Problem Statement

In this assignment, students will be using the K-nearest neighbors algorithm to predict how many points NBA players scored in the 2013-2014 season.

A look at the data

Before we dive into the algorithm, let's take a look at our data. Each row in the data contains information on how a player performed in the 2013-2014 NBA season.

Download 'nba_2013.csv' file from this link: https://www.dropbox.com/s/b3nv38jjo5dxcl6/nba_2013.csv?dl=0 (https://www.dropbox.com/s/b3nv38jjo5dxcl6/nba_2013.csv?dl=0)

Here are some selected columns from the data: player - name of the player pos - the position of the player g - number of games the player was in gs - number of games the player started pts - total points the player scored

There are many more columns in the data, mostly containing information about average player game performance over the course of the season. See this site for an explanation of the rest of them.

We can read our dataset in and figure out which columns are present:

In [1]:
```
# importing important library
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
%matplotlib inline
with open("nba_2013.csv", 'r') as csvfile:
```

In [2]:

Out[2]:

	player	pos	age	bref_team_id	g	gs	mp	fg	fga	fg.	...	drb	trb	ast	stl	blk	tov	pf	pts
0	Quincy Acy	SF	23	TOT	63	0	847	66	141	0.468	...	144	216	28	23	26	30	122	171
1	Steven Adams	C	20	OKC	81	20	1197	93	185	0.503	...	190	332	43	40	57	71	203	265
2	Jeff Adrien	PF	27	TOT	53	12	961	143	275	0.520	...	204	306	38	24	36	39	108	362
3	Arron Afflalo	SG	28	ORL	73	73	2552	464	1011	0.459	...	230	262	248	35	3	146	136	1330
4	Alexis Ajinca	C	25	NOP	56	30	951	136	249	0.546	...	183	277	40	23	46	63	187	328

5 rows × 31 columns

In [3]:
```
# data info
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 481 entries, 0 to 480
Data columns (total 31 columns):
player          481 non-null object
pos             481 non-null object
age             481 non-null int64
bref_team_id    481 non-null object
g               481 non-null int64
gs              481 non-null int64
mp              481 non-null int64
fg              481 non-null int64
fga             481 non-null int64
fg.             479 non-null float64
x3p             481 non-null int64
x3pa            481 non-null int64
x3p.            414 non-null float64
x2p             481 non-null int64
x2pa            481 non-null int64
x2p.            478 non-null float64
efg.            479 non-null float64
ft              481 non-null int64
fta             481 non-null int64
ft.             461 non-null float64
orb             481 non-null int64
drb             481 non-null int64
trb             481 non-null int64
ast             481 non-null int64
stl             481 non-null int64
blk             481 non-null int64
tov             481 non-null int64
pf              481 non-null int64
pts             481 non-null int64
season          481 non-null object
season_end      481 non-null int64
dtypes: float64(5), int64(22), object(4)
memory usage: 116.6+ KB
```

In [4]:
```
# columns name
```

Out[4]:
```
Index(['player', 'pos', 'age', 'bref_team_id', 'g', 'gs', 'mp', 'fg', 'fga',
       'fg.', 'x3p', 'x3pa', 'x3p.', 'x2p', 'x2pa', 'x2p.', 'efg.', 'ft',
       'fta', 'ft.', 'orb', 'drb', 'trb', 'ast', 'stl', 'blk', 'tov', 'pf',
       'pts', 'season', 'season_end'],
      dtype='object')
```

In [5]:
```
# checking for null value
```

Out[5]:
```
player           0
pos              0
age              0
bref_team_id     0
g                0
gs               0
mp               0
fg               0
fga              0
fg.              2
x3p              0
x3pa             0
x3p.            67
x2p              0
x2pa             0
x2p.             3
efg.             2
ft               0
fta              0
ft.             20
orb              0
drb              0
trb              0
ast              0
stl              0
blk              0
tov              0
pf               0
pts              0
season           0
season_end       0
dtype: int64
```

In [6]:
```
# droping columns having null values
```

In [7]:
```
# checking for null values
```

Out[7]:
```
player          0
pos             0
age             0
bref_team_id    0
g               0
gs              0
mp              0
fg              0
fga             0
fg.             0
x3p             0
x3pa            0
x3p.            0
x2p             0
x2pa            0
x2p.            0
efg.            0
ft              0
fta             0
ft.             0
orb             0
drb             0
trb             0
ast             0
stl             0
blk             0
tov             0
pf              0
pts             0
season          0
season_end      0
dtype: int64
```

In [8]:
```
# checking df shape
```

Out[8]:
```
(403, 31)
```

In [9]:
```
# making a new data frame x

x=nba[['g', 'gs', 'mp', 'fg', 'fga',
       'fg.', 'x3p', 'x3pa', 'x3p.', 'x2p', 'x2pa', 'x2p.', 'efg.', 'ft',
       'fta', 'ft.', 'orb', 'drb', 'trb', 'ast', 'stl', 'blk', 'tov', 'pf',
      ]]
```

Out[9]:

	g	gs	mp	fg	fga	fg.	x3p	x3pa	x3p.	x2p	...	fta	ft.	orb	drb	trb	ast	stl	blk	tov
0	63	0	847	66	141	0.468	4	15	0.266667	62	...	53	0.660	72	144	216	28	23	26	30
3	73	73	2552	464	1011	0.459	128	300	0.426667	336	...	336	0.815	32	230	262	248	35	3	146
4	56	30	951	136	249	0.546	0	1	0.000000	136	...	67	0.836	94	183	277	40	23	46	63
6	69	69	2498	652	1423	0.458	3	15	0.200000	649	...	360	0.822	166	599	765	178	63	68	123
7	65	2	1072	134	300	0.447	2	13	0.153846	132	...	50	0.660	119	192	311	71	24	33	44

5 rows × 24 columns

In [10]:

```
<class 'pandas.core.frame.DataFrame'>
Int64Index: 403 entries, 0 to 480
Data columns (total 24 columns):
g       403 non-null int64
gs      403 non-null int64
mp      403 non-null int64
fg      403 non-null int64
fga     403 non-null int64
fg.     403 non-null float64
x3p     403 non-null int64
x3pa    403 non-null int64
x3p.    403 non-null float64
x2p     403 non-null int64
x2pa    403 non-null int64
x2p.    403 non-null float64
efg.    403 non-null float64
ft      403 non-null int64
fta     403 non-null int64
ft.     403 non-null float64
orb     403 non-null int64
drb     403 non-null int64
trb     403 non-null int64
ast     403 non-null int64
stl     403 non-null int64
blk     403 non-null int64
tov     403 non-null int64
pf      403 non-null int64
dtypes: float64(5), int64(19)
memory usage: 78.7 KB
```

In [11]:

```
# making new data frame y
y=nba[['pts']]
```

Out[11]:

	pts
0	171
3	1330
4	328
6	1603
7	303

Step 1:- We will train the model without doing any data scaling

In [12]:
```
# importing the libraries
from sklearn.model_selection import train_test_split
from sklearn.neighbors import KNeighborsRegressor
from sklearn.metrics import mean_squared_error

# dividing into train-test set
x_train,x_test,y_train,y_test=train_test_split(x,y,test_size=0.25, random_state=42)

# printing the shape of the data frame
print("x_train shape:",x_train.shape)
print("x_test shape:",x_test.shape)
print("y_train shape:",y_train.shape)
```

```
x_train shape: (302, 24)
x_test shape: (101, 24)
y_train shape: (302, 1)
y_test shape: (101, 1)
```

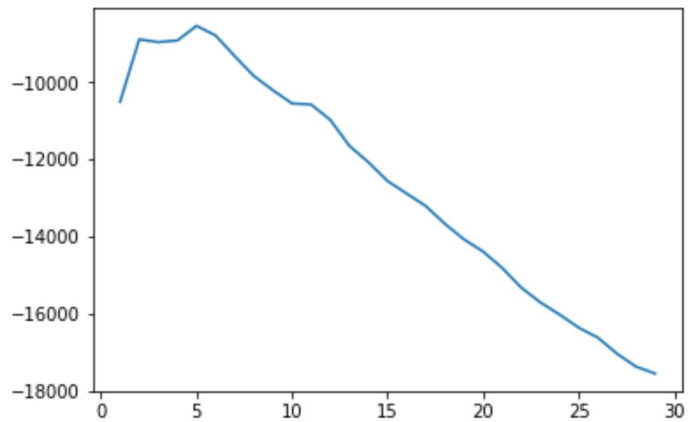
In [13]:
```
# ignoring the warnings
import warnings
warnings.filterwarnings('ignore')
from sklearn.model_selection import cross_val_score

#finding the best k value using cross validation
error=[]
for i in range(1,30,1):
    knn=KNeighborsRegressor(n_neighbors=i);
    scores=cross_val_score(knn,x_train,y_train,cv=10,scoring='mean_squared_error')
    error.append(scores.mean())
```

Out[13]:
```
[-10510.917096774194,
 -8892.457715053763,
 -8965.86028673835,
 -8922.141061827957,
 -8543.483415053763]
```

In [14]:

In [15]:
```
# plotting error vs k value
```

Out[15]:
```
[<matplotlib.lines.Line2D at 0x1bfdf3a2978>]
```



In [16]:
```
# model training and prediction on optimal k value
regressor=KNeighborsRegressor(n_neighbors=6)
regressor.fit(x_train,y_train)
y_predict=regressor.predict(x_test)
error=mean_squared_error(y_test,y_predict)
```

Out[16]:
```
4938.488723872388
```

Step 2:- We will train the model after doing the normalization

In [17]:

Out[17]:

	g	gs	mp	fg	fga	fg.	x3p	x3pa	x3p.	x2p	...	fta	ft.	orb	drb	trb	ast	stl	blk	tov
0	63	0	847	66	141	0.468	4	15	0.266667	62	...	53	0.660	72	144	216	28	23	26	30
3	73	73	2552	464	1011	0.459	128	300	0.426667	336	...	336	0.815	32	230	262	248	35	3	146
4	56	30	951	136	249	0.546	0	1	0.000000	136	...	67	0.836	94	183	277	40	23	46	63
6	69	69	2498	652	1423	0.458	3	15	0.200000	649	...	360	0.822	166	599	765	178	63	68	123
7	65	2	1072	134	300	0.447	2	13	0.153846	132	...	50	0.660	119	192	311	71	24	33	44

5 rows × 24 columns

In [18]:
```
# normalizing the data of the data frame
x_norm=(x-x.min())/(x.max()-x.min())
```

Out[18]:

	g	gs	mp	fg	fga	fg.	x3p	x3pa	x3p.	x2p	...	
0	0.753086	0.000000	0.269663	0.077739	0.081899	0.710167	0.015326	0.022801	0.266667	0.087819	...	0.0646
3	0.876543	0.890244	0.817014	0.546525	0.598220	0.696510	0.490421	0.486971	0.426667	0.475921	...	0.4166
4	0.666667	0.365854	0.303050	0.160188	0.145994	0.828528	0.000000	0.000000	0.000000	0.192635	...	0.0820
6	0.827160	0.841463	0.799679	0.767962	0.842730	0.694992	0.011494	0.022801	0.200000	0.919263	...	0.4465
7	0.777778	0.024390	0.341894	0.157833	0.176261	0.678300	0.007663	0.019544	0.153846	0.186969	...	0.0609

5 rows × 24 columns

In [19]:
```
# training test split
x_train,x_test,y_train,y_test=train_test_split(x_norm,y,test_size=0.25, random_state=4

# printing the shape
print("x_train shape:",x_train.shape)
print("x_test shape:",x_test.shape)
print("y_train shape:",y_train.shape)
```

```
x_train shape: (302, 24)
x_test shape: (101, 24)
y_train shape: (302, 1)
y_test shape: (101, 1)
```

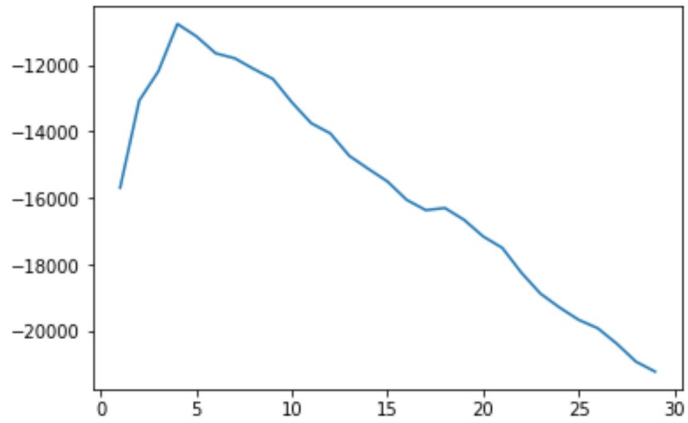
In [20]:
```
# filtering the warnings
import warnings
warnings.filterwarnings('ignore')
from sklearn.model_selection import cross_val_score

# finding optimal k value using cross validation
error=[]
for i in range(1,30,1):
    knn=KNeighborsRegressor(n_neighbors=i);
    scores=cross_val_score(knn,x_train,y_train,cv=10,scoring='mean_squared_error')
    error.append(scores.mean())
```

Out[20]:
```
[-15690.274731182795,
 -13072.992768817205,
 -12194.670896057349,
 -10771.17627016129,
 -11147.162313978493]
```

In [21]:

In [22]:
```
# plotting error vs k value
```

Out[22]:
```
[<matplotlib.lines.Line2D at 0x1bfe053f748>]
```



In [23]:
```
# training and predicting model on the optimal k value
regressor=KNeighborsRegressor(n_neighbors=4)
regressor.fit(x_train,y_train)
y_predict=regressor.predict(x_test)
error=mean_squared_error(y_test,y_predict)
```

Out[23]:
```
6814.95853960396
```

Step 3:- We will train the model after doing the standardization

In [24]:

Out[24]:

	g	gs	mp	fg	fga	fg.	x3p	x3pa	x3p.	x2p	...	fta	ft.	orb	drb	trb	ast	stl	blk	tov
0	63	0	847	66	141	0.468	4	15	0.266667	62	...	53	0.660	72	144	216	28	23	26	30
3	73	73	2552	464	1011	0.459	128	300	0.426667	336	...	336	0.815	32	230	262	248	35	3	146
4	56	30	951	136	249	0.546	0	1	0.000000	136	...	67	0.836	94	183	277	40	23	46	63
6	69	69	2498	652	1423	0.458	3	15	0.200000	649	...	360	0.822	166	599	765	178	63	68	123
7	65	2	1072	134	300	0.447	2	13	0.153846	132	...	50	0.660	119	192	311	71	24	33	44

5 rows × 24 columns

In [25]:
```
# standardizing value by using below formula a type of scaling
x_stand=(x-x.mean())/x.std()
```

Out[25]:

	g	gs	mp	fg	fga	fg.	x3p	x3pa	x3p.	x2p	...
0	0.235407	-0.944580	-0.613829	-0.877328	-0.925592	0.482473	-0.826813	-0.859228	-0.115785	-0.723659	...
3	0.676249	1.455748	1.338616	1.426921	1.432458	0.359705	1.545983	1.248019	0.935220	1.106739	...
4	-0.073182	0.041856	-0.494735	-0.472058	-0.632869	1.546458	-0.903355	-0.962741	-1.867461	-0.229318	...
6	0.499912	1.324224	1.276779	2.515361	2.549144	0.346064	-0.845948	-0.859228	-0.553704	3.197668	...
7	0.323576	-0.878818	-0.356175	-0.483638	-0.494638	0.196015	-0.865084	-0.874015	-0.856879	-0.256039	...

5 rows × 24 columns

In [26]:
```
# dividing the model into train and test
x_train,x_test,y_train,y_test=train_test_split(x_stand,y,test_size=0.25, random_state=

#printing the shape
print("x_train shape:",x_train.shape)
print("x_test shape:",x_test.shape)
print("y_train shape:",y_train.shape)
```

```
x_train shape: (302, 24)
x_test shape: (101, 24)
y_train shape: (302, 1)
y_test shape: (101, 1)
```

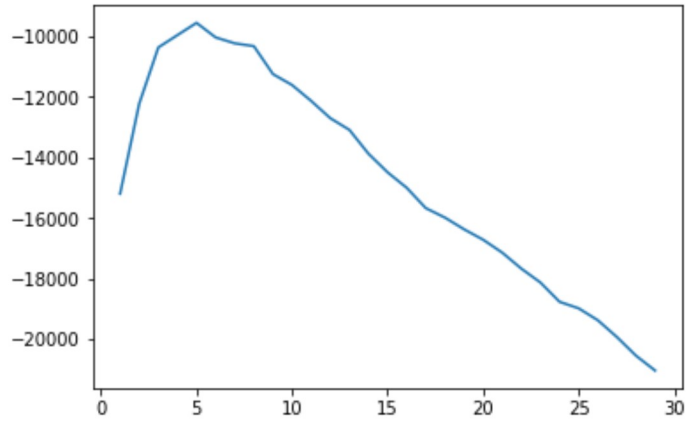
In [27]:
```
# ignoring the warnings
import warnings
warnings.filterwarnings('ignore')
from sklearn.model_selection import cross_val_score

# finding optimal k value by using cross validation
error=[]
for i in range(1,30,1):
    knn=KNeighborsRegressor(n_neighbors=i);
    scores=cross_val_score(knn,x_train,y_train,cv=10,scoring='mean_squared_error')
    error.append(scores.mean())
```

Out[27]:
```
[-15198.023978494622,
 -12223.87870967742,
 -10368.022234169652,
 -9961.159865591399,
 -9555.96498064516]
```

In [28]:

In [29]:
```
# plotting graph between error vs k value
```

Out[29]:
```
[<matplotlib.lines.Line2D at 0x1bfe07e8748>]
```



In [30]:
```
# training model and predicting value on the optimal k value
regressor=KNeighborsRegressor(n_neighbors=5)
regressor.fit(x_train,y_train)
y_predict=regressor.predict(x_test)
error=mean_squared_error(y_test,y_predict)
```

Out[30]:
```
9396.441188118812
```

Conclusion

For data without any scaling Mean squared error =4938.488723872388 , at k=6

For nornalized data Mean squared error =6814.95853960396 , at k=4

For standardized data Mean squared error = 9396.441188118812 , at k=5