# exp8

April 21, 2022

[ ]:
```
import pandas as pd
import numpy as np
from sklearn.ensemble import RandomForestClassifier
from sklearn.model_selection import train_test_split
from sklearn import metrics
from sklearn.datasets import load_breast_cancer
import matplotlib.pyplot as plt
```

[ ]:
```
data = load_breast_cancer()
X = pd.DataFrame(data['data'], columns=data['feature_names'])
X
```

[ ]:

| | mean radius | mean texture | mean perimeter | mean area | mean smoothness | \ |
|---|---|---|---|---|---|---|
| 0 | 17.99 | 10.38 | 122.80 | 1001.0 | 0.11840 | |
| 1 | 20.57 | 17.77 | 132.90 | 1326.0 | 0.08474 | |
| 2 | 19.69 | 21.25 | 130.00 | 1203.0 | 0.10960 | |
| 3 | 11.42 | 20.38 | 77.58 | 386.1 | 0.14250 | |
| 4 | 20.29 | 14.34 | 135.10 | 1297.0 | 0.10030 | |
| .. | … | … | … | … | … | |
| 564 | 21.56 | 22.39 | 142.00 | 1479.0 | 0.11100 | |
| 565 | 20.13 | 28.25 | 131.20 | 1261.0 | 0.09780 | |
| 566 | 16.60 | 28.08 | 108.30 | 858.1 | 0.08455 | |
| 567 | 20.60 | 29.33 | 140.10 | 1265.0 | 0.11780 | |
| 568 | 7.76 | 24.54 | 47.92 | 181.0 | 0.05263 | |

| | mean compactness | mean concavity | mean concave points | mean symmetry | \ |
|---|---|---|---|---|---|
| 0 | 0.27760 | 0.30010 | 0.14710 | 0.2419 | |
| 1 | 0.07864 | 0.08690 | 0.07017 | 0.1812 | |
| 2 | 0.15990 | 0.19740 | 0.12790 | 0.2069 | |
| 3 | 0.28390 | 0.24140 | 0.10520 | 0.2597 | |
| 4 | 0.13280 | 0.19800 | 0.10430 | 0.1809 | |
| .. | … | … | … | … | |
| 564 | 0.11590 | 0.24390 | 0.13890 | 0.1726 | |
| 565 | 0.10340 | 0.14400 | 0.09791 | 0.1752 | |
| 566 | 0.10230 | 0.09251 | 0.05302 | 0.1590 | |
| 567 | 0.27700 | 0.35140 | 0.15200 | 0.2397 | |
| 568 | 0.04362 | 0.00000 | 0.00000 | 0.1587 | |

```
     mean fractal dimension  …  worst radius  worst texture  \
0                   0.07871  …        25.380          17.33
1                   0.05667  …        24.990          23.41
2                   0.05999  …        23.570          25.53
3                   0.09744  …        14.910          26.50
4                   0.05883  …        22.540          16.67
..                      …  …           …             …
564                 0.05623  …        25.450          26.40
565                 0.05533  …        23.690          38.25
566                 0.05648  …        18.980          34.12
567                 0.07016  …        25.740          39.42
568                 0.05884  …         9.456          30.37

     worst perimeter  worst area  worst smoothness  worst compactness  \
0             184.60      2019.0           0.16220            0.66560
1             158.80      1956.0           0.12380            0.18660
2             152.50      1709.0           0.14440            0.42450
3              98.87       567.7           0.20980            0.86630
4             152.20      1575.0           0.13740            0.20500
..               …         …               …                 …
564           166.10      2027.0           0.14100            0.21130
565           155.00      1731.0           0.11660            0.19220
566           126.70      1124.0           0.11390            0.30940
567           184.60      1821.0           0.16500            0.86810
568            59.16       268.6           0.08996            0.06444

     worst concavity  worst concave points  worst symmetry  \
0             0.7119                0.2654          0.4601
1             0.2416                0.1860          0.2750
2             0.4504                0.2430          0.3613
3             0.6869                0.2575          0.6638
4             0.4000                0.1625          0.2364
..               …                   …              …
564           0.4107                0.2216          0.2060
565           0.3215                0.1628          0.2572
566           0.3403                0.1418          0.2218
567           0.9387                0.2650          0.4087
568           0.0000                0.0000          0.2871

     worst fractal dimension
0                    0.11890
1                    0.08902
2                    0.08758
3                    0.17300
4                    0.07678
..                       …
564                  0.07115
```

```
565                  0.06637
566                  0.07820
567                  0.12400
568                  0.07039

[569 rows x 30 columns]
```

[ ]:
```
y = abs(pd.Series(data['target'])-1)
y
```

[ ]:
```
0      1
1      1
2      1
3      1
4      1
      ..
564    1
565    1
566    1
567    1
568    0
Length: 569, dtype: int32
```

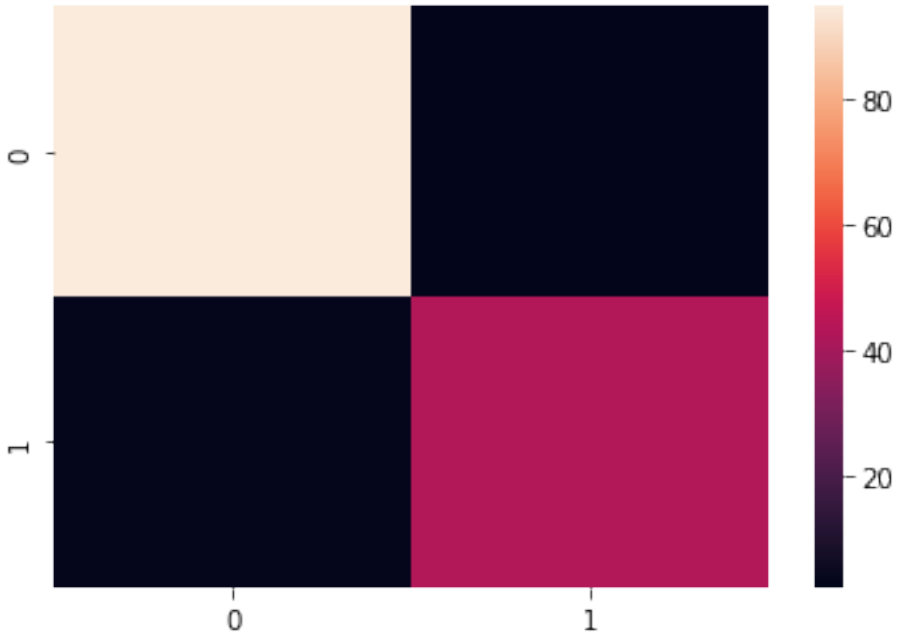
[ ]:
```
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.25)
```

[ ]:
```
model = RandomForestClassifier(random_state=1)
model.fit(X_train, y_train)
preds = model.predict(X_test)
```

[ ]:
```
import seaborn as sn

confusion = metrics.confusion_matrix(y_test, preds)
sn.heatmap(data = confusion)
confusion
```

[ ]:
```
array([[95,  2],
       [ 3, 43]], dtype=int64)
```




[ ]:
```
accuracy = metrics.accuracy_score(y_test, preds)
accuracy
```

[ ]: 0.965034965034965

[ ]:
```
precision_positive = metrics.precision_score(y_test, preds, pos_label=1)
precision_negative = metrics.precision_score(y_test, preds, pos_label=0)
precision_positive, precision_negative
```

[ ]: (0.9555555555555556, 0.9693877551020408)

[ ]:
```
recall_sensitivity = metrics.recall_score(y_test, preds, pos_label=1)
recall_specificity = metrics.recall_score(y_test, preds, pos_label=0)
recall_sensitivity, recall_specificity
```

[ ]: (0.9347826086956522, 0.979381443298969)

[ ]:
```
f1_positive = metrics.f1_score(y_test, preds, pos_label=1)
f1_negative = metrics.f1_score(y_test, preds, pos_label=0)
f1_positive, f1_negative
```

[ ]: (0.945054945054945, 0.9743589743589743)

[ ]:
```
y_pred_proba=model.predict_proba(X_test)[:,1]
fpr, tpr, threshold=metrics.roc_curve(y_test,y_pred_proba)
auroc=metrics.roc_auc_score(y_test,y_pred_proba)
```

```
fig,ax=plt.subplots(1,1,figsize=(5,5))
ax.plot(fpr,tpr)
ax.plot(fpr,fpr,"g--")
ax.set_xlabel("False Positive Rate")
ax.set_ylabel("True Positive Rate")
ax.set_title(f"ROC Curve, AUROC: {auroc:.2f}")
```

[ ]: Text(0.5, 1.0, 'ROC Curve, AUROC: 0.99')