t-SNE_credit_card

March 18, 2018

```
In [1]: import pandas as pd
        import matplotlib.pyplot as plt
        import seaborn as sns
        from sklearn.preprocessing import StandardScaler
        import scipy
```

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

```
In [3]: trans={1:'fraud', 0:'genuine'}
```

```
In [5]: df['Class']=df['Class'].apply(lambda x:trans[x])
```

```
In [6]: from sklearn.manifold import TSNE
```

```
In [7]: scaler=StandardScaler()
```

```
In [8]: labels=df['Class']
```

```
In [9]: data=df.drop(['Class', 'Amount', 'Time'],axis=1)
```

```
In [10]: std_data=scaler.fit_transform(data)
```

```
In [11]: import numpy as np
```

```
In [12]: np.shape(std_data)
```

```
Out[12]: (284807, 28)
```

```
In [103]: p= 75    # perplexity
          n=3000   # steps
          n_data=20000 # data points
```

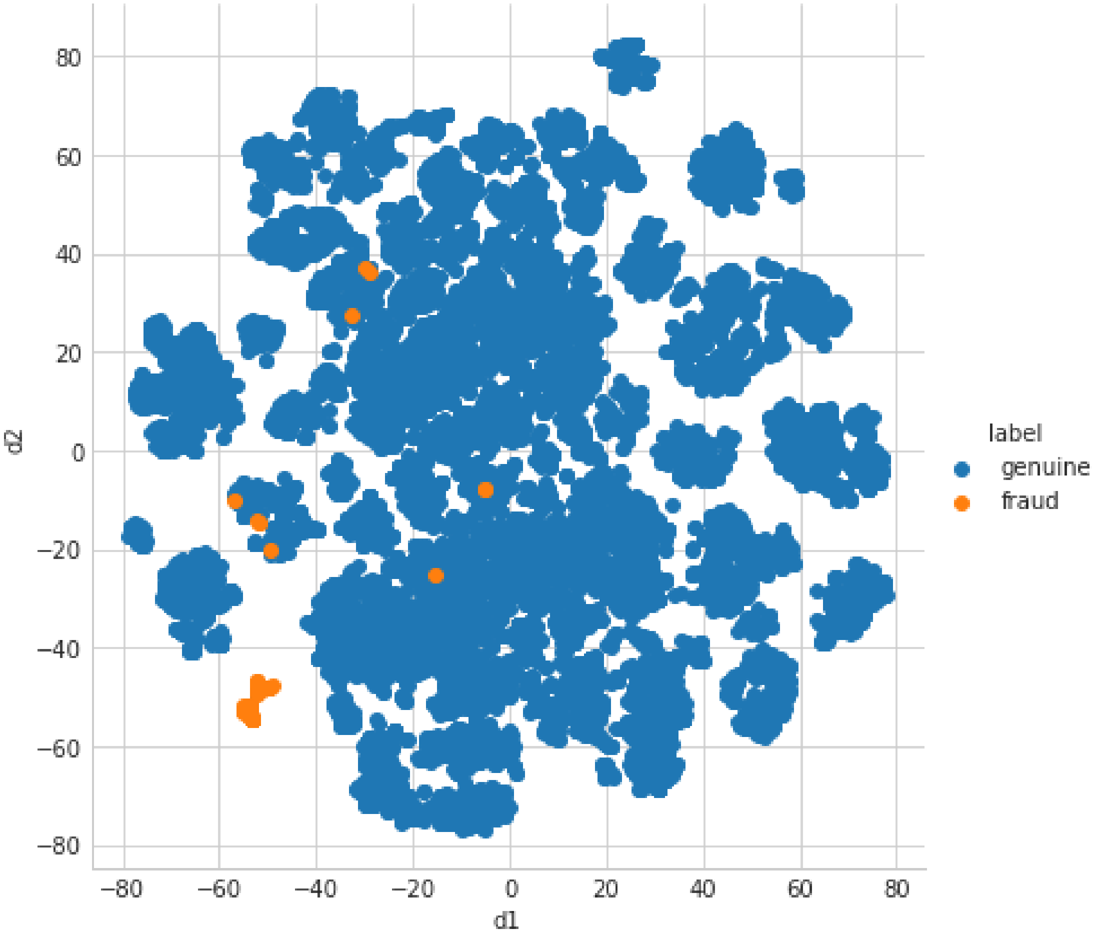
keep perplexity lesser than number of fraudulent transactions

0.1 Keep number of data points and steps fixed and vary perplexity

```
In [104]: np.shape(np.where(labels[:n_data]=='fraud'))
```

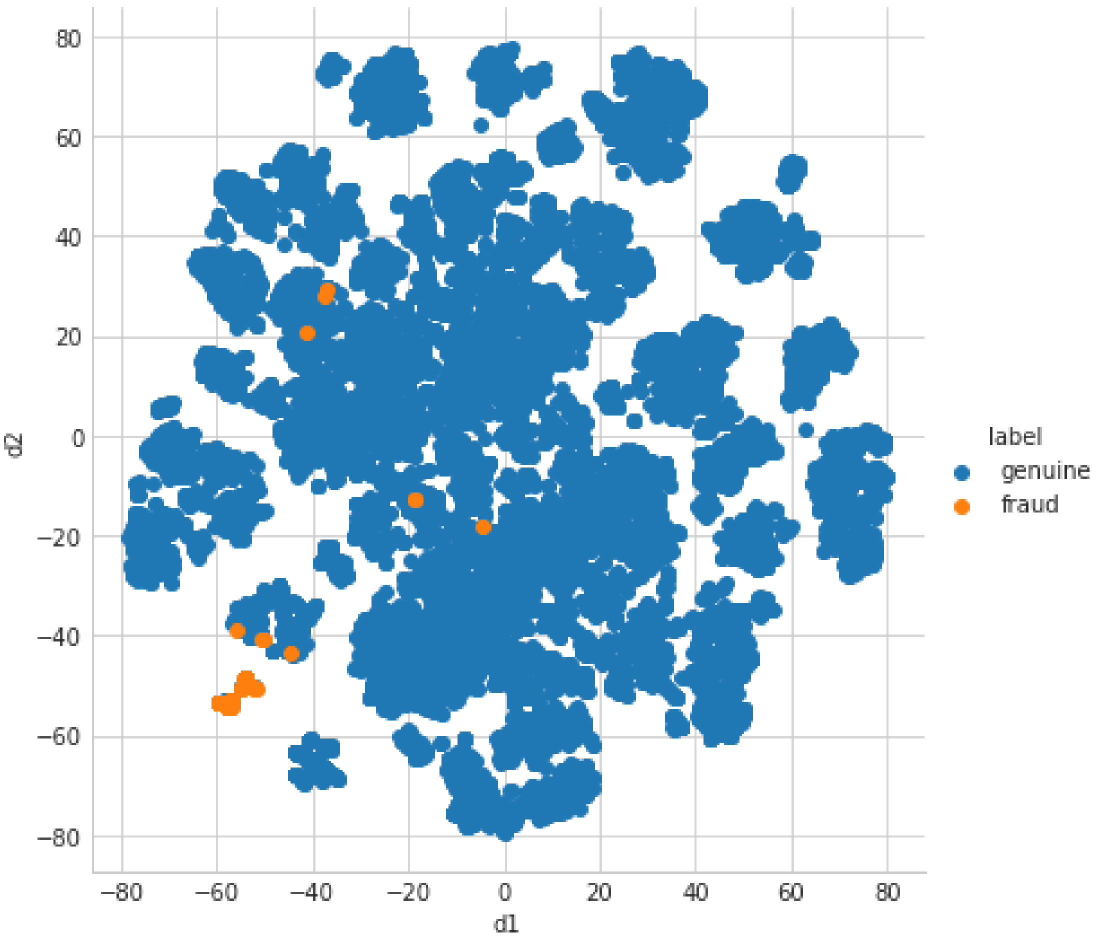
```
Out[104]: (1, 85)
```

```
In [105]: model=TSNE(perplexity=p, n_iter=n, random_state=0)

In [106]: vec_2d=model.fit_transform(std_data[:n_data])

In [107]: output=np.vstack((vec_2d.T, labels[:n_data])).T

In [108]: plot=pd.DataFrame(data=output, columns=['d1', 'd2', 'label'])

In [31]: sns.set_style("whitegrid")

In [32]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
         plt.show()
```



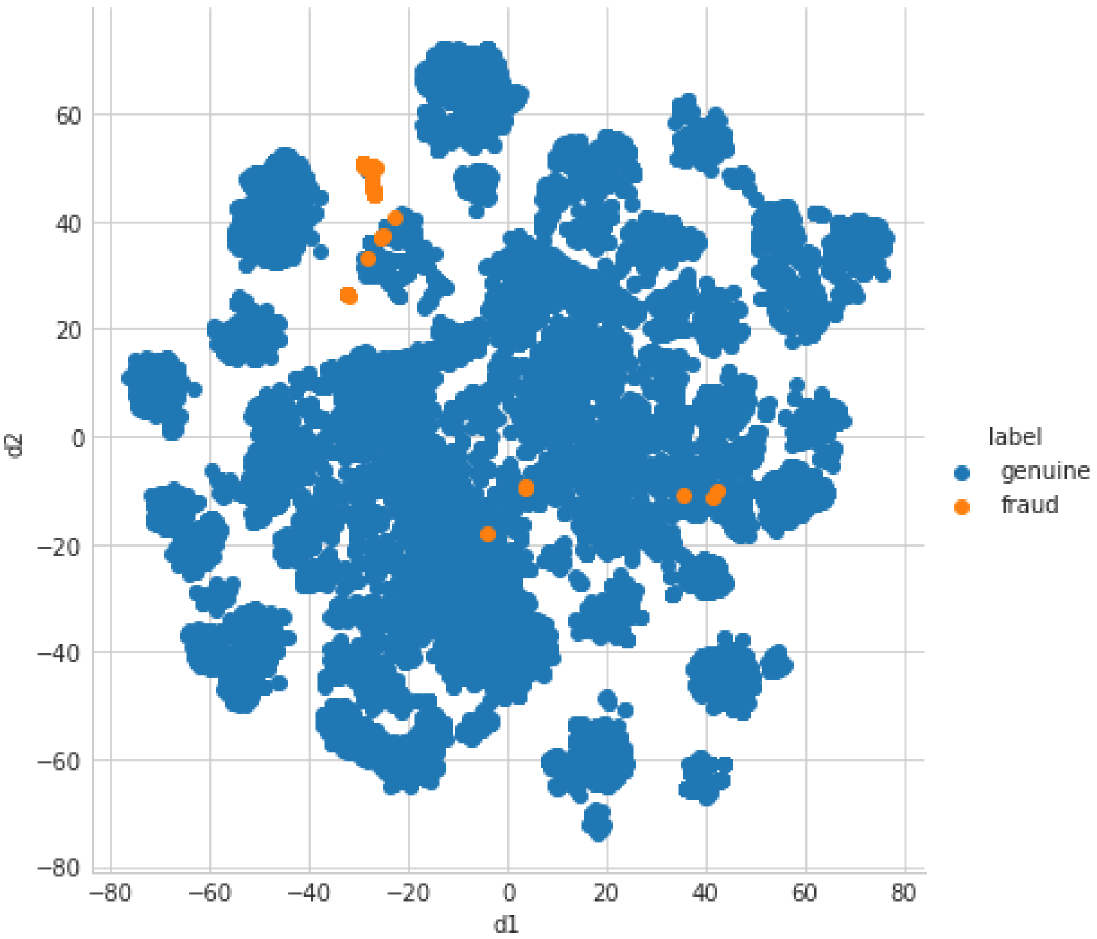
perplexity = 30 num_data_points=20k steps=1000

```
In [39]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
         plt.show()
```



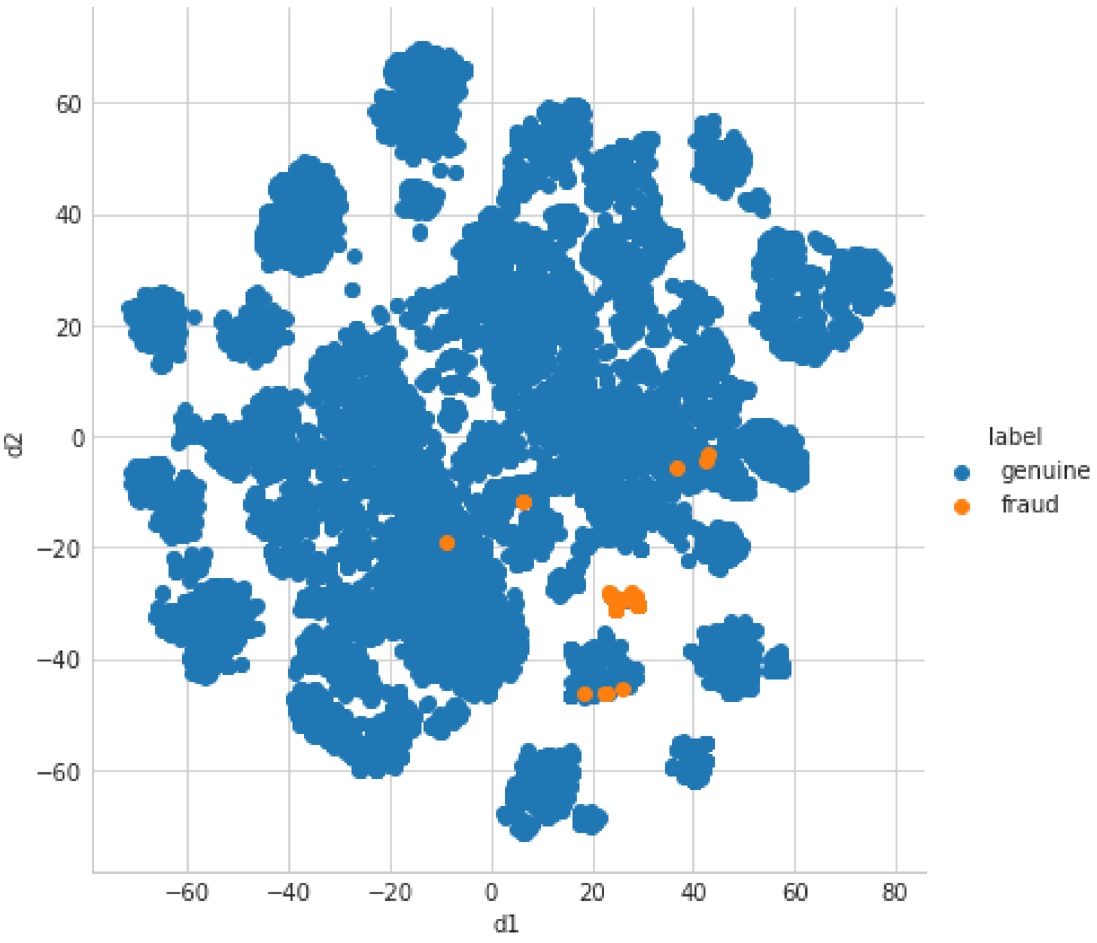
perplexity = 50 num_data_points=20k steps=1000

```
In [46]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
         plt.show()
```



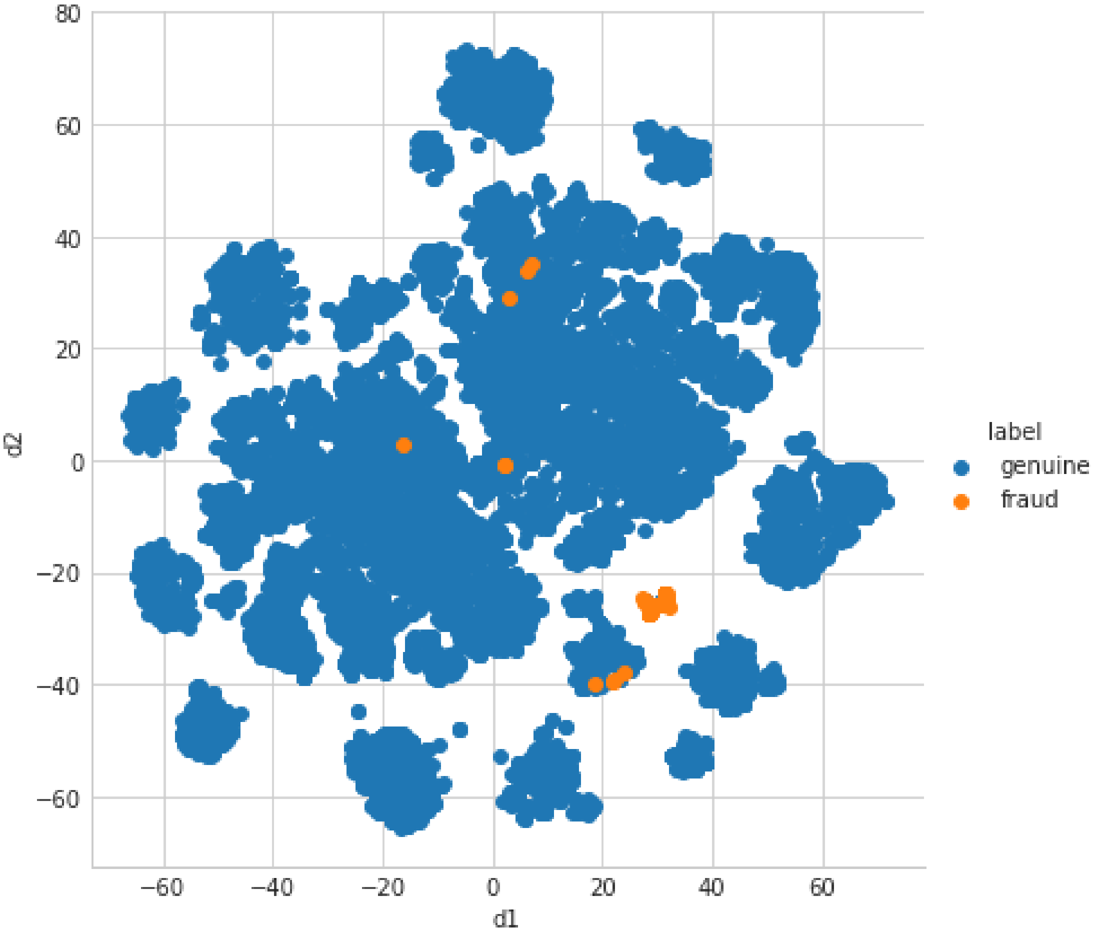
perplexity = 70 num_data_points=20k steps=1000

```
In [81]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
         plt.show()
```



perplexity = 80 num_data_points=20k steps=1000

```
In [88]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
         plt.show()
```

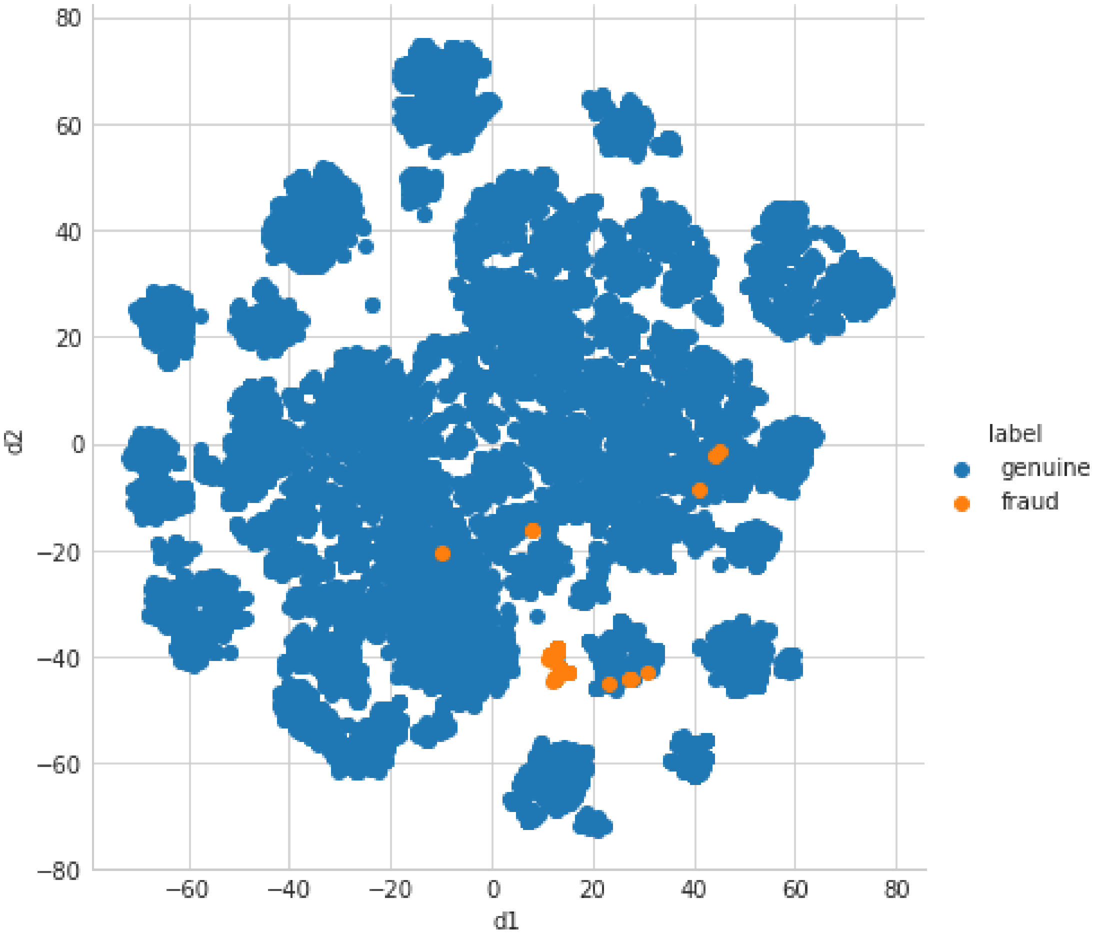


perplexity = 100 num_data_points=20k steps=1000

0.2 Conclusion

As soon as p exceeds number of fraudulent transactions, more number of clusters of fraudulent transactions start forming. Hence the ideal value of p lies between 70 and 80.

```
In [95]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
         plt.show()
```

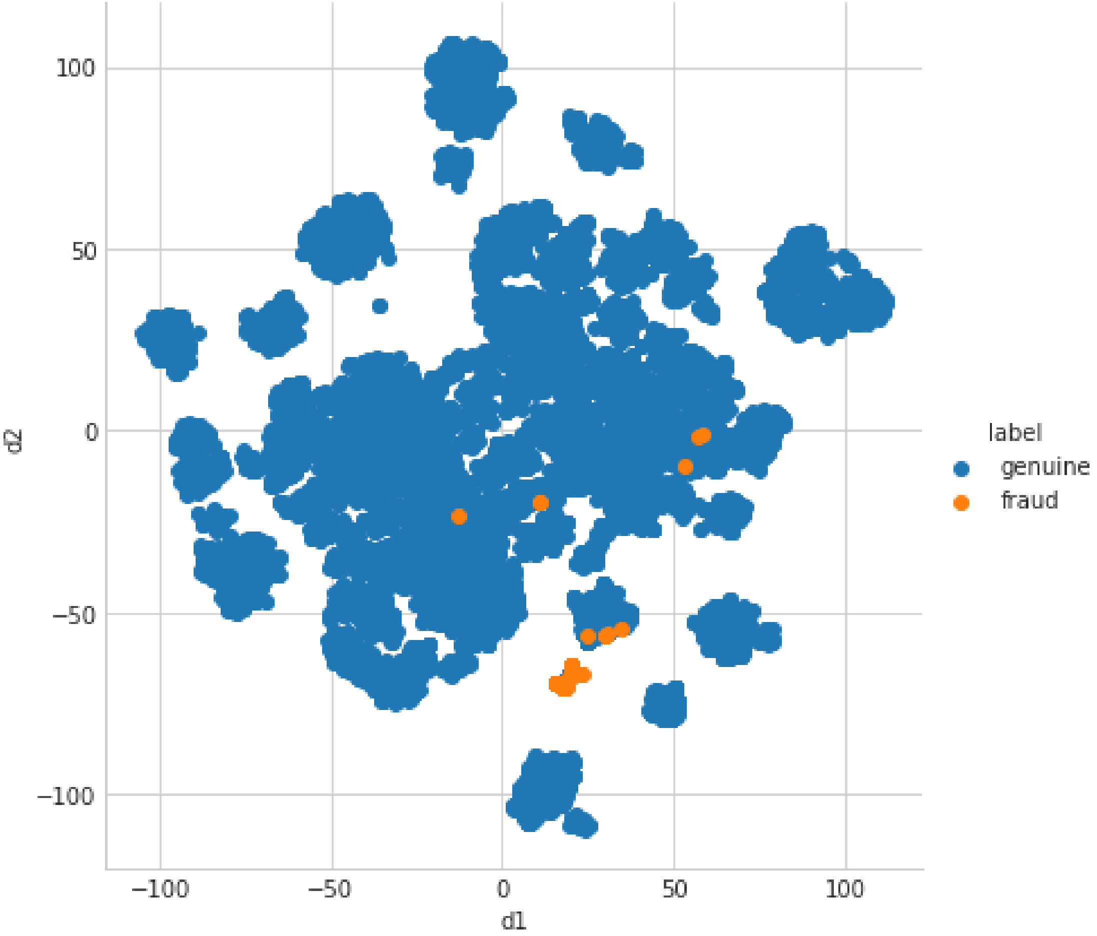


perplexity = 75 num_data_points=20k steps=1000

0.3 Finding saturation value of step

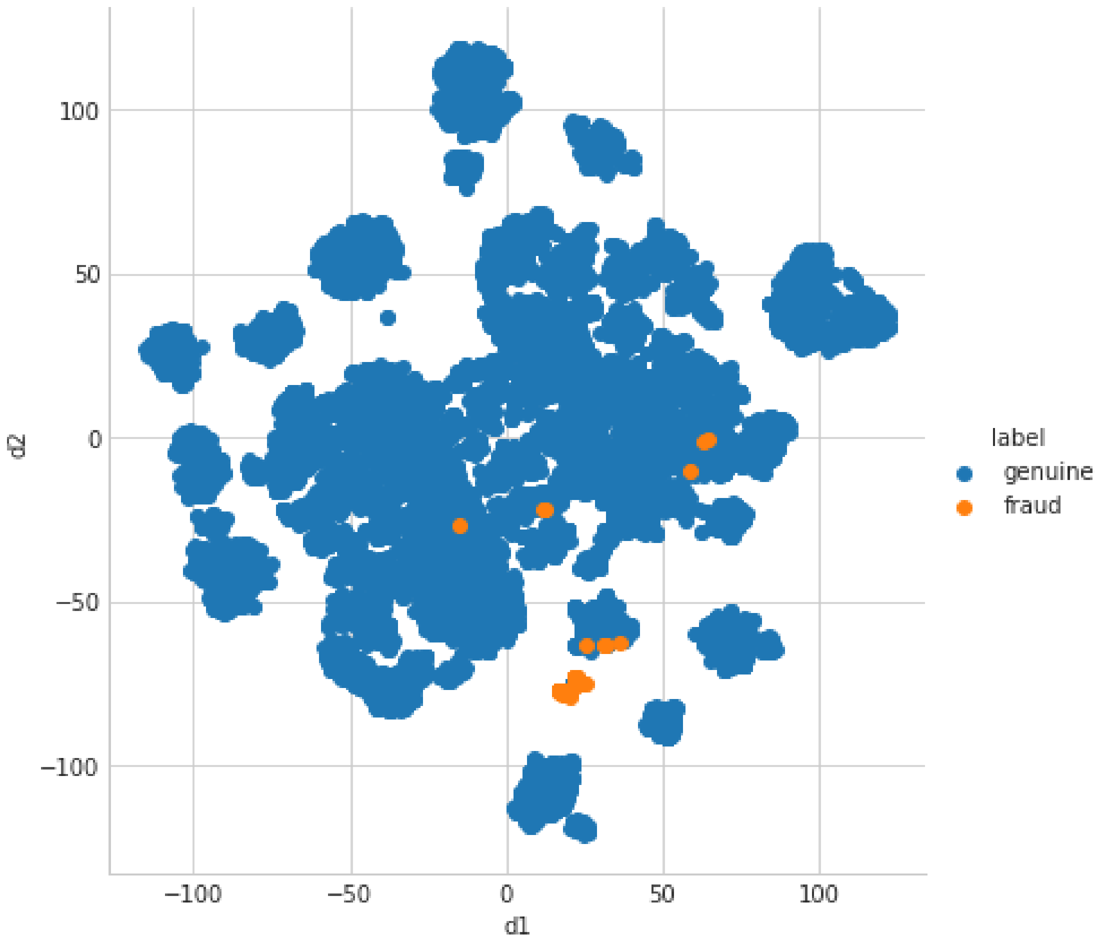
Optimal perplexity = 75

```
In [102]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
          plt.show()
```



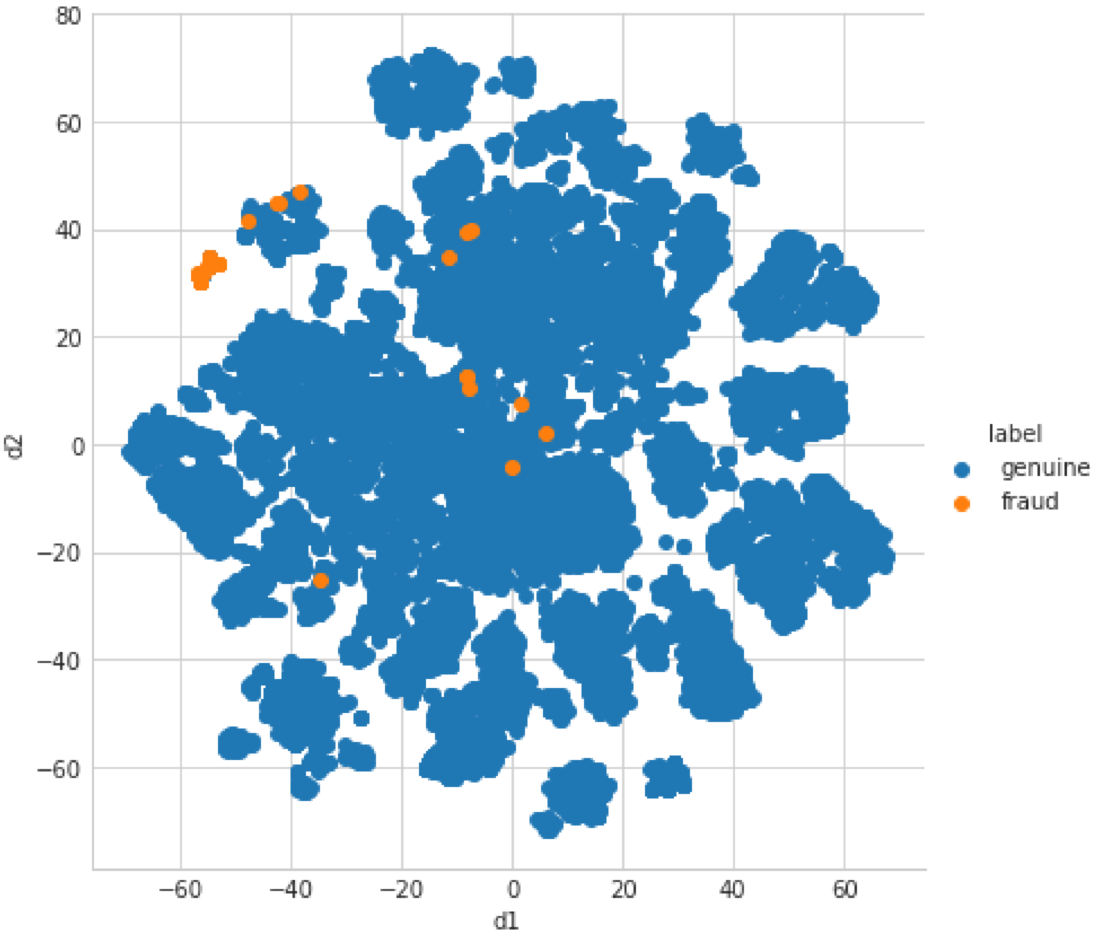
step=2000

```
In [109]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
          plt.show()
```



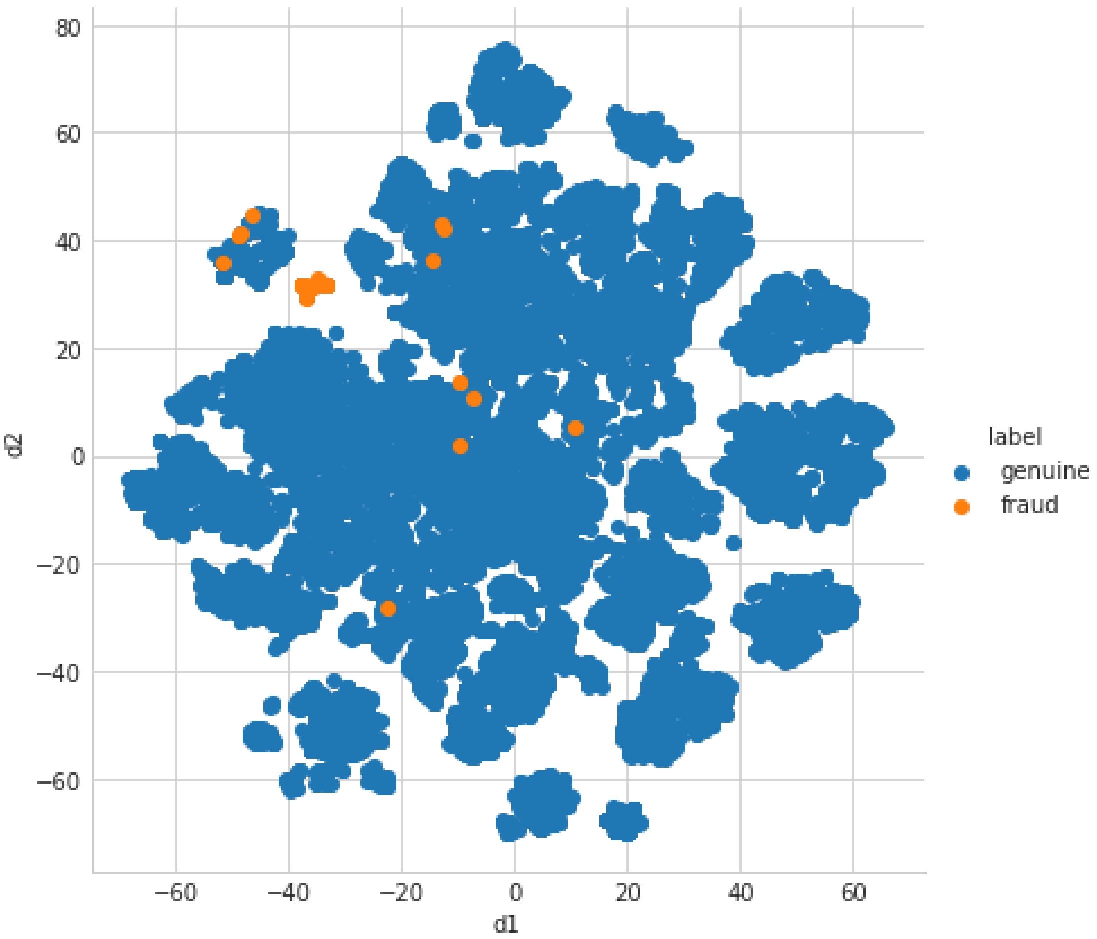
step=3000 Since not much difference in shapes is visible to the naked eye it is safe to conclude a saturation limit of 2000 steps

```
In [53]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
         plt.show()
```



perplexity = 70 num_data_points=30k steps=1000

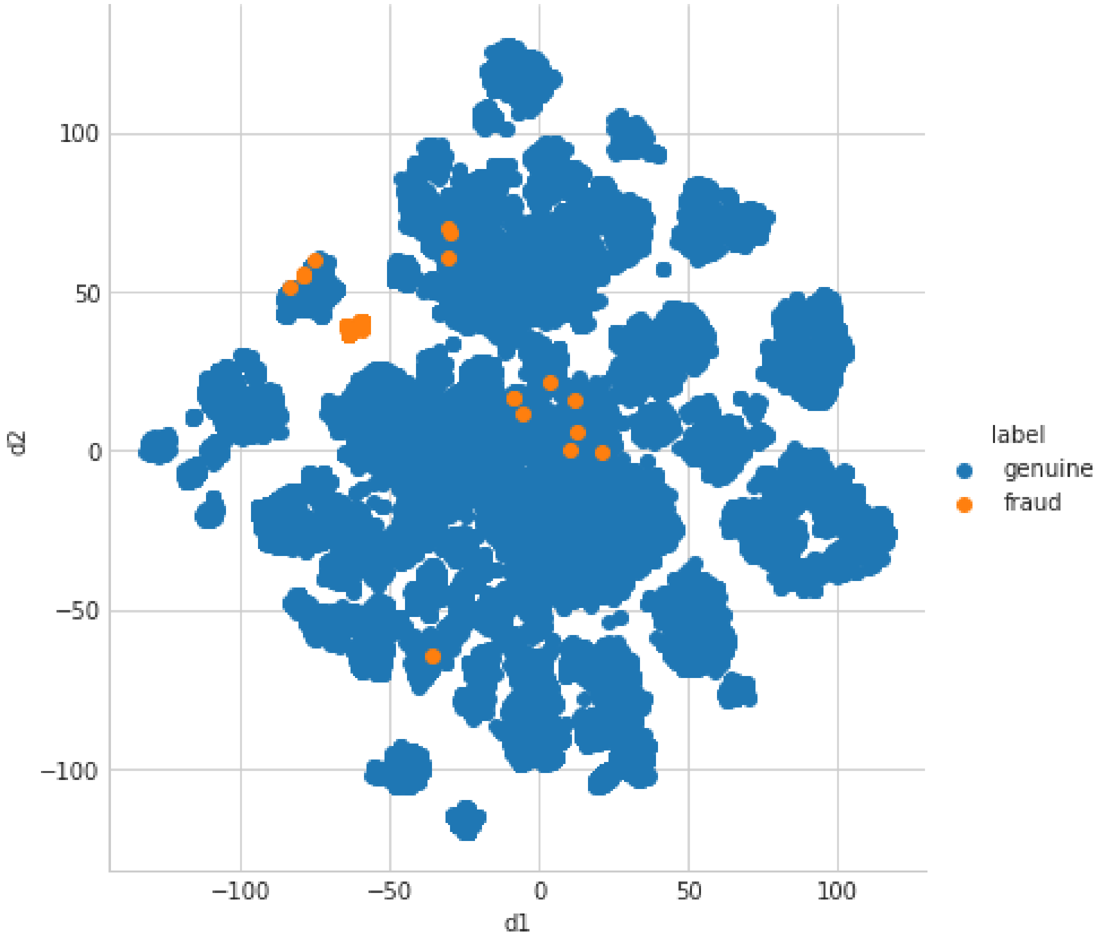
```
In [60]: sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
         plt.show()
```



perplexity = 70 num_data_points=30k steps=1000

1 Testing the observed values on larger dataset

```
In [110]: p= 75    # perplexity
          n=2000   # steps
          n_data=40000 # data points

          model=TSNE(perplexity=p, n_iter=n, random_state=0)

          vec_2d=model.fit_transform(std_data[:n_data])

          output=np.vstack((vec_2d.T, labels[:n_data])).T

          plot=pd.DataFrame(data=output, columns=['d1', 'd2', 'label'])

          sns.FacetGrid(plot, hue='label', size=6).map(plt.scatter, 'd1', 'd2').add_legend()
          plt.show()
```



2 Observations

The value of perplexity and step determined for smaller dataset is not working well with larger dataset. This is obvious as number of fraudulent transactions in larger dataset is more than that in smaller. However these values work well for smaller dataset of 20k datapoints.