Assignment2_Questions3_4

April 9, 2020

[28]:
```
from sklearn.cluster import KMeans
from sklearn.metrics import silhouette_score

from sklearn.preprocessing import MinMaxScaler, StandardScaler
from sklearn.decomposition import PCA
import pandas as pd
from adjustText import adjust_text
import matplotlib.pylab as plt

data = pd.read_csv('/Users/nivethida/Downloads/universities_pca_2.csv')

scaler = MinMaxScaler() # min max scaler
pcs = PCA(whiten=True)
scaledData = pd.DataFrame(pcs.fit_transform(scaler.fit_transform(data.iloc[:,1:
 ↪])),
                          columns=['PC{}'.format(i) for i in range(1, len(data.
 ↪iloc[:,1:].columns) + 1)])

cols=['PC1', 'PC2', 'PC3', 'PC4'] # I want to use four components as decided in␣
 ↪Question 2

silhouette=[]
inertia=[]
clusters=[]
for i in range(2,40):
    kmeans = KMeans(n_clusters=i, random_state=0).fit(scaledData[cols])
    silhouette.append(silhouette_score(scaledData[cols],kmeans.labels_))
    inertia.append(kmeans.inertia_)
    clusters.append(i)

print('The max silhouette value is: ',max(silhouette))

# The max silhouette value is .24790
```

```
The max silhouette value is:  0.24790817427525624
```

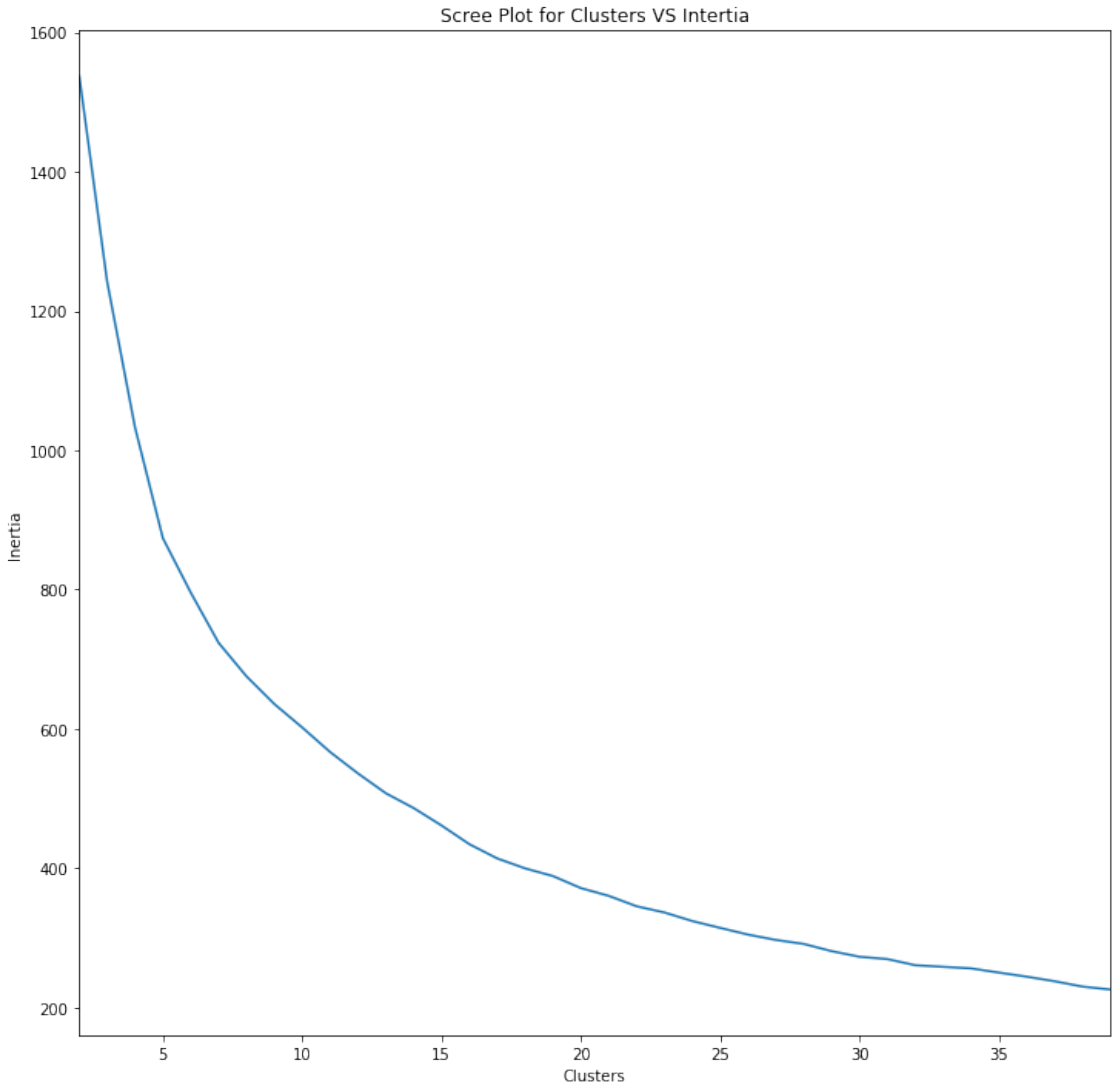
[29]:
```
kmeansEvaluvation=pd.DataFrame({'silhouette_score': silhouette,'inertia':␣
↪inertia,},index=clusters)
kmeansEvaluvation.head(8)
# From kmeans_rval I could see that the max silhouette value is at 7
```

[29]:

	silhouette_score	inertia
2	0.195671	1537.064365
3	0.224127	1242.066680
4	0.232772	1032.877437
5	0.242852	873.815038
6	0.234080	795.741180
7	0.247908	723.554175
8	0.231479	675.467224
9	0.233063	635.667998

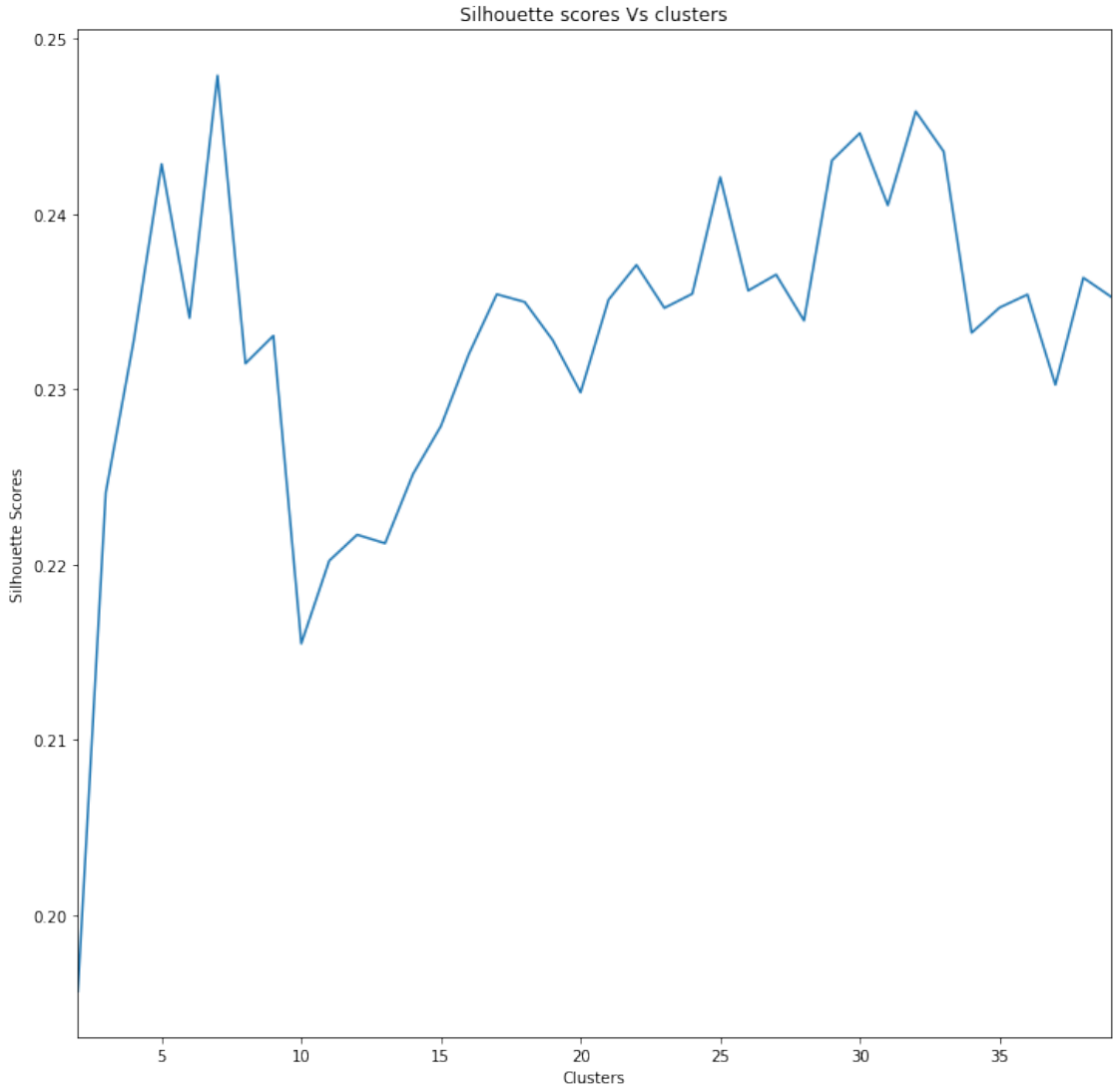
[30]:
```
kmeansEvaluvation['inertia'].plot(figsize=(12, 12))
plt.xlabel('Clusters')
plt.ylabel('Inertia')
plt.title('Scree Plot for Clusters VS Intertia')

# Looks like the inflection point is around 6 or 7
```

[30]:
```
Text(0.5, 1.0, 'Scree Plot for Clusters VS Intertia')
```



[31]:
```
kmeansEvaluvation['silhouette_score'].plot(figsize=(12, 12))
plt.xlabel('Clusters')
plt.ylabel('Silhouette Scores')
plt.title('Silhouette scores Vs clusters')

# The Silhouette score is at peak around 7 clusters for four components.
```

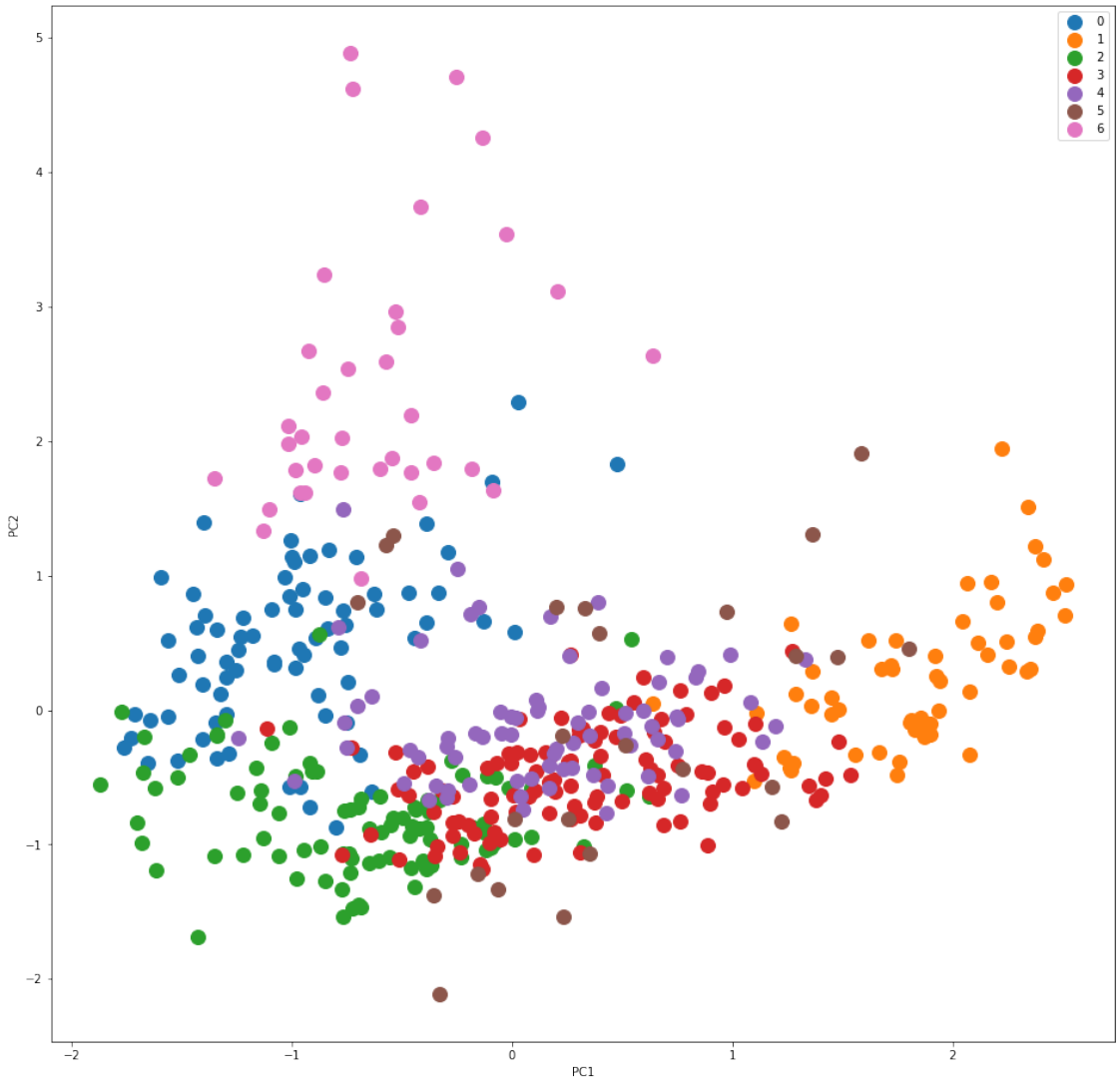
[31]:
```
Text(0.5, 1.0, 'Silhouette scores Vs clusters')
```



[32]:
```
# Here taking clusters = 7 ans it is the ideal number of clusters based on the␣
 ↪Silhouette score and Inertia
kmeans= KMeans(n_clusters=7).fit(scaledData[cols])
scaledData['cluster']=kmeans.labels_


groups = scaledData.groupby('cluster')

data['cluster']=scaledData['cluster']
ax = scaledData.plot.scatter(x='PC1', y='PC2', figsize=(16, 16))
points = scaledData[['PC1','PC2']]
```

```
for name, group in groups:
    ax.plot(group.PC1, group.PC2, marker='o', linestyle='', ms=12, label=name)␣
 ↪#grouping subplots
ax.legend()

# Below scatter plots represents the 7 clusters with 7 center means.
```

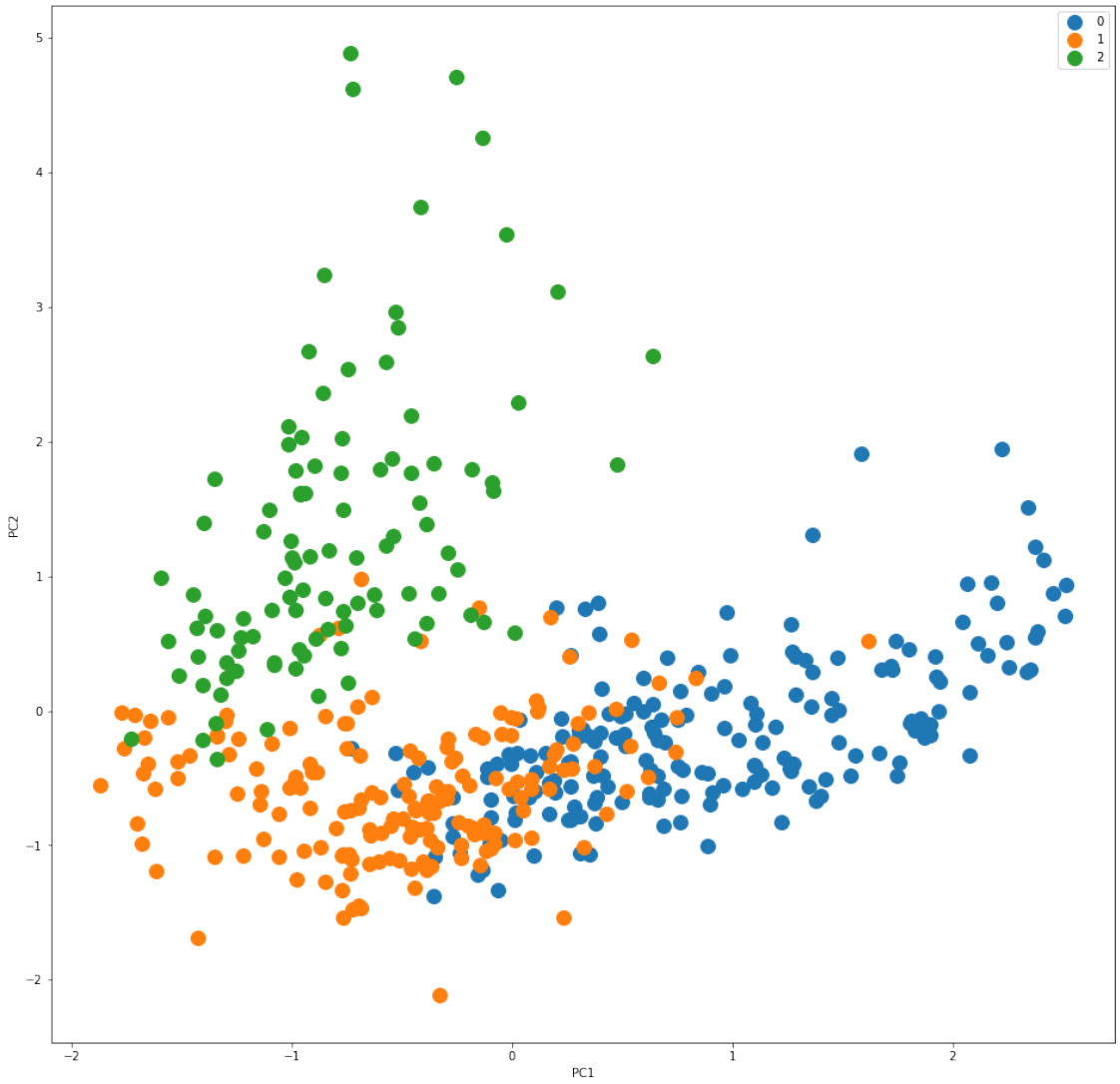
[32]: <matplotlib.legend.Legend at 0x1a22c669d0>



[33]:
```
# Subcategory 4
# Here taking clusters = 3.
kmeans= KMeans(n_clusters=3).fit(scaledData[cols])
scaledData['cluster']=kmeans.labels_
```

```
groups = scaledData.groupby('cluster')

data['cluster']=scaledData['cluster']
ax = scaledData.plot.scatter(x='PC1', y='PC2', figsize=(16, 16))
points = scaledData[['PC1','PC2']]


for name, group in groups:
    ax.plot(group.PC1, group.PC2, marker='o', linestyle='', ms=12, label=name)␣
 ↪#grouping subplots
ax.legend()

# Below scatter plots represents the 3 clusters with three centroids means and␣
 ↪is easy to visualize with dilineations.
```

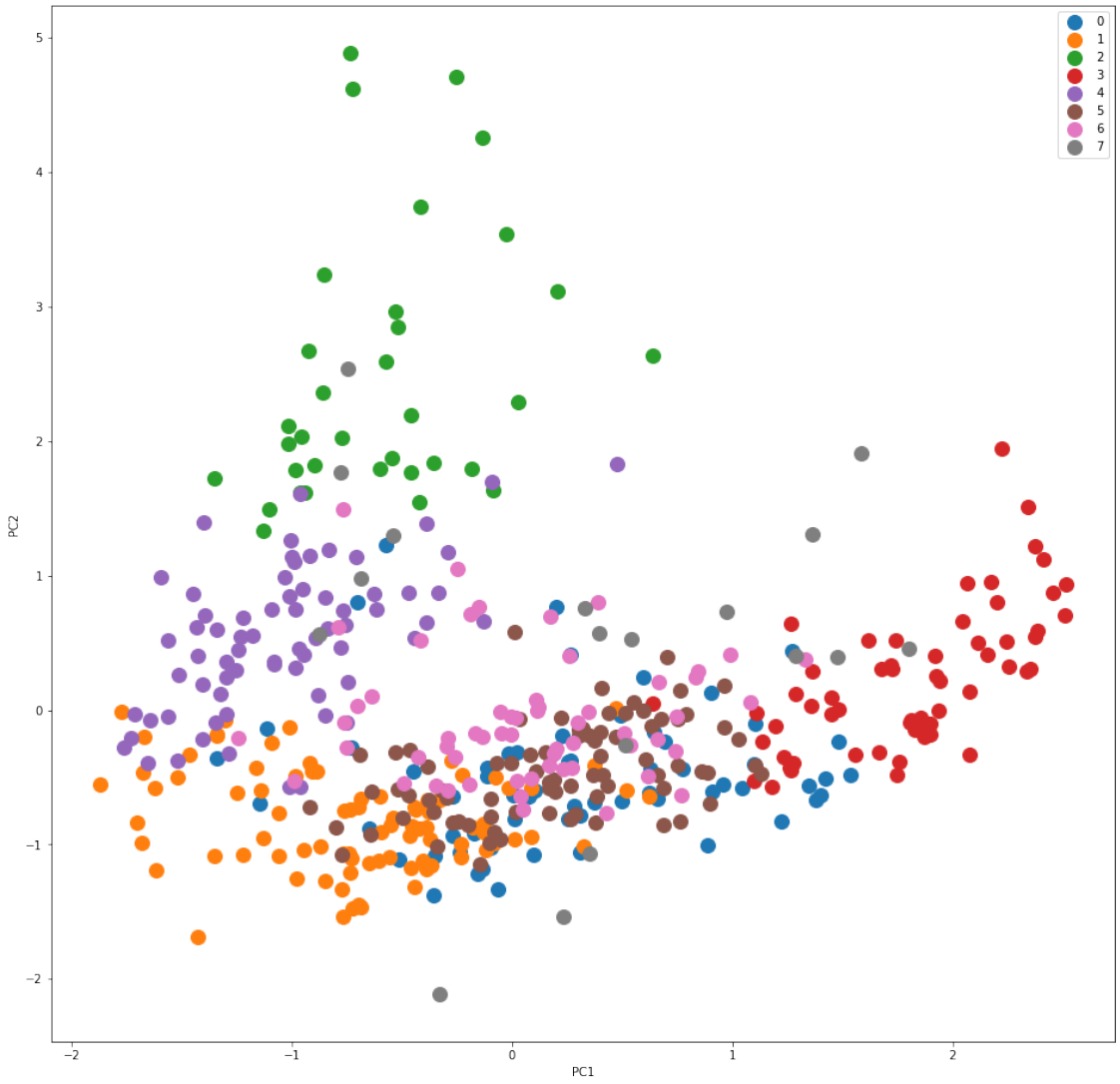
[33]: <matplotlib.legend.Legend at 0x1a1fe5b490>



[34]:
```
# What if we increase the cluster to 8
kmeans= KMeans(n_clusters=8).fit(scaledData[cols])
scaledData['cluster']=kmeans.labels_


groups = scaledData.groupby('cluster')

data['cluster']=scaledData['cluster']
ax = scaledData.plot.scatter(x='PC1', y='PC2', figsize=(16, 16))
points = scaledData[['PC1','PC2']]


for name, group in groups:
```

```
    ax.plot(group.PC1, group.PC2, marker='o', linestyle='', ms=12, label=name)␣
 ↪#grouping subplots
ax.legend()

# Below scatter plots represents the 8 clusters with 8 new centroids for each␣
 ↪cluster but no definite delineations.
```

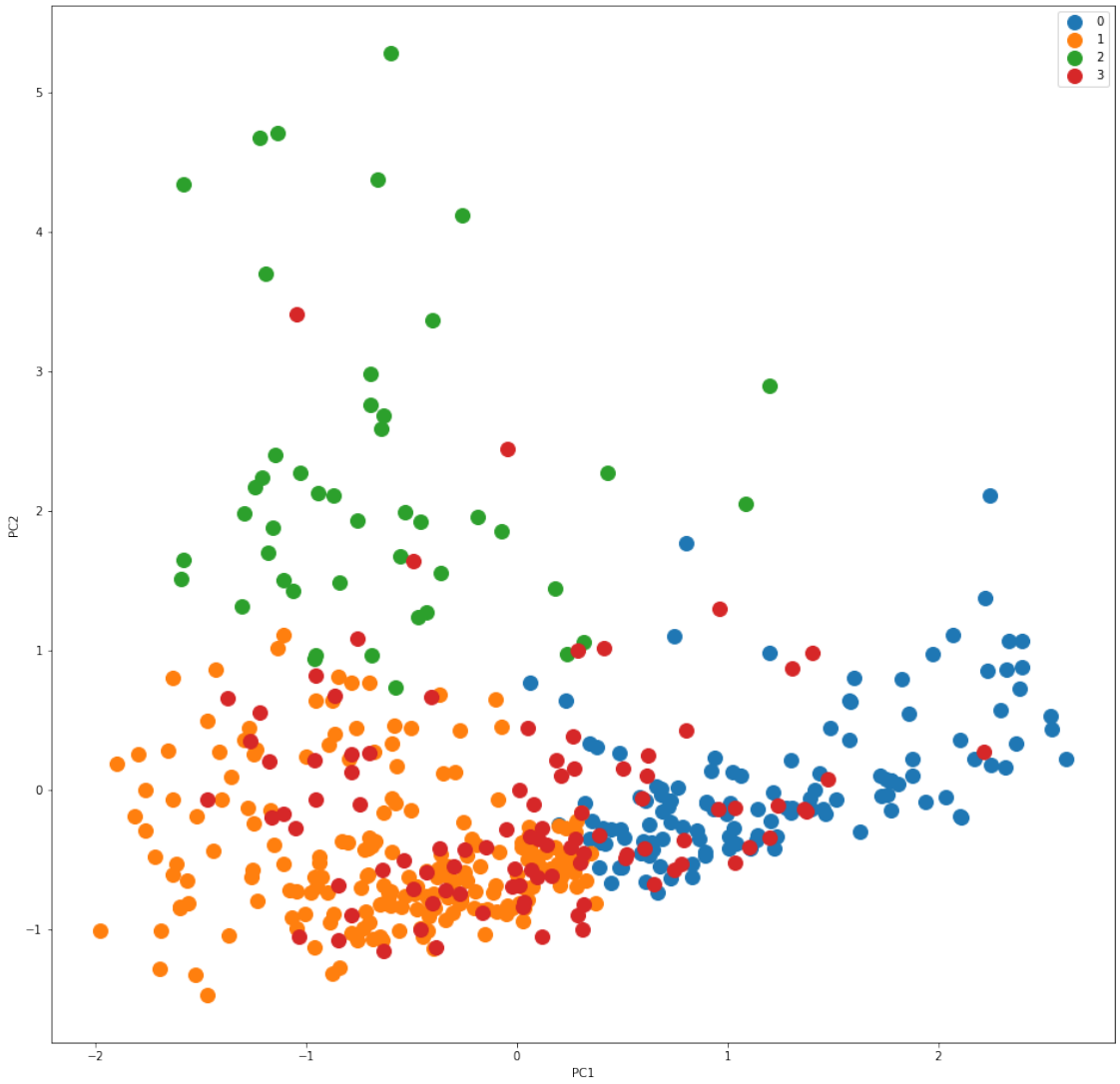
[34]: <matplotlib.legend.Legend at 0x1a23acee50>



[36]:
```
# Changing the standardisation method and plotting the kmeans clusters.
data = pd.read_csv('/Users/nivethida/Downloads/universities_pca_2.csv')


scaler = StandardScaler() # Standard scaler
```

```
pcs = PCA(whiten=True)
scaledData = pd.DataFrame(pcs.fit_transform(scaler.fit_transform(data.iloc[:,1:
↪])),
                          columns=['PC{}'.format(i) for i in range(1, len(data.
↪iloc[:,1:].columns) + 1)])
# Here i took clusters = 4

kmeans= KMeans(n_clusters=4).fit(scaledData[cols])
scaledData['cluster']=kmeans.labels_


groups = scaledData.groupby('cluster')

data['cluster']=scaledData['cluster']
ax = scaledData.plot.scatter(x='PC1', y='PC2', figsize=(16, 16))
points = scaledData[['PC1','PC2']]


for name, group in groups:
    ax.plot(group.PC1, group.PC2, marker='o', linestyle='', ms=12, label=name)
ax.legend()

# With with different standardisation method also the cluster shape didnt vary␣
↪much,
```

[36]: <matplotlib.legend.Legend at 0x1a20f63810>


0
1
2
3
PC2
PC1
5
4
3
2
1
0
−1
−2
−1
0
1
2

[ ]: