Clustering

1. DBSCAN

Using DBSCAN iterate (for-loop) through different values of `min_samples` (1 to 10) and `epsilon` (.05 to .5, in steps of .01) to find clusters in the road-data used in the Lesson and calculate the Silohouette Coeff for `min_samples` and `epsilon`. Plot ***one*** line plot with the multiple lines generated from the min_samples and epsilon values. Use a 2D array to store the SilCoeff values, one dimension represents `min_samples`, the other represents epsilon.

Expecting a plot of `epsilon` vs `sil_score`.

In [1]:

```
import pandas as pd
%matplotlib notebook
import matplotlib.pyplot as plt
import seaborn
from mpl_toolkits.mplot3d import Axes3D
plt.rcParams['font.size'] = 14
from sklearn.cluster import KMeans
from sklearn.cluster import DBSCAN
from sklearn import metrics
import numpy as np
```

In [2]:

```
X = pd.read_csv('3D_spatial_network.txt.gz', header = None, names = ['osm', 'lat','lon
X = X.drop(['osm'], axis = 1).sample(10000)
X.head()
```

Out[2]:

	lat	lon	alt
303798	8.589836	57.115182	7.700476
158998	10.267503	57.408115	68.657142
178640	10.280112	57.617054	7.464112
165903	10.300761	56.995853	1.766809
202198	9.208045	56.682584	11.678611

In [3]:

```
XX = X.copy()
XX['alt'] = (X.alt - X.alt.mean())/X.alt.std()
XX['lat'] = (X.lat - X.lat.mean())/X.lat.std()
XX['lon'] = (X.lon - X.lon.mean())/X.lon.std()
```

In [4]:

```
XX.head()
```

Out[4]:

	lat	lon	alt
303798	-1.796207	0.115299	-0.779079
158998	0.868993	1.131534	2.514090
178640	0.889024	1.856380	-0.791848
165903	0.921827	-0.298673	-1.099643
202198	-0.814098	-1.385458	-0.564161

In [5]:

```
min_samples = np.arange(2, 12, 1)
epsilons = np.arange(.05, .5, .01)
all_scores = []
for min_sample in min_samples:
    scores = []
    for epsilon in epsilons:
        print(min_sample)
        print(epsilon)
        dbscan = DBSCAN(eps = epsilon, min_samples = min_sample)
#         dbscan = DBSCAN(epsilon, min_sample)
        labels = dbscan.fit_predict(XX[['lat','lon', 'alt']])
#         km = KMeans(n_clusters = min_samples, random_state = 1)
#         labels = km.fit_predict(XX[['lon', 'lat', 'alt']])
#         calculate silouette score here
        score = (metrics.silhouette_score(XX[['lon', 'lat', 'alt']], labels))

        scores.append(score)

    all_scores.append(scores)
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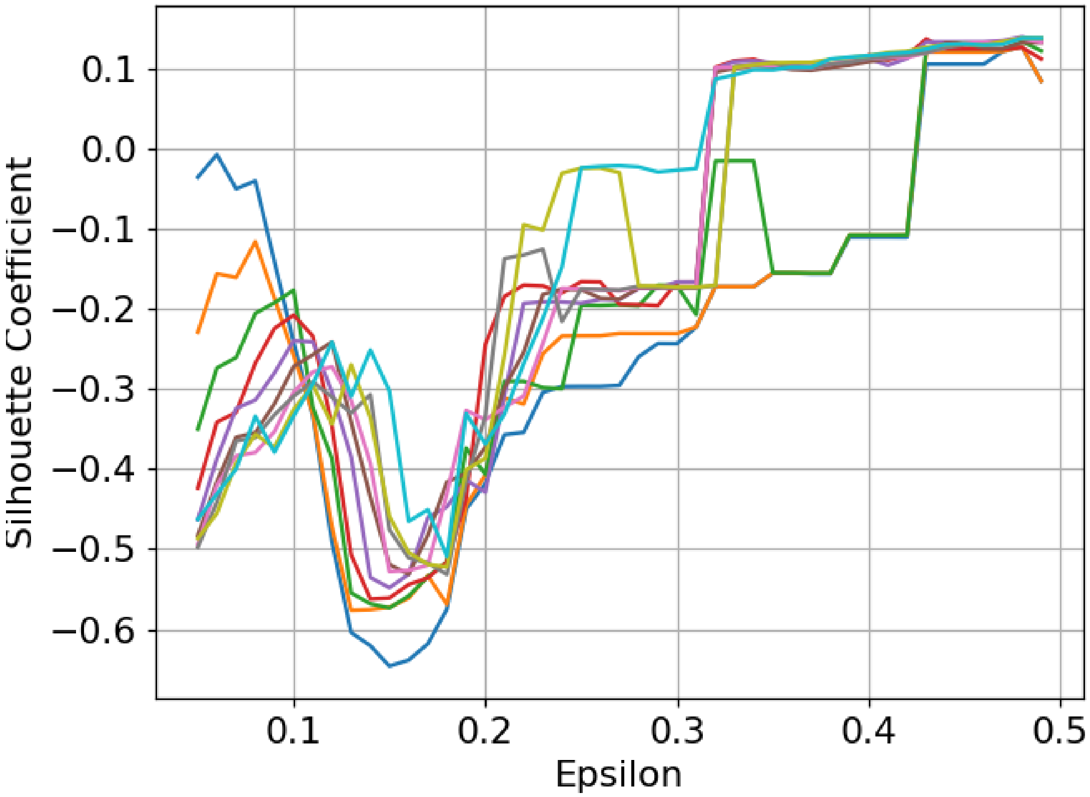
```

In [15]:

```
# plot the results
all_scores_new = np.transpose(all_scores)plt.figure()
plt.plot(epsilons, all_scores_new)
plt.xlabel('Epsilon')
plt.ylabel('Silhouette Coefficient')
plt.grid(True)
plt.show()
```



2. Clustering your own data

Using your own data, find relevant clusters/groups within your data (repeat the above). If your data is labeled with a class that you are attempting to predict, be sure to not use it in training and clustering.

You may use the labels to compare with predictions to show how well the clustering performed using one of the clustering metrics (http://scikit-learn.org/stable/modules/clustering.html#clustering-performance-evaluation).

If you don't have labels, use the silhouette coefficient to show performance. Find the optimal fit for your data but you don't need to be as exhaustive as above.

Additionally, show the clusters in 2D or 3D plots.

As a bonus, try using PCA first to condense your data from N columns to less than N.

Two items are expected:

- Metric Evaluation Plot (like in 1.)
- Plots of the clustered data

In [18]:
```
data = pd.read_csv('bikeshare_hour_count.csv', index_col = False)
data = data.drop(['tuesday'], axis = 1)
data = data.drop(['wednesday'], axis = 1)
data = data.drop(['thursday'], axis = 1)
data = data.drop(['friday'], axis = 1)
data = data.drop(['saturday'], axis = 1)
data = data.drop(['sunday'], axis = 1)
data
```

Out[18]:

	hour	monday
0	0.0	21
1	0.1	39
2	0.2	31
3	0.3	26
4	0.4	19
...	...	...
235	23.5	36
236	23.6	37
237	23.7	30
238	23.8	33
239	23.9	34

240 rows × 2 columns

In [24]:
```
data_new = pd.read_csv('bikeshare.csv.gz', index_col = False, nrows=50000)
data_new.head()
```

Out[24]:

	Duration (ms)	Start date	End date	Start station number	Start station	End station number	End station	Bike number	Member Type
0	301295	3/31/2016 23:59	4/1/2016 0:04	31280	11th & S St NW	31506	1st & Rhode Island Ave NW	W00022	Registered
1	557887	3/31/2016 23:59	4/1/2016 0:08	31275	New Hampshire Ave & 24th St NW	31114	18th St & Wyoming Ave NW	W01294	Registered
2	555944	3/31/2016 23:59	4/1/2016 0:08	31101	14th & V St NW	31221	18th & M St NW	W01416	Registered
3	766916	3/31/2016 23:57	4/1/2016 0:09	31226	34th St & Wisconsin Ave NW	31214	17th & Corcoran St NW	W01090	Registered
4	139656	3/31/2016 23:57	3/31/2016 23:59	31011	23rd & Crystal Dr	31009	27th & Crystal Dr	W21934	Registered

In [21]:

```
df = data.copy()

df['hour'] = (df.hour - df.hour.mean())/df.hour.std()
df['monday'] = (df.monday - df.monday.mean())/df.monday.std()
```

In [24]:

```
k_range = range(2, 40)
scores = []
for k in k_range:
    km = KMeans(n_clusters = k, random_state = 1)
    labels = km.fit_predict(df[['hour', 'monday']])
    scores.append(metrics.silhouette_score(df[['hour', 'monday']], labels))
```

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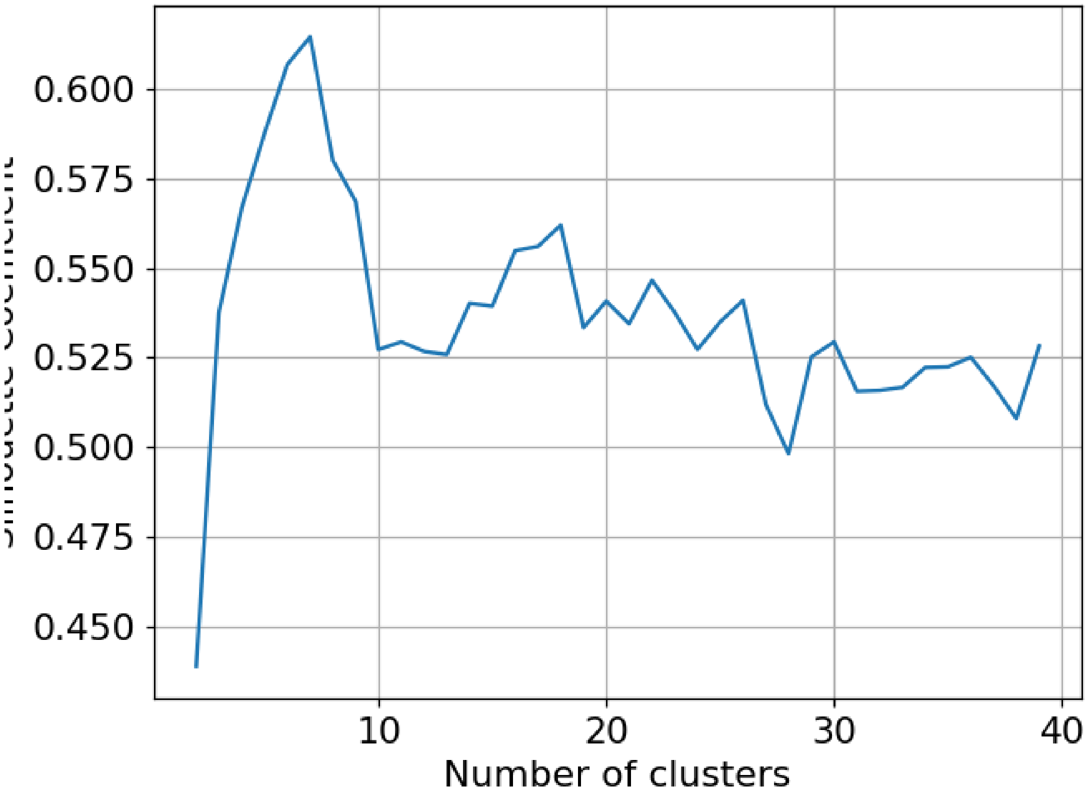
```

In [25]:

```
# plot the results
plt.figure()
plt.plot(k_range, scores)
plt.xlabel('Number of clusters')
plt.ylabel('Silhouette Coefficient')
plt.grid(True)
plt.show()
```



In [25]:
```
df_new = data_new.rename(columns={"Duration (ms)": "duration", "Start station number":

df_new['start_station_number'] = (df_new.start_station_number - df_new.start_station_n
df_new['duration'] = (df_new.duration - df_new.duration.mean())/df_new.duration.std()
```

In [26]:
```
k_range = range(2, 40)
scores = []
for k in k_range:
    km = KMeans(n_clusters = k, random_state = 1)
    labels = km.fit_predict(df_new[['start_station_number', 'duration']])
    scores.append(metrics.silhouette_score(df_new[['start_station_number', 'duration']
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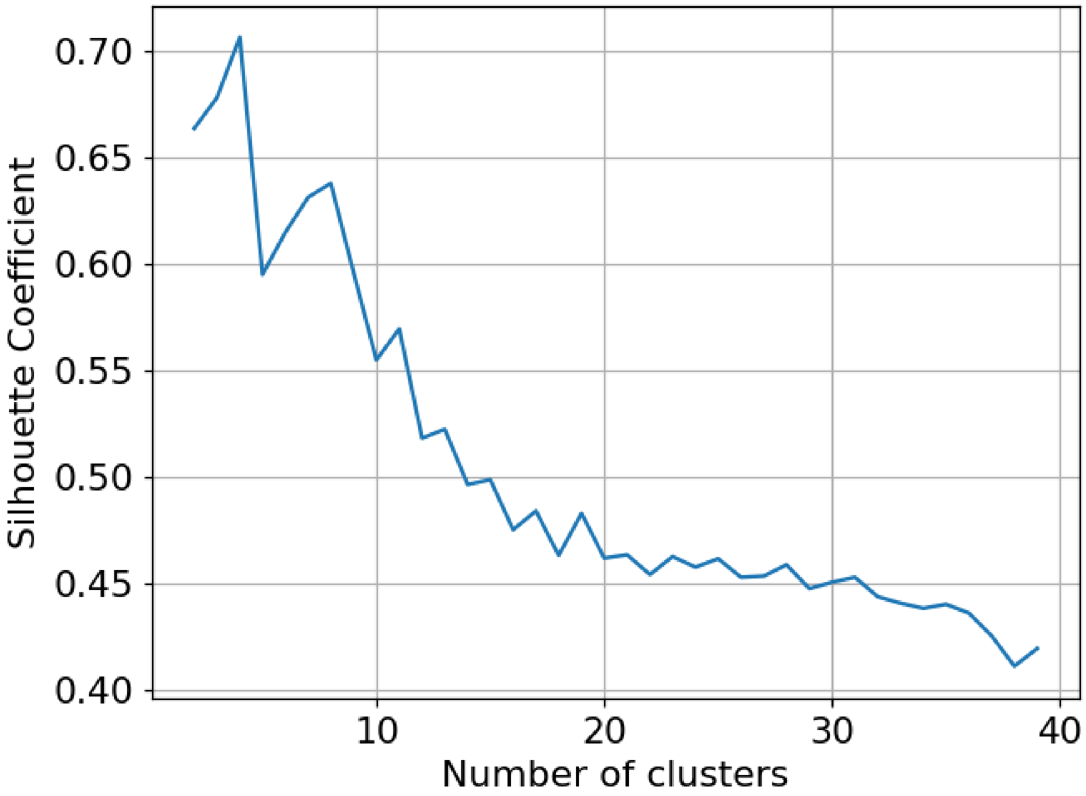
```

In [27]:

```python
# plot the results
plt.figure()
plt.plot(k_range, scores)
plt.xlabel('Number of clusters')
plt.ylabel('Silhouette Coefficient')
plt.grid(True)
plt.show()
```


Silhouette Coefficient
0.70
0.65
0.60
0.55
0.50
0.45
0.40
10
20
30
40
Number of clusters

```
In [ ]:
```