Breast cancer Wisconsin 特徵資訊解析

1. ID number

   患者編號

2. Diagnosis (M = malignant, B = benign)

   診斷結果(M:惡性，B:良性)

Ten real-valued features are computed for each cell nucleus:

以下的 10 種特徵皆是以細胞核為基準計算

1. radius (mean of distances from center to points on the perimeter)

   半徑(癌細胞核的中心至其圓周的長度的平均值)

2. texture (standard deviation of gray-scale values)

   紋理(灰階值的標準差)

3. perimeter

   癌細胞之周長

4. area

   癌細胞所占面積

5. smoothness (local variation in radius lengths)

   平滑度(癌細胞在其半徑長度內的局部變化)

6. compactness (perimeter^2 / area — 1.0)

   癌細胞緊緻性(半徑 ^{2}/ 癌細胞面積 - 1)

7. concavity (severity of concave portions of the contour)

   凹陷度(輪廓凹陷的嚴重程度)

8. concave points (number of concave portions of the contour)

   凹陷點(輪廓凹陷處的數量)

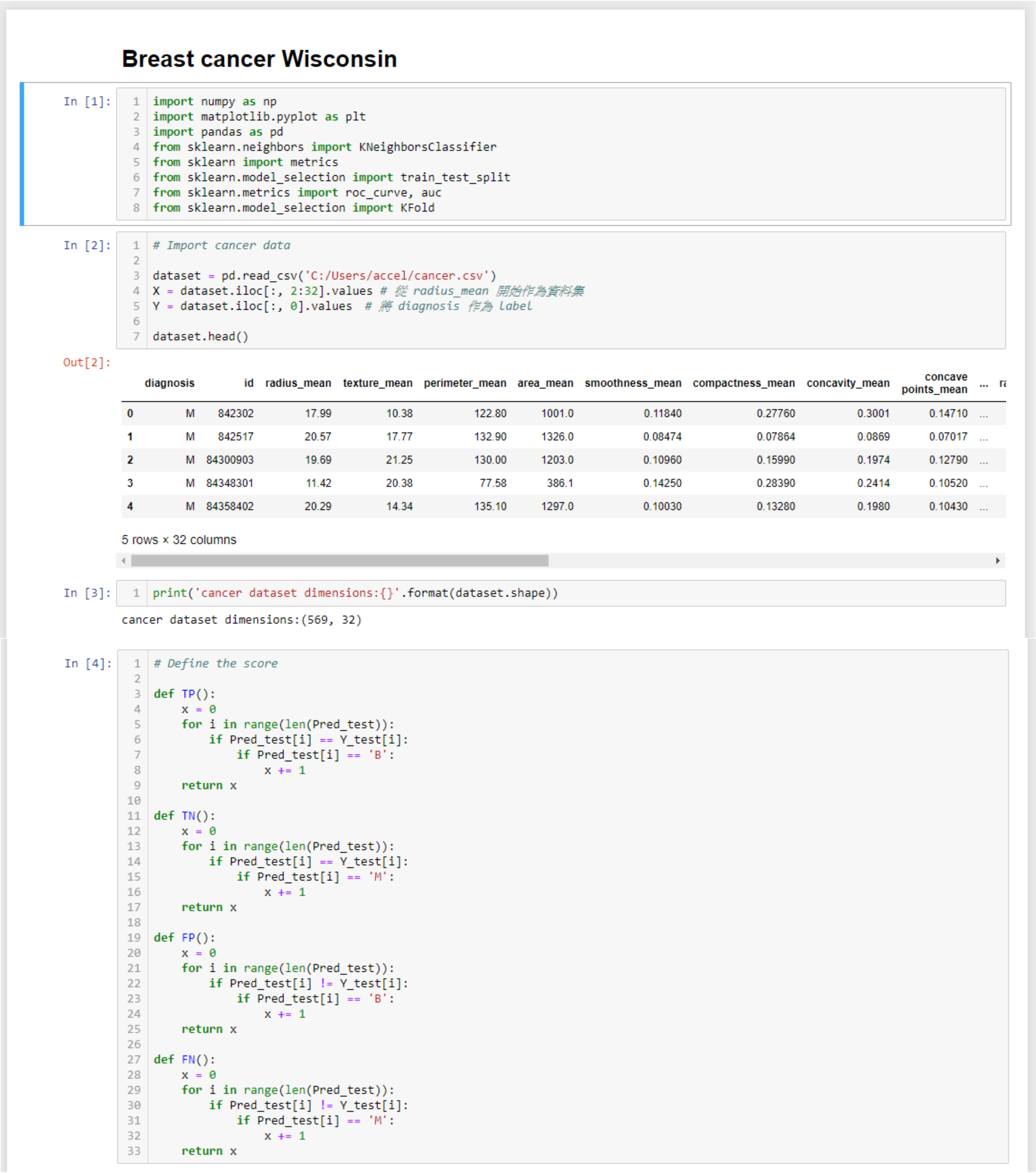
9. symmetry

   對稱

10. fractal dimension (“coastline approximation” — 1)

    分形維度(水平近似值 - 1)

Python code



Breast cancer Wisconsin

In [1]:
```python
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.neighbors import KNeighborsClassifier
from sklearn import metrics
from sklearn.model_selection import train_test_split
from sklearn.metrics import roc_curve, auc
from sklearn.model_selection import KFold
```

In [2]:
```python
# Import cancer data

dataset = pd.read_csv('C:/Users/accel/cancer.csv')
X = dataset.iloc[:, 2:32].values # 從 radius_mean 開始作為資料集
Y = dataset.iloc[:, 0].values  # 將 diagnosis 作為 label

dataset.head()
```

Out[2]:

	diagnosis	id	radius_mean	texture_mean	perimeter_mean	area_mean	smoothness_mean	compactness_mean	concavity_mean	concave points_mean	...	ra
0	M	842302	17.99	10.38	122.80	1001.0	0.11840	0.27760	0.3001	0.14710	...	
1	M	842517	20.57	17.77	132.90	1326.0	0.08474	0.07864	0.0869	0.07017	...	
2	M	84300903	19.69	21.25	130.00	1203.0	0.10960	0.15990	0.1974	0.12790	...	
3	M	84348301	11.42	20.38	77.58	386.1	0.14250	0.28390	0.2414	0.10520	...	
4	M	84358402	20.29	14.34	135.10	1297.0	0.10030	0.13280	0.1980	0.10430	...	

5 rows × 32 columns

In [3]:
```python
print('cancer dataset dimensions:{}'.format(dataset.shape))
```

```
cancer dataset dimensions:(569, 32)
```

In [4]:
```python
# Define the score

def TP():
    x = 0
    for i in range(len(Pred_test)):
        if Pred_test[i] == Y_test[i]:
            if Pred_test[i] == 'B':
                x += 1
    return x

def TN():
    x = 0
    for i in range(len(Pred_test)):
        if Pred_test[i] == Y_test[i]:
            if Pred_test[i] == 'M':
                x += 1
    return x

def FP():
    x = 0
    for i in range(len(Pred_test)):
        if Pred_test[i] != Y_test[i]:
            if Pred_test[i] == 'B':
                x += 1
    return x

def FN():
    x = 0
    for i in range(len(Pred_test)):
        if Pred_test[i] != Y_test[i]:
            if Pred_test[i] == 'M':
                x += 1
    return x
```

In [5]:

```
# 10 fold cross validation

KF = KFold(n_splits=10)

XtrainL = []
XtestL = []
YtrainL = []
YtestL = []
# split features
for X_train_index, X_test_index in KF.split(X): # X_train:X_test = 9:1, test依序從左至右
    X_train = X[X_train_index]
    X_test = X[X_test_index]
    XtrainL.append(X_train) # 儲存每次的訓練資料集
    XtestL.append(X_test) # 儲存每次的測試資料集

# split labels
for Y_train_index, Y_test_index in KF.split(Y):
    Y_train = Y[Y_train_index]
    Y_test = Y[Y_test_index]
    YtrainL.append(Y_train)
    YtestL.append(Y_test)
```

In [6]:

```
predL = []
precL = []
recL =[]
f1L = []

# 儲存10次驗證的準確率
for i in range(10):
    KNN = KNeighborsClassifier()
    KNN.fit(XtrainL[i], YtrainL[i]) # train

    Pred_test = KNN.predict(X_test) # Predict

    Precision = TP() / (TP() + FP()) # Scoring
    Recall = TP() / (TP() + FN())
    F1 = (2 * Precision * Recall) / (Precision + Recall)

    # store the scores
    predL.append(Pred_test)
    precL.append(round(Precision*100, 1))
    recL.append(round(Recall*100, 1))
    f1L.append(round(F1*100, 1))

print('Precision of test set:{}'.format(precL))
print('Recall of test set:{}'.format(recL))
print('F1-measure of test set:{}'.format(f1L))
```

```
Precision of test set:[97.7, 97.7, 97.7, 97.7, 97.7, 97.7, 97.7, 97.7, 97.7, 97.7]
Recall of test set:[100.0, 100.0, 100.0, 100.0, 100.0, 100.0, 100.0, 100.0, 100.0, 97.7]
F1-measure of test set:[98.9, 98.9, 98.9, 98.9, 98.9, 98.9, 98.9, 98.9, 98.9, 97.7]
```

In [7]:

```
# change label into binary
for i in range(len(YtestL[9])):
    if YtestL[9][i] == 'M':
        YtestL[9][i] = 0
    elif YtestL[9][i] == 'B':
        YtestL[9][i] = 1

for i in range(len(predL[9])):
    if predL[9][i] == 'M':
        predL[9][i] = 0
    elif predL[9][i] == 'B':
        predL[9][i] = 1

# 為符合 roc_curve 的參數規格, 將 array 轉為  list
Y_true = list(YtestL[9])
Y_pred = list(predL[9])

print(Y_true)
print(Y_pred)
```

```
[1, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1]
[1, 0, 1, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1]
```

In [8]:

```
fpr, tpr, threshold = roc_curve(Y_true, Y_pred, pos_label=1)
```

In [9]:

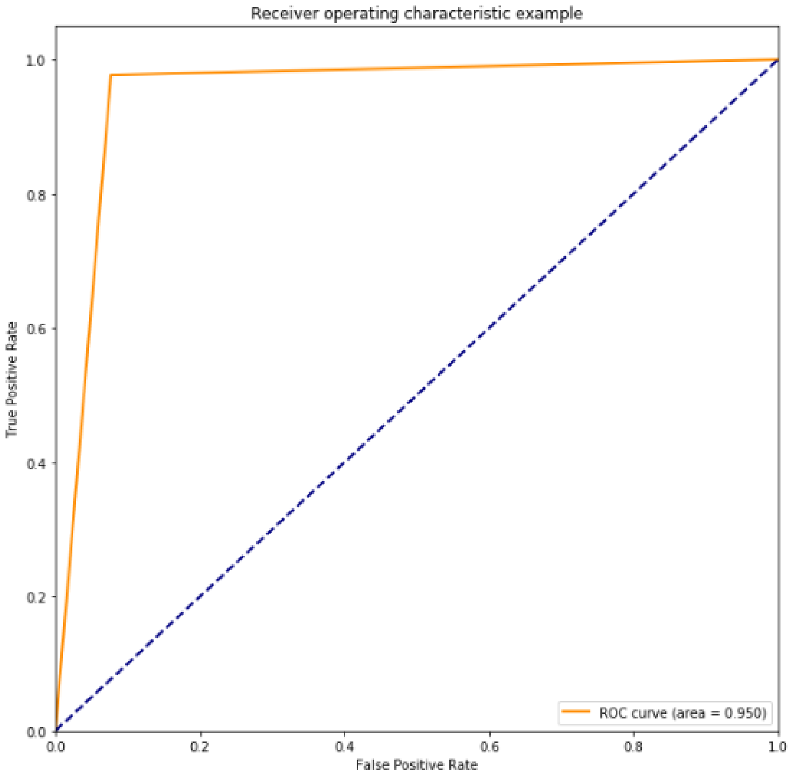
```python
# roc curve & auc

roc_auc = auc(fpr,tpr) ###计算auc的值

plt.figure()
lw = 2
plt.figure(figsize=(10,10))
plt.plot(fpr, tpr, color='darkorange',
         lw=lw, label='ROC curve (area = %0.3f)' % roc_auc) ###FPR:row，TPR:column
plt.plot([0, 1], [0, 1], color='navy', lw=lw, linestyle='--')
plt.xlim([0.0, 1.0])
plt.ylim([0.0, 1.05])
plt.xlabel('False Positive Rate')
plt.ylabel('True Positive Rate')
plt.title('Receiver operating characteristic example')
plt.legend(loc="lower right")

plt.show()
```

```
<Figure size 432x288 with 0 Axes>
```


Receiver operating characteristic example
True Positive Rate
False Positive Rate
ROC curve (area = 0.950)