5c-K-Means.Clustering

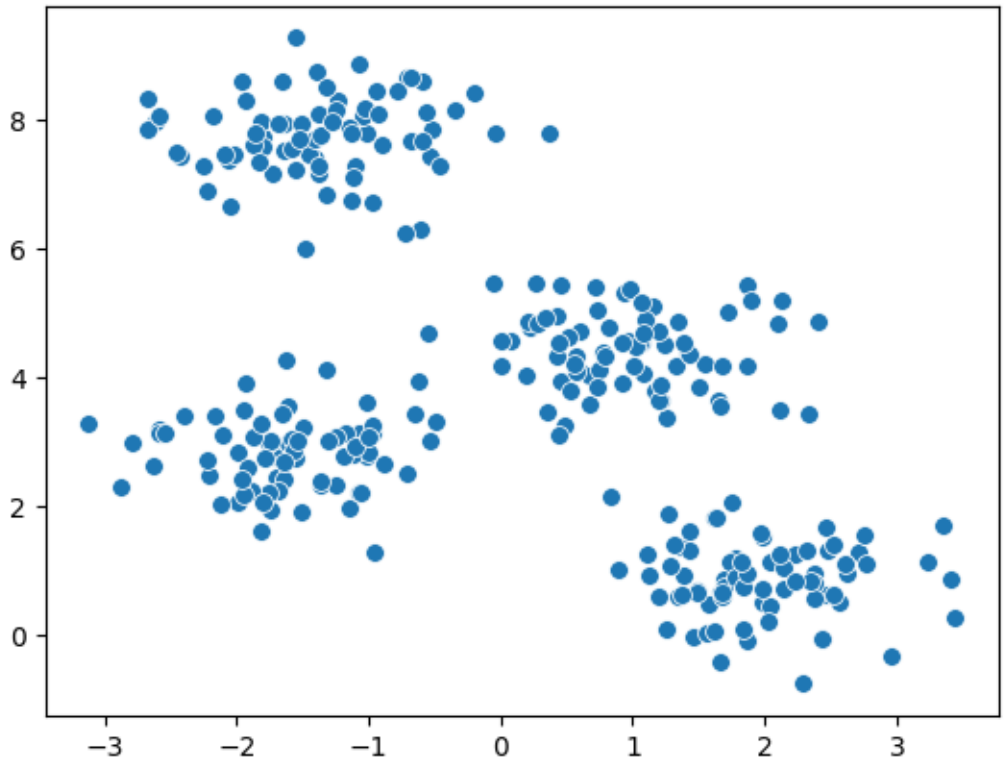
November 13, 2024

[1]:
```
import pandas as pd
from sklearn.cluster import KMeans
from sklearn.datasets import make_blobs
from sklearn.preprocessing import MinMaxScaler
import matplotlib.pyplot as plt
import seaborn as sns
```

1 Example with Making Blobs

[2]:
```
X, y_true = make_blobs(
        n_samples=300,
        centers=4,
        cluster_std=0.60,
        random_state=0,
)
# plt.scatter(X[:, 0], X[:, 1], s=50, );
sns.scatterplot(x = X[:, 0], y = X[:, 1], s=50) ;
;
```

[2]:
```
''
```



1.1 KMeans

[3]:
```
kmeans = KMeans(n_clusters=4, n_init=10).fit(X)
kmeans.labels_
```

[3]:
```
array([1, 3, 0, 3, 1, 1, 2, 0, 3, 3, 2, 3, 0, 3, 1, 0, 0, 1, 2, 2, 1, 1,
       0, 2, 2, 0, 1, 0, 2, 0, 3, 3, 0, 3, 3, 3, 3, 3, 2, 1, 0, 2, 0, 0,
       2, 2, 3, 2, 3, 1, 2, 1, 3, 1, 1, 2, 3, 2, 3, 1, 3, 0, 3, 2, 2, 2,
       3, 1, 3, 2, 0, 2, 3, 2, 2, 3, 2, 0, 1, 3, 1, 0, 1, 1, 3, 0, 1, 0,
       3, 3, 0, 1, 3, 2, 2, 0, 1, 1, 0, 2, 3, 1, 3, 1, 0, 1, 1, 0, 3, 0,
       2, 2, 1, 3, 1, 0, 3, 1, 1, 0, 2, 1, 2, 1, 1, 1, 1, 2, 1, 2, 3, 2,
       2, 1, 3, 2, 2, 3, 0, 3, 3, 2, 0, 2, 0, 2, 3, 0, 3, 3, 3, 0, 3, 0,
       1, 2, 3, 2, 1, 0, 3, 0, 0, 1, 0, 2, 2, 0, 1, 0, 0, 3, 1, 0, 2, 3,
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       3, 1, 1, 2, 1, 2, 0, 3, 3, 0, 0, 3, 0, 1, 2, 0, 1, 2, 3, 2, 1, 0,
       1, 3, 3, 3, 3, 2, 2, 3, 0, 2, 1, 0, 2, 2, 2, 1, 1, 3, 0, 0, 2, 1,
       3, 2, 0, 3, 0, 1, 1, 2, 2, 0, 1, 1, 1, 0, 3, 3, 1, 1, 0, 1, 1, 1,
       3, 2, 3, 0, 1, 1, 3, 3, 3, 1, 1, 0, 3, 2], dtype=int32)
```
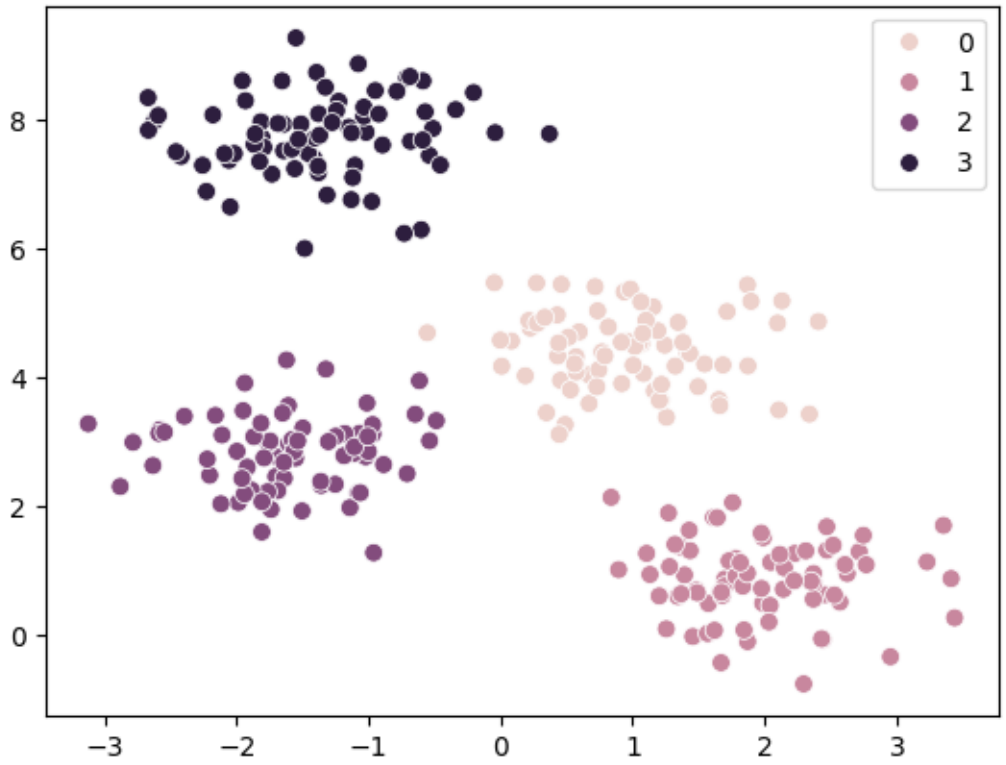

[4]:
```
sns.scatterplot(x = X[:,0], y = X[:,1], hue = kmeans.labels_, s=50) ;
```



1.2 Example with Pima Indians Dataset

[5]:
```
col_names = ['pregnant', 'glucose', 'bp', 'skin', 'insulin', 'bmi', 'pedigree',␣
↪'age', 'label']
url = "https://ddc-datascience.s3.amazonaws.com/pima-indians-diabetes.csv"
pima = pd.read_csv( url, header=None, names=col_names)
pima.head()
```

[5]:

	pregnant	glucose	bp	skin	insulin	bmi	pedigree	age	label
0	6	148	72	35	0	33.6	0.627	50	1
1	1	85	66	29	0	26.6	0.351	31	0
2	8	183	64	0	0	23.3	0.672	32	1
3	1	89	66	23	94	28.1	0.167	21	0
4	0	137	40	35	168	43.1	2.288	33	1

[6]:
```
pima["label"].value_counts()
```

[6]:
```
label
0    500
1    268
Name: count, dtype: int64
```

[7]:
```
# Drop the label & some of the other variables for simplicity
pima_X = pima.drop(['label', 'skin', 'pedigree', 'bp'], axis = 1).copy()
pima_X.head()
```

[7]:

	pregnant	glucose	insulin	bmi	age
0	6	148	0	33.6	50
1	1	85	0	26.6	31
2	8	183	0	23.3	32
3	1	89	94	28.1	21
4	0	137	168	43.1	33

[8]:
```
# Scale data
scaler = MinMaxScaler()
scaler.fit(pima_X)
pima_X_scaled = scaler.transform(pima_X)
# Convert back to data frame
pima_X_scaled = pd.DataFrame(pima_X_scaled, columns = pima_X.columns)
pima_X_scaled.head()
```

[8]:

	pregnant	glucose	insulin	bmi	age
0	0.352941	0.743719	0.000000	0.500745	0.483333
1	0.058824	0.427136	0.000000	0.396423	0.166667
2	0.470588	0.919598	0.000000	0.347243	0.183333
3	0.058824	0.447236	0.111111	0.418778	0.000000
4	0.000000	0.688442	0.198582	0.642325	0.200000

1.3 KMeans

[9]:
```
# Fit k-means w/ 4 clusters
kmeans = KMeans(n_clusters=4, n_init=10).fit(pima_X_scaled)
kmeans.labels_
```

[9]:
```
array([1, 2, 3, 2, 0, 2, 2, 3, 0, 1, 2, 3, 3, 0, 1, 3, 0, 3, 2, 2, 0, 3,
       3, 3, 3, 3, 3, 2, 3, 3, 1, 0, 2, 2, 3, 2, 3, 3, 2, 1, 0, 3, 3, 3,
       3, 0, 2, 2, 3, 2, 2, 2, 2, 1, 3, 2, 0, 2, 0, 2, 2, 3, 2, 0, 3, 2,
       2, 1, 2, 0, 2, 0, 3, 0, 2, 2, 3, 2, 2, 2, 2, 2, 3, 2, 3, 2, 3, 2,
       3, 2, 2, 0, 3, 1, 2, 3, 2, 2, 2, 0, 0, 2, 2, 2, 2, 2, 2, 0, 2, 2,
       0, 3, 2, 2, 3, 1, 3, 2, 2, 2, 0, 2, 2, 1, 2, 2, 0, 2, 0, 1, 0, 3,
       0, 3, 2, 0, 2, 2, 2, 0, 1, 3, 2, 3, 0, 2, 3, 2, 1, 2, 0, 2, 3, 0,
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       0, 0, 3, 2, 0, 2, 3, 2, 2, 0, 2, 1, 0, 2, 2, 3, 2, 0, 0, 3, 2, 3,
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       0, 2, 0, 2, 2, 3, 0, 2, 1, 2, 2, 3, 2, 2, 3, 2, 2, 3, 3, 3, 0, 2,
       0, 1, 2, 2, 2, 0, 3, 0, 3, 1, 2, 1, 2, 3, 3, 3, 2, 2, 1, 2],
      dtype=int32)
```
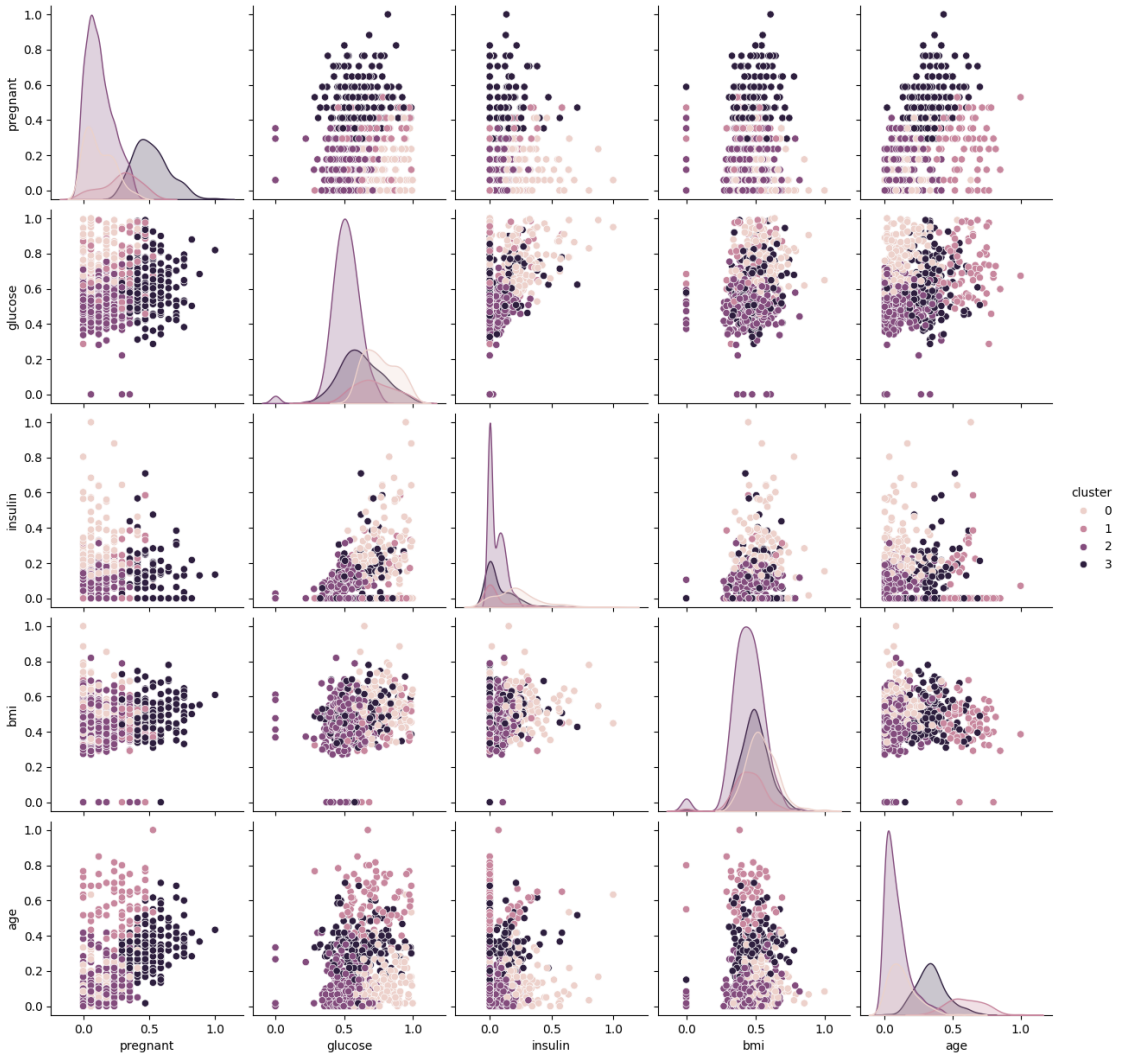

[10]:
```
# Add a new column to pima_X_scaled with the cluster assignment
pima_X_scaled['cluster'] = kmeans.labels_
pima_X_scaled['cluster'].value_counts()
```

[10]:
```
cluster
2    366
3    171
0    153
1     78
Name: count, dtype: int64
```

[11]:
```
sns.pairplot(pima_X_scaled, hue='cluster') ;
```



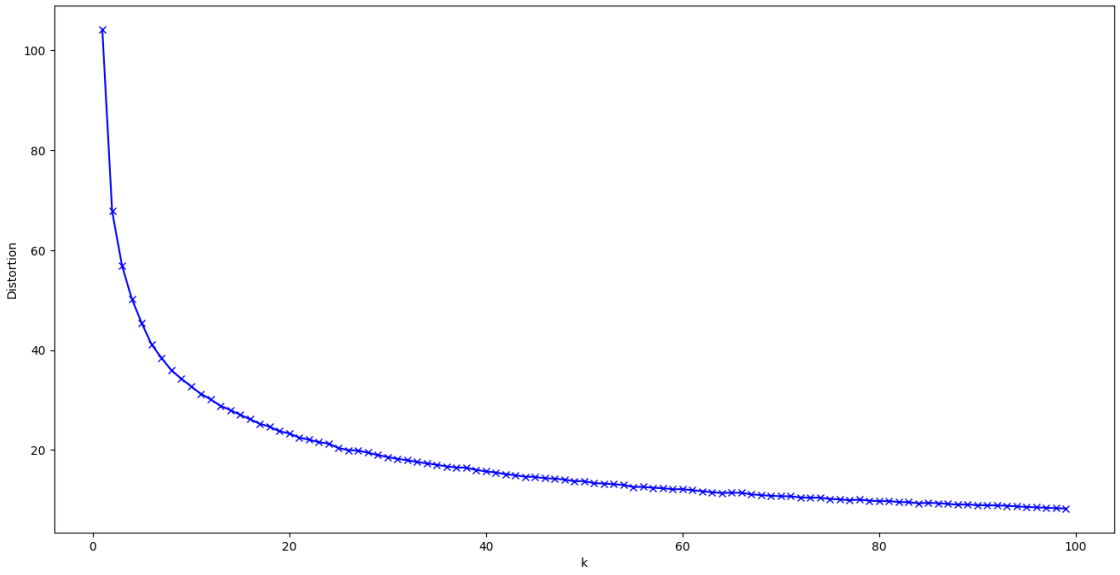
1.4 Choosing K - the elbow method

[12]:
```
# Drop cluster column
pima_X_scaled.drop('cluster', axis = 1, inplace = True)
```

[13]:
```
distortions = []
K = range(1,100)
for k in K:
    kmeans = KMeans(n_clusters=k, n_init = 10)
    kmeans.fit(pima_X_scaled)
    distortions.append(kmeans.inertia_)
```

[14]:
```
plt.figure(figsize=(16,8))
plt.plot(K, distortions, 'bx-')
```

```
plt.xlabel('k')
plt.ylabel('Distortion')
plt.show()
```



[15]:

```
%%capture
!pip install -U yellowbrick
```

[16]:

```
from yellowbrick.cluster.elbow import kelbow_visualizer
```

[17]:

```
# Use the quick method and immediately show the figure
kelbow_visualizer(KMeans(random_state=4, n_init=10), pima_X_scaled, k=(1,10)) ;
;
```

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families were found: Arial, Liberation Sans, Bitstream Vera Sans, sans-serif
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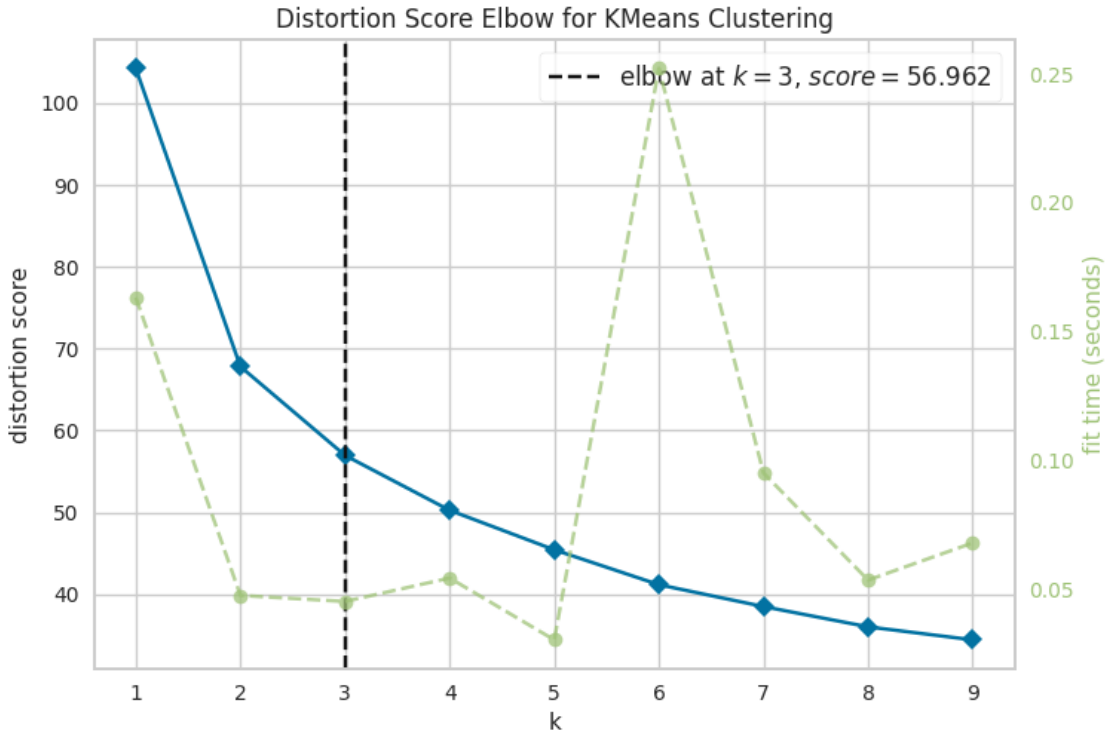

```
[17]: ''
```

2 Fit again with k = 3

```
[18]: kmeans = KMeans(n_clusters=3, n_init=10).fit(pima_X_scaled)
```

```
[19]: sns.pairplot(pima_X_scaled.assign(cluster=kmeans.labels_), hue='cluster') ;
```

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