Kmeans and Hierarchical Clustering on SEED dataset

```
'''Demonstrating seed dataset on various techniques'''
# Importing library
# Adding Preliminary Libraries

import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
%matplotlib inline
```

```
#Importing Dataset
#To demonstrate various clustering algorithms in python, the Iris dataset will be used which has three classes
# in the dependent variable (three type of Iris flowers) and using this dataset clusters will be formed.
seed = pd.read_csv('Seed_Data.csv')
seed
```

	A	P	C	LK	WK	A_Coef	LKG	target
0	15.26	14.84	0.8710	5.763	3.312	2.221	5.220	0
1	14.88	14.57	0.8811	5.554	3.333	1.018	4.956	0
2	14.29	14.09	0.9050	5.291	3.337	2.699	4.825	0
3	13.84	13.94	0.8955	5.324	3.379	2.259	4.805	0
4	16.14	14.99	0.9034	5.658	3.562	1.355	5.175	0
...	...	...	...	...	...	...	...	...
205	12.19	13.20	0.8783	5.137	2.981	3.631	4.870	2
206	11.23	12.88	0.8511	5.140	2.795	4.325	5.003	2
207	13.20	13.66	0.8883	5.236	3.232	8.315	5.056	2
208	11.84	13.21	0.8521	5.175	2.836	3.598	5.044	2
209	12.30	13.34	0.8684	5.243	2.974	5.637	5.063	2

210 rows × 8 columns

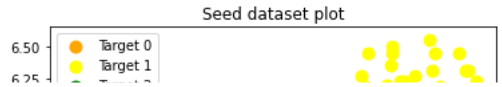
```
#Preparing Data
#Here we have the target variable ‘Type’. We need to remove the target variable so that this dataset can be used to work in an unsupervis
#(Note that we transformed the dataset to an array so that we can plot the graphs of the clusters).

Y = seed['target']          # Split off classifications
X = seed.iloc[:, [0, 1, 2, 3, 4, 5, 6]].values # Split off features
```

```
# Now we will separate the target variable from the original dataset and again convert it to an array by using numpy.

Y = seed['target']
Y = np.array(Y)
```

Seed dataset clustering plot

```
# Visualise Classes
# seed dataset has three classes in target

plt.scatter(X[Y == 0, 0], X[Y == 0, 6], s =80, c = 'orange', label = 'Target 0')
plt.scatter(X[Y == 1, 0], X[Y == 1, 6], s =80,  c = 'yellow', label = 'Target 1')
plt.scatter(X[Y == 2, 0], X[Y == 2, 6], s =80,  c = 'green', label = 'Target 2')
plt.title('Seed dataset plot')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x7f0c01d1f6a0>
```



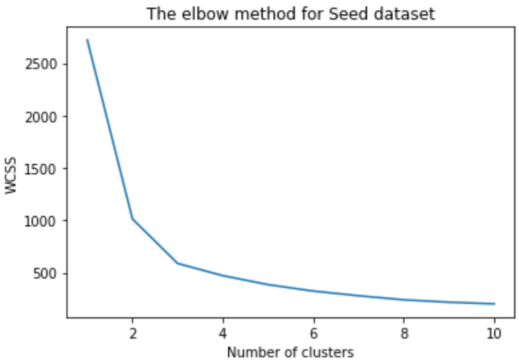
Kmeans Clustering for Seed Dataset

```
'''Kmeans is a kind of Unsupervised type of Clustering . It basically takes input from Dataset and predicts the clusters
accordingly'''

# Wine dataset for KMeans

from sklearn.cluster import KMeans


# Calculating WCSS (within-cluster sums of squares)

wcss=[]
for i in range(1, 11):
    kmeans = KMeans(n_clusters = i, init = 'k-means++', max_iter = 300, n_init = 10, random_state = 0)
    kmeans.fit(X)
    wcss.append(kmeans.inertia_)
```

Elbow plot (Kmeans) for SEED dataset

```
# Plot the WCSS

plt.plot(range(1, 11), wcss)
plt.title('The elbow method for Seed dataset')
plt.xlabel('Number of clusters')
plt.ylabel('WCSS')
```

```
Text(0, 0.5, 'WCSS')
```




```
# Running K-Means Model

cluster_Kmeans = KMeans(n_clusters=3)
model_kmeans = cluster_Kmeans.fit(X)
pred_kmeans = model_kmeans.labels_
pred_kmeans
```

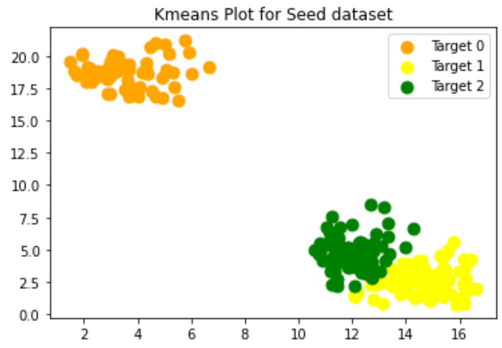
```
array([1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 2, 1, 1,
       1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 2, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 1, 1,
       1, 1, 1, 2, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       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, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0,
       1, 1, 1, 1, 0, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
       2, 2, 2, 1, 2, 2, 2, 2, 2, 2, 2, 2], dtype=int32)
```

Kmeans Clustering plot for Seed dataset

```
# Visualizing Output
# In the above output we got value labels: ‘0’, ‘1’  and ‘2’. For a better understanding, we can visualize these clusters.

plt.scatter(X[pred_kmeans == 0, 5], X[pred_kmeans == 0, 0], s = 80, c = 'orange', label = 'Target 0')
plt.scatter(X[pred_kmeans == 1, 0], X[pred_kmeans == 1, 5], s = 80, c = 'yellow', label = 'Target 1')
```

```
plt.scatter(X[pred_kmeans == 2, 0], X[pred_kmeans == 2, 5], s = 80, c = 'green', label = 'Target 2')

plt.title('Kmeans Plot for Seed dataset')

plt.legend()
```

```
<matplotlib.legend.Legend at 0x7f0bf728aac0>
```




```
# KNN accuracy

seed=pd.read_csv('Seed_Data.csv')


X=seed.iloc[:,:-1].values
y=seed.iloc[:,-1].values


# Splitting the dataset into the Training set and Test set

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 = 0)


# Calculating Accuracy score, Confusion matrix, Classification report.

from sklearn import neighbors, datasets, preprocessing
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.metrics import classification_report
from sklearn.metrics import confusion_matrix

X=seed.iloc[:,:-1].values
y=seed.iloc[:,-1].values

Xtrain, Xtest, y_train, y_test = train_test_split(X, y)
scaler = preprocessing.StandardScaler().fit(Xtrain)
Xtrain = scaler.transform(Xtrain)
Xtest = scaler.transform(Xtest)

knn = neighbors.KNeighborsClassifier(n_neighbors=14)
knn.fit(Xtrain, y_train)
y_pred = knn.predict(Xtest)

print('Accuracy score:', accuracy_score(y_test, y_pred))
print('Confusion matrix:')
print(confusion_matrix(y_test, y_pred))
print('Classification report:')
print(classification_report(y_test, y_pred))
```

```
Accuracy score: 0.8679245283018868
Confusion matrix:
[[16  1  5]
 [ 1 18  0]
 [ 0  0 12]]
Classification report:
              precision    recall  f1-score   support

           0       0.94      0.73      0.82        22
           1       0.95      0.95      0.95        19
           2       0.71      1.00      0.83        12

    accuracy                           0.87        53
   macro avg       0.86      0.89      0.87        53
weighted avg       0.89      0.87      0.87        53
```

```
from sklearn.metrics import cohen_kappa_score
cluster = cohen_kappa_score(y_test, y_pred)
cluster
```

```
0.8016042780748662
```

```
from sklearn.metrics import cohen_kappa_score
cluster = cohen_kappa_score(y_test, y_pred)
cluster
```

```
0.7862595419847328
```

Hierarchical clustering Analysis (HCA) for Seed dataset

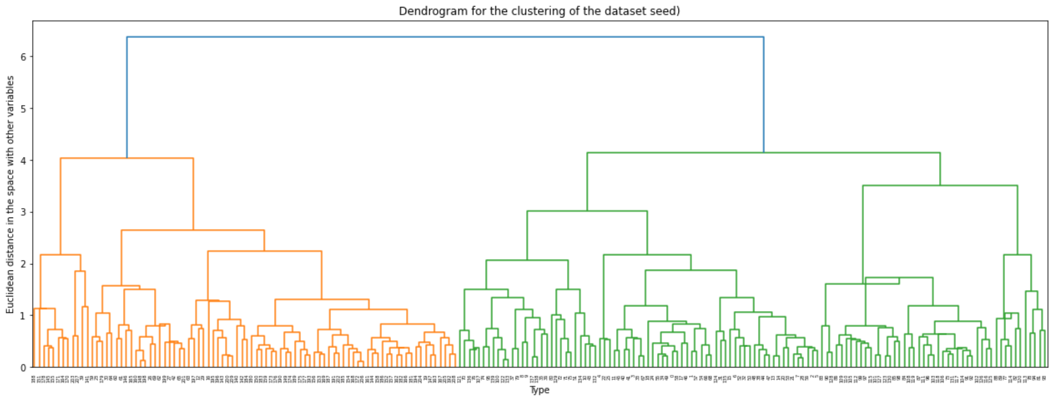
```
# Import Library for Hierarchical clustering

import matplotlib.pyplot as plt
from sklearn.cluster import AgglomerativeClustering
```

```
# Plotting of Dendrogram

import scipy.cluster.hierarchy as sch
```

Hierarchical Dendogram plot for Seed dataset

```
#Decide the number of clusters by using this dendrogram
Z = sch.linkage(X, method = 'median')
plt.figure(figsize=(20,7))
den = sch.dendrogram(Z)
plt.title('Dendrogram for the clustering of the dataset seed)')
plt.xlabel('Type')
plt.ylabel('Euclidean distance in the space with other variables')
```

```
Text(0, 0.5, 'Euclidean distance in the space with other variables')
```




```
# Building an Agglomerative Clustering Model

#Initialise Model

cluster_H = AgglomerativeClustering(n_clusters=3)
```

```
# Modelling the data
model_clt = cluster_H.fit(X)
model_clt
pred1 = model_clt.labels_
pred1
```

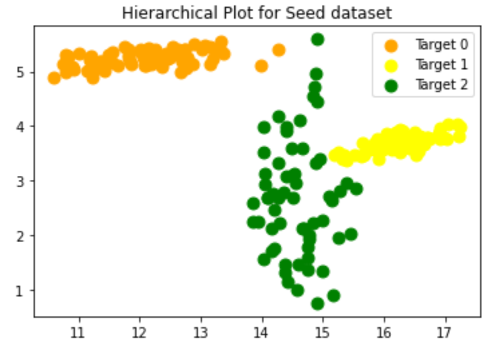
```
array([2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 0, 2, 2, 0, 2, 2,
       2, 0, 2, 2, 0, 0, 2, 2, 0, 2, 2, 2, 2, 2, 2, 2, 2, 0, 2, 2, 0, 2,
       2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 0, 0, 0, 0, 0, 0, 0,
       2, 2, 2, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
```

```
       1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1,
       2, 1, 2, 2, 1, 2, 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, 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, 0, 0,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
```

Hierarchical cluster plot for dataset

```
# Plotting the HCA Cluster

plt.scatter(X[pred1 == 0, 0], X[pred1 == 0, 3], s = 80, c = 'orange', label = 'Target 0')
plt.scatter(X[pred1 == 1, 1], X[pred1 == 1, 4], s = 80, c = 'yellow', label = 'Target 1')
plt.scatter(X[pred1 == 2, 1], X[pred1 == 2, 5], s = 80, c = 'green', label = 'Target 2')
plt.title('Hierarchical Plot for Seed dataset')
plt.legend()
```

```
<matplotlib.legend.Legend at 0x7f0bf6c09880>
```



Hierarchical clustering Accuracy for Seed dataset

```
import sklearn.metrics as sm

target = pd.DataFrame(seed.target)
#based on the dendrogram we have two clusetes
k =3
#build the model
HClustering = AgglomerativeClustering(n_clusters=k , affinity="euclidean",linkage="ward")
#fit the model on the dataset
HClustering.fit(X)
#accuracy of the model
sm.accuracy_score(target,HClustering.labels_)
```

```
0.3761904761904762
```