

Chapter 17: Demo LLE

```
In [0]: from sklearn.datasets import make_swiss_roll
```

```
In [0]: X, t = make_swiss_roll(n_samples=1000, noise=0.2, random_state=41)
```

```
In [0]: X
```

```
Out[3]: array([[ 5.27336593,  0.17908113,  4.83303567],
 [ 2.03125563,  4.16459399, -4.68255974],
 [ 0.85309232, 20.90012948, -11.15183668],
 ...,
 [ 6.60249152,  0.50710576, 12.30210256],
 [ 5.90783552, 13.09870753, -1.0956307 ],
 [10.4320605 ,  9.29453856,  8.55622118]])
```

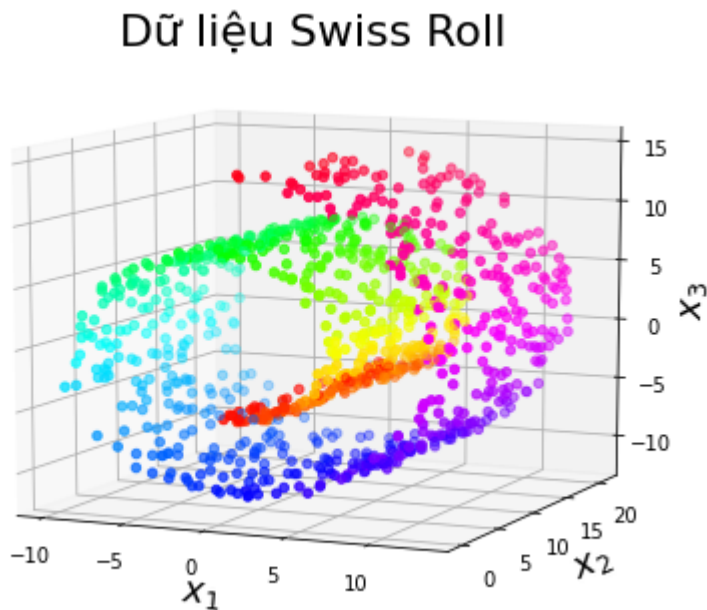
```
In [0]: t
```

```
Out[4]: array([ 7.07728842,  5.14683186, 11.09123177,  5.12207923,  5.80965653,
 10.40368902,  6.51186808, 11.01300118, 13.35913125,  8.65929831,
  7.84386429,  7.37991815,  6.46805799,  7.70108475,  9.24729685,
  5.36760395, 11.35669318,  7.67814921, 11.73650969,  8.46545616,
 10.44478831, 11.57792963,  8.68736484,  8.42488643,  6.90103518,
  8.87497981,  8.2280328 , 10.21274632,  5.65516248, 11.69946589,
  5.49651101,  5.90202163,  7.75556996, 10.77183596, 14.13218811,
  7.36076715, 10.19972701, 12.93646022, 12.15173585,  6.76781707,
  7.9792256 , 11.51237233,  8.04799107,  9.05423626,  7.01578265,
  7.37642694, 12.49990833, 12.95314845,  6.05795512,  7.35200377,
  9.66199158, 13.20277527, 10.39041192, 11.23240975,  7.37578329,
  7.31841058,  6.18536005, 10.96844735, 13.59814952, 11.13369277,
 12.84580966, 13.30313621, 12.39679199, 12.53257836,  4.96777266,
  6.98326802,  7.22246003,  8.2957971 ,  9.22922981,  7.74169259,
  8.8315476 ,  9.97395199,  8.42245745, 10.16238814,  8.2760808 ,
  6.63218511,  8.14509263, 11.3382222 , 11.66096809, 11.14561518,
  5.65683635,  6.48845194,  9.56615665, 12.77430644,  5.01973501,
  6.52249359, 12.5309007 , 11.93874094,  9.67536181, 13.28319053,
  8.81144472,  9.35340969,  9.27098401,  6.10877438, 10.01613053,
  0.71001777, 12.05112041,  5.00160364,  5.00732005,  7.00000000])
```

```
In [0]: import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
```

```
In [0]: # ban dau
fig = plt.figure(figsize=(16,13))
ax = fig.add_subplot(2, 2, 1, projection='3d')
ax.scatter(X[:, 0], X[:, 1], X[:, 2], c=t, cmap=plt.cm.hsv)
ax.view_init(10, -66)
ax.set_xlabel("$x_1$", fontsize=18)
ax.set_ylabel("$x_2$", fontsize=18)
ax.set_zlabel("$x_3$", fontsize=18)
ax.set_title("Dữ liệu Swiss Roll", fontsize=22)
```

Out[6]: Text(0.5, 0.92, 'Dữ liệu Swiss Roll')



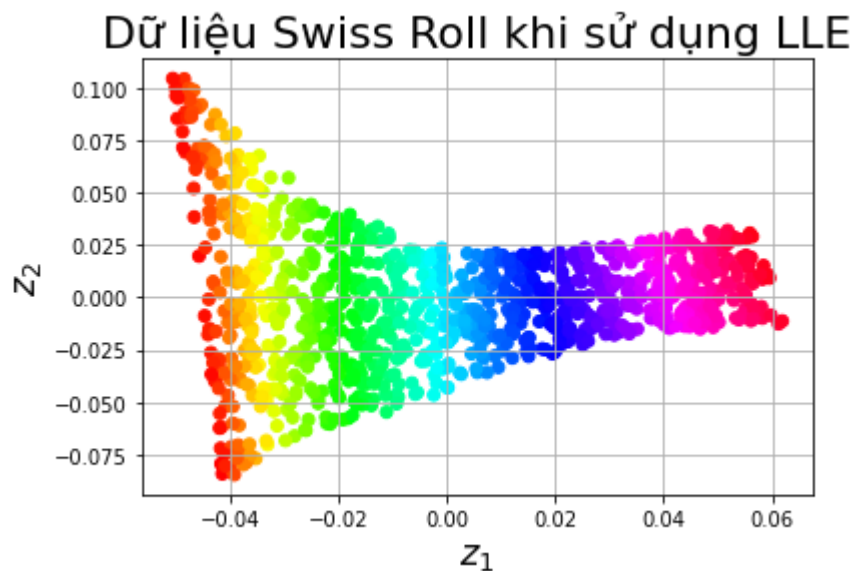
```
In [0]: from sklearn.manifold import LocallyLinearEmbedding
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```
In [0]: lle = LocallyLinearEmbedding(n_components=2,
                                     n_neighbors=10,
                                     random_state=42)
X_reduced = lle.fit_transform(X)
```

In [0]: X_reduced

Out[9]: array([[-0.02911278, 0.05697208],
 [-0.04602962, 0.06451161],
 [0.01954969, -0.02684515],
 ...,
 [0.04923591, 0.03083726],
 [-0.03589353, -0.0166996],
 [0.04740873, 0.01104797]])

```
In [0]: # sau khi giam chieu
plt.title("Dữ liệu Swiss Roll khi sử dụng LLE",
          fontsize=22)
plt.scatter(X_reduced[:, 0], X_reduced[:, 1], c=t,
            cmap=plt.cm.hsv)
plt.xlabel("$z_1$", fontsize=18)
plt.ylabel("$z_2$", fontsize=18)
plt.grid(True)
plt.show()
```



In [0]: # Với cách làm này tưởng tượng như gỡ bánh bông Lan khúc gỡ ra để dễ quan sát

In [0]: # <https://cs.nyu.edu/~roweis/Lle/algorithm.html>