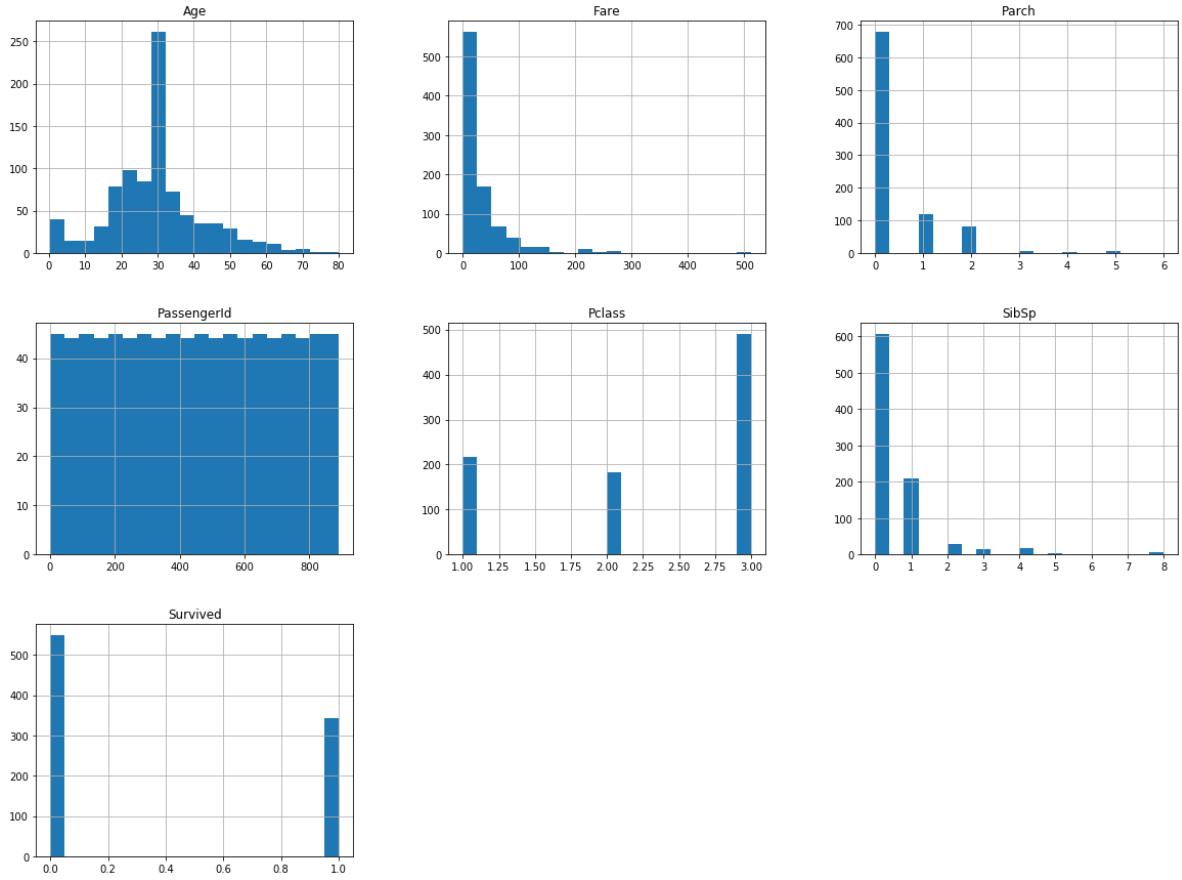
Data Visualisation

In [9]:

```
df.hist(bins=20,figsize=(20,15))
```

Out[9]:

```
array([[<matplotlib.axes._subplots.AxesSubplot object at 0x000001EA0FB00780
>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA0FDF3B70
>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA0FE261D0
>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x000001EA0FE4D860
>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA0FE77EF0
>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA0FE77F28
>],
       [<matplotlib.axes._subplots.AxesSubplot object at 0x000001EA0FECDC50
>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA0FEFF320
>,
        <matplotlib.axes._subplots.AxesSubplot object at 0x000001EA0FF269B0
>]],
      dtype=object)
```



As stated in the given problem , analysis need to be done based upon these features (Pclass, Sex, Age, SibSp (Siblings aboard), Parch (Parents/children aboard) ,and Fare)

Create a dataframe having these features from titainc dataset.

In [10]:

```
df_titanic = df[['Survived','Pclass', 'Sex', 'Age', 'SibSp','Parch','Fare']]
df_titanic.head()
```

Out[10]:

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

In [11]:

```
# Transforming Text values of "Sex" feature into Numerical values
# pandas.factorize() to convert Categorical object into numerical values
#replacing 'male' with Zero and 'female' with 1
df_titanic['Sex'], _ = pd.factorize(df_titanic['Sex'])
df_titanic.head(5)
```

```
C:\Users\mkarthikeyan\AppData\Local\Continuum\anaconda3\lib\site-packages\ip
ykernel_launcher.py:4: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/s
table/indexing.html#indexing-view-versus-copy (http://pandas.pydata.org/pand
as-docs/stable/indexing.html#indexing-view-versus-copy)
  after removing the cwd from sys.path.
```

Out[11]:

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

Select features

In [12]:

```
y = pd.DataFrame(df_titanic['Survived'])
X = df_titanic[['Pclass', 'Sex', 'Age', 'SibSp','Parch','Fare']]
```

Splitting Data into Train and Test set

In [13]:

```
# split data randomly into 80% training and 20% test
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=40 ,
print("The Size of Fetures data(X) for Training set" , X_train.shape)
print("The Size of Fetures data(X) for Test set" , X_test.shape)
print("The Size of Target data(y) for Training set" , y_train.shape)
print("The Size of Target data(y) for Test set" , y_test.shape)
```

```
The Size of Fetures data(X) for Training set (712, 6)
The Size of Fetures data(X) for Test set (179, 6)
The Size of Target data(y) for Training set (712, 1)
The Size of Target data(y) for Test set (179, 1)
```

Decision Tree Modeling

In [14]:

```
from sklearn.tree import DecisionTreeClassifier
# creating decision tree classifier based upon gini and splitting the data with best strate
dec_Tree_Model = DecisionTreeClassifier(criterion='gini' , random_state=0 , splitter='best'
```

In [15]:

```
# Selection of dependent and independent variables....
dependentFeatures = y.columns.tolist()  # Dependent variable
independentFeatures = X.columns.tolist() # Independent variable

#Creating target claas variable for passengers for survived (1) or not-survived (0)
target_cls = {y.Survived.unique()[0]:'Not-Survived',y.Survived.unique()[1]:'Survived'}
target_cls_var=list(target_cls.values())

print("Dependent Variable:",dependentFeatures)
print("Independent Variable:",independentFeatures)
print("Target class Variable:",target_cls_var)
```

```
Dependent Variable: ['Survived']
Independent Variable: ['Pclass', 'Sex', 'Age', 'SibSp', 'Parch', 'Fare']
Target class Variable: ['Not-Survived', 'Survived']
```

Fitting the model with train set

In [16]:

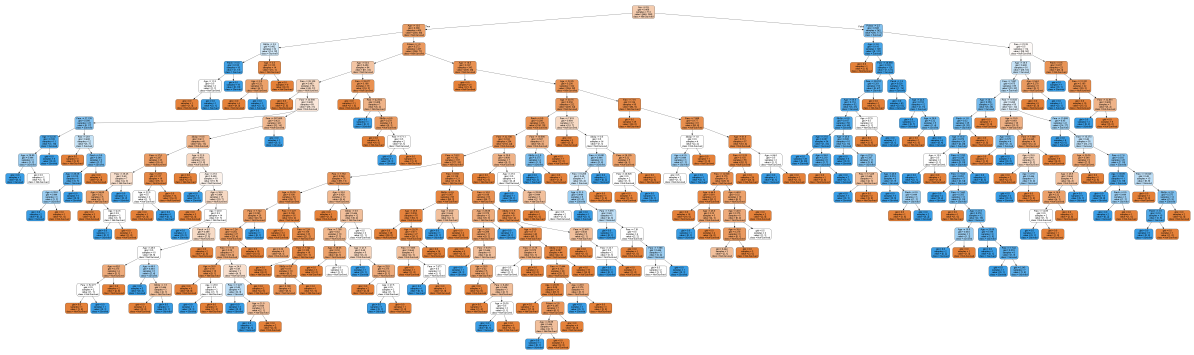
```
dec_Tree_Model.fit(X_train[independentFeatures], y_train[dependentFeatures])
```

Out[16]:

```
DecisionTreeClassifier(class_weight=None, criterion='gini', max_depth=None,
            max_features=None, max_leaf_nodes=None,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, presort=False, random_state=0,
            splitter='best')
```

In [17]:

```
from sklearn.tree import export_graphviz
dotDataTrain = export_graphviz(dec_Tree_Model, out_file=None, filled=True, rounded=True, fe
graph_train = pydotplus.graph_from_dot_data(dotDataTrain)
graph_train.write_jpeg('Survived_Passenger_TrainingSet.jpeg')
display(Image(graph_train.create_png()))
```



In [18]:

```
#Predicting the probability for Training data
y_pred_prob_train = dec_Tree_Model.predict_proba(X_train)
y_pred_prob_train[0:5]
```

Out[18]:

```
array([[1., 0.],
       [0., 1.],
       [1., 0.],
       [1., 0.],
       [0., 1.]])
```

In [19]:

```
#Predicting the Accuracy score for Training data
y_pred_train_score = dec_Tree_Model.predict(X_train)
y_pred_train_score[0:5]
```

Out[19]:

```
array([0, 1, 0, 0, 1], dtype=int64)
```

Fitting the model with test set

In [20]:

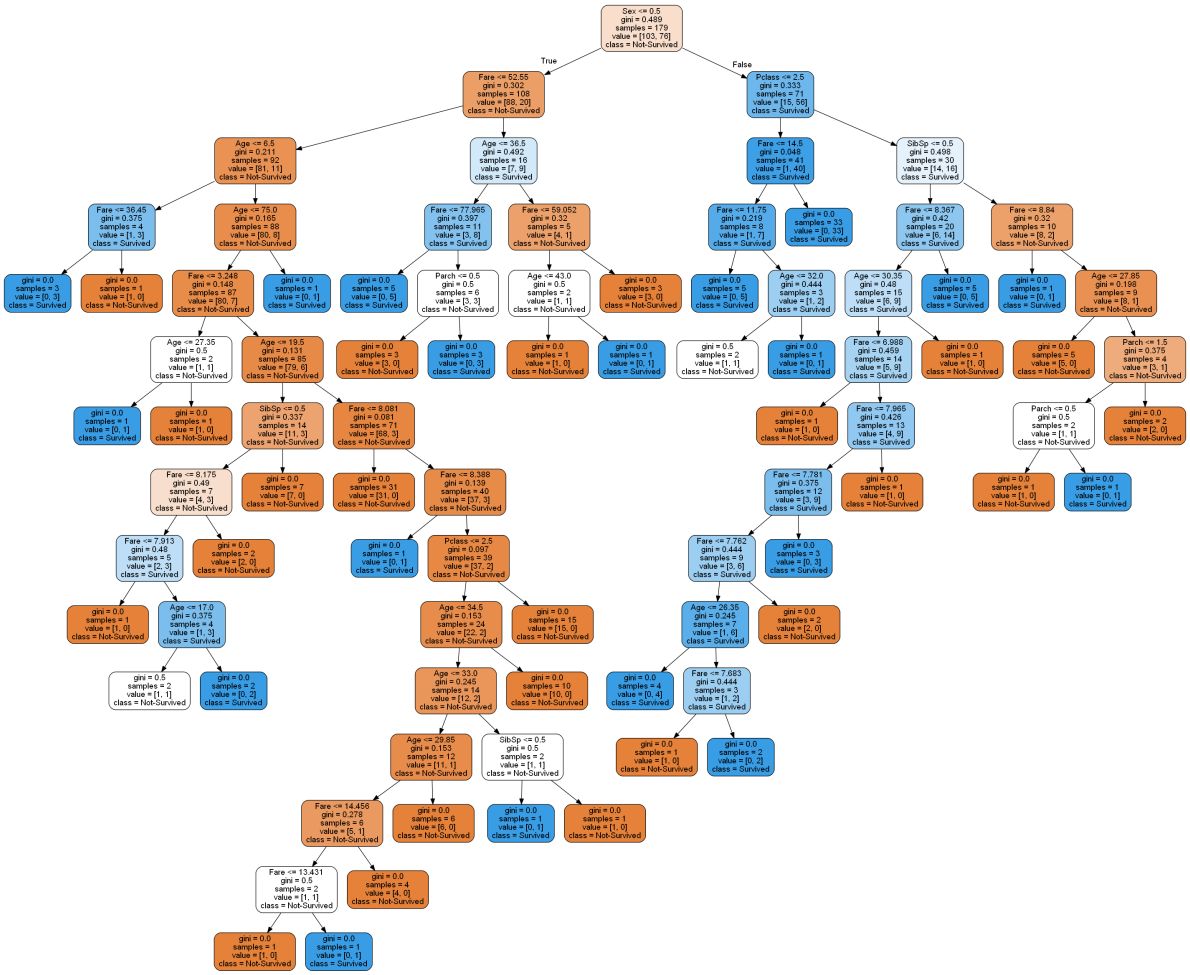
```
dec_Tree_Model.fit(X_test[independentFeatures], y_test[dependentFeatures])
```

Out[20]:

```
DecisionTreeClassifier(class_weight=None, criterion='gini', max_depth=None,
            max_features=None, max_leaf_nodes=None,
            min_impurity_decrease=0.0, min_impurity_split=None,
            min_samples_leaf=1, min_samples_split=2,
            min_weight_fraction_leaf=0.0, presort=False, random_state=0,
            splitter='best')
```

In [21]:

```
from sklearn.tree import export_graphviz
dotDataTrain = export_graphviz(dec_Tree_Model, out_file=None, filled=True, rounded=True, fe
graph_train = pydotplus.graph_from_dot_data(dotDataTrain)
graph_train.write_jpeg('Survived_Passenger_TestSet.jpeg')
display(Image(graph_train.create_png()))
```



In [22]:

```
#Predicting the probability for Test data
y_pred_prob_test = dec_Tree_Model.predict_proba(X_test)
y_pred_prob_test[0:5]
```

Out[22]:

```
array([[1., 0.],
       [1., 0.],
       [0., 1.],
       [1., 0.],
       [1., 0.]])
```

In [23]:

```
#Predicting the Accuracy score for Test data
y_pred_test_score = dec_Tree_Model.predict(X_test)
y_pred_test_score[0:5]
```

Out[23]:

```
array([0, 0, 1, 0, 0], dtype=int64)
```

Model Performance Evaluation

In [24]:

```
# Test Set
count_misclassified_train = (np.array(y_test.Survived) != y_pred_test_score).sum()
print('Misclassified samples in test data: {}'.format(count_misclassified_train))
accuracy_train_data = metrics.accuracy_score(np.array(y_test.Survived), y_pred_test_score)
print('Accuracy based upon test data: {:.4f}'.format(accuracy_train_data))
```

```
Misclassified samples in test data: 2
Accuracy based upon test data: 0.9888
```

In [25]:

```
from sklearn.metrics import classification_report, confusion_matrix
print("The Confusion matrix based upon test data \n", confusion_matrix(np.array(y_test.Surv
print("The Classification report based upon test data \n",classification_report(np.array(y_
```

```
The Confusion matrix based upon test data
 [[103   0]
 [  2  74]]

The Classification report based upon test data
              precision    recall  f1-score   support

          0       0.98      1.00      0.99       103
          1       1.00      0.97      0.99        76

avg / total       0.99      0.99      0.99       179
```

Conclusion:

As we observe that our model has misclassified 2 instances out of 179 cases in test set. Hence, the overall accuracy of the model is 98.88 %