Prescriptive Analytics & Preparing The Data

In [1]:
```
import numpy as np
import pandas as pd

import sklearn as sk
from sklearn.metrics import accuracy_score
from sklearn.metrics import mean_squared_error, r2_score
from pandas.plotting import scatter_matrix
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import StandardScaler
from sklearn.neighbors import KNeighborsClassifier
from sklearn.metrics import confusion_matrix
from sklearn.metrics import f1_score
print('numpy version:', np.__version__)
print('pandas version:', pd.__version__)
print('scikit-learn version:', sk.__version__)
```

```
numpy version: 1.16.4
pandas version: 0.23.4
scikit-learn version: 0.21.2
```

In [2]:
```
#Inserting the datasets
df = pd.read_csv(r"C:\Users\HP\Desktop\Datasets/Fifa_cleaned.csv",
                 encoding='UTF-8', sep=',', skiprows=0, index_col=False
)
df.drop(['Number','work_rate'],axis=1,inplace=True)
data = pd.DataFrame(df)
df =df[df["age"]<=21]
df =df[df["potential"]>60]
```

In [3]:
```
#Changing Rates from string to numeric

def Rates(r):
```

```
    if r== 'Low':
        return 1
    elif r== 'Medium':
        return 2
    elif r== 'High':
        return 3

df['attacking_rates']= df['attacking_rates'].apply(Rates)
df['defensive_rates']= df['defensive_rates'].apply(Rates)

df.head(5)
```

Out[3]:

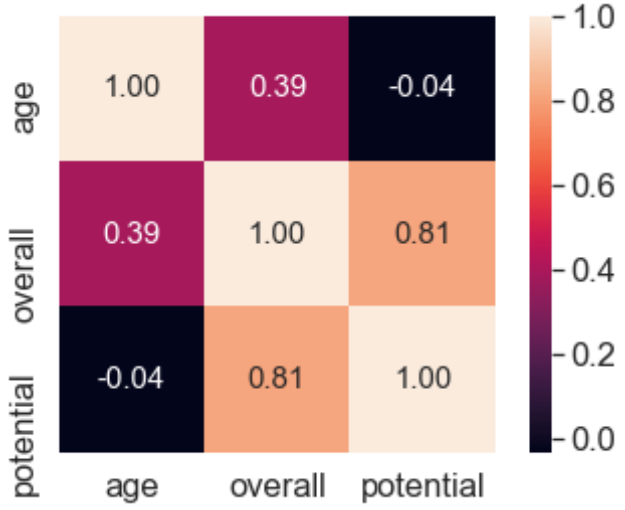
	name	age	nationality	overall	potential	club	value	wage	international reputation
25	K. Mbappé	19	France	88	95	Paris Saint-Germain	81000000.0	100000.0	3.0
154	O. Dembélé	21	France	83	92	FC Barcelona	40000000.0	155000.0	3.0
155	Gabriel Jesus	21	Brazil	83	92	Manchester City	41000000.0	130000.0	2.0
225	M. de Ligt	18	Netherlands	82	91	Ajax	27000000.0	11000.0	2.0
227	Arthur	21	Brazil	82	90	FC Barcelona	32500000.0	125000.0	1.0

5 rows × 45 columns

Start Predicting the potential rate of a player

In [25]:
```
## Try to use correlation heat map to see how all the different combine
d features
#in this heat map it is explain that overall have high corelattion betw
een potential outcome
```

```
import seaborn as sns
import matplotlib.pyplot as plt
cor=['age','overall','potential']
cm = np.corrcoef(df[cor].values,rowvar=0)
sns.set(font_scale=1.5)
hm = sns.heatmap(cm,
    cbar=True,
    annot=True,
    square=True,
    fmt='.2f',
    annot_kws={'size': 15},
    yticklabels=cor,
    xticklabels=cor)
plt.show()
```



In [5]:
```
#Lock the datasets
x = df.loc[:,['age','overall']]
y = df.loc[:,['potential']]
```

In [6]:
```
#feature Scalling and splitting the datasets
x_train, x_test, y_train, y_test = train_test_split(x, y, test_size=.25
)
```

```
sc_x =StandardScaler()
sc_x.fit(x_train)
x_train= sc_x.fit_transform(x_train)
x_test= sc_x.transform(x_test)
print('Train shape:', x_train.shape, y_train.shape)
print('Test shape:', x_test.shape, y_test.shape)
```

```
Train shape: (3499, 2) (3499, 1)
Test shape: (1167, 2) (1167, 1)
```

In [7]:
```
import math
math.sqrt(len(y_test))
```

Out[7]:
```
34.161381705077446
```

In [8]:
```
#Define the model with KNN
classifier= KNeighborsClassifier(n_neighbors=11,p=2,metric='euclidean')

#Predict the test result

classifier.fit(x_train,y_train)
y_pred= classifier.predict(x_test)
y_pred
```

```
C:\Users\HP\Anaconda3\lib\site-packages\ipykernel_launcher.py:6: DataCo
nversionWarning: A column-vector y was passed when a 1d array was expec
ted. Please change the shape of y to (n_samples, ), for example using r
avel().
```

Out[8]:
```
array([72, 76, 79, ..., 81, 65, 76], dtype=int64)
```

In [9]:
```
#Evaluate Model
#Prediction Result
e = confusion_matrix(y_test,y_pred)
print('F1 Score')
print((f1_score(y_test,y_pred,pos_label='positive',average='micro')))
```

```
print('Accuracy Score')
print((accuracy_score(y_test,y_pred)))
```

```
F1 Score
0.14224507283633248
Accuracy Score
0.14224507283633248
```

```
C:\Users\HP\Anaconda3\lib\site-packages\sklearn\metrics\classification.
py:1259: UserWarning: Note that pos_label (set to 'positive') is ignore
d when average != 'binary' (got 'micro'). You may use labels=[pos_labe
l] to specify a single positive class.
  % (pos_label, average), UserWarning)
```

In [10]:
```
#Predict a player potential with Dummy Data

#Player number 1
print("Player Potential number 1 :")
#A player age is 17 ans overall is 75
player1 = sc_x.transform([['17','75']])
print("Predict Player potential :",classifier.predict(player1))

#Player Number 2
print("Player Potential number 2 :")
#A player age is 20 and overall is 68
player2 = sc_x.transform([['20','68']])
print("Predict Player potential :",classifier.predict(player2))

#Player Number 3
print("Player Potential number 3 :")
#A player age is 19 and overall is 80
player3 = sc_x.transform([['19','80']])
print("Predict Player potential :",classifier.predict(player3))

#Player Number 4
print("Player Potential number 4 :")
#A player age is 21 and overall is 84
player4 = sc_x.transform([['21','83']])
print("Predict Player potential :",classifier.predict(player4))
```

```
#Player Number 5
print("Player Potential number 5 :")
#A player age is 16 and overall is 60
player5 = sc_x.transform([['16','60']])
print("Predict Player potential :",classifier.predict(player5))
```

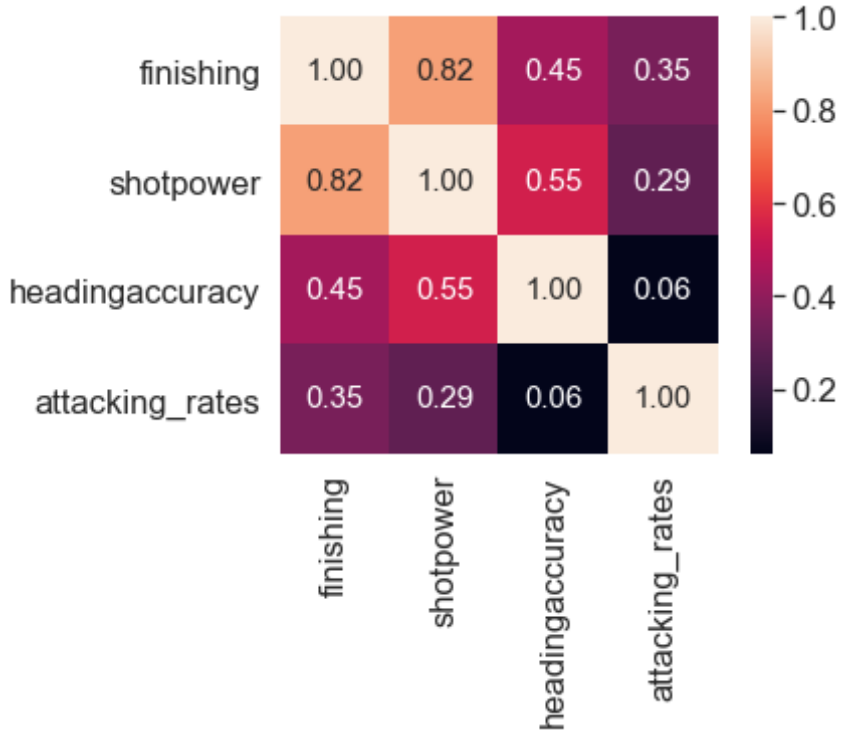
```
Player Potential number 1 :
Predict Player potential : [88]
Player Potential number 2 :
Predict Player potential : [75]
Player Potential number 3 :
Predict Player potential : [86]
Player Potential number 4 :
Predict Player potential : [89]
Player Potential number 5 :
Predict Player potential : [75]
```

Predicting Attacking Rates of a player

In [11]:
```
## Predicting Attacking Rates of a player
#Lock the datasets
df1 = df.copy()
pd.options.display.float_format = '{:,.0f}'.format
#Lock the datasets
x1 = df1.loc[:,['finishing','shotpower','headingaccuracy']]
y1 = df1.loc[:,['attacking_rates']]
```

In [12]:
```
##Try to see the correlation using heat map
##As you can see in the map below finishing have the largest corelation
 wiht attacking_rates
cor1=['finishing','shotpower','headingaccuracy','attacking_rates']
cm1= np.corrcoef(df[cor1].values,rowvar=0)
sns.set(font_scale=1.5)
hm1 = sns.heatmap(cm1,
    cbar=True,
    annot=True,
```

```
    square=True,
    fmt='.2f',
    annot_kws={'size': 15},
    yticklabels=cor1,
    xticklabels=cor1)
plt.show()
```



In [13]:
```
#feature Scalling and splitting the datasets
x1_train, x1_test, y1_train, y1_test = train_test_split(x1, y1, test_si
ze=.25)

sc_x1 =StandardScaler()
sc_x1.fit(x1_train)
x1_train= sc_x1.fit_transform(x1_train)
x1_test= sc_x1.transform(x1_test)
```

```
print('Train shape:', x1_train.shape, y1_train.shape)
print('Test shape:', x1_test.shape, y1_test.shape)
```

```
Train shape: (3499, 3) (3499, 1)
Test shape: (1167, 3) (1167, 1)
```

In [14]:
```
#Define the model with KNN
classifier1= KNeighborsClassifier(n_neighbors=11,p=2,metric='euclidean'
)

#Predict the test result

classifier1.fit(x1_train,y1_train)
y1_pred= classifier1.predict(x1_test)
y1_pred
```

```
C:\Users\HP\Anaconda3\lib\site-packages\ipykernel_launcher.py:6: DataCo
nversionWarning: A column-vector y was passed when a 1d array was expec
ted. Please change the shape of y to (n_samples, ), for example using r
avel().
```

Out[14]:
```
array([2, 2, 2, ..., 2, 2, 3], dtype=int64)
```

In [15]:
```
#Evaluate Model
#Prediction Result
e1 = confusion_matrix(y1_test,y1_pred)
print('F1 Score')
print(f1_score(y1_test,y1_pred,pos_label='positive',average='micro'))
print('Accuracy Score')
print(accuracy_score(y1_test,y1_pred))
```

```
F1 Score
0.7352185089974294
Accuracy Score
0.7352185089974294
```

```
C:\Users\HP\Anaconda3\lib\site-packages\sklearn\metrics\classification.
py:1259: UserWarning: Note that pos_label (set to 'positive') is ignore
```

```
d when average != 'binary' (got 'micro'). You may use labels=[pos_labe
l] to specify a single positive class.
  % (pos_label, average), UserWarning)
```

In [16]:
```
##Start predicting attacking rates of a player

#Player number 1
print("Player  number 1 :")
#A player have finishing ,shot power , heading accuracy
player1 = sc_x1.transform([['85','76','83']])
print("Predict Player Attacking_rates :",classifier1.predict(player1))

#Player number 2
print("Player  number 3 :")
#A player have finishing ,shot power , heading accuracy
player2 = sc_x1.transform([['33','52','74']])
print("Predict Player  Attacking_rates :",classifier1.predict(player2))

#Player number 3
print("Player  number 3 :")
#A player have finishing ,shot power , heading accuracy
player3 = sc_x1.transform([['50','65','44']])
print("Predict Player  Attacking_rates :",classifier1.predict(player3))
```

```
Player  number 1 :
Predict Player Attacking_rates : [3]
Player  number 3 :
Predict Player  Attacking_rates : [2]
Player  number 3 :
Predict Player  Attacking_rates : [2]
```

Predicting accuracy score with decision Tree Classifier

In [17]:
```
## Try to do decision tree with potential Player
from sklearn.tree import DecisionTreeClassifier
```

```
x2_train, x2_test, y2_train, y2_test = train_test_split(x, y, test_size
=.25)
clf=DecisionTreeClassifier(criterion = "entropy", splitter="best", max_
depth=5, min_samples_split=50, min_samples_leaf=5)
clf.fit(x2_train, y2_train)
```

Out[17]:
```
DecisionTreeClassifier(class_weight=None, criterion='entropy', max_dept
h=5,
                       max_features=None, max_leaf_nodes=None,
                       min_impurity_decrease=0.0, min_impurity_split=No
ne,
                       min_samples_leaf=5, min_samples_split=50,
                       min_weight_fraction_leaf=0.0, presort=False,
                       random_state=None, splitter='best')
```

In [18]:
```
#Predicting the dataset
y2_pred =clf.predict(x2_test)

print(y2_pred)
```

```
[75 71 85 ... 66 68 68]
```

In [19]:
```
#Accuracy score & Evaluating Model
from sklearn.metrics import classification_report, confusion_matrix
print(confusion_matrix(y2_test, y2_pred))
print(classification_report(y2_test, y2_pred))
```

```
[[ 0  3  0  9  2  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  3  0 10  3  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  2  0  4  5  0  0  3  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  3  0 11  4  0  6 14  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0
```

```
   0  0  0  0  0  0  0]
 [ 0  1  0  5 11  0  6 16  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  9  5  4  5 15  2  0  2  0  0  3  0  0  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  2  0  4  6  4 13 18  1  0  1  0  2  0  0  0  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  4  3  0  8 20  4  0  0  1  3  1  2  0  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  3  4  1  5 24  3  0  1  1 15  4  3  2  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  2  4  0  5 24  8  0  2  3 14  4  2  1  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  1  1  0  4 21  2  0  5  1 18  1 14  0  0  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0 15  2  0  6  2 19  5 14  3  2  0  1  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  2  1 11  2  0  4  1 16  2 21  3  2  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  2  0  8  1  0  6  2 19  1 24  3 10  0  0  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  2  0  0  2  4  7  2 38  5 10  0  4  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  2  0  0  0  4  8  3 24  1 12  0  3  0  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  1  0  0  0  2  2  1 16  3  9  0  6  2  0  0  0
0
```

```
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  2  0  1 20  8 22  0  7  4  0  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0 11  1 21  0  5 10  1  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  1  6  1 20  0  8  8  0  0  0
0
   1  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  5  0  9  0  7 10  1  0  0
0
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  5  0  5  8  3  0  0
1
   0  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  4  0  7 12  0  0  0
2
   2  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  3  0  5  9  4  0  0
1
   4  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  7  1  0  0
4
   4  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  3  0  1  0  0
0
  11  0  0  0  1  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
1
   3  0  0  0  2  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  1  0  0  0  0
1
   3  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0
   1  0  0  0  0  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0
```

```
   1  0  0  0  1  0  0]
 [ 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
0
   0  0  0  0  1  0  0]]
              precision    recall  f1-score   support

          61       0.00      0.00      0.00        15
          62       0.21      0.18      0.19        17
          63       0.00      0.00      0.00        14
          64       0.18      0.28      0.22        39
          65       0.23      0.28      0.25        39
          66       0.29      0.09      0.14        45
          67       0.24      0.25      0.25        51
          68       0.10      0.43      0.17        46
          69       0.12      0.05      0.07        66
          70       0.00      0.00      0.00        69
          71       0.17      0.07      0.10        68
          72       0.09      0.03      0.04        69
          73       0.13      0.25      0.17        65
          74       0.03      0.01      0.02        76
          75       0.19      0.51      0.28        74
          76       0.03      0.02      0.02        57
          77       0.07      0.21      0.11        42
          78       0.00      0.00      0.00        64
          79       0.08      0.10      0.09        49
          80       0.11      0.18      0.14        45
          81       0.09      0.03      0.05        32
          82       0.00      0.00      0.00        23
          83       0.00      0.00      0.00        28
          84       0.10      0.04      0.06        26
          85       0.13      0.25      0.17        16
          86       0.00      0.00      0.00        16
          87       0.00      0.00      0.00         7
          88       0.00      0.00      0.00         5
          89       0.00      0.00      0.00         1
          90       0.00      0.00      0.00         2
          93       0.00      0.00      0.00         1

    accuracy                           0.13      1167
```

```
   macro avg       0.08      0.11      0.08      1167
weighted avg       0.10      0.13      0.10      1167
```

```
C:\Users\HP\Anaconda3\lib\site-packages\sklearn\metrics\classification.
py:1437: UndefinedMetricWarning: Precision and F-score are ill-defined
and being set to 0.0 in labels with no predicted samples.
  'precision', 'predicted', average, warn_for)
```

Try to predict using Decision Tree Regression

In [20]:
```
df.describe()
```

Out[20]:

	age	overall	potential	value	wage	international reputation	weak foot	skill moves	body type	crossing
count	4,666	4,666	4,666	4,642	4,642	4,666	4,666	4,666	4,666	4,666
mean	20	61	73	1,180,330	4,242	1	3	2	2	45
std	1	6	6	3,006,853	8,855	0	1	1	1	16
min	16	46	61	40,000	1,000	1	1	1	1	6
25%	19	56	69	170,000	1,000	1	3	2	1	34
50%	20	61	73	400,000	1,000	1	3	2	2	47
75%	21	65	78	875,000	4,000	1	3	3	2	57
max	21	88	95	81,000,000	155,000	3	5	5	3	83

8 rows × 39 columns

In [21]:
```
#Training the data
x3_train, x3_test, y3_train, y3_test = train_test_split(x, y, test_size
=.25)
```

In [22]:
```
#Using Regressor Method

from sklearn.linear_model import LinearRegression
regressor = LinearRegression()
reg =regressor.fit(x3_train, y3_train)
```

In [23]:
```
#Try to make prediction by using predict method
y3_pred = reg.predict(x3_test)
print(y3_pred)
```

```
[[69.06506243]
 [73.55115085]
 [75.27846316]
 ...
 [78.26098278]
 [79.98829509]
 [77.34139075]]
```

In [24]:
```
##Evaluate the prediction
from sklearn import metrics
print('Mean Absolute Error:', metrics.mean_absolute_error(y3_test, y3_p
red))
print('Root Mean Squared Error:', np.sqrt(metrics.mean_squared_error(y3
_test, y3_pred)))
r_squarev = reg.score(x3_test, y3_test)
print("R2 accuracy", r_squarev)
##the mean absolute error for our algorithm is 2.12, which is less than
 10 percent of the mean of all the values in
##the 'potential' column.This means that our algorithm did a fine predi
ction job.
```

```
Mean Absolute Error: 1.9752509171164714
Root Mean Squared Error: 2.440035312179004
R2 accuracy 0.8115779667854733
```

In [ ]: