Московский Государственный Технический Университет
им. Н. Э. Баумана

Рулежный контроль №2
по курсу: «Технологии машинного обучения»

Кластеризация данных.

Выполнила:
Студентка группы ИУ5-63
Нурлыева Д.Д.

Москва
2019

Задание¶
Вариант №2. Кластеризация данных.
Данный вариант выполняется на основе материалов лекции.
Необходимо решить задачу кластеризации на основе любого выбранного Вами датасета.
Кластеризуйте данные с помощью трех различных алгоритмов кластеризации. Алгоритмы выбираются произвольным образом, рекомендуется использовать алгоритмы из лекции.
Сравните качество кластеризации для трех алгоритмов с помощью следующих метрик качества кластеризации:

- Adjusted Rand index
- Adjusted Mutual Information
- Homogeneity, completeness, V-measure
- Коэффициент силуэта
- Сделате выводы о том, какой алгоритм осуществляет более качественную кластеризацию на Вашем наборе данных

In [304]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans, MiniBatchKMeans
from sklearn.preprocessing import LabelEncoder, OneHotEncoder
from sklearn.impute import SimpleImputer
from sklearn.impute import MissingIndicator
%matplotlib inline
sns.set(style="ticks")
```

TThe dataset contains several parameters which are considered important during the application for Masters Programs. The parameters included are :

1. GRE Scores (out of 340)
2. TOEFL Scores (out of 120)
3. University Rating (out of 5)
4. Statement of Purpose and Letter of Recommendation Strength (out of 5)
5. Undergraduate GPA (out of 10)
6. Research Experience (either 0 or 1)
7. Chance of Admit (ranging from 0 to 1)

In [254]:
```
data=pd.read_csv('/Users/user/Desktop/Admission_Predict.csv')
data.head()
```
Out[254]:

	Serial No.	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	1	337	118	4	4.5	4.5	9.65	1	0.92
1	2	324	107	4	4.0	4.5	8.87	1	0.76
2	3	316	104	3	3.0	3.5	8.00	1	0.72
3	4	322	110	3	3.5	2.5	8.67	1	0.80
4	5	314	103	2	2.0	3.0	8.21	0	0.65

In [255]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 400 entries, 0 to 399
Data columns (total 9 columns):
Serial No.           400 non-null int64
GRE Score            400 non-null int64
```

```
TOEFL Score           400 non-null int64
University Rating     400 non-null int64
SOP                   400 non-null float64
LOR                   400 non-null float64
CGPA                  400 non-null float64
Research              400 non-null int64
Chance of Admit       400 non-null float64
dtypes: float64(4), int64(5)
memory usage: 28.2 KB
```

In [256]:

```
data.isnull().sum()
```

Out[256]:

```
Serial No.            0
GRE Score             0
TOEFL Score           0
University Rating     0
SOP                   0
LOR                   0
CGPA                  0
Research              0
Chance of Admit       0
dtype: int64
```

In [257]:

```
data.drop(["Serial No."], axis = 1, inplace=True)
```

In [258]:

```
data.head()
```

Out[258]:

	GRE Score	TOEFL Score	University Rating	SOP	LOR	CGPA	Research	Chance of Admit
0	337	118	4	4.5	4.5	9.65	1	0.92
1	324	107	4	4.0	4.5	8.87	1	0.76
2	316	104	3	3.0	3.5	8.00	1	0.72
3	322	110	3	3.5	2.5	8.67	1	0.80
4	314	103	2	2.0	3.0	8.21	0	0.65

Кластеризация¶

K-means¶

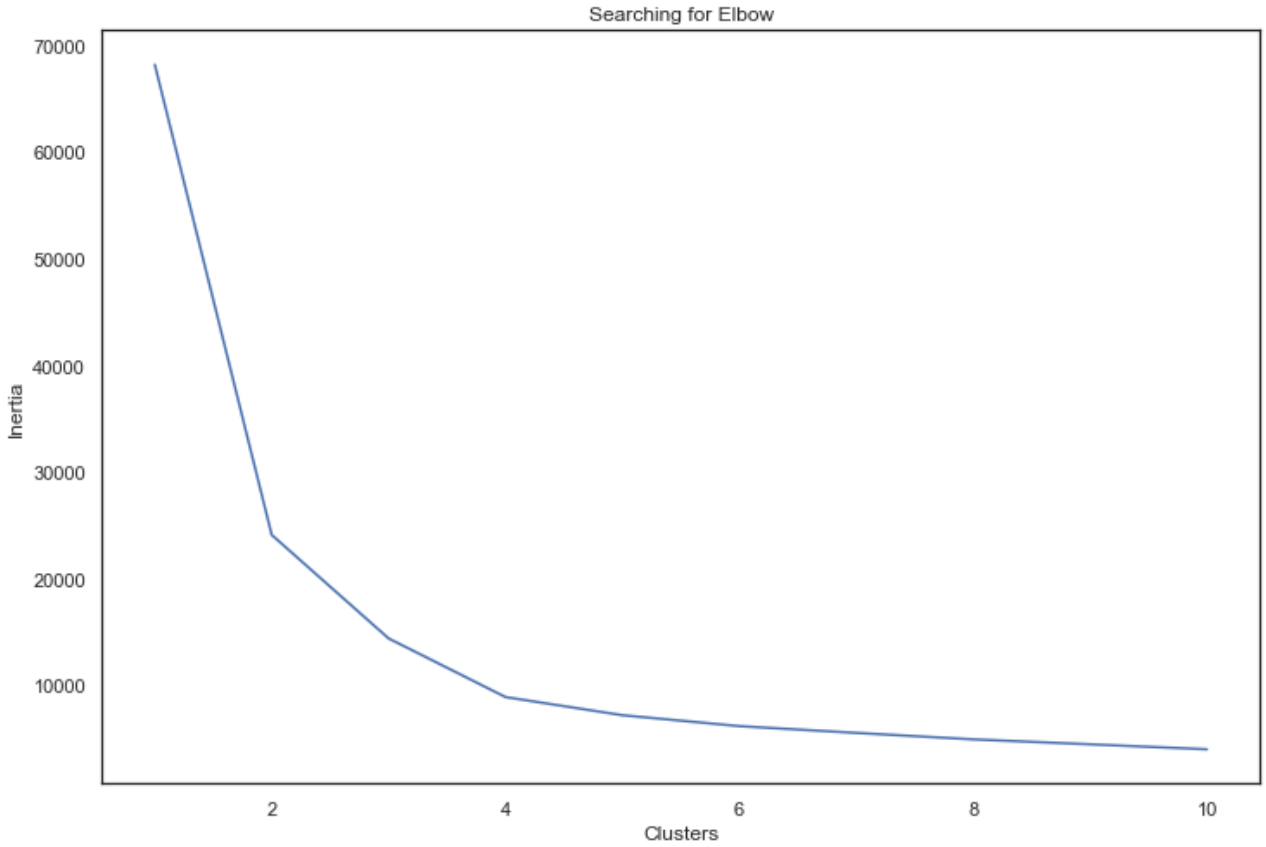
In [259]:

```
target=data['University Rating']
X = data.drop(['University Rating'], axis=1)
```

In [260]:

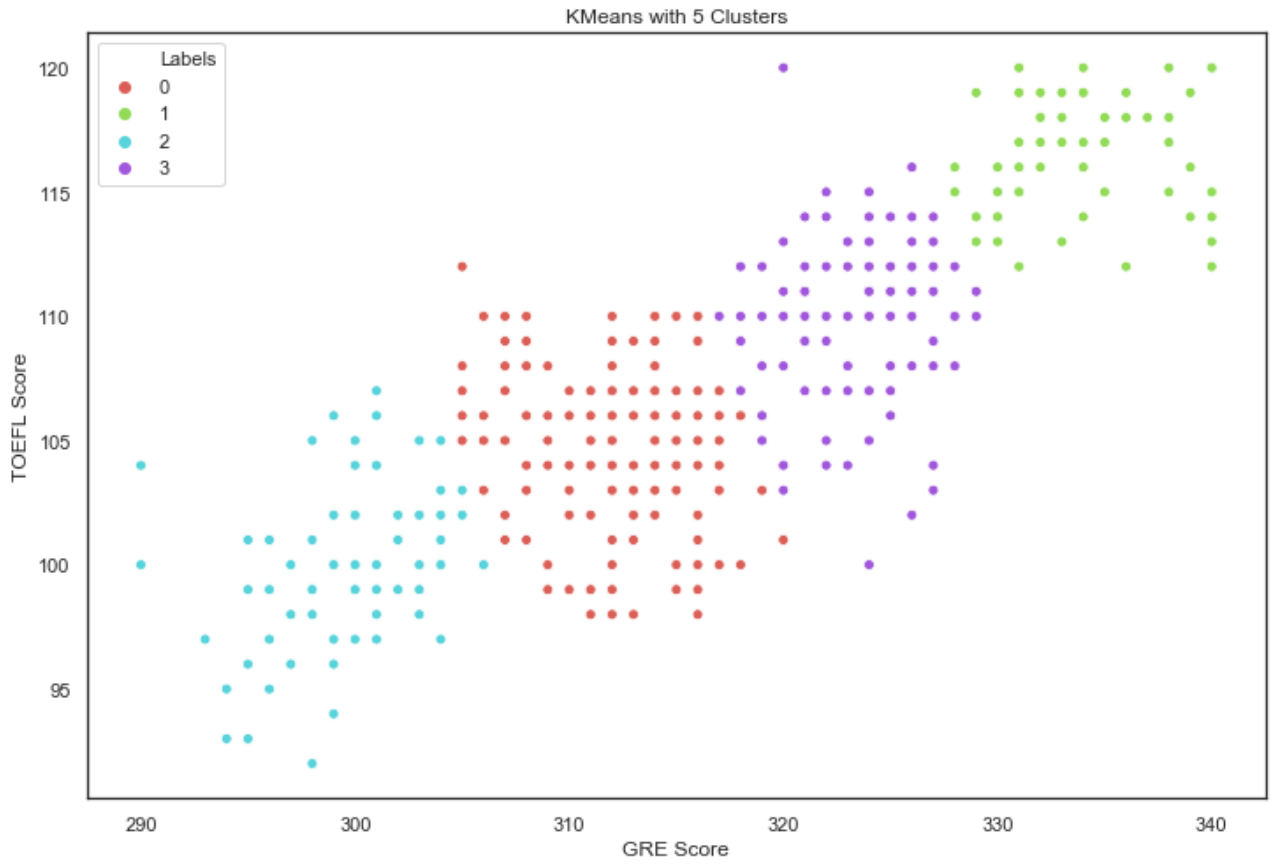
```
from sklearn.cluster import KMeans

clusters = []

for i in range(1, 11):
    km = KMeans(n_clusters=i).fit(X)
    clusters.append(km.inertia_)

fig, ax = plt.subplots(figsize=(12, 8))
sns.lineplot(x=list(range(1, 11)), y=clusters, ax=ax)
ax.set_title('Searching for Elbow')
ax.set_xlabel('Clusters')
```

```
ax.set_ylabel('Inertia')

plt.show()
```



In [264]:

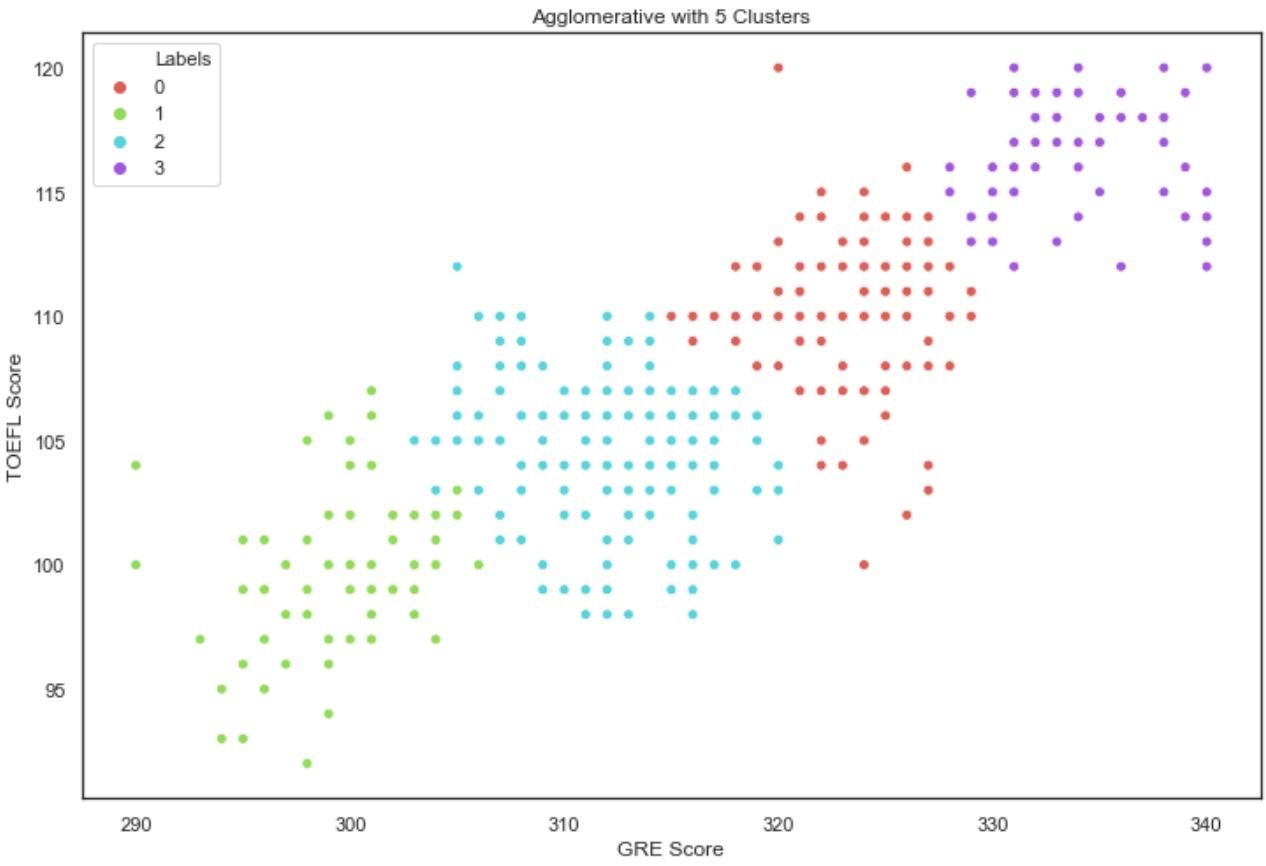
```
km5 = KMeans(n_clusters=4).fit(X)

X['Labels'] = km5.labels_
plt.figure(figsize=(12, 8))
sns.scatterplot(X['GRE Score'], X['TOEFL Score'], hue=X['Labels'],
                palette=sns.color_palette('hls', 4))
plt.title('KMeans with 5 Clusters')
plt.show()
```



Иерархическая кластеризация¶

In [266]:

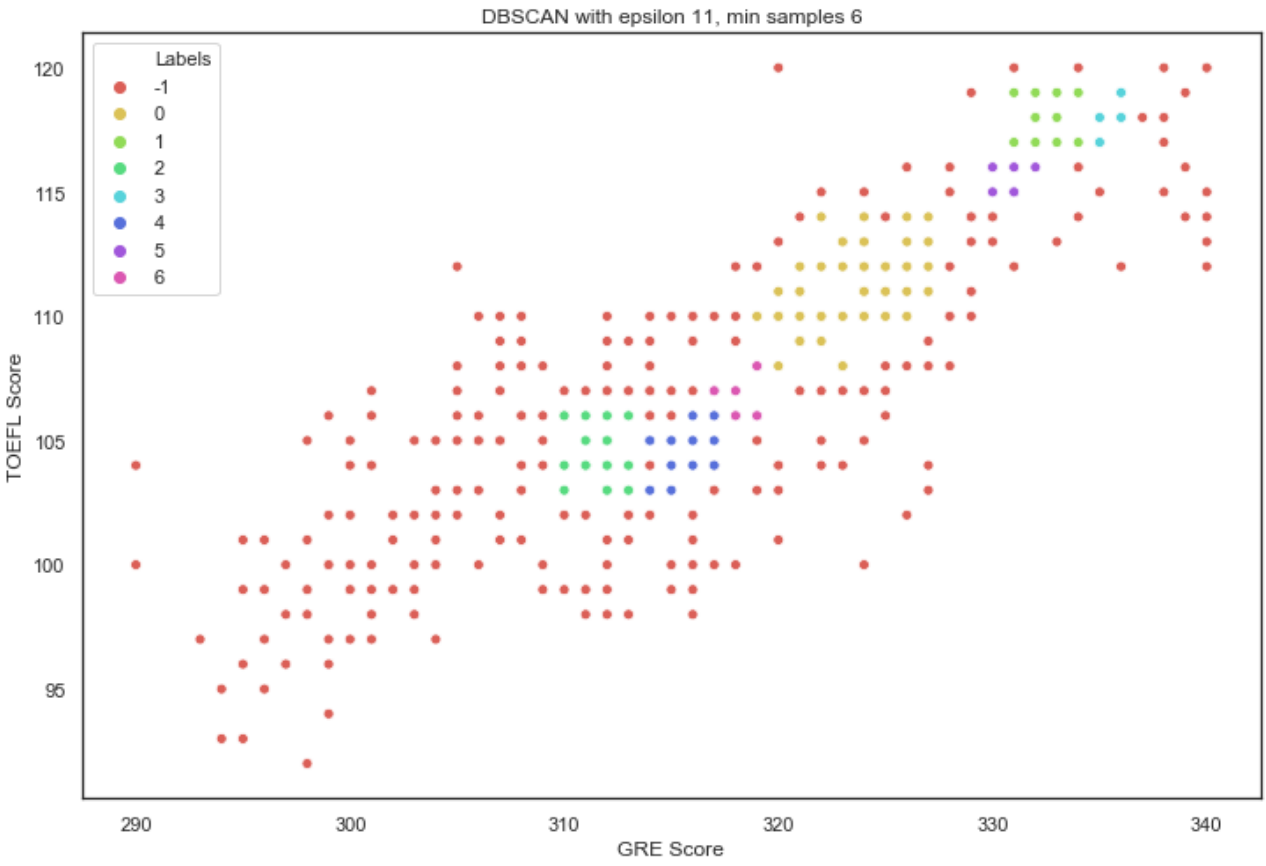
```
from sklearn.cluster import AgglomerativeClustering

agglom = AgglomerativeClustering(n_clusters=4, linkage='average').fit(X)

X['Labels'] = agglom.labels_
plt.figure(figsize=(12, 8))
sns.scatterplot(X['GRE Score'], X['TOEFL Score'], hue=X['Labels'],
                palette=sns.color_palette('hls', 4))
plt.title('Agglomerative with 5 Clusters')
plt.show()
```



DBSCAN¶

In [302]:

```
from sklearn.cluster import DBSCAN

db = DBSCAN(eps=2, min_samples=10).fit(X)

X['Labels'] = db.labels_
plt.figure(figsize=(12, 8))
sns.scatterplot(X['GRE Score'], X['TOEFL Score'], hue=X['Labels'],
                palette=sns.color_palette('hls',
np.unique(db.labels_).shape[0]))
plt.title('DBSCAN with epsilon 11, min samples 6')
plt.show()
```



Метрики¶

In [303]:

```
from sklearn import metrics
import pandas as pd
from sklearn.cluster import KMeans, AgglomerativeClustering,
AffinityPropagation, SpectralClustering

algorithms = []
algorithms.append(KMeans(n_clusters=4, random_state=1))
algorithms.append(DBSCAN(eps=2, min_samples=10))
algorithms.append(AgglomerativeClustering(n_clusters=4))

y=target
data = []
for algo in algorithms:
    algo.fit(X)
    data.append(({
        'ARI': metrics.adjusted_rand_score(y, algo.labels_),
        'AMI': metrics.adjusted_mutual_info_score(y, algo.labels_),
        'Homogenity': metrics.homogeneity_score(y, algo.labels_),
        'Completeness': metrics.completeness_score(y, algo.labels_),
        'V-measure': metrics.v_measure_score(y, algo.labels_),
        'Silhouette': metrics.silhouette_score(X, algo.labels_)}))

results = pd.DataFrame(data=data, columns=['ARI', 'AMI', 'Homogenity',
                                           'Completeness', 'V-measure',
                                           'Silhouette'],
                       index=['K-means', 'DBSCAN', 'Agglomerative'])
```

```
results
```
Out[303]:

	ARI	AMI	Homogenity	Completeness	V-measure	Silhouette
K-means	0.167845	0.218413	0.226443	0.254430	0.239622	0.442864
DBSCAN	0.001334	0.082075	0.098998	0.138382	0.115423	-0.168741
Agglomerative	0.147047	0.208131	0.216269	0.241346	0.228120	0.413533

Вывод¶

По данным полученным выше (ARI, AMI, Homogenity, Completeness, V-measure, Silhouette):

- Наиболее качественную кластеризацию осуществляет метод K-means
- Самый худший результат у алгоритма DBSCAN