Tsne(CreditCardFraudDetection)

April 8, 2018

1 CreditCardFraud Detection Visualization using T-SNE

```
In [1]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        import seaborn as sns
        import pickle
```

```
In [2]: df = pd.read_csv('creditcard.csv')
        df.shape
```

```
Out[2]: (284807, 31)
```

Observation: 1)There are 284807 data points i.e this many no.of transactions 2)There are 31 Features i.e 31 dimensions

1.1 Description

Time -> Its the seconds elapsed between each transaction and the first transaction in the dataset Class: 1 -> fraud, 0 -> no harm

1.1.1 Considering 50086 Data Points

```
In [4]: s1 = df[df['Class']==0]
        sampleClass1=s1[0:50000];

        s2 = df[df['Class']==1]
        sampleClass2=s2[0:86];

        sample = sampleClass1.append(sampleClass2)
        sample.shape
```

```
Out[4]: (50086, 31)
```

```
In [5]: classes = sample['Class']

        sample = sample.drop("Class",axis=1)
        sample.head()
```

```
Out[5]:    Time        V1        V2        V3        V4        V5        V6        V7  \
        0   0.0 -1.359807 -0.072781  2.536347  1.378155 -0.338321  0.462388  0.239599
        1   0.0  1.191857  0.266151  0.166480  0.448154  0.060018 -0.082361 -0.078803
        2   1.0 -1.358354 -1.340163  1.773209  0.379780 -0.503198  1.800499  0.791461
        3   1.0 -0.966272 -0.185226  1.792993 -0.863291 -0.010309  1.247203  0.237609
        4   2.0 -1.158233  0.877737  1.548718  0.403034 -0.407193  0.095921  0.592941

                 V8        V9   ...          V20       V21       V22       V23  \
        0  0.098698  0.363787   ...     0.251412 -0.018307  0.277838 -0.110474
        1  0.085102 -0.255425   ...    -0.069083 -0.225775 -0.638672  0.101288
        2  0.247676 -1.514654   ...     0.524980  0.247998  0.771679  0.909412
        3  0.377436 -1.387024   ...    -0.208038 -0.108300  0.005274 -0.190321
        4 -0.270533  0.817739   ...     0.408542 -0.009431  0.798278 -0.137458

                V24       V25       V26       V27       V28  Amount
        0  0.066928  0.128539 -0.189115  0.133558 -0.021053  149.62
        1 -0.339846  0.167170  0.125895 -0.008983  0.014724    2.69
        2 -0.689281 -0.327642 -0.139097 -0.055353 -0.059752  378.66
        3 -1.175575  0.647376 -0.221929  0.062723  0.061458  123.50
        4  0.141267 -0.206010  0.502292  0.219422  0.215153   69.99

        [5 rows x 30 columns]
```

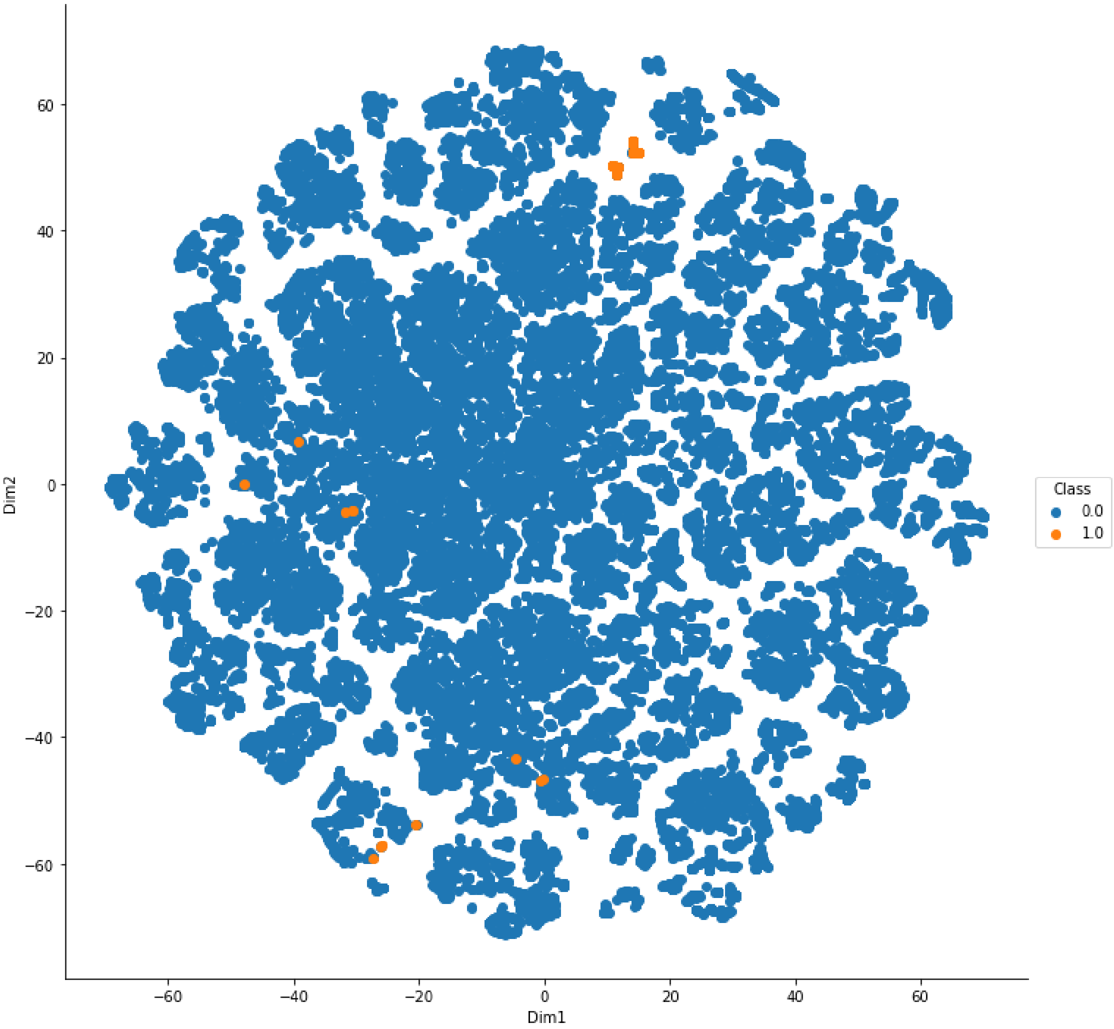
```
In [6]: from sklearn.preprocessing import StandardScaler
        stdzidData = StandardScaler().fit_transform(sample)
        stdzidData.shape
```

```
Out[6]: (50086, 30)
```

```
In [ ]: from sklearn.manifold import TSNE


        model = TSNE(n_components=2, random_state=0)




        tsneData = model.fit_transform(stdzidData)

        tsneData = np.vstack((tsneData.T,classes)).T

        print(tsneData.T.shape)

        tsne_df = pd.DataFrame(data = tsneData,columns=("Dim1","Dim2","Class"))
        tsne_df.head()
```

```
In [7]: # getting tsne_df from the pickle file into
        # which we have loaded in the above step
        pickle_in=open("50KDataPointsTsne.pickle","rb")
        tsne_df = pickle.load(pickle_in)
```

```
In [8]: sns.FacetGrid(tsne_df,hue="Class",size=10).map(plt.scatter,"Dim1","Dim2").add_legend()

        plt.show()
```



1.1.2 Perplexity = 100

```
In [13]: s1 = df[df['Class']==0]
         sampleClass1=s1[0:5000];

         s2 = df[df['Class']==1]
         sampleClass2=s2[0:9];
         sample = sampleClass1.append(sampleClass2)
         sample.shape

Out[13]: (5009, 31)

In [14]: classes = sample['Class']

         sample = sample.drop("Class",axis=1)
         sample.head()

Out[14]:    Time        V1        V2        V3        V4        V5        V6        V7  \
         0   0.0 -1.359807 -0.072781  2.536347  1.378155 -0.338321  0.462388  0.239599
         1   0.0  1.191857  0.266151  0.166480  0.448154  0.060018 -0.082361 -0.078803
         2   1.0 -1.358354 -1.340163  1.773209  0.379780 -0.503198  1.800499  0.791461
         3   1.0 -0.966272 -0.185226  1.792993 -0.863291 -0.010309  1.247203  0.237609
         4   2.0 -1.158233  0.877737  1.548718  0.403034 -0.407193  0.095921  0.592941

                  V8        V9   ...         V20       V21       V22       V23  \
         0  0.098698  0.363787   ...    0.251412 -0.018307  0.277838 -0.110474
         1  0.085102 -0.255425   ...   -0.069083 -0.225775 -0.638672  0.101288
         2  0.247676 -1.514654   ...    0.524980  0.247998  0.771679  0.909412
         3  0.377436 -1.387024   ...   -0.208038 -0.108300  0.005274 -0.190321
         4 -0.270533  0.817739   ...    0.408542 -0.009431  0.798278 -0.137458

                 V24       V25       V26       V27       V28  Amount
         0  0.066928  0.128539 -0.189115  0.133558 -0.021053  149.62
         1 -0.339846  0.167170  0.125895 -0.008983  0.014724    2.69
         2 -0.689281 -0.327642 -0.139097 -0.055353 -0.059752  378.66
         3 -1.175575  0.647376 -0.221929  0.062723  0.061458  123.50
         4  0.141267 -0.206010  0.502292  0.219422  0.215153   69.99

         [5 rows x 30 columns]

In [15]: from sklearn.preprocessing import StandardScaler
         stdzidData = StandardScaler().fit_transform(sample)
         stdzidData.shape

Out[15]: (5009, 30)
```

1.1.3 Perplexity=20

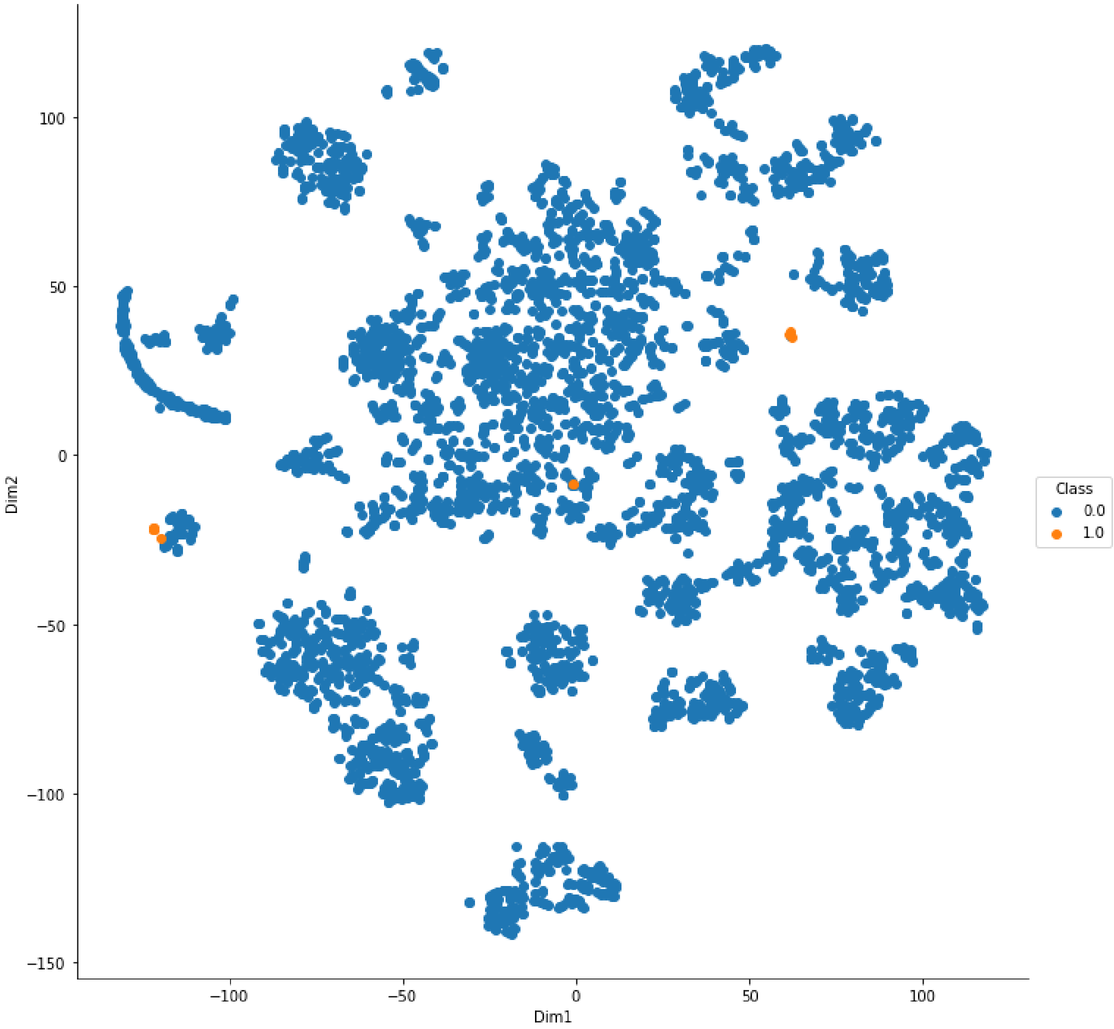
```
In [18]: from sklearn.manifold import TSNE


         model = TSNE(n_components=2, random_state=0,perplexity=20, n_iter=5000)



         tsneData = model.fit_transform(stdzidData)
```

```
        tsneData = np.vstack((tsneData.T,classes)).T

        print(tsneData.T.shape)

        tsne_df = pd.DataFrame(data = tsneData,columns=("Dim1","Dim2","Class"))
        tsne_df.head()
```

```
(3, 5009)
```

```
Out[18]:          Dim1       Dim2  Class
        0    0.575464  42.368244    0.0
        1  117.171600 -44.305717    0.0
        2   -3.074323 -52.404091    0.0
        3   33.981457  -2.546606    0.0
        4   -0.782740  28.125124    0.0
```

```
In [19]: sns.FacetGrid(tsne_df,hue="Class",size=10).map(plt.scatter,"Dim1","Dim2").add_legend(

        plt.show()
```



1.1.4 Perplexity =10 and iter=2000

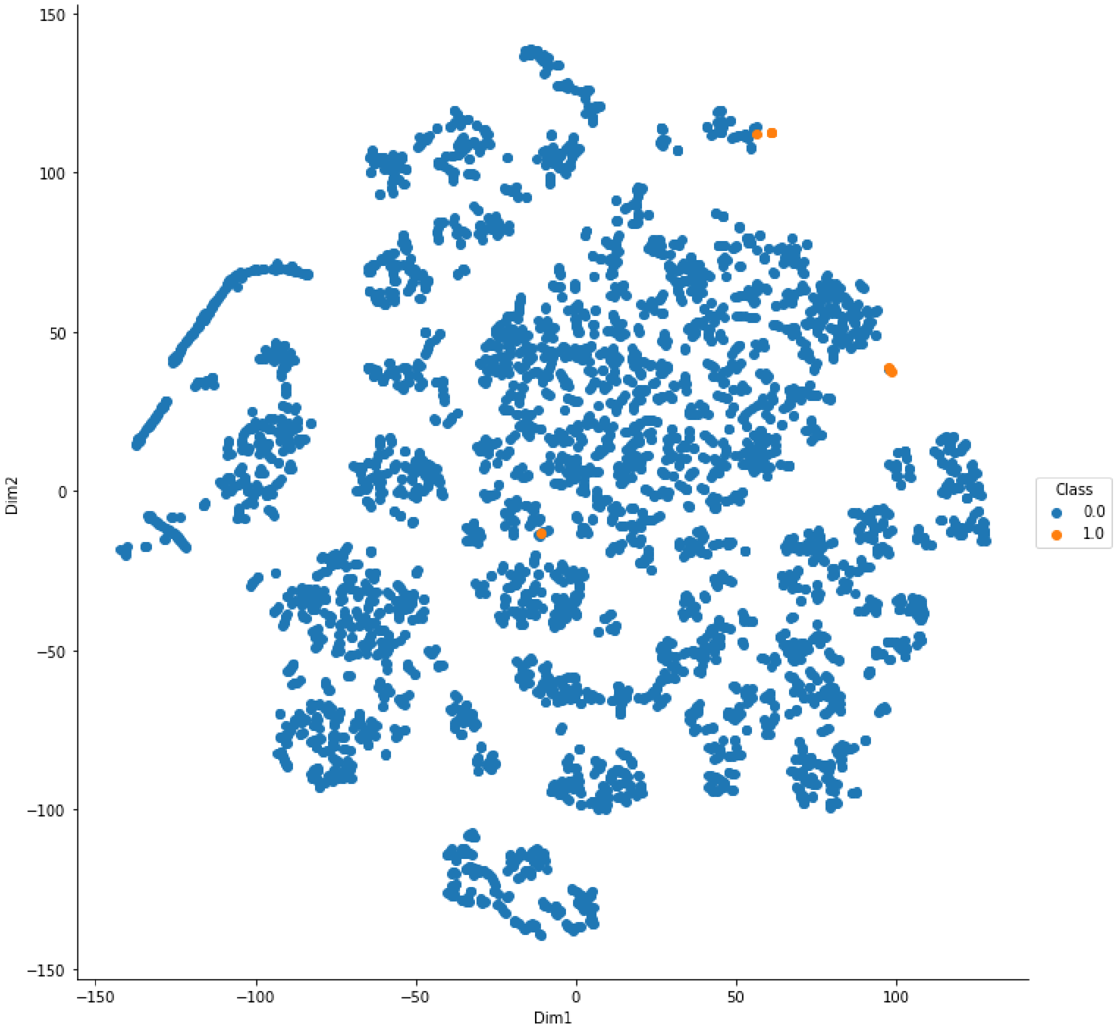
```
In [20]: from sklearn.manifold import TSNE


         model = TSNE(n_components=2, random_state=0,perplexity=10, n_iter=2000)



         tsneData = model.fit_transform(stdzidData)

         tsneData = np.vstack((tsneData.T,classes)).T

         print(tsneData.T.shape)
```

```
        tsne_df = pd.DataFrame(data = tsneData,columns=("Dim1","Dim2","Class"))
        tsne_df.head()
```

```
(3, 5009)
```

```
Out[20]:          Dim1       Dim2  Class
         0   7.428113  11.981552    0.0
         1  81.495552 -98.177994    0.0
         2 -41.879108  -0.417826    0.0
         3  -0.314163 -32.616764    0.0
         4   4.384876  32.115753    0.0
```

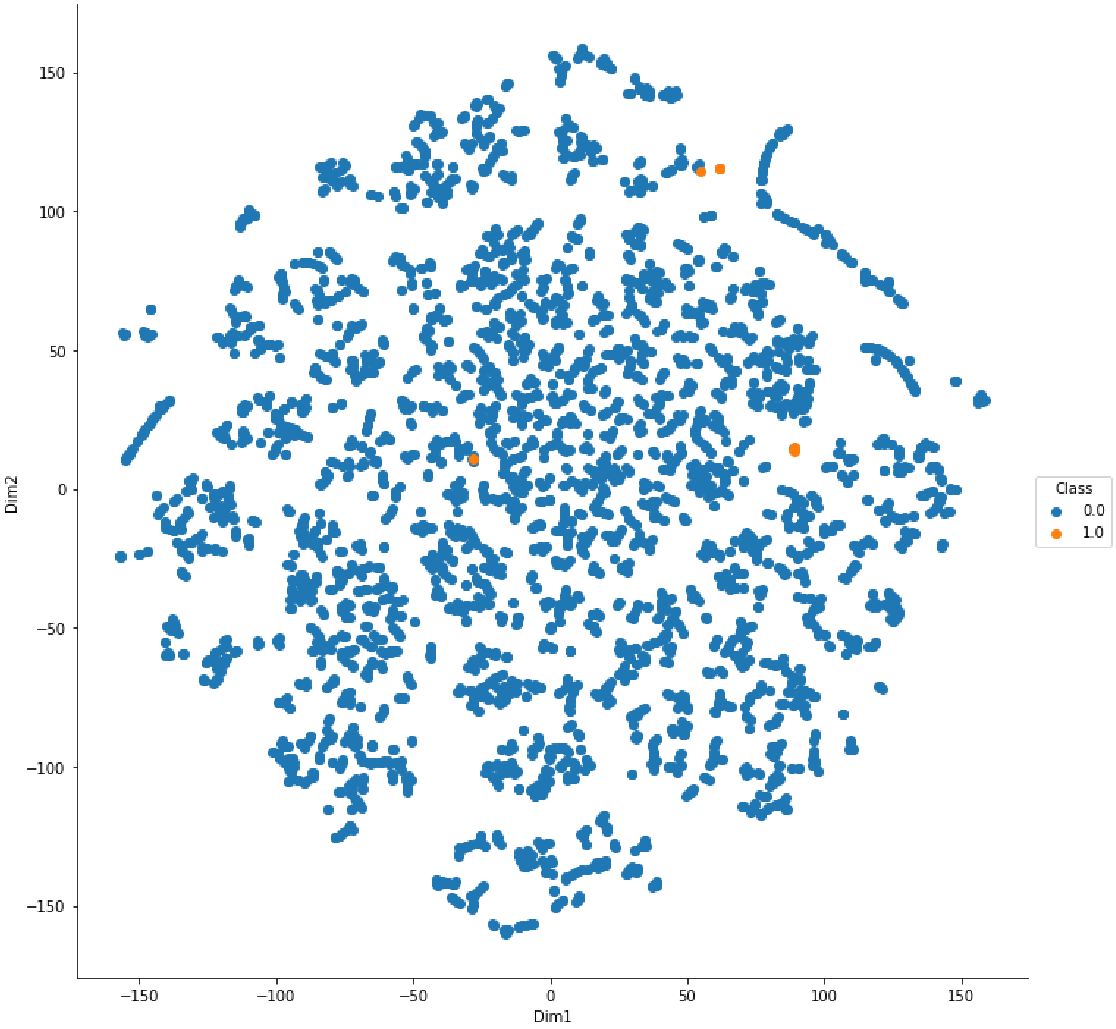
```
In [21]: sns.FacetGrid(tsne_df,hue="Class",size=10).map(plt.scatter,"Dim1","Dim2").add_legend(

         plt.show()
```



1.1.5 Perplexity = 5

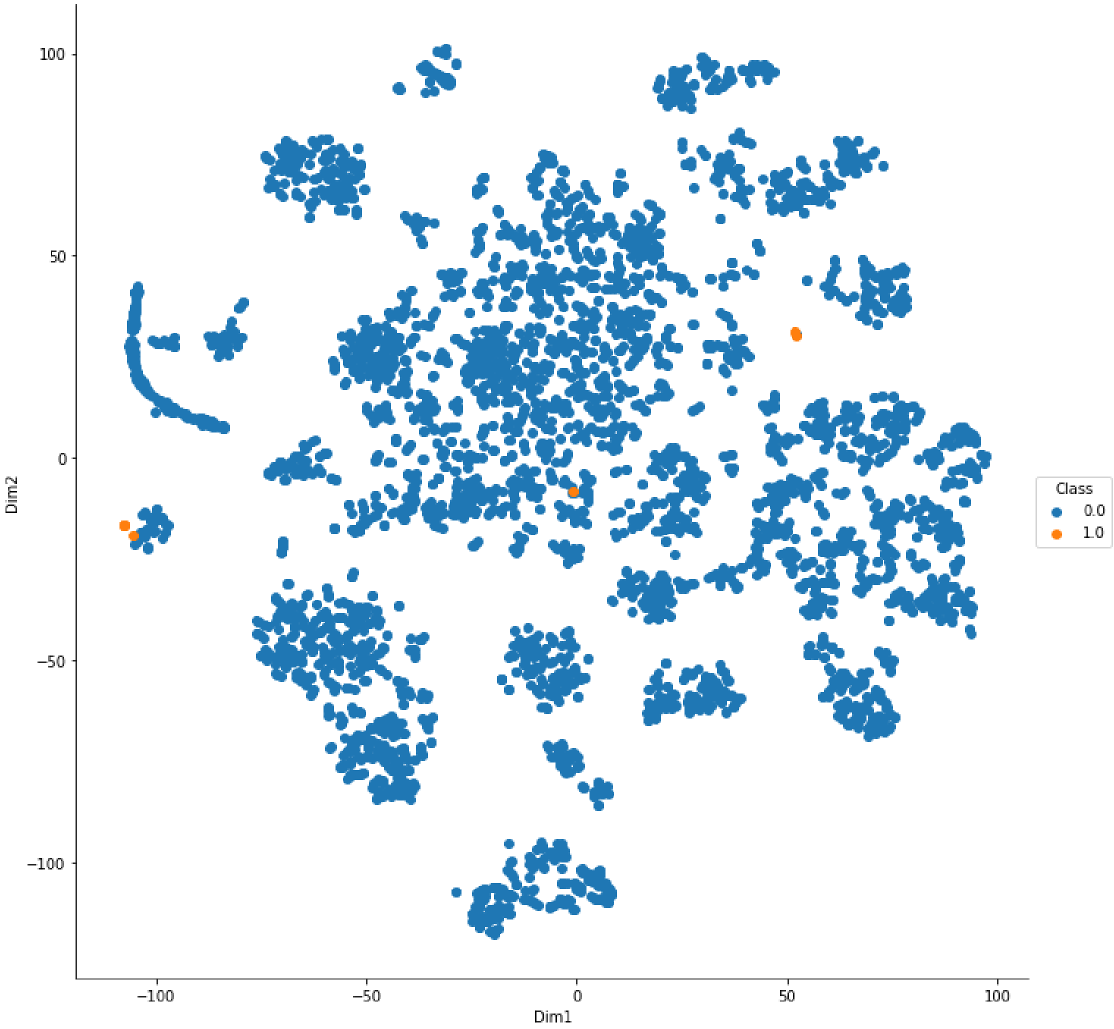
```
In [23]: model = TSNE(n_components=2, random_state=0,perplexity=5, n_iter=2000)



         tsneData = model.fit_transform(stdzidData)

         tsneData = np.vstack((tsneData.T,classes)).T

         print(tsneData.T.shape)

         tsne_df = pd.DataFrame(data = tsneData,columns=("Dim1","Dim2","Class"))
         tsne_df.head()

         sns.FacetGrid(tsne_df,hue="Class",size=10).map(plt.scatter,"Dim1","Dim2").add_legend(

         plt.show()
```

```
(3, 5009)
```



1.1.6 Perplexity =20

```
In [24]: model = TSNE(n_components=2, random_state=0,perplexity=20, n_iter=2000)



         tsneData = model.fit_transform(stdzidData)

         tsneData = np.vstack((tsneData.T,classes)).T

         print(tsneData.T.shape)

         tsne_df = pd.DataFrame(data = tsneData,columns=("Dim1","Dim2","Class"))
         tsne_df.head()
         sns.FacetGrid(tsne_df,hue="Class",size=10).map(plt.scatter,"Dim1","Dim2").add_legend(

         plt.show()

(3, 5009)
```

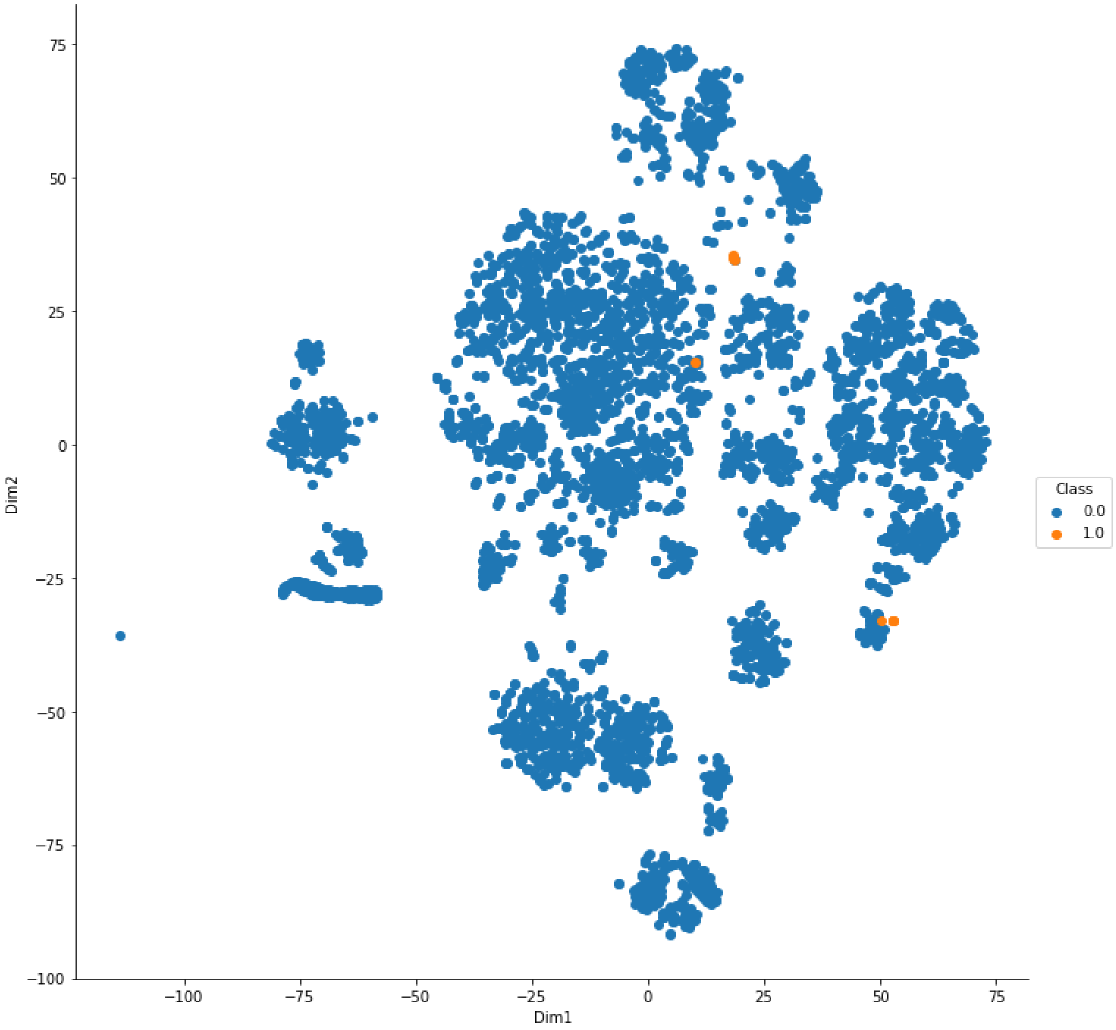


1.1.7 Perplexity = 50

```
In [26]: model = TSNE(n_components=2, random_state=0,perplexity=50, n_iter=2000)


         tsneData = model.fit_transform(stdzidData)

         tsneData = np.vstack((tsneData.T,classes)).T
```

```
print(tsneData.T.shape)

tsne_df = pd.DataFrame(data = tsneData,columns=("Dim1","Dim2","Class"))
tsne_df.head()

sns.FacetGrid(tsne_df,hue="Class",size=10).map(plt.scatter,"Dim1","Dim2").add_legend()

plt.show()
```

```
(3, 5009)
```



2 Summary:

Here We have used the T-SNE technique to visualize the Transactions of type Class 0 and 1, by reducing no.of features from 30 to 2 with T-SNE.

Here We have illustrated the plots by considering different no.of samples with different sample sizes with Different Perplexities and No.of Iterations.

At Perplexity 5,20 and no.of iterations 2000 The graph is some what acceptable.