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SECTION : 5CSE09

ROLL NUMBER : 20191CSE0794

TOPIC : CLOUD COMPUTING (Kernel PCA)

```
print(__doc__)
```

Automatically created module for IPython interactive environment

```
import numpy as np
import matplotlib.pyplot as plt
```

```
from sklearn.decomposition import PCA, KernelPCA
from sklearn.datasets import make_circles
```

```
np.random.seed(0)
```

```
X, y = make_circles(n_samples=400, factor=.3, noise=.05)
```

```
kpca = KernelPCA(kernel="rbf", fit_inverse_transform=True, gamma=10)
X_kpca = kpca.fit_transform(X)
X_back = kpca.inverse_transform(X_kpca)
pca = PCA()
X_pca = pca.fit_transform(X)
```

```
# Plot results
```

```
plt.figure()
plt.subplot(2, 2, 1, aspect='equal')
plt.title("Original space")
reds = y == 0
blues = y == 1

plt.scatter(X[reds, 0], X[reds, 1], c="red",
            s=20, edgecolor='k')
plt.scatter(X[blues, 0], X[blues, 1], c="blue",
            s=20, edgecolor='k')
plt.xlabel("$x_1$")
plt.ylabel("$x_2$")
```

```
X1, X2 = np.meshgrid(np.linspace(-1.5, 1.5, 50), np.linspace(-1.5, 1.5, 50))
X_grid = np.array([np.ravel(X1), np.ravel(X2)]).T
# projection on the first principal component (in the phi space)
Z_grid = kpca.transform(X_grid)[: , 0].reshape(X1.shape)
plt.contour(X1, X2, Z_grid, colors='grey', linewidths=1, origin='lower')
```

```
plt.subplot(2, 2, 2, aspect='equal')
plt.scatter(X_pca[reds, 0], X_pca[reds, 1], c="red",
            s=20, edgecolor='k')
plt.scatter(X_pca[blues, 0], X_pca[blues, 1], c="blue",
```

```

s=20, edgecolor='k')
plt.title("Projection by PCA")
plt.xlabel("1st principal component")
plt.ylabel("2nd component")

plt.subplot(2, 2, 3, aspect='equal')
plt.scatter(X_kpca[reds, 0], X_kpca[reds, 1], c="red",
            s=20, edgecolor='k')
plt.scatter(X_kpca[blues, 0], X_kpca[blues, 1], c="blue",
            s=20, edgecolor='k')
plt.title("Projection by KPCA")
plt.xlabel(r"1st principal component in space induced by  $\phi$ ")
plt.ylabel("2nd component")

plt.subplot(2, 2, 4, aspect='equal')
plt.scatter(X_back[reds, 0], X_back[reds, 1], c="red",
            s=20, edgecolor='k')
plt.scatter(X_back[blues, 0], X_back[blues, 1], c="blue",
            s=20, edgecolor='k')
plt.title("Original space after inverse transform")
plt.xlabel("$x_1$")
plt.ylabel("$x_2$")

plt.tight_layout()
plt.show()

```



