import套件

In [90]:
```
import pandas as pd
#from sklearn.preprocessing import OneHotEncoder
#from sklearn.preprocessing import LabelEncoder
from sklearn.utils import shuffle
from sklearn import tree
```

讀取資料

In [91]:
```
df = pd.read_csv(f'character-deaths.csv')
df.head()
```

Out[91]:

	Name	Allegiances	Death Year	Book of Death	Death Chapter	Book Intro Chapter	Gender	Nobility	GoT	CoK	SoS	FfC	DwD
0	Addam Marbrand	Lannister	NaN	NaN	NaN	56.0	1	1	1	1	1	1	0
1	Aegon Frey (Jinglebell)	None	299.0	3.0	51.0	49.0	1	1	0	0	1	0	0
2	Aegon Targaryen	House Targaryen	NaN	NaN	NaN	5.0	1	1	0	0	0	0	1
3	Adrack Humble	House Greyjoy	300.0	5.0	20.0	20.0	1	1	0	0	0	0	1
4	Aemon Costayne	Lannister	NaN	NaN	NaN	NaN	1	1	0	0	1	0	0

死亡年 填0轉1

In [92]:
```
death_set = set(df[df['Death Year'].notna()]['Death Year'])
death_dict = dict.fromkeys(death_set,1)
death_dict
```

Out[92]:
```
{297.0: 1, 298.0: 1, 299.0: 1, 300.0: 1}
```

In [93]:
```
df['Death Year'] = df['Death Year'].map(death_dict).fillna(0).astype('int')
df['Book Intro Chapter'] = df['Book Intro Chapter'].fillna(0)
```

In [94]:
```
df.head()
```

Out[94]:

	Name	Allegiances	Death Year	Book of Death	Death Chapter	Book Intro Chapter	Gender	Nobility	GoT	CoK	SoS	FfC	DwD
0	Addam Marbrand	Lannister	0	NaN	NaN	56.0	1	1	1	1	1	1	0
1	Aegon Frey (Jinglebell)	None	1	3.0	51.0	49.0	1	1	0	0	1	0	0
2	Aegon Targaryen	House Targaryen	0	NaN	NaN	5.0	1	1	0	0	0	0	1
3	Adrack Humble	House Greyjoy	1	5.0	20.0	20.0	1	1	0	0	0	0	1
4	Aemon Costayne	Lannister	0	NaN	NaN	0.0	1	1	0	0	1	0	0

做OHE並且concat起來

In [95]:
```
df = pd.concat([df,pd.get_dummies(df['Allegiances'])],axis=1)
df.head(5)
```

Out[95]:

	Name	Allegiances	Death Year	Book of Death	Death Chapter	Book Intro Chapter	Gender	Nobility	GoT	CoK	...	House Tyrell	Lannister	Martell	Night's Watch	None	Stark	Targaryen	Tully	Tyrell	Wildling
0	Addam Marbrand	Lannister	0	NaN	NaN	56.0	1	1	1	1	...	0	1	0	0	0	0	0	0	0	0
1	Aegon Frey (Jinglebell)	None	1	3.0	51.0	49.0	1	1	0	0	...	0	0	0	0	1	0	0	0	0	0
2	Aegon Targaryen	House Targaryen	0	NaN	NaN	5.0	1	1	0	0	...	0	0	0	0	0	0	0	0	0	0
3	Adrack Humble	House Greyjoy	1	5.0	20.0	20.0	1	1	0	0	...	0	0	0	0	0	0	0	0	0	0
4	Aemon Costayne	Lannister	0	NaN	NaN	0.0	1	1	0	0	...	0	1	0	0	0	0	0	0	0	0

5 rows × 34 columns

確定一下分類無誤

In [96]:
```
print(df[df['Allegiances']=='Lannister'][['Allegiances','Lannister']].head(5))
set(df[df['Allegiances']=='Lannister']['Lannister'])
```

```
   Allegiances  Lannister
0    Lannister          1
4    Lannister          1
27   Lannister          1
38   Lannister          1
45   Lannister          1
```

Out[96]:
```
{1}
```

我不知道隨機取是什麼意思，我就用shuffle

好像有train_test_split可以用

In [97]:
```
shuffle_df = shuffle(df)
train_df = shuffle_df[0:int(len(df)*0.75)]
test_df = shuffle_df[int(len(df)*0.75)+1:]
```

In [98]:
```
train_df.drop(labels=['Death Year','Allegiances','Name','Book of Death','Death Chapter'],axis=1)
```

Out[98]:

	Book Intro Chapter	Gender	Nobility	GoT	CoK	SoS	FfC	DwD	Arryn	Baratheon	...	House Tyrell	Lannister	Martell	Night's Watch	None	Stark	Targaryen	Tully	Tyrell	Wildling
50	6.0	1	0	0	0	1	1	0	0	0	...	1	0	0	0	0	0	0	0	0	0
546	59.0	1	1	1	0	1	0	0	0	0	...	0	0	0	0	1	0	0	0	0	0
123	41.0	1	0	0	0	0	1	0	1	0	...	0	0	0	0	0	0	0	0	0	0
720	14.0	1	1	0	0	1	0	0	0	0	...	0	1	0	0	0	0	0	0	0	0
210	19.0	1	1	0	0	0	1	0	0	0	...	0	0	0	0	0	0	0	0	0	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
688	16.0	1	0	0	1	0	0	0	0	0	...	0	0	0	0	1	0	0	0	0	0
735	14.0	1	1	0	0	1	1	0	0	0	...	0	0	0	0	1	0	0	0	0	0
760	19.0	1	1	0	0	0	1	0	0	0	...	0	0	0	0	0	0	0	0	0	0
553	31.0	1	1	1	0	0	0	0	0	0	...	0	0	0	0	1	0	0	0	0	0
731	7.0	1	0	0	0	0	0	1	0	0	...	0	0	0	1	0	0	0	0	0	0

687 rows × 29 columns

標註label與確認有無NaN

In [99]:
```
X = train_df.drop(labels=['Death Year','Allegiances','Name','Book of Death','Death Chapter'],axis=1)
Y = train_df['Death Year']
```

In [100…
```
X.describe()
```

Out[100]:

	Book Intro Chapter	Gender	Nobility	GoT	CoK	SoS	FfC	DwD	Arryn	Baratheon	...	House Tyrell	Lannister	Martell	Night's Watch	
count	687.000000	687.000000	687.000000	687.000000	687.000000	687.000000	687.00000	687.000000	687.000000	687.000000	...	687.000000	687.000000	687.000000	687.000000	687.
mean	28.921397	0.834061	0.468705	0.263464	0.346434	0.435226	0.27802	0.298399	0.026201	0.055313	...	0.014556	0.084425	0.029112	0.131004	0.
std	20.250896	0.372297	0.499383	0.440833	0.476180	0.496148	0.44835	0.457889	0.159849	0.228757	...	0.119854	0.278227	0.168243	0.337651	0.
min	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.00000	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.000000	0.
25%	11.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.00000	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.000000	0.
50%	28.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.00000	0.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.000000	0.
75%	43.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.00000	1.000000	0.000000	0.000000	...	0.000000	0.000000	0.000000	0.000000	1.
max	78.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.00000	1.000000	1.000000	1.000000	...	1.000000	1.000000	1.000000	1.000000	1.

8 rows × 29 columns

In [101…
```
X[X['Book Intro Chapter'].isna()]
```

Out[101]:

	Book Intro Chapter	Gender	Nobility	GoT	CoK	SoS	FfC	DwD	Arryn	Baratheon	...	House Tyrell	Lannister	Martell	Night's Watch	None	Stark	Targaryen	Tully	Tyrell	Wildling

0 rows × 29 columns

長樹，限制深度在4避免畫不出圖

In [102…
```
clf = tree.DecisionTreeClassifier(max_depth=4)
clf = clf.fit(X, Y)
```

測試集資料處理

In [103…
```
Xp = test_df.drop(labels=['Death Year','Allegiances','Name','Book of Death','Death Chapter'],axis=1)
Yp = test_df['Death Year']
```

In [104…
```
clf.predict(Xp)
```

Out[104]:
```
array([0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0,
       1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 1, 0, 1, 0,
       0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 1,
       1, 1, 1, 1, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1,
       0, 1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0,
       0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1,
       0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 1,
       1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 0, 1,
       1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0,
       1, 1, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0,
       1, 1, 1, 1, 0, 0, 0, 0, 1])
```

In [105…
```
print(len(clf.predict(Xp)),len(Yp))
```

```
229 229
```

In [106…
```
test_label = Yp.reset_index()['Death Year']
```

In [107…
```
result = pd.concat([pd.DataFrame(test_label),pd.DataFrame(clf.predict(Xp))],axis=1)
result.head(5)
```

Out[107]:

	Death Year	0
0	0	0
1	0	0
2	0	0
3	0	0
4	1	1

In [108…
```
result = result.rename(columns={'Death Year':'Death',0:'Predict'})
result.head(5)
```

Out[108]:

	Death	Predict
0	0	0
1	0	0
2	0	0
3	0	0
4	1	1

手算acc

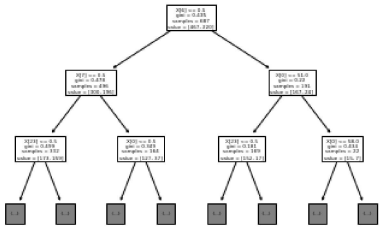
In [109…
```
counter = 0
for i in range(len(result)):
    if result['Death'][i]==result['Predict'][i]:
        counter+=1
counter/len(result)
```

Out[109]:
```
0.6943231441048034
```

畫圖

In [110…
```
import matplotlib.pyplot as plt
from sklearn.tree import plot_tree
```

In [111…
```
plot_tree(clf,max_depth=2)
plt.show()
```



計算confusion matrix

In [112…
```
from sklearn.metrics import accuracy_score
from sklearn.metrics import confusion_matrix
from sklearn.metrics import classification_report
```

In [113…
```
y_pred = result['Predict']
y_true = result['Death']
accuracy_score(y_true, y_pred)
```

Out[113]:
```
0.6943231441048034
```

In [114…
```
confusion_matrix(y_true, y_pred)
```

Out[114]:
```
array([[102,  42],
       [ 28,  57]], dtype=int64)
```

In [115…
```
print(classification_report(y_true, y_pred))
```

```
              precision    recall  f1-score   support

           0       0.78      0.71      0.74       144
           1       0.58      0.67      0.62        85

    accuracy                           0.69       229
   macro avg       0.68      0.69      0.68       229
weighted avg       0.71      0.69      0.70       229
```

圖片輸出

In [116…
```
X.columns
```

Out[116]:
```
Index(['Book Intro Chapter', 'Gender', 'Nobility', 'GoT', 'CoK', 'SoS', 'FfC',
       'DwD', 'Arryn', 'Baratheon', 'Greyjoy', 'House Arryn',
       'House Baratheon', 'House Greyjoy', 'House Lannister', 'House Martell',
       'House Stark', 'House Targaryen', 'House Tully', 'House Tyrell',
       'Lannister', 'Martell', 'Night's Watch', 'None', 'Stark', 'Targaryen',
       'Tully', 'Tyrell', 'Wildling'],
      dtype='object')
```

In [117…
```
import graphviz
dot_data = tree.export_graphviz(clf, out_file=None,feature_names=X.columns)
graph = graphviz.Source(dot_data)
graph.render("hw1")
```

Out[117]:
```
'hw1.pdf'
```

In [ ]:
```

```