IEMS 308 – Homework 1

January 29, 2021

1 IEMS 308 Homework 1 - Melissa Melnick

[1]:
```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans
from sklearn.preprocessing import OneHotEncoder
from sklearn.preprocessing import OneHotEncoder
from sklearn import preprocessing
```

[2]:
```
#read in file
file = pd.read_csv('../Desktop/Medicare_Provider_Util_Payment_PUF_CY2018/
 ↪medicare.txt', sep = '\t')
```

```
/opt/anaconda3/lib/python3.8/site-
packages/IPython/core/interactiveshell.py:3071: DtypeWarning: Columns (10) have
mixed types.Specify dtype option on import or set low_memory=False.
  has_raised = await self.run_ast_nodes(code_ast.body, cell_name,
```

[3]:
```
#slim down originial data set to desired attributes
mo_file = file[file['nppes_provider_state'] == 'MO']
spec_mo_data = mo_file[['nppes_provider_zip', 'bene_unique_cnt',
                        'average_submitted_chrg_amt',␣
 ↪'average_Medicare_payment_amt']]
```

[4]:
```
#create new column for first zones in Missouri based on first 3 digits of Zip␣
 ↪Code
zone_dict= {'631':'STL METRO', '630':'STL METRO', '633':'STL METRO', '635':
 ↪'NORTHEAST',
            '634':'NORTHEAST', '652':'NORTHEAST', '650':'NORTHEAST', '651':
 ↪'NORTHEAST',
            '636': 'SOUTHEAST', '637': 'SOUTHEAST', '638': 'SOUTHEAST', '639':␣
 ↪'SOUTHEAST',
             '655': 'SOUTHEAST', '654': 'SOUTHEAST', '641': 'KC METRO', '640':␣
 ↪'KC METRO',
            '653': 'SOUTHWEST', '647': 'SOUTHWEST', '657': 'SOUTHWEST', '648':␣
 ↪'SOUTHWEST',
```

```
           '656': 'SOUTHWEST', '658': 'SOUTHWEST', '644': 'NORTHWEST', '645':␣
 ↪'NORTHWEST',
            '646': 'NORTHWEST'}

spec_mo_data.loc[:, 'zone'] = spec_mo_data['nppes_provider_zip'].astype(str).
 ↪str[0:3]
spec_mo_data.loc[:, 'zone'].replace(zone_dict, inplace = True)
```

```
/opt/anaconda3/lib/python3.8/site-packages/pandas/core/indexing.py:845:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  self.obj[key] = _infer_fill_value(value)
/opt/anaconda3/lib/python3.8/site-packages/pandas/core/indexing.py:966:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  self.obj[item] = s
/opt/anaconda3/lib/python3.8/site-packages/pandas/core/generic.py:6746:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame

See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  self._update_inplace(new_data)
```

[5]:
```
#delete original zip code column
del spec_mo_data['nppes_provider_zip']
```

[6]:
```
#delete incorrect zips
spec_mo_data = spec_mo_data[spec_mo_data.loc[:,'zone'].isin(zone_dict.values())]
```

[7]:
```
#turn zone into dummy variables and add to dataset
spec_mo_data = pd.concat([spec_mo_data,pd.
 ↪get_dummies(spec_mo_data['zone'],prefix='zone')],axis=1)
```

[8]:
```
#drop original zone column
spec_mo_data.drop(['zone'],axis=1, inplace=True)
```

[9]:
```
#remove outliers
```

```
cols_of_interest = ['bene_unique_cnt', 'average_submitted_chrg_amt',␣
↪'average_Medicare_payment_amt']
for column in cols_of_interest:
    try:
        mean = spec_mo_data[column].mean()
        stddev = spec_mo_data[column].std()
        for value in spec_mo_data[column]:
            if value > mean + 2*stddev:
                spec_mo_data = spec_mo_data[spec_mo_data[column] != value]
            elif value < mean - 2*stddev:
                spec_mo_data = spec_mo_data[spec_mo_data[column] != value]
    except:
        continue
```

[10]:
```
#reset indices on pared down data set
spec_mo_data.reset_index(drop=True, inplace=True)
```

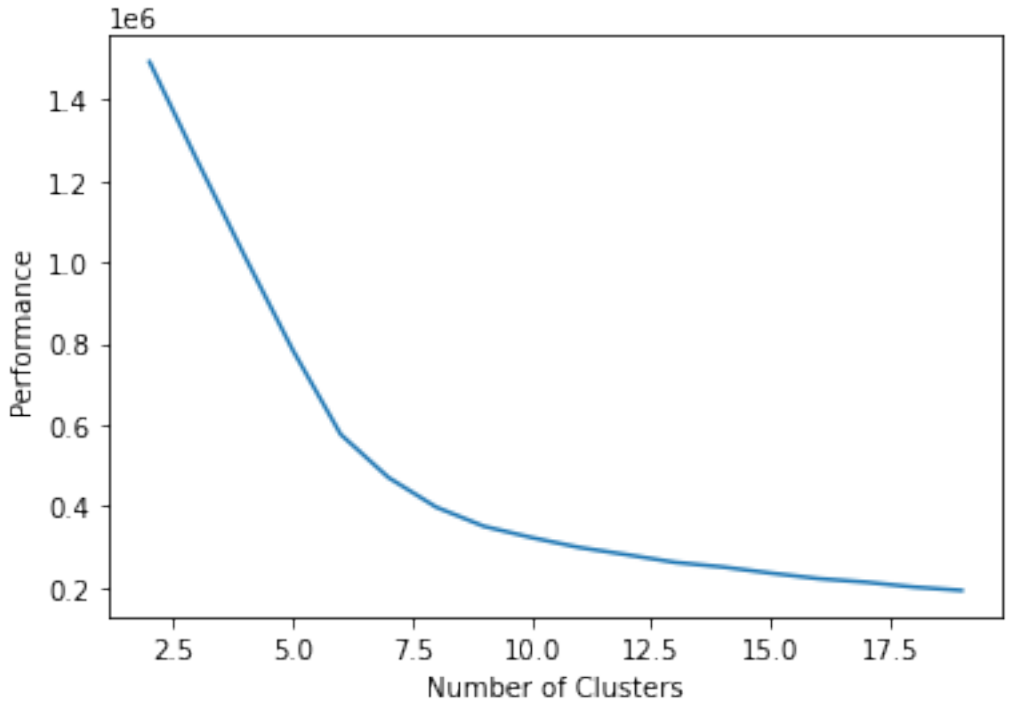
[11]:
```
#scale the data
scale_tech = preprocessing.StandardScaler().fit(spec_mo_data)
mo_dat_scaled = scale_tech.transform(spec_mo_data)
```

[12]:
```
#create dataframe of scaled data
mdc = pd.DataFrame(mo_dat_scaled)
```

[13]:
```
#find optimal number of clusters
sse = []
for clusters in range(2,20):
    kmeans = KMeans(n_clusters=clusters, random_state=0).fit(mo_dat_scaled)
    sse.append(kmeans.inertia_)

fig = plt.figure(figsize = (6,4))
ax = fig.add_subplot(1,1,1)
ax.plot(range(2,20),sse)
ax.set_xlabel("Number of Clusters")
ax.set_ylabel("Performance")
```

[13]:
```
Text(0, 0.5, 'Performance')
```



[14]:
```
#run kmeans
kmeans = KMeans(n_clusters =6)
kmeans = kmeans.fit(mo_dat_scaled)
labels = kmeans.predict(mo_dat_scaled)
centroids = kmeans.cluster_centers_
```

[15]:
```
#turn the clusters into a series to be added to dataframe
label_col = pd.Series(labels)
label_col
```

[15]:
```
0         3
1         3
2         3
3         0
4         0
         ..
192911    2
192912    2
192913    2
192914    2
192915    2
Length: 192916, dtype: int32
```

[17]:
```
spec_mo_data = pd.concat([spec_mo_data,pd.DataFrame(label_col,␣
↪columns=["Cluster"])],axis=1)
```

[18]:
```
spec_mo_data['Cluster'].value_counts()
```

[18]:
```
0    77641
4    36026
5    32518
2    24446
1    16860
3     5425
Name: Cluster, dtype: int64
```

[19]:
```
spec_mo_data
```

[19]:

	bene_unique_cnt	average_submitted_chrg_amt	\
0	291.0	69.742268	
1	30.0	35.000000	
2	321.0	25.000000	
3	26.0	120.000000	
4	29.0	140.000000	
…	…	…	
192911	16.0	75.000000	
192912	12.0	106.000000	
192913	216.0	160.422311	
192914	112.0	225.897638	
192915	136.0	167.711268	

	average_Medicare_payment_amt	zone_KC METRO	zone_NORTHEAST	\
0	52.208935	0	0	
1	18.650000	0	0	
2	18.520000	0	0	
3	48.601930	0	0	
4	75.194697	0	0	
…	…	…	…	
192911	32.200000	0	1	
192912	54.180000	0	1	
192913	76.992151	0	1	
192914	103.588268	0	1	
192915	82.612465	0	1	

	zone_NORTHWEST	zone_SOUTHEAST	zone_SOUTHWEST	zone_STL METRO	\
0	1	0	0	0	
1	1	0	0	0	
2	1	0	0	0	
3	0	0	0	1	
4	0	0	0	1	

```
…                …              …              …              …
192911           0              0              0              0
192912           0              0              0              0
192913           0              0              0              0
192914           0              0              0              0
192915           0              0              0              0

        Cluster
0             3
1             3
2             3
3             0
4             0
…           …
192911        2
192912        2
192913        2
192914        2
192915        2

[192916 rows x 10 columns]
```

[20]:
```
#look at data
mo_dat_pp = spec_mo_data.groupby(["Cluster"])

mo_dat_pp_mean = mo_dat_pp.mean()
mo_dat_pp_mean
```

[20]:
```
         bene_unique_cnt  average_submitted_chrg_amt  \
Cluster
0              63.101544                  237.157214
1              74.391340                  237.524044
2              67.882762                  216.395654
3              72.544516                  209.294697
4              65.893577                  210.956379
5              66.905252                  199.032762

         average_Medicare_payment_amt  zone_KC METRO  zone_NORTHEAST  \
Cluster
0                           56.195835              0               0
1                           47.287634              0               0
2                           49.634866              0               1
3                           55.352187              0               0
4                           55.724893              1               0
5                           48.383723              0               0

         zone_NORTHWEST  zone_SOUTHEAST  zone_SOUTHWEST  zone_STL METRO
```

Cluster				
0	0	0	0	1
1	0	1	0	0
2	0	0	0	0
3	1	0	0	0
4	0	0	0	0
5	0	0	1	0

[ ]: