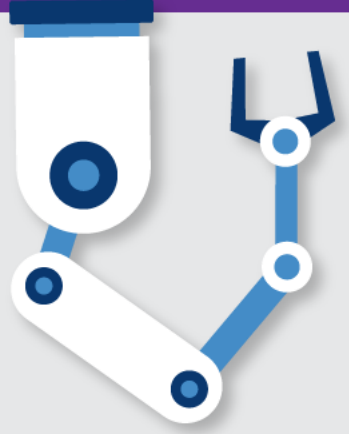
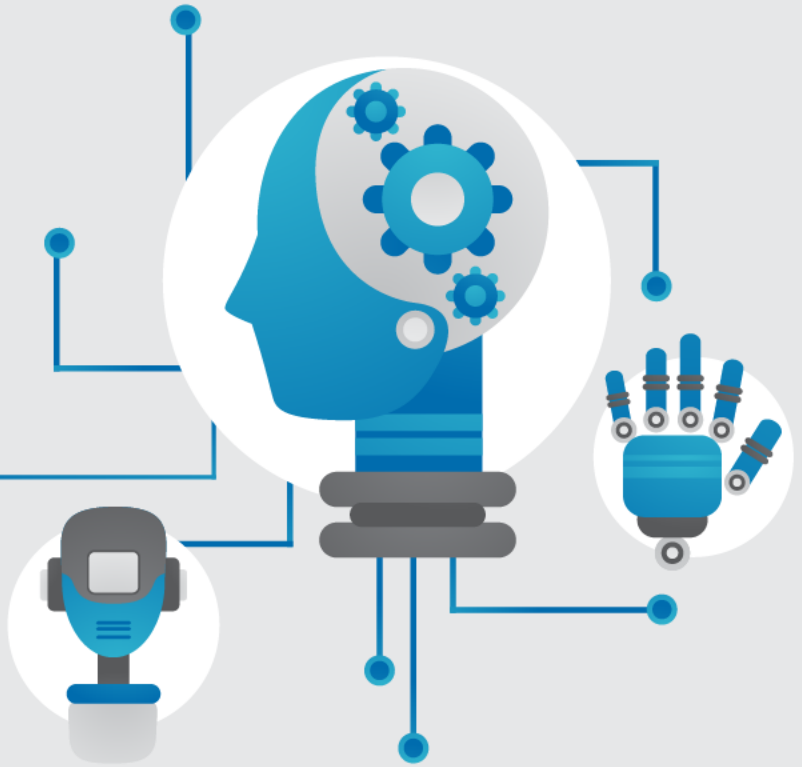


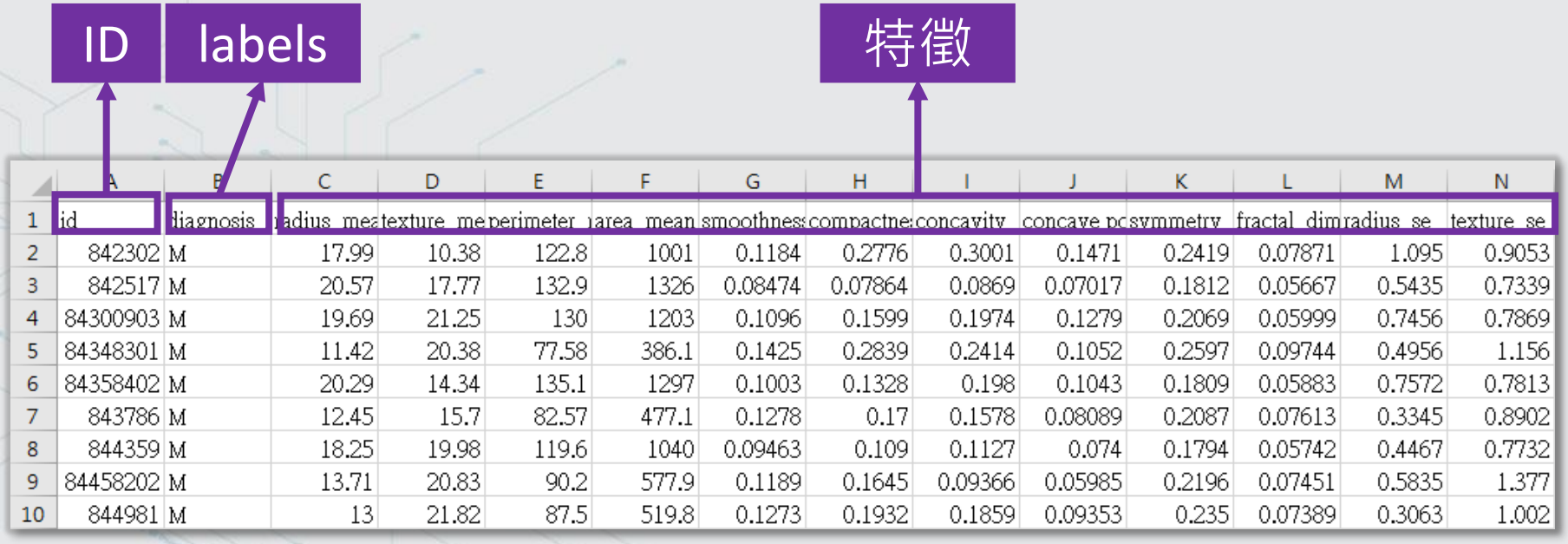
Logistic Regression
模型建置流程



Kaggle數據集 –
Breast Cancer Wisconsin (Diagnostic) Data Set

機器學習實務

- 資料檔案：**data.csv**
- 含有569筆資料，每筆資料有32格欄位，
  第一格為ID，第二格為labels，
  之後的30格為該筆資料的特徵。



	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	id	diagnosis	radius_mea	texture_me	perimeter_	area_mean	smoothness	compactne	concavity_	concave po	symmetry_	fractal_dim	radius_se	texture_se
2	842302	M	17.99	10.38	122.8	1001	0.1184	0.2776	0.3001	0.1471	0.2419	0.07871	1.095	0.9053
3	842517	M	20.57	17.77	132.9	1326	0.08474	0.07864	0.0869	0.07017	0.1812	0.05667	0.5435	0.7339
4	84300903	M	19.69	21.25	130	1203	0.1096	0.1599	0.1974	0.1279	0.2069	0.05999	0.7456	0.7869
5	84348301	M	11.42	20.38	77.58	386.1	0.1425	0.2839	0.2414	0.1052	0.2597	0.09744	0.4956	1.156
6	84358402	M	20.29	14.34	135.1	1297	0.1003	0.1328	0.198	0.1043	0.1809	0.05883	0.7572	0.7813
7	843786	M	12.45	15.7	82.57	477.1	0.1278	0.17	0.1578	0.08089	0.2087	0.07613	0.3345	0.8902
8	844359	M	18.25	19.98	119.6	1040	0.09463	0.109	0.1127	0.074	0.1794	0.05742	0.4467	0.7732
9	84458202	M	13.71	20.83	90.2	577.9	0.1189	0.1645	0.09366	0.05985	0.2196	0.07451	0.5835	1.377
10	844981	M	13	21.82	87.5	519.8	0.1273	0.1932	0.1859	0.09353	0.235	0.07389	0.3063	1.002

Logistic Regression 模型建置流程

1.資料前處理

2.建構模型與參數設置

3.模型訓練與評估

4.調整模型參數

5.重複步驟2 ~ 4直到模型效率無法再改進

資料前處理

- **從sklearn.datasets載入數據資料**
  函式回傳一個Bunch物件，Bunch是一個類似dictionary的物件。裡面包含六大類資料
  - ✓data
  - ✓target
  - ✓target_names
  - ✓feature_names
  - ✓DESCR
  - ✓filename

```
from sklearn.datasets import load_breast_cancer
bunch = load_breast_cancer()
print(bunch)
```

資料前處理

- 訓練資料

```
data = bunch.data
print(data)
print(type(data))
print(data.shape)
```

```
[[1.799e+01 1.038e+01 1.228e+02 ... 2.654e-01 4.601e-01 1.189e-01]
 [2.057e+01 1.777e+01 1.329e+02 ... 1.860e-01 2.750e-01 8.902e-02]
 [1.969e+01 2.125e+01 1.300e+02 ... 2.430e-01 3.613e-01 8.758e-02]
 ...
 [1.660e+01 2.808e+01 1.083e+02 ... 1.418e-01 2.218e-01 7.820e-02]
 [2.060e+01 2.933e+01 1.401e+02 ... 2.650e-01 4.087e-01 1.240e-01]
 [7.760e+00 2.454e+01 4.792e+01 ... 0.000e+00 2.871e-01 7.039e-02]]
<class 'numpy.ndarray'>
(569, 30)
```

威斯康辛乳癌數據集處理

- 分類的標籤

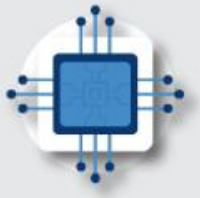
```
labels = bunch.target
print(labels)
print(type(labels))
print(labels.shape)
```

```
[0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0
 1 0 0 0 0 0 0 0 0 1 0 1 1 1 1 1 0 0 1 0 0 1 1 1 1 0 1 0 0 1 1 1 1 0 1 0 0
 1 0 1 0 0 1 1 1 0 0 1 0 0 0 1 1 1 0 1 1 0 0 1 1 1 0 0 1 1 1 1 0 1 1 0 1 1
 1 1 1 1 1 1 0 0 0 1 0 0 1 1 1 0 0 1 0 1 0 0 1 0 0 1 1 0 1 1 0 1 1 1 1 0 1
 1 1 1 1 1 1 1 1 0 1 1 1 1 0 0 1 0 1 1 0 0 1 1 0 0 1 1 1 1 0 1 1 0 0 0 1 0
 1 0 1 1 1 0 1 1 0 0 1 0 0 0 0 1 0 0 0 1 0 1 0 1 1 0 1 0 0 0 0 1 1 0 0 1 1
 1 0 1 1 1 1 1 0 0 1 1 0 1 1 0 0 1 0 1 1 1 1 0 1 1 1 1 1 0 1 0 0 0 0 0 0 0
 0 0 0 0 0 0 0 1 1 1 1 1 1 0 1 0 1 1 0 1 1 0 1 0 0 1 1 1 1 1 1 1 1 1 1 1 1
 1 0 1 1 0 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 1 1 0 1 0 1 1 1 1 0 0 0 1 1
 1 1 0 1 0 1 0 1 1 1 0 1 1 1 1 1 1 1 1 0 0 0 1 1 1 1 1 1 1 1 1 1 1 0 0 1 0 0
 0 1 0 0 1 1 1 1 1 0 1 1 1 1 1 0 1 1 1 0 1 1 0 0 1 1 1 1 1 1 0 1 1 1 1 1 1
 1 0 1 1 1 1 1 0 1 1 0 1 1 1 1 1 1 1 1 1 1 1 1 1 0 1 0 0 1 0 1 1 1 1 1 0 1 1
 0 1 0 1 1 0 1 0 1 1 1 1 1 1 1 1 0 0 1 1 1 1 1 1 0 1 1 1 1 1 1 1 1 1 1 0 1
 1 1 1 1 1 1 0 1 0 1 1 0 1 1 1 1 1 1 0 0 1 0 1 0 1 1 1 1 1 0 1 1 0 1 0 1 0 0
 1 1 1 0 1 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]
<class 'numpy.ndarray'>
(569,)
```

資料前處理

- 將data以及labels分割成train和test資料

```
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(data, labels,
                                                    test_size=0.3,
                                                    shuffle=True,
                                                    stratify=labels)
```



建構模型與參數設置

建構模型與參數設置

```
from sklearn.linear_model import LogisticRegression
logisticRegression = LogisticRegression(verbose=1, n_jobs=-1)
```

模型訓練與評估

模型訓練與評估

```
logisticRegression = logisticRegression.fit(X_train, y_train)
accuracy = logisticRegression.score(X_test, y_test)
print("Accuracy:", accuracy)
```

```
[Parallel(n_jobs=-1)]: Using backend LokyBackend with 8 concurrent workers.
```

```
Accuracy: 0.935672514619883
```

```
[Parallel(n_jobs=-1)]: Done   1 out of   1 | elapsed:    0.2s finished
```

模型訓練與評估

- 由於數據集的資料類別分類不是平均的，
  所以需要計算類別的數量。

```
import numpy as np
unique, counts = np.unique(y_train, return_counts=True)
dict(zip(unique, counts))
```

```
{0: 148, 1: 250}
```

調整模型參數

- 調整模型參數

```
from sklearn.linear_model import LogisticRegression
class_weight = { 0 : 148, 1 : 250 }
logisticRegression = LogisticRegression(verbose=1, n_jobs=-1,
                                        class_weight=class_weight)
```

模型訓練與評估

模型訓練與評估

```
logisticRegression = logisticRegression.fit(X_train, y_train)
accuracy = logisticRegression.score(X_test, y_test)
print("Accuracy:", accuracy)
```

```
Accuracy: 0.9649122807017544
```

```
[Parallel(n_jobs=-1)]: Using backend LokyBackend with 8 concurrent workers.
[Parallel(n_jobs=-1)]: Done   1 out of   1 | elapsed:    0.0s finished
```

特徵選擇

遞迴特徵刪除（Recursive Feature Elimination）

- ✓使用一個基礎模型（model）來對features進行多輪訓練，每輪訓練後，將該訓練中權重（weight）平方最小的特徵去除，再基於新的特徵進行下一輪訓練。

- ✓使用sklearn.feature_selection import RFE 實作

遞迴特徵刪除

程式碼

```
X_train, X_test, Y_train, Y_test =
train_test_split(bunch.data,bunch.target,test_size=0.3,
shuffle=True,stratify=bunch.target)

# 建立模型
logreg = LogisticRegression(C=1e5)

# 用RFE,遞迴特徵選擇
# 參數estimator裡放機器學習模型
# 參數n_feature_to_select為要選擇的特徵個數
# 建立 Logistic Regression Classifier
sklearn.feature_selection import RFE
selector = RFE(estimator=logreg,n_features_to_select=27)
selector = selector.fit(X_train, Y_train)
X_train = selector.transform(X_train)
X_test = selector.transform(X_test)
```

模型訓練與評估

程式碼

```
from sklearn.model_selection import train_test_split
from sklearn.feature_selection import RFE
from sklearn.linear_model import LogisticRegression
from sklearn import datasets

# 載入資料
bunch = datasets.load_breast_cancer()
X_train, X_test, Y_train, Y_test =
train_test_split(bunch.data,bunch.target,test_size=
0.3,shuffle=True,stratify=bunch.target)

# 建立模型
logreg = LogisticRegression(C=1e5,class_weight='balanced')
```

模型訓練與評估

程式碼

```
# 用RFE,遞迴特徵選擇
selector = RFE(estimator=logreg,n_features_to_select=27)
selector = selector.fit(X_train, Y_train)
X_train = selector.transform(X_train)
X_test = selector.transform(X_test)

# 進行訓練
logreg.fit(X_train, Y_train)

# 進行預測
acc = logreg.score(X_test, Y_test)
print('Accuracy:',acc)
```

```
Accuracy: 0.9824561403508771
```