降维：对手写数字集降维

1、导入所需模块和库

```
from sklearn.decomposition import PCA
from sklearn.ensemble import RandomForestClassifier as RFC
from sklearn.model_selection import cross_val_score
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
```

2、导入数据，探索数据

```
data = pd.read_csv('data/digit_recognizor.csv')
```

```
X = data.iloc[:,1:]
y = data.iloc[:,0]
```

```
X.shape
```

```
(42000, 784)
```

3、画累计方差贡献率曲线，找出最佳降维的维度的范围

```
%%time
pca = PCA()
pca_model = pca.fit(X)
```

```
Wall time: 4.87 s
```

```
## PCA的参数 n_components:
#1.为空 -- 实际的维数，没有降低维数
#2.整数 -- 降维到指定值 - 最大就是你的维度
#3.[0-1]之间的浮点数，另一个参数 svd_solver = 'full' ，，希望保留百分比的信息量
#4.'mle',最大似然估计自动选超参数的方法！！ -- 计算量相当可观
```

```
pca_model.explained_variance_ratio_ # 可解释性方差
```

```
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       4.01309170e-34, 4.01309170e-34, 4.01309170e-34, 4.01309170e-34,
       4.01309170e-34, 4.01309170e-34, 4.01309170e-34, 4.01309170e-34,
       4.01309170e-34, 4.01309170e-34, 4.01309170e-34, 4.01309170e-34,
       4.01309170e-34, 4.01309170e-34, 4.01309170e-34, 4.01309170e-34,
       4.01309170e-34, 4.01309170e-34, 4.01309170e-34, 4.01309170e-34,
       4.01309170e-34, 4.01309170e-34, 4.01309170e-34, 3.98635846e-34,
       2.59836120e-34, 8.99428984e-35, 7.17312032e-35, 1.82665870e-35])
```
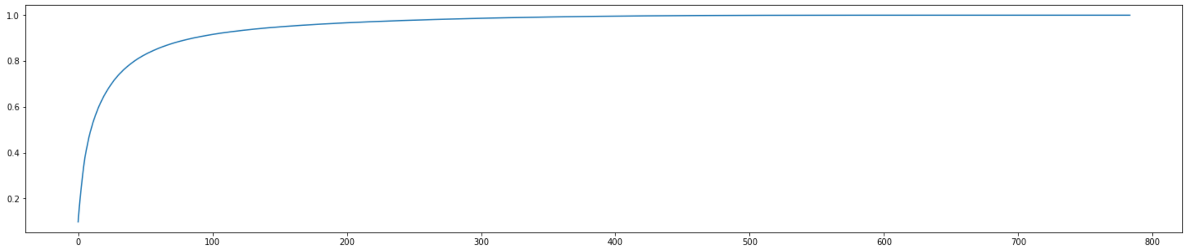

```
pca_model.explained_variance_ratio_.sum()
```

```
1.0
```

```
plt.figure(figsize=[25,5])
plt.plot(np.cumsum(pca_model.explained_variance_ratio_))
```

```
[<matplotlib.lines.Line2D at 0x2890d4ee8e0>]
```



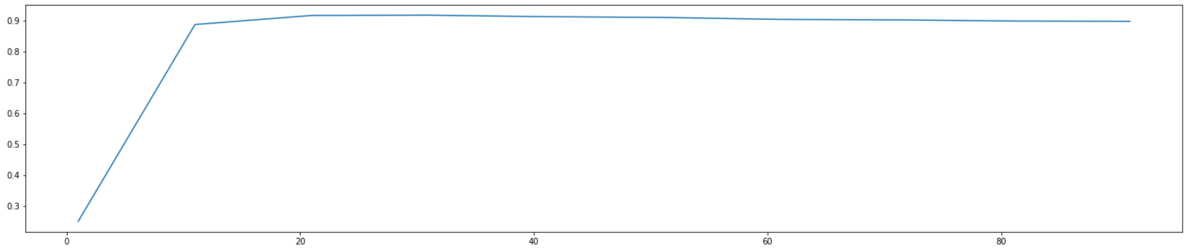
4.维度的学习曲线，搜索最佳维度的范围

```
%%time

scores = []
for i in range(1,101,10):
    X_dr = PCA(i).fit_transform(X)
    score = 
cross_val_score(RFC(n_estimators=10,random_state=100),X_dr,y,cv=5).mean()
    scores.append(score)
```

```
Wall time: 2min 41s
```

```
plt.figure(figsize=[25,5])
plt.plot(range(1,101,10),scores)
```

```
[<matplotlib.lines.Line2D at 0x2890d59ed00>]
```



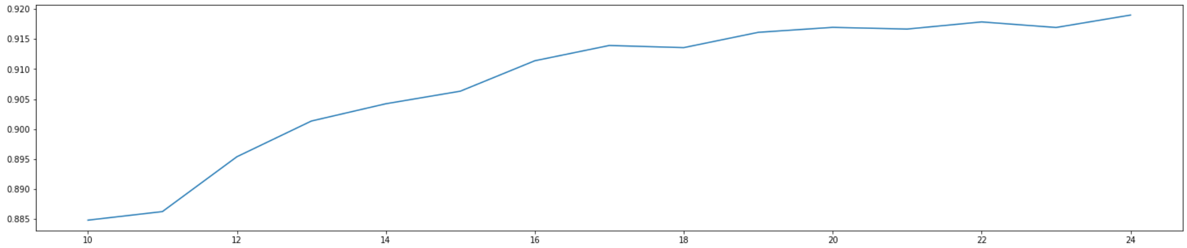
5、细化学习曲线

```
%%time

scores = []
for i in range(10,25):
    X_dr = PCA(i).fit_transform(X)
    score = 
cross_val_score(RFC(n_estimators=10,random_state=100),X_dr,y,cv=5).mean()
    scores.append(score)
```

```
Wall time: 2min 49s
```

```
plt.figure(figsize=[25,5])
plt.plot(range(10,25),scores)
```

```
[<matplotlib.lines.Line2D at 0x2890f26a2b0>]
```



6、在最佳维度下，查看模型效果

```
X_dr = PCA(24).fit_transform(X)
cross_val_score(RFC(n_estimators=10,random_state=100),X_dr,y,cv=5).mean()
```

```
0.9172857142857144
```

7、 尝试换一下模型

```
%%time

from sklearn.neighbors import KNeighborsClassifier as KNN
cross_val_score(KNN(),X_dr,y,cv=5).mean()
```

```
Wall time: 36.3 s
```

```
0.9703333333333333
```

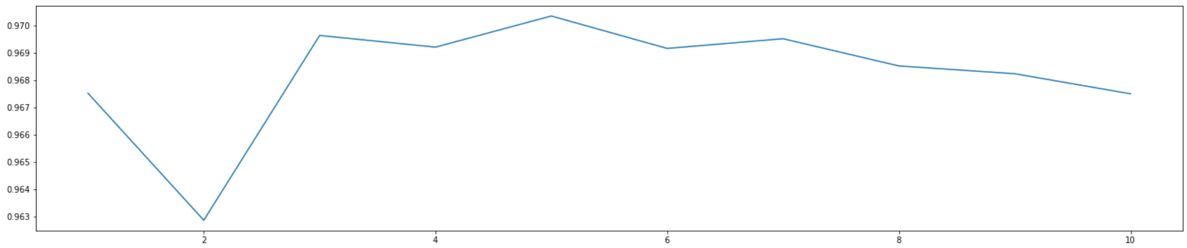
8 KNN的k值的学习曲线

```
%%time

scores = []
for i in range(10):
    X_dr = PCA(24).fit_transform(X)
    score = cross_val_score(KNN(n_neighbors=i+1),X_dr,y,cv=5).mean()
    scores.append(score)
```

```
Wall time: 5min 49s
```

```
plt.figure(figsize=[25,5])
plt.plot(range(1,11),scores)
```

```
[<matplotlib.lines.Line2D at 0x2890f284190>]
```



```
cross_val_score(KNN(n_neighbors=5),X_dr,y,cv=5).mean()
#cross_val_score(KNN(5),X_dr,y,cv=5).mean()
```

```
0.9705238095238095
```

```
# 40 -> 1
```