Clasification

January 10, 2021

1 Clustering Model

1.1 Libraries

[1]:
```
import pandas as pd
import dask.dataframe as dd
import numpy as np
import random

from sklearn.preprocessing import StandardScaler,MinMaxScaler
from sklearn.decomposition import PCA
from sklearn.manifold import TSNE,MDS
from sklearn.cluster import AgglomerativeClustering,KMeans
from sklearn.mixture import GaussianMixture

from scipy.stats import kruskal

from sklearn.feature_selection import SelectKBest

import matplotlib.pyplot as plt
import seaborn as sns
```

1.2 Data Loading

1.2.1 We're gonna use a sample, to calculate the sample size we're going to use the next functions:

[2]:
```
csv = '2018_Yellow_Taxi_Trip_Data.csv'

fields = ['passenger_count', 'trip_distance', 'tip_amount',
          'total_amount', 'PULocationID', 'DOLocationID']
```

[3]:
```
temp =dd.read_csv(csv,
                  usecols=fields,
                  dtype={'passenger_count':'int8', 'trip_distance':'float32',
                         'total_amount':'float32', 'PULocationID': 'int16',
```

```
                        'DOLocationID':'int16', 'tip_amount': 'float16'})
```

1.2.2 Vamos a predecir el numero de pasajeros.

Tiramos los que tengan 0, 7,8 y 9 pasajeros

[4]:
```
temp = temp[temp['passenger_count'] > 0]
temp = temp[temp['passenger_count'] < 7]
temp = temp[temp['trip_distance'] > 0]
temp = temp[temp['total_amount'] > 0]
```

[5]:
```
df = temp.sample(frac=0.000008).compute()
```

[6]:
```
df.describe()
```

[6]:

	passenger_count	trip_distance	PULocationID	DOLocationID	tip_amount	\
count	815.000000	815.000000	815.000000	815.000000	815.000000	
mean	1.592638	2.939276	161.150920	157.980368	1.917969	
std	1.205412	3.818235	67.278825	71.961135	2.480469	
min	1.000000	0.070000	4.000000	1.000000	0.000000	
25%	1.000000	0.920000	113.000000	107.000000	0.000000	
50%	1.000000	1.570000	162.000000	162.000000	1.450195	
75%	2.000000	3.110000	233.000000	233.000000	2.455078	
max	6.000000	34.900002	264.000000	265.000000	25.546875	

	total_amount
count	815.000000
mean	16.325069
std	13.937790
min	3.300000
25%	8.300000
50%	11.800000
75%	18.299999
max	153.350006

[7]:
```
df.describe(percentiles=[0.001, 0.01, 0.99]).T[['0.1%', '1%', '99%']]
```

[7]:

	0.1%	1%	99%
passenger_count	1.00000	1.0	6.000000
trip_distance	0.09442	0.3	18.647400
PULocationID	6.44200	13.0	264.000000
DOLocationID	1.00000	7.0	264.000000
tip_amount	0.00000	0.0	11.703125
total_amount	3.70700	4.8	69.197600

1.3 Visualization

[8]:
```
varc = [v for v in df.columns if v != "passenger_count"]
varc
```

[8]:
```
['trip_distance', 'PULocationID', 'DOLocationID', 'tip_amount', 'total_amount']
```

[9]:
```
X = df[varc].copy()
```

1.3.1 PCA

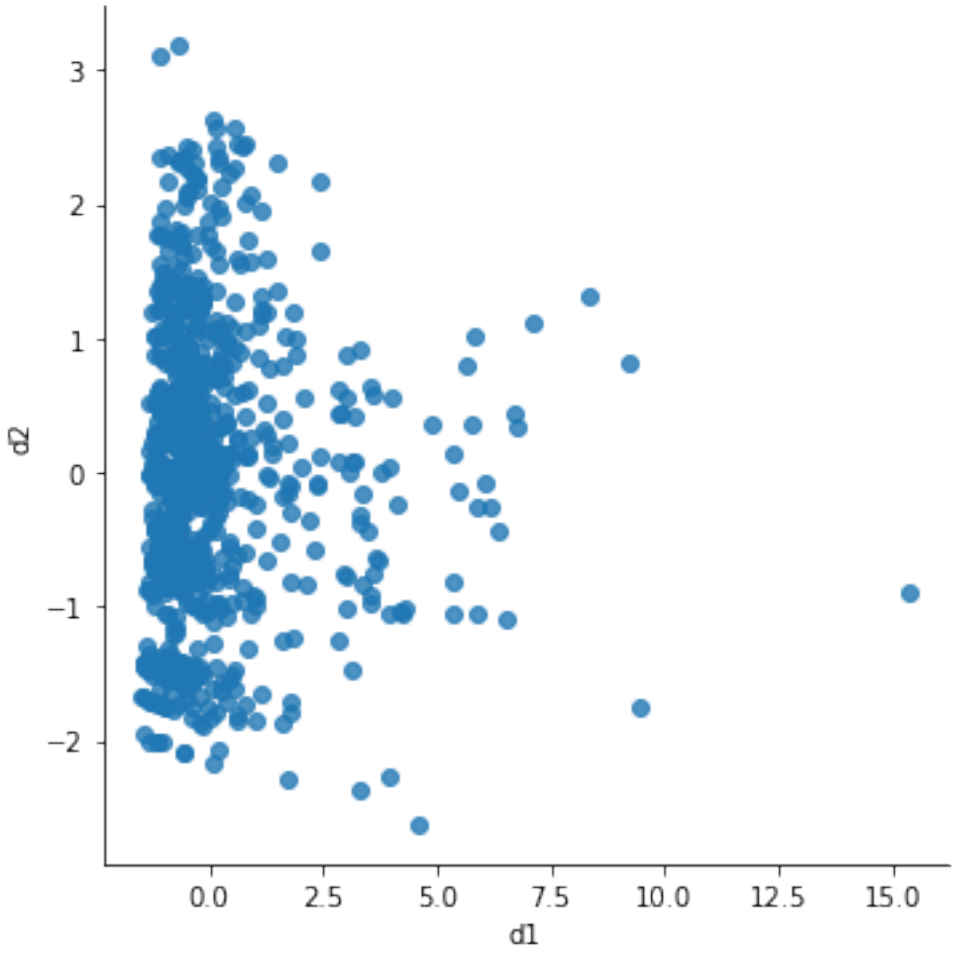
[10]:
```
sc = StandardScaler()
sc.fit(X)
Xs = pd.DataFrame(sc.transform(X),columns=varc)
pca = PCA(n_components=2)
pca.fit(Xs)
pca.explained_variance_ratio_.cumsum()
```

[10]:
```
array([0.5179963 , 0.74349976], dtype=float32)
```

[11]:
```
Xp = pd.DataFrame(pca.transform(Xs),columns=['d1','d2'])
```

[12]:
```
sns.lmplot(data=Xp,x='d1',y='d2',fit_reg=False)
```

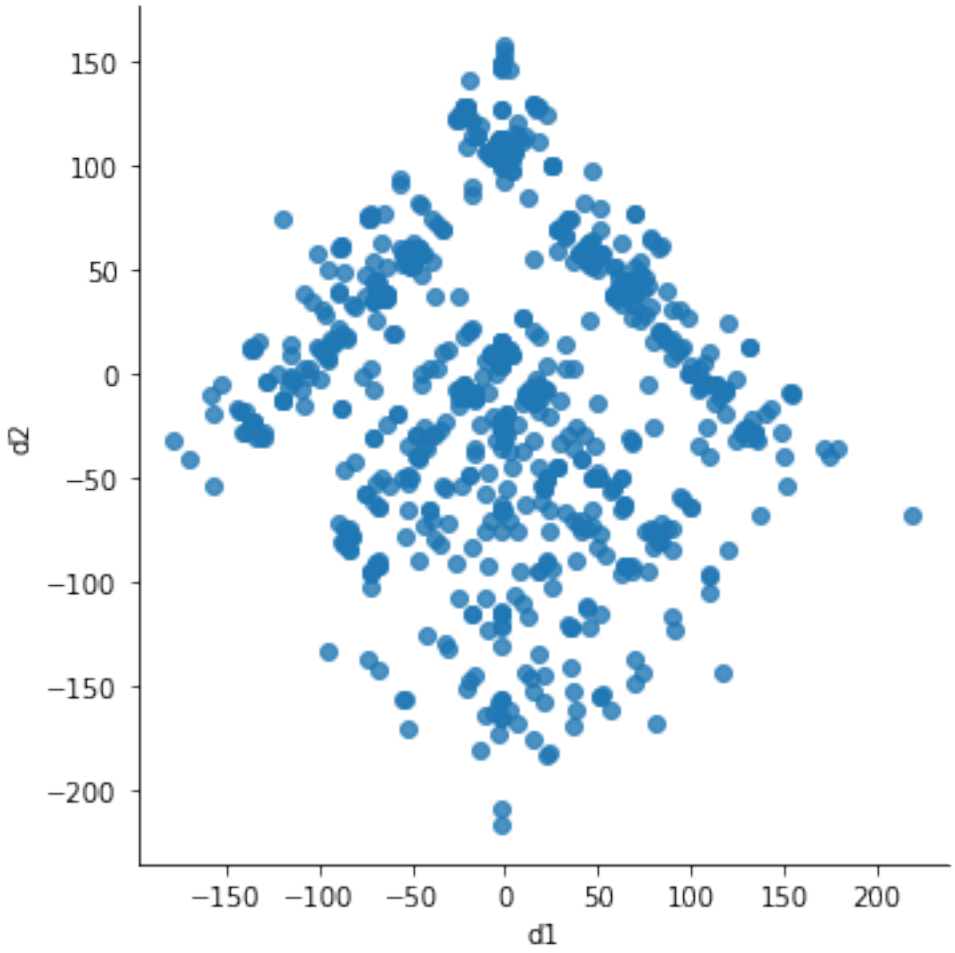
[12]:
```
<seaborn.axisgrid.FacetGrid at 0x7f574c407550>
```



1.3.2 MDS

[13]:
```
mds = MDS(n_components=2,n_jobs=-1)
Xm = pd.DataFrame(mds.fit_transform(X),columns=['d1','d2'])
sns.lmplot(data=Xm,x='d1',y='d2',fit_reg=False)
```

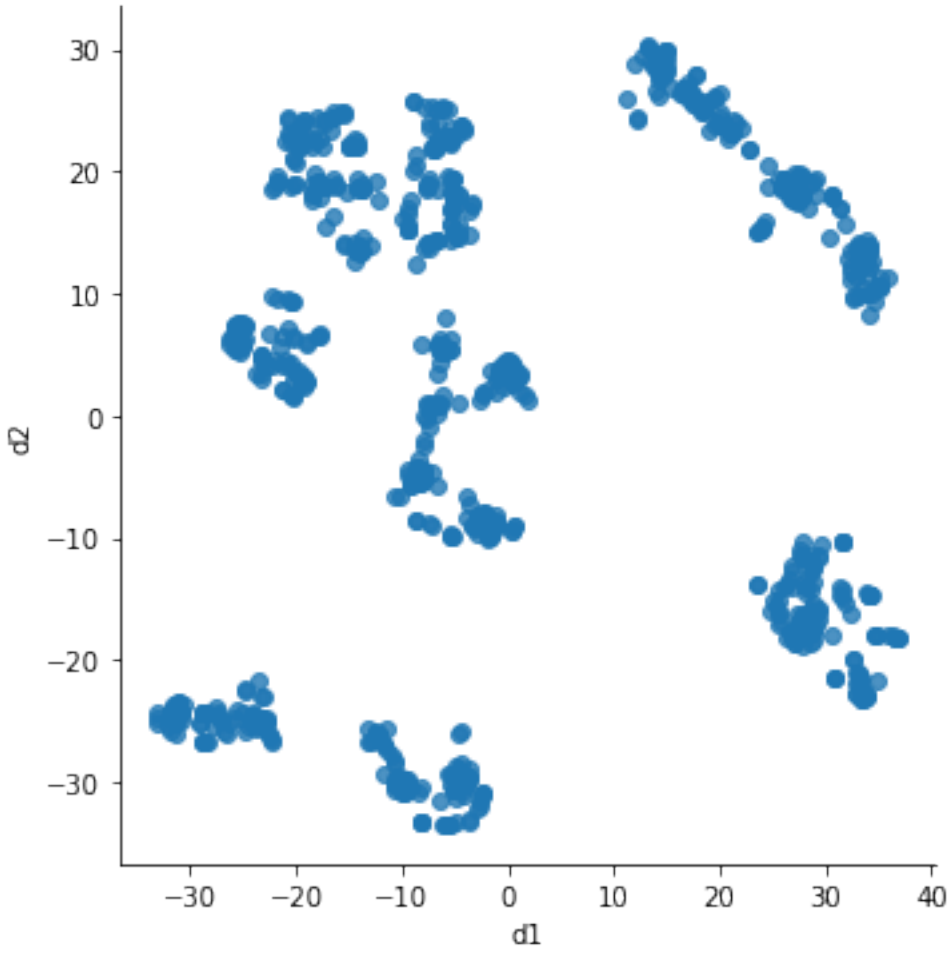
[13]: <seaborn.axisgrid.FacetGrid at 0x7f574c3175f8>



1.3.3 T-SNE

[14]:
```
tsne = TSNE(n_components=2,n_jobs=-1)
Xt = pd.DataFrame(tsne.fit_transform(X),columns=['d1','d2'])
sns.lmplot(data=Xt,x='d1',y='d2',fit_reg=False)
```

[14]:
```
<seaborn.axisgrid.FacetGrid at 0x7f574c2dfa58>
```



1.4 Exploratory Analysis

[15]:
```
X.describe(percentiles=np.arange(0,1,0.1))
```

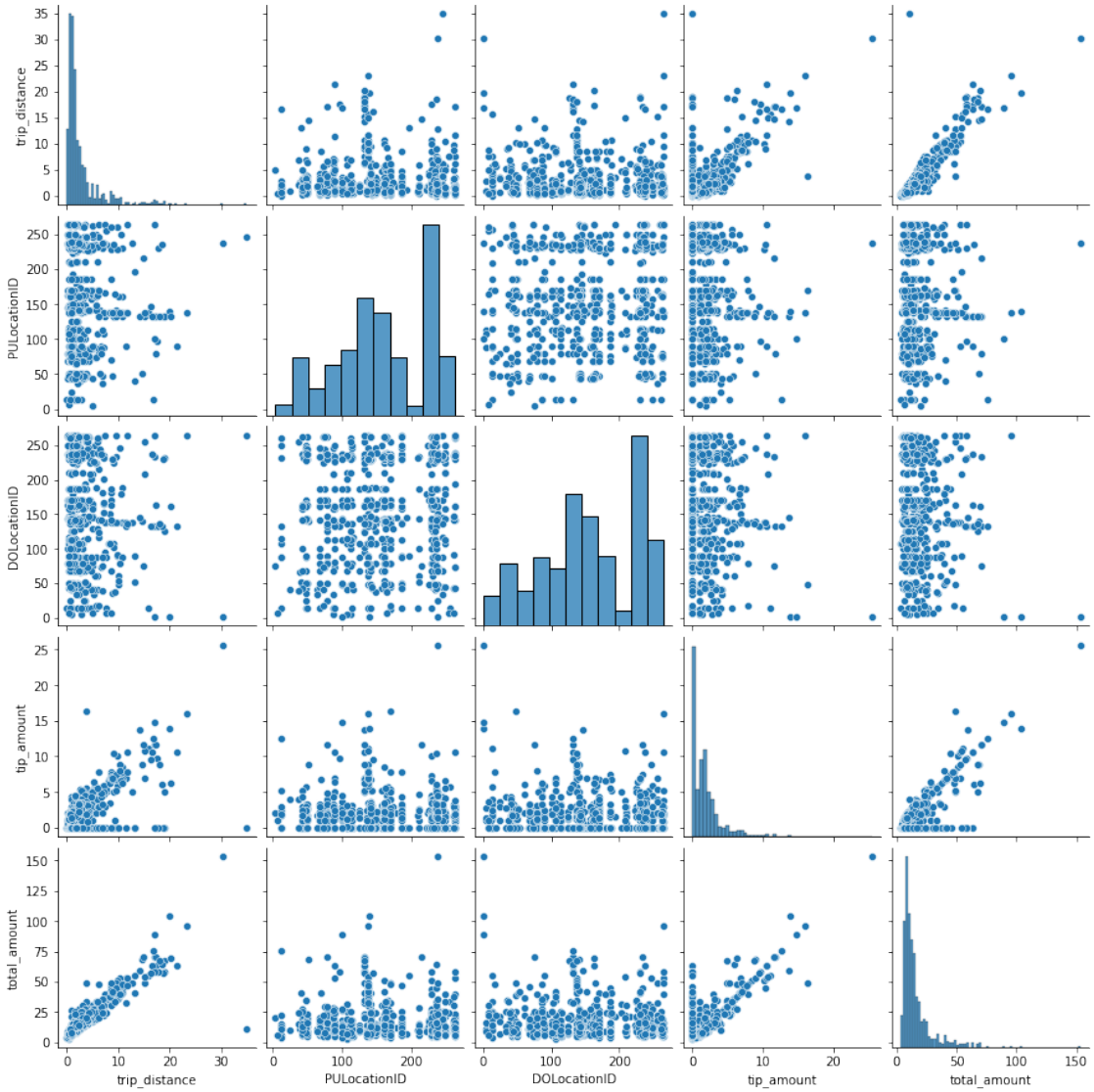
[15]:

	trip_distance	PULocationID	DOLocationID	tip_amount	total_amount
count	815.000000	815.000000	815.000000	815.000000	815.000000
mean	2.939276	161.150920	157.980368	1.917969	16.325069
std	3.818235	67.278825	71.961135	2.480469	13.937790
min	0.070000	4.000000	1.000000	0.000000	3.300000
0%	0.070000	4.000000	1.000000	0.000000	3.300000
10%	0.600000	68.000000	48.000000	0.000000	6.368000
20%	0.818000	100.000000	87.000000	0.000000	7.850000
30%	1.040000	132.000000	125.000000	0.000000	8.800000
40%	1.296000	141.000000	142.000000	1.000000	10.300000
50%	1.570000	162.000000	162.000000	1.450195	11.800000
60%	1.918000	170.000000	170.000000	1.781641	13.800000

70%	2.600000	230.000000	230.000000	2.160156	16.000000
80%	3.700000	236.000000	236.000000	2.951563	20.768000
90%	7.108000	239.000000	241.400000	4.558594	32.016000
max	34.900002	264.000000	265.000000	25.546875	153.350006

[16]:
```
sns.pairplot(X)
```

[16]: <seaborn.axisgrid.PairGrid at 0x7f574c2c6d68>



[17]:
```
X.corr()
```

[17]:

	trip_distance	PULocationID	DOLocationID	tip_amount	\
trip_distance	1.000000	-0.034582	-0.089966	0.644051	

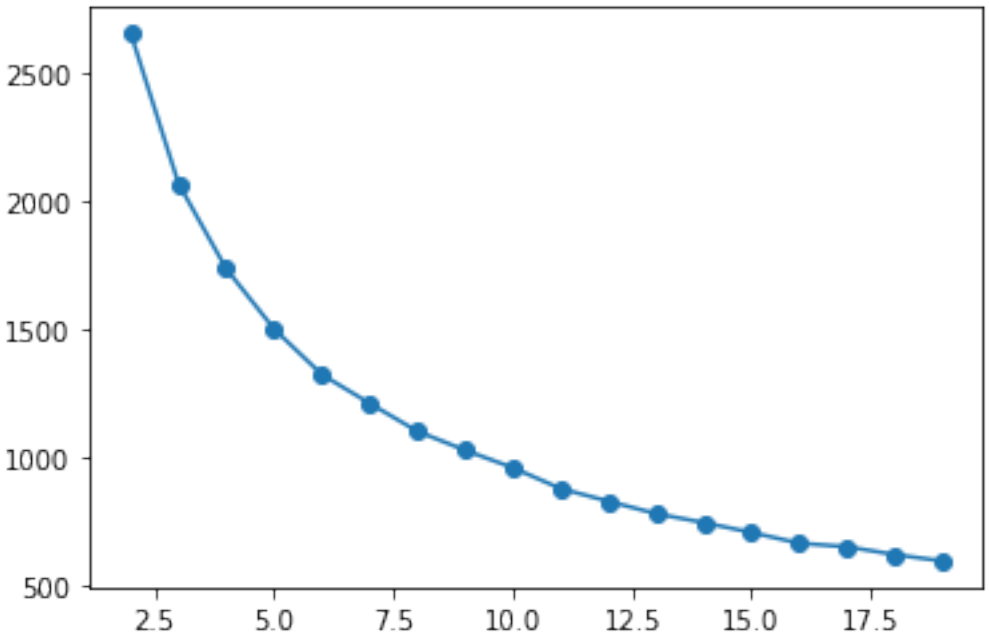
```
PULocationID       -0.034582      1.000000      0.141475   -0.020398
DOLocationID       -0.089966      0.141475      1.000000   -0.061298
tip_amount          0.644051     -0.020398     -0.061298    1.000000
total_amount        0.907124     -0.039812     -0.112205    0.799711
```

```
               total_amount
trip_distance      0.907124
PULocationID      -0.039812
DOLocationID      -0.112205
tip_amount         0.799711
total_amount       1.000000
```

1.4.1 # of Clusters

[18]:
```
l = []
for k in range(2,20):
    cl = KMeans(n_clusters=k)
    cl.fit(Xs)
    l.append(cl.inertia_)
plt.plot(range(2,20),l,marker='o')
```

[18]: [<matplotlib.lines.Line2D at 0x7f5768fc6240>]



[19]:
```
k = 7
```

[20]:
```
varc = X.columns.tolist()
varc
```

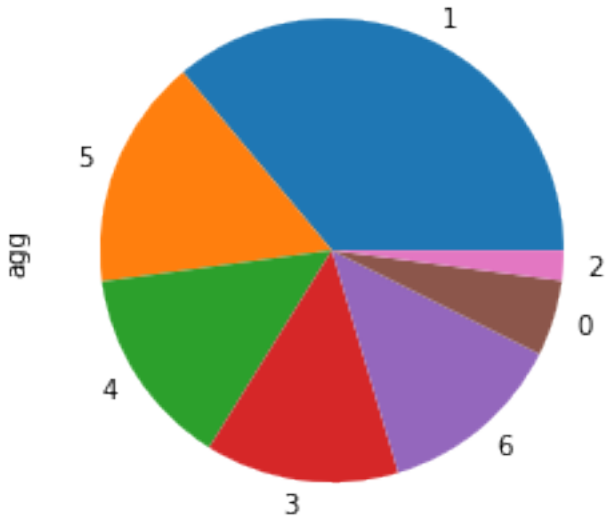
[20]: ['trip_distance', 'PULocationID', 'DOLocationID', 'tip_amount', 'total_amount']

1.5 Modelo no supervisado (Aglomerativo)

[21]:
```
cl = 'agg'
agg = AgglomerativeClustering(n_clusters=k)
X[cl]=Xs[cl]=Xm[cl]=Xt[cl]=Xp[cl]=df[cl] = agg.fit_predict(Xs[varc])
display(df[cl].value_counts(True).sort_index())
df[cl].value_counts().plot(kind='pie')
```

```
0    0.052761
1    0.360736
2    0.020859
3    0.134969
4    0.139877
5    0.160736
6    0.130061
Name: agg, dtype: float64
```

[21]: <AxesSubplot:ylabel='agg'>

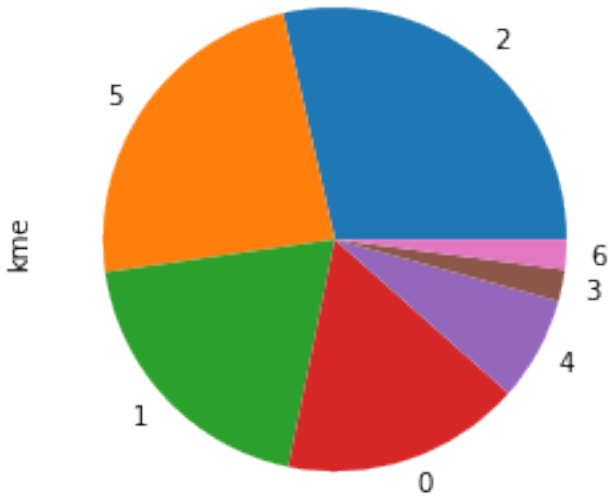


1.6 K-Means

[22]:
```
cl = 'kme'
agg = KMeans(n_clusters=k)
X[cl]=Xs[cl]=Xm[cl]=Xt[cl]=Xp[cl]=df[cl] = agg.fit_predict(Xs[varc])
display(df[cl].value_counts(True).sort_index())
df[cl].value_counts().plot(kind='pie')
```

```
0    0.166871
1    0.195092
2    0.285890
3    0.022086
4    0.072393
5    0.236810
6    0.020859
Name: kme, dtype: float64
```

[22]: <AxesSubplot:ylabel='kme'>

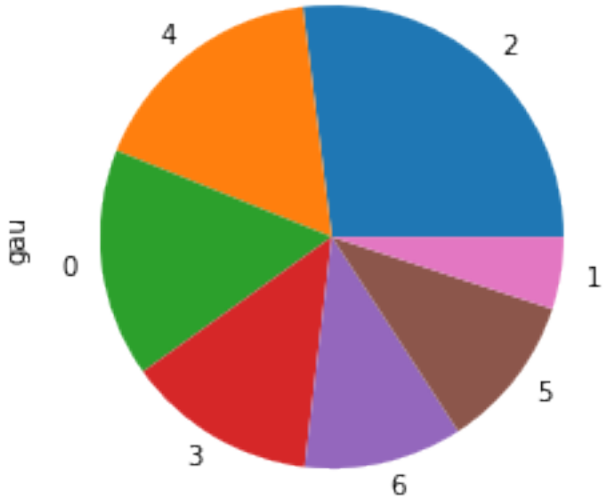


1.7 Gaussian Mixture

[23]:
```
cl = 'gau'
agg = GaussianMixture(n_components=k)
X[cl]=Xs[cl]=Xm[cl]=Xt[cl]=Xp[cl]=df[cl] = agg.fit_predict(Xs[varc])
display(df[cl].value_counts(True).sort_index())
df[cl].value_counts().plot(kind='pie')
```

```
0    0.159509
1    0.050307
2    0.269939
3    0.132515
4    0.169325
5    0.107975
6    0.110429
Name: gau, dtype: float64
```

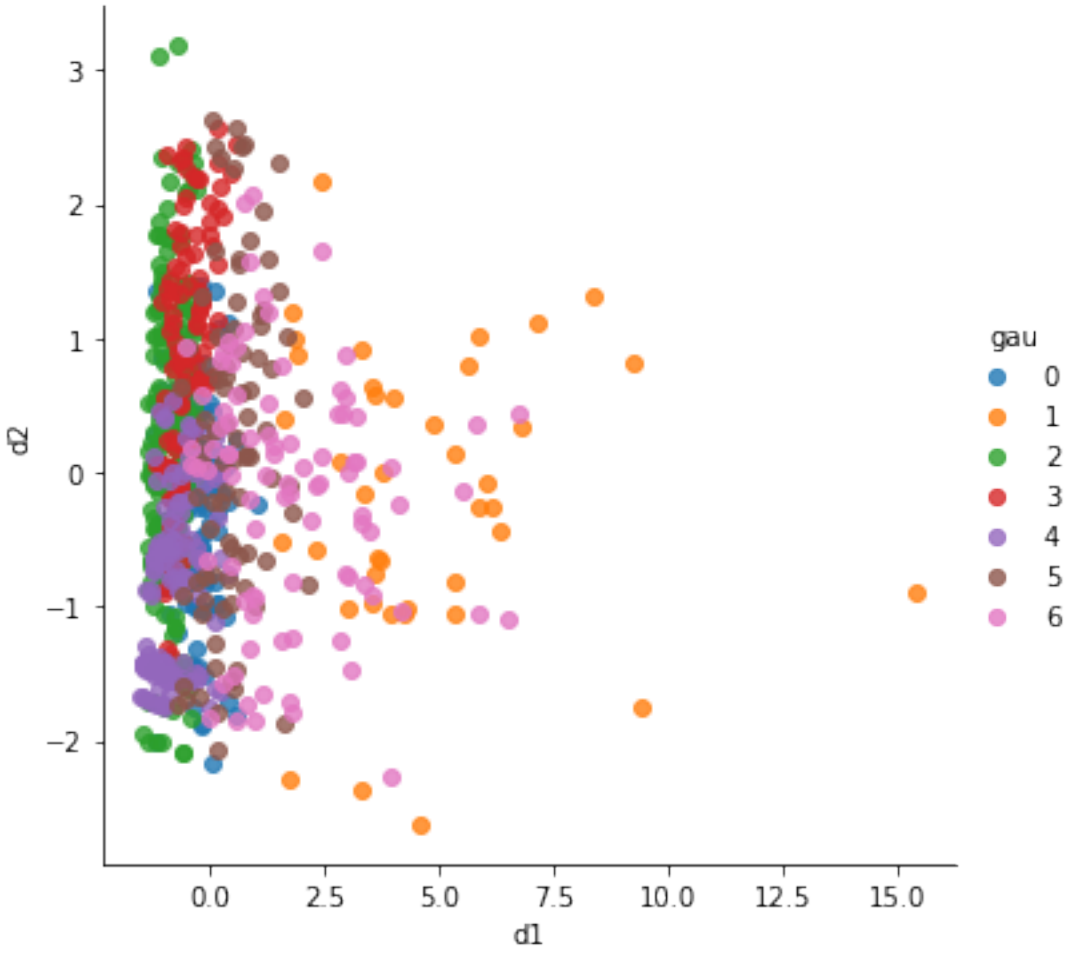
[23]: <AxesSubplot:ylabel='gau'>

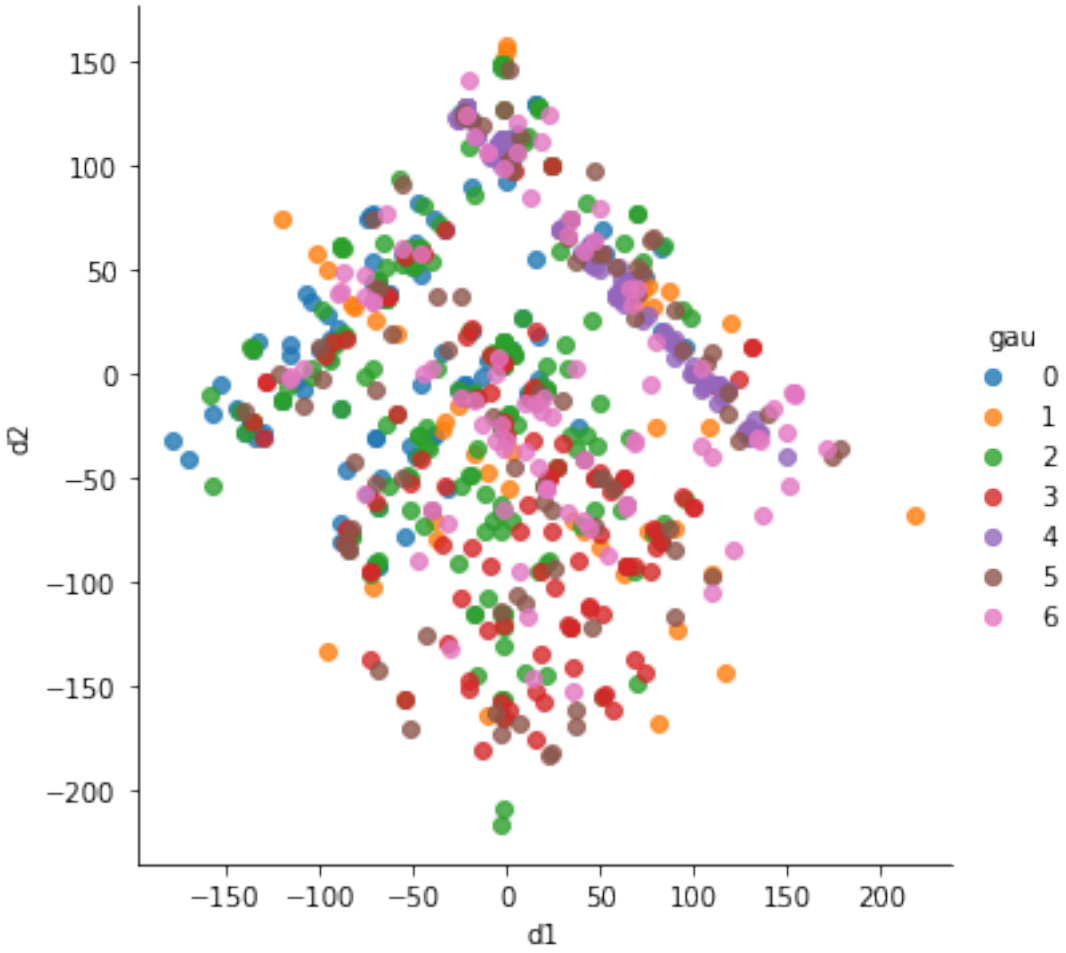


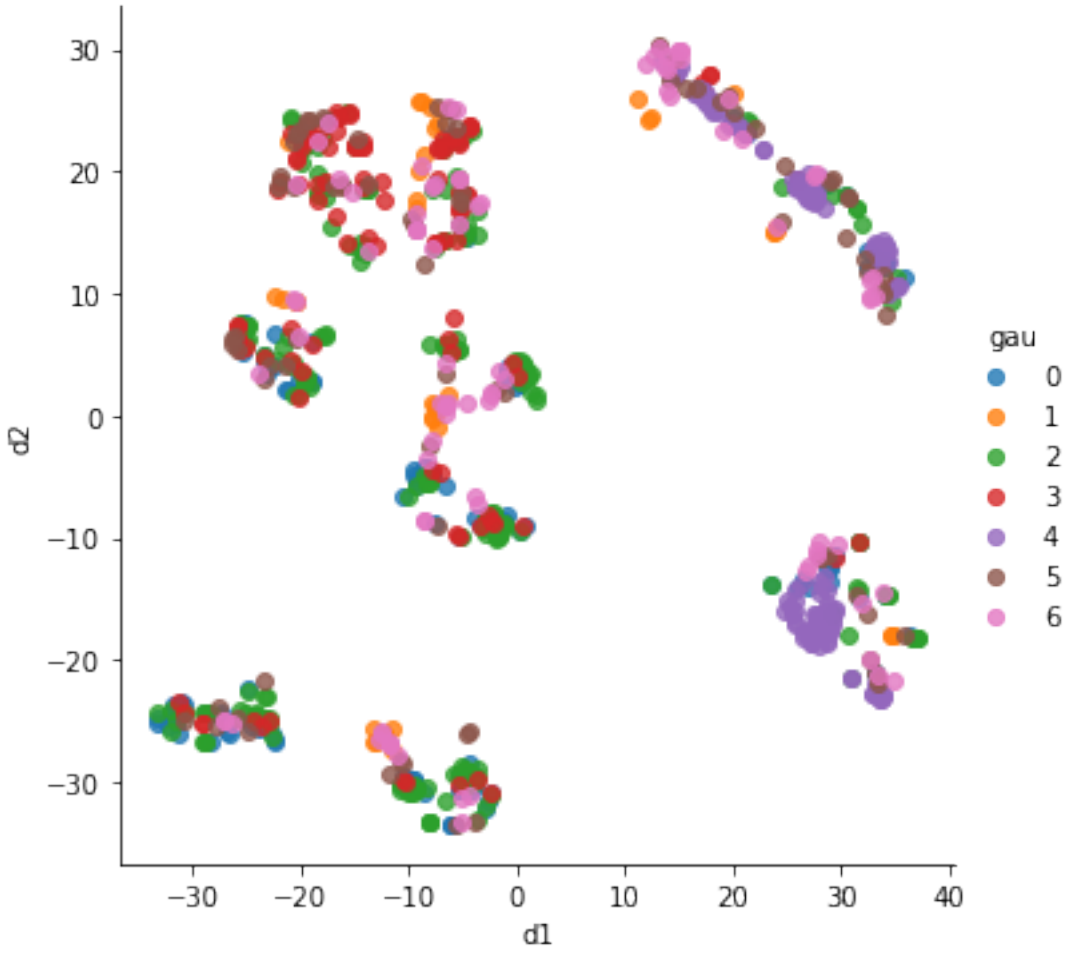
1.8 2D Visualization

[24]:
```
sns.lmplot(data=Xp,x='d1',y='d2',fit_reg=False,hue='gau')
sns.lmplot(data=Xm,x='d1',y='d2',fit_reg=False,hue='gau')
sns.lmplot(data=Xt,x='d1',y='d2',fit_reg=False,hue='gau')
```

[24]: <seaborn.axisgrid.FacetGrid at 0x7f577ab21588>


3
2
1
0
−1
−2
d2
0.0
2.5
5.0
7.5
10.0
12.5
15.0
d1
gau
0
1
2
3
4
5
6


150
100
50
0
−50
−100
−150
−200
d2
−150
−100
−50
0
50
100
150
200
d1
gau
0
1
2
3
4
5
6



1.9 Perfilamiento

$p - value < \alpha$ Son diferentes y por tanto la variable sirve para perfilar

[25]:
```
pd.DataFrame(map(lambda v:(v,kruskal(*[d[v].tolist() for _,d in df.
↪groupby('gau')]).pvalue),
      varc),columns=['variable','p-value'])
```

[25]:

	variable	p-value
0	trip_distance	2.843500e-109
1	PULocationID	1.830534e-42
2	DOLocationID	1.184611e-25
3	tip_amount	3.332350e-60
4	total_amount	1.057493e-129

[26]:
```
sk = SelectKBest(k='all')
sk.fit(X[varc],X['gau'])
```

[26]:
```
SelectKBest(k='all')
```

[27]:
```
best = [v for v,x in zip(varc,sk.get_support()) if x]
best
```

[27]:
```
['trip_distance', 'PULocationID', 'DOLocationID', 'tip_amount', 'total_amount']
```

1.10 Examples

[64]:
```
k = 5
cl = 2
for id in df.loc[df['gau']==cl].sample(k).DOLocationID:
    print(id)
```

```
140
142
246
224
238
```

[69]:
```
i = 5
cluster = 4
for id in df.loc[df['gau']==cluster].sample(i).trip_distance:
    print(id)
```

```
0.699999988079071
1.2999999523162842
0.4699999988079071
0.6000000238418579
0.49000000953674316
```

2 Persistencia

[71]:
```
import pickle
pickle.dump((sc, agg),open('gaussian cluster_midterm.pkl','wb'))
```