DM end term exam 1 Problem 2

Import libraries

In [1]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
from sklearn.manifold import MDS, LocallyLinearEmbedding, Isomap, TS
NE
```

Parameters

In [2]:
```
csv_in = 'dm-end1-2.csv'
n_components = 2
n_neighbors = 30
n_obj = 10
```

Read CSV file

In [3]:
```
df = pd.read_csv(csv_in, delimiter=',', skiprows=0, header=0)
print(df.shape)
print(df.info())
display(df.head())
```

```
(1000, 785)
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1000 entries, 0 to 999
Columns: 785 entries, label to pixel784
dtypes: float64(784), int64(1)
memory usage: 6.0 MB
None
```

	label	pixel1	pixel2	pixel3	pixel4	pixel5	pixel6	pixel7	pixel8	pixel9	...	pixel775	p
0	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	
1	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	
2	9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	
3	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	
4	8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	

5 rows × 785 columns

Separate data

In [4]:
```
df_X = df.loc[:, 'pixel1':]
obj = df['label']
display(df_X.head())
print(obj.head())
```

	pixel1	pixel2	pixel3	pixel4	pixel5	pixel6	pixel7	pixel8	pixel9	pixel10	...	pixel775
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0

5 rows × 784 columns

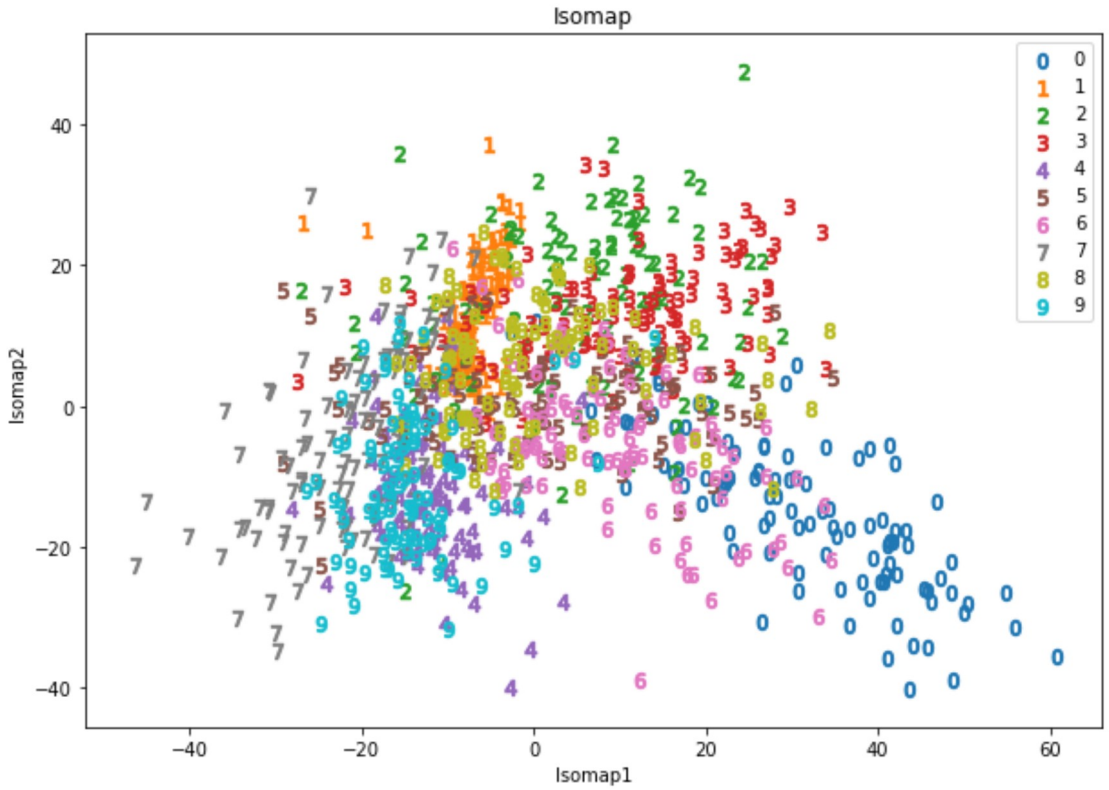
```
0    3
1    9
2    9
3    8
4    8
Name: label, dtype: int64
```

Standardization

In [5]:
```
sc = StandardScaler()
X = sc.fit_transform(df_X)
```

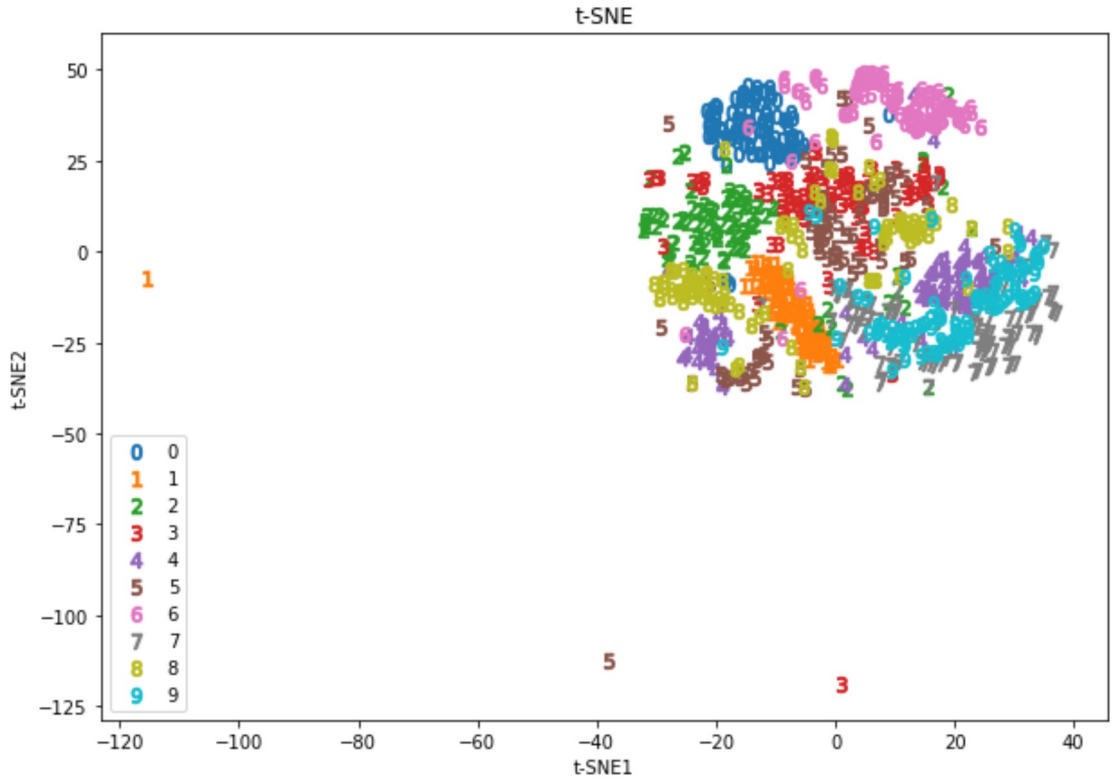
Manifold learning

In [11]:
```
%%time
# Isomap
Y = Isomap(n_neighbors, n_components,).fit_transform(X)
plt.figure(figsize=(10,7))
plt.title("Isomap")
for i in range(n_obj):
    marker = '${}$'.format(i)
    y1 = Y[ obj==i ]
    plt.scatter(y1[:, 0], y1[:, 1], marker=marker, s=70, label=i)
plt.xlabel('Isomap1')
plt.ylabel('Isomap2')
plt.legend()
plt.show()
```




```
CPU times: user 2.53 s, sys: 20.8 ms, total: 2.55 s
Wall time: 2 s
```

In [10]:
```
%%time
# t-SNE
Y = TSNE(n_components=n_components,
         perplexity=30, n_iter=1000,
         random_state=9).fit_transform(X)
plt.figure(figsize=(10,7))
plt.title("t-SNE")
for i in range(n_obj):
    marker = '${}$'.format(i)
    y1 = Y[ obj==i ]
    plt.scatter(y1[:, 0], y1[:, 1], marker=marker, s=70, label=i)
plt.xlabel('t-SNE1')
plt.ylabel('t-SNE2')
plt.legend()
plt.show()
```




```
CPU times: user 19.2 s, sys: 87 ms, total: 19.3 s
Wall time: 3.55 s
```

In [ ]: