Importing Libraries

In [2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib.axes as ax
import seaborn as sns

from sklearn.manifold import TSNE
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
sns.set()
```

t-Distributed Stochastic Neighbor Embedding

- Used for data reduction
- Unsupervised Non Linear Technique

Data Reduction :

A process of reducing the higher dimension data to lower dimensional data to make the model less expensive is called data reduction.

Loading Data

In [4]:
```
data = pd.read_csv(r'C:\Users\vamsi\Desktop\ML\Data Dimensionality\bank_note_
data.head()
```

Out[4]:

	Image.Var	Image.Skew	Image.Curt	Entropy	Class
0	3.62160	8.6661	-2.8073	-0.44699	0
1	4.54590	8.1674	-2.4586	-1.46210	0
2	3.86600	-2.6383	1.9242	0.10645	0
3	3.45660	9.5228	-4.0112	-3.59440	0
4	0.32924	-4.4552	4.5718	-0.98880	0

In [5]:
```
data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1372 entries, 0 to 1371
Data columns (total 5 columns):
 #   Column      Non-Null Count  Dtype  
---  ------      --------------  -----  
 0   Image.Var   1372 non-null   float64
 1   Image.Skew  1372 non-null   float64
 2   Image.Curt  1372 non-null   float64
 3   Entropy     1372 non-null   float64
 4   Class       1372 non-null   int64  
dtypes: float64(4), int64(1)
memory usage: 53.7 KB
```

In [6]:
```
data.describe()
```

Out[6]:

	Image.Var	Image.Skew	Image.Curt	Entropy	Class
count	1372.000000	1372.000000	1372.000000	1372.000000	1372.000000
mean	0.433735	1.922353	1.397627	-1.191657	0.444606
std	2.842763	5.869047	4.310030	2.101013	0.497103
min	-7.042100	-13.773100	-5.286100	-8.548200	0.000000
25%	-1.773000	-1.708200	-1.574975	-2.413450	0.000000
50%	0.496180	2.319650	0.616630	-0.586650	0.000000
75%	2.821475	6.814625	3.179250	0.394810	1.000000
max	6.824800	12.951600	17.927400	2.449500	1.000000

In [7]:
```
# 0 - Fake
# 1 - Genuine

data['Class'].unique()
```

Out[7]:
```
array([0, 1], dtype=int64)
```

In [8]:
```
data['Class'].value_counts()
```

Out[8]:
```
0    762
1    610
Name: Class, dtype: int64
```

In [12]:
```
features = data.columns[:-1]
targets = data.columns[-1]
```

In [16]:
```
features
```

Out[16]:
```
Index(['Image.Var', 'Image.Skew', 'Image.Curt', 'Entropy'], dtype='object')
```

In [17]:
```
targets
```

Out[17]:
```
'Class'
```

Data Standardization

In [23]:
```
sc = StandardScaler()

data_norm = data.copy()
data_norm[features] = sc.fit_transform(data[features])
data_norm.head()
```

Out[23]:

	Image.Var	Image.Skew	Image.Curt	Entropy	Class
0	1.121806	1.149455	-0.975970	0.354561	0
1	1.447066	1.064453	-0.895036	-0.128767	0
2	1.207810	-0.777352	0.122218	0.618073	0
3	1.063742	1.295478	-1.255397	-1.144029	0
4	-0.036772	-1.087038	0.736730	0.096587	0

TSNE

In [24]:
```
tsne = TSNE(learning_rate=500,n_components=2)

x_tsne = tsne.fit_transform(data_norm[features])
y_tsne = data[targets]
```

In [25]:
```
x_tsne
```

Out[25]:
```
array([[-27.237383,  29.306349],
       [-25.27884 ,  32.84963 ],
       [  3.876689, -57.66353 ],
       ...,
       [ 52.99383 ,  20.727926],
       [ 47.00991 ,  14.900087],
       [ 20.33418 , -10.116031]], dtype=float32)
```

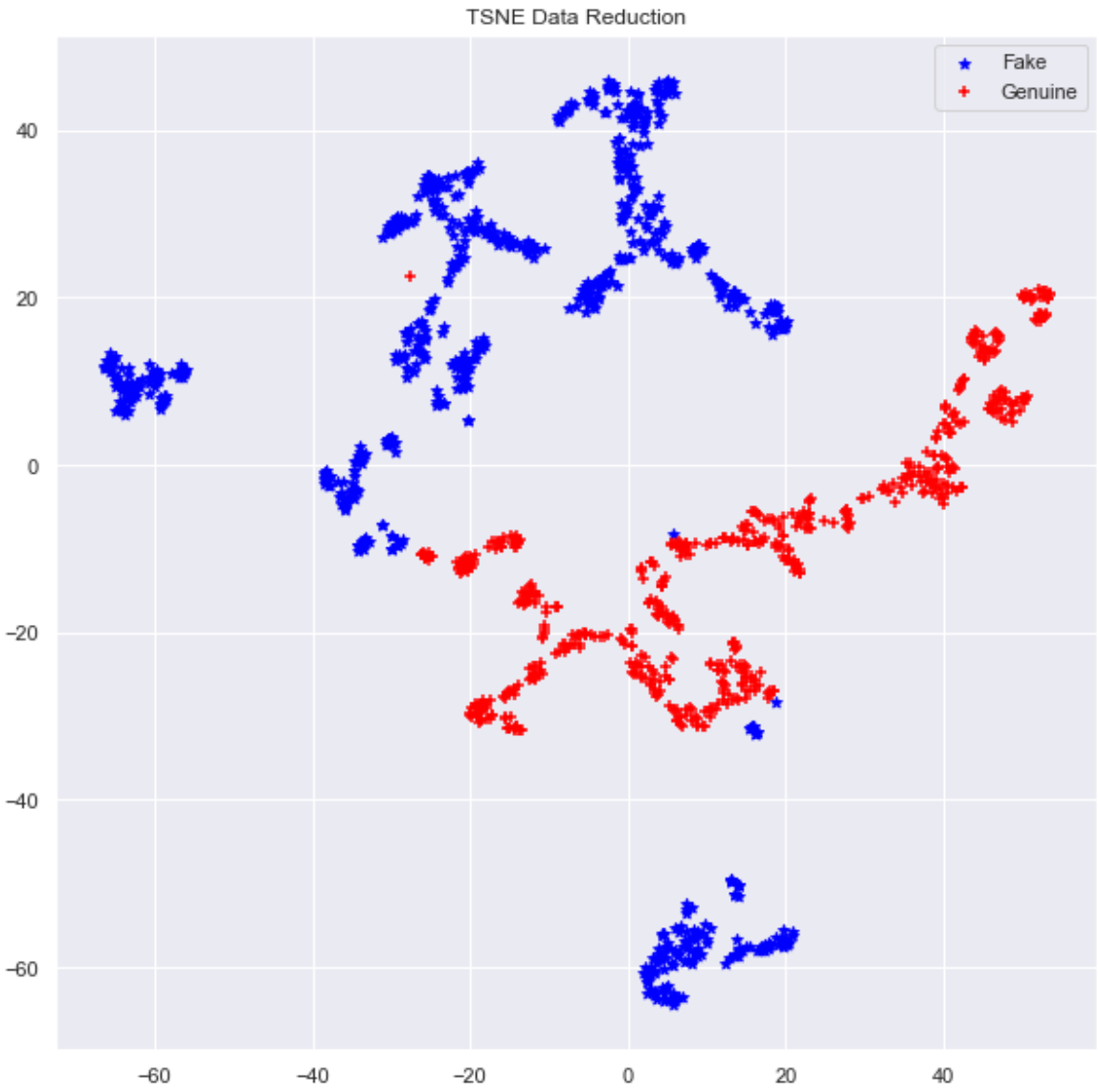
In [26]:
```
y_tsne
```

Out[26]:
```
0       0
1       0
2       0
3       0
4       0
       ..
1367    1
1368    1
1369    1
1370    1
1371    1
Name: Class, Length: 1372, dtype: int64
```

VIsualization

In [29]:

```
#TSNE Visualization
plt.figure(figsize=(10,10))
for i in range(0,x_tsne.shape[0]):
    if y_tsne[i]==0:
        c1 = plt.scatter(x_tsne[i][0],x_tsne[i][1],c='blue',marker='*')
    elif y_tsne[i]==1:
        c2 = plt.scatter(x_tsne[i][0],x_tsne[i][1],c='red',marker='+')
plt.legend([c1,c2],['Fake','Genuine','Cluster3','Cluster4','Cluster5','Cluste
plt.title('TSNE Data Reduction')
plt.show()
```



In [ ]: