

# ROC 曲線と ROC 曲線下面積

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## 1 目的

原データまたは度数分布表データに基づいて、ROC 曲線を描く。また、ROC 曲線下面積を計算する。

## 2 使用法

疾病群, 健康群の原データについて

```
import sys
sys.path.append("statlib")
from plot import ROC_curve0
ROC0(disease, normal, lowest=NULL, width=NULL, verbose=True)
```

度数分布表の形でまとめられているデータについて

```
import sys
sys.path.append("statlib")
from plot import ROC_curve
ROC(x, disease, normal, verbose=True)
```

### 2.1 引数

|         |                                       |
|---------|---------------------------------------|
| disease | 疾病群の測定値ベクトル                           |
| normal  | 健康者群の測定値ベクトル                          |
| lowest  | 最も小さい値のキリのよい数値                        |
| width   | 階級幅 (計算精度) のキリのよい数値                   |
|         | lowest か width がデフォルト値なら, データから適当に決める |
| x       | 分割表の下限值のベクトル (例題参照)                   |
| verbose | 必要最小限のプリント出力をする                       |

### 2.2 戻り値の名前

|          |           |
|----------|-----------|
| "result" | 結果表       |
| "cindex" | ROC 曲線下面積 |

### 3 使用例

#### 3.1 度数分布表を与える場合

```
x = [100, 220, 230, 240, 250, 260, 270, 280, 290, 300, 320, 340, 360,
     400]
disease = [3, 2, 1, 4, 7, 4, 16, 5, 3, 9, 10, 5, 10, 21]
normal = [25, 7, 19, 17, 7, 8, 7, 6, 2, 2, 0, 0, 0, 0]

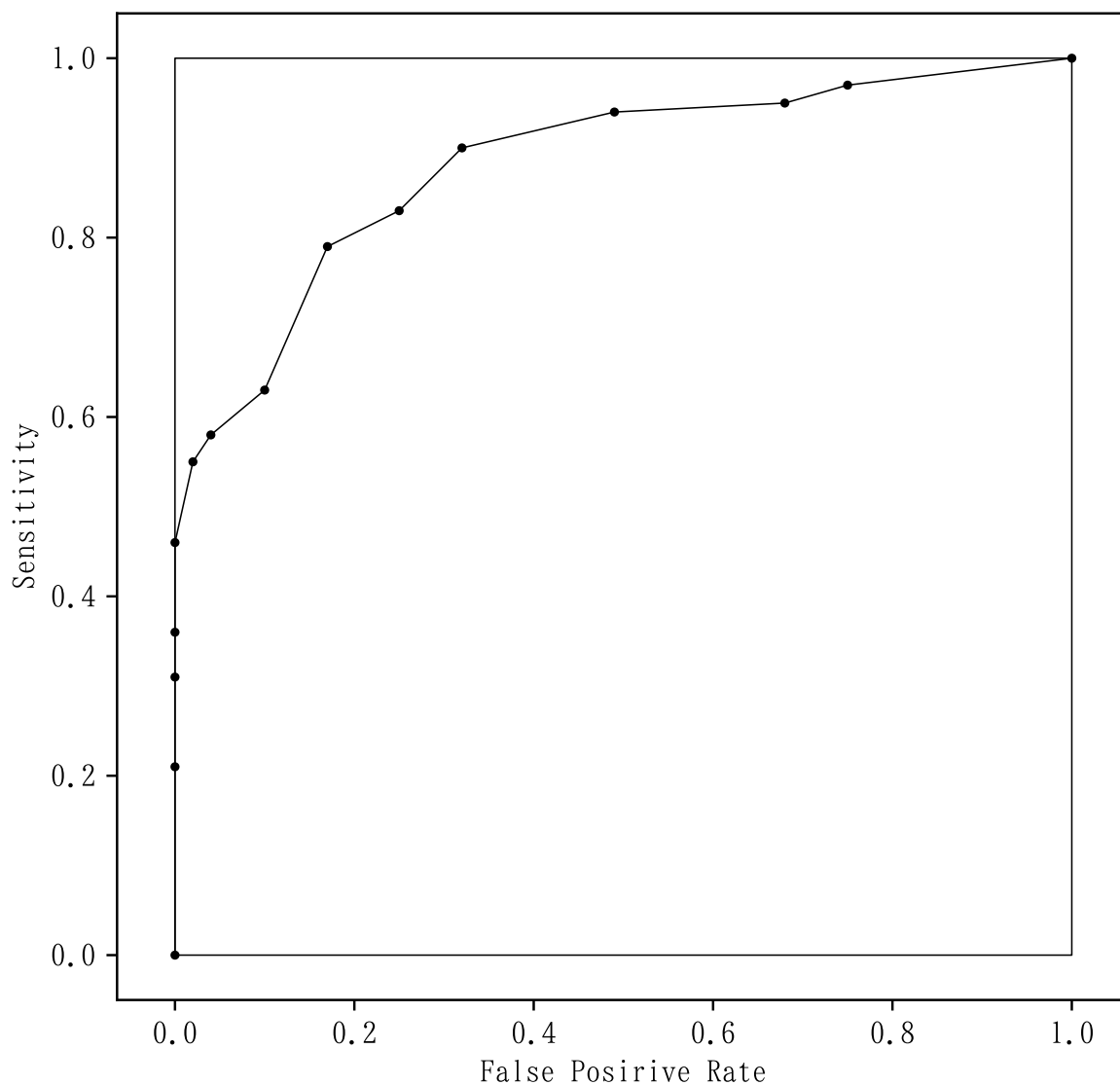
import sys
sys.path.append("statlib")
from plot import ROC_curve

a = ROC_curve(x, disease, normal)
```

ROC 曲線下面積

c index = 0.88215

|    | Value | Disease | Normal | Sensitivity | Specificity | F. P. rate |
|----|-------|---------|--------|-------------|-------------|------------|
| 0  | 100   | 3       | 25     | 1.00        | 0.00        | 1.00       |
| 1  | 220   | 2       | 7      | 0.97        | 0.25        | 0.75       |
| 2  | 230   | 1       | 19     | 0.95        | 0.32        | 0.68       |
| 3  | 240   | 4       | 17     | 0.94        | 0.51        | 0.49       |
| 4  | 250   | 7       | 7      | 0.90        | 0.68        | 0.32       |
| 5  | 260   | 4       | 8      | 0.83        | 0.75        | 0.25       |
| 6  | 270   | 16      | 7      | 0.79        | 0.83        | 0.17       |
| 7  | 280   | 5       | 6      | 0.63        | 0.90        | 0.10       |
| 8  | 290   | 3       | 2      | 0.58        | 0.96        | 0.04       |
| 9  | 300   | 9       | 2      | 0.55        | 0.98        | 0.02       |
| 10 | 320   | 10      | 0      | 0.46        | 1.00        | 0.00       |
| 11 | 340   | 5       | 0      | 0.36        | 1.00        | 0.00       |
| 12 | 360   | 10      | 0      | 0.31        | 1.00        | 0.00       |
| 13 | 400   | 21      | 0      | 0.21        | 1.00        | 0.00       |



### 3.2 原データを与える場合

```
disease = [95, 95, 109, 103, 109, 107, 116, 108, 90, 114, 93, 134,
123,
105, 108, 91, 95, 109, 104, 109, 132, 120, 123, 128, 104, 98,
111, 100, 128, 95, 121, 100, 98, 113, 90, 108, 109, 108, 115,
113, 102, 121, 121, 94, 103, 104, 110, 110, 116, 89, 110, 125,
116, 123, 111, 118, 117, 114, 108, 110, 109, 106, 100, 94, 114,
110, 113, 89, 113, 111, 115, 107, 118, 94, 112, 120, 99, 113]

normal = [93, 91, 92, 100, 85, 83, 83, 100, 88, 97, 108, 103, 94, 76,
92, 89, 99, 87, 87, 118, 96, 100, 97, 100, 90, 112, 100, 106,
113, 100, 100, 93, 94, 105, 109, 92, 92, 100, 101, 93, 112, 89,
85, 91, 101, 104, 109, 95, 85, 112, 93, 115, 95, 104, 109, 104,
103, 106, 93, 103, 108, 120, 112, 95, 95, 103, 87, 100, 99, 88,
123, 90, 100, 82, 91, 79, 104, 105, 101, 97, 104, 91, 118, 102,
93, 108, 94, 106, 100, 89, 98, 92, 119, 107, 109, 83, 111, 98]

import sys
```

```

sys.path.append("statlib")
from plot import ROC_curve0

a = ROC_curve0(disease, normal)

```

最小値 x = 76

最大値 x = 134

最小値より小さいキリのよい数値 = 76

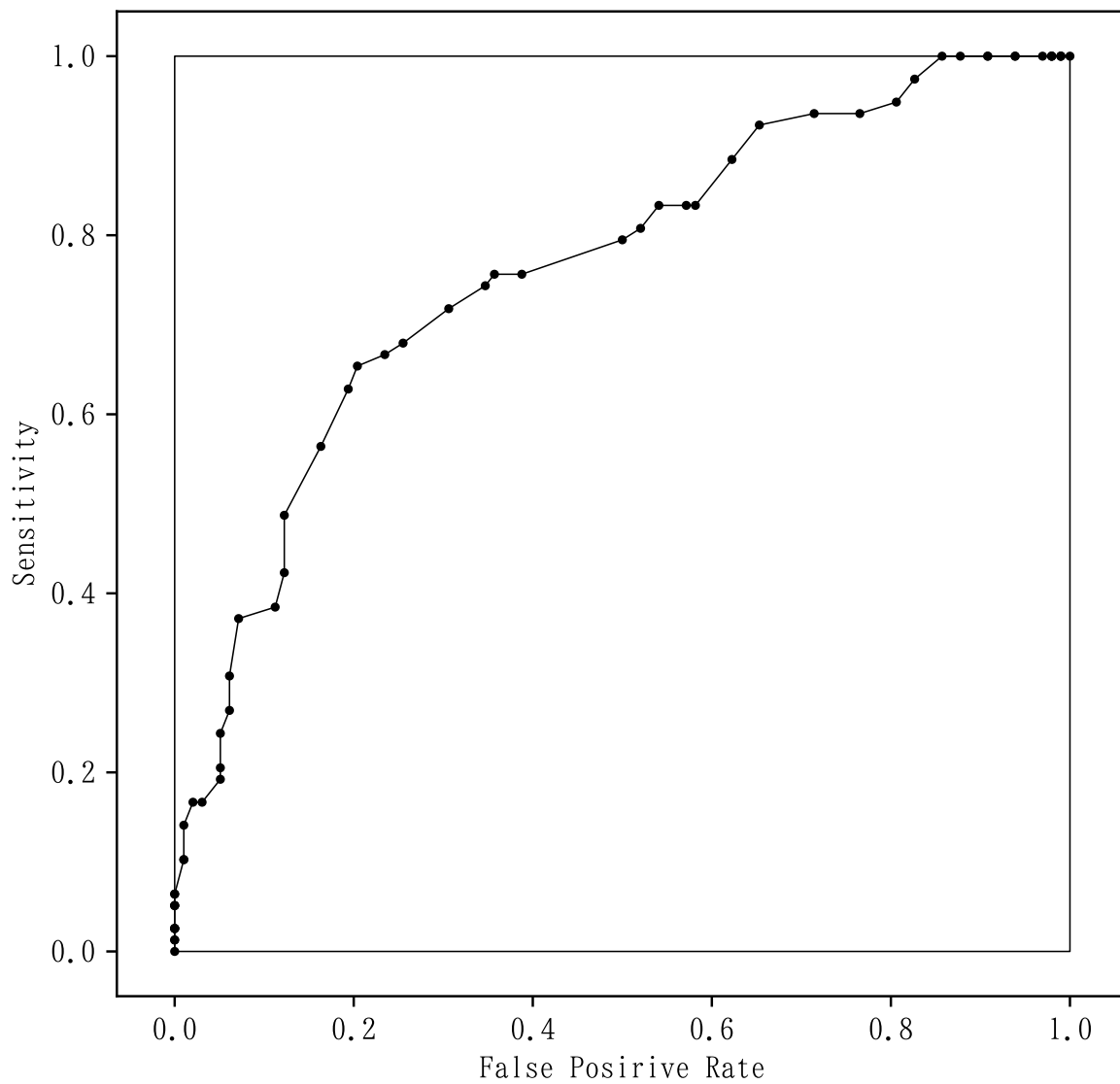
度数分布を作成する階級幅の切りのよい数値 = 1

ROC 曲線下面積

c index = 0.76262

|    | Value | Disease | Normal | Sensitivity | Specificity | F. P. rate |
|----|-------|---------|--------|-------------|-------------|------------|
| 0  | 76.0  | 0.0     | 1.0    | 1.000000    | 0.000000    | 1.000000   |
| 1  | 77.0  | 0.0     | 0.0    | 1.000000    | 0.010204    | 0.989796   |
| 2  | 78.0  | 0.0     | 0.0    | 1.000000    | 0.010204    | 0.989796   |
| 3  | 79.0  | 0.0     | 1.0    | 1.000000    | 0.010204    | 0.989796   |
| 4  | 80.0  | 0.0     | 0.0    | 1.000000    | 0.020408    | 0.979592   |
| 5  | 81.0  | 0.0     | 0.0    | 1.000000    | 0.020408    | 0.979592   |
| 6  | 82.0  | 0.0     | 1.0    | 1.000000    | 0.020408    | 0.979592   |
| 7  | 83.0  | 0.0     | 3.0    | 1.000000    | 0.030612    | 0.969388   |
| 8  | 84.0  | 0.0     | 0.0    | 1.000000    | 0.061224    | 0.938776   |
| 9  | 85.0  | 0.0     | 3.0    | 1.000000    | 0.061224    | 0.938776   |
| 10 | 86.0  | 0.0     | 0.0    | 1.000000    | 0.091837    | 0.908163   |
| 11 | 87.0  | 0.0     | 3.0    | 1.000000    | 0.091837    | 0.908163   |
| 12 | 88.0  | 0.0     | 2.0    | 1.000000    | 0.122449    | 0.877551   |
| 13 | 89.0  | 2.0     | 3.0    | 1.000000    | 0.142857    | 0.857143   |
| 14 | 90.0  | 2.0     | 2.0    | 0.974359    | 0.173469    | 0.826531   |
| 15 | 91.0  | 1.0     | 4.0    | 0.948718    | 0.193878    | 0.806122   |
| 16 | 92.0  | 0.0     | 5.0    | 0.935897    | 0.234694    | 0.765306   |
| 17 | 93.0  | 1.0     | 6.0    | 0.935897    | 0.285714    | 0.714286   |
| 18 | 94.0  | 3.0     | 3.0    | 0.923077    | 0.346939    | 0.653061   |
| 19 | 95.0  | 4.0     | 4.0    | 0.884615    | 0.377551    | 0.622449   |
| 20 | 96.0  | 0.0     | 1.0    | 0.833333    | 0.418367    | 0.581633   |
| 21 | 97.0  | 0.0     | 3.0    | 0.833333    | 0.428571    | 0.571429   |
| 22 | 98.0  | 2.0     | 2.0    | 0.833333    | 0.459184    | 0.540816   |
| 23 | 99.0  | 1.0     | 2.0    | 0.807692    | 0.479592    | 0.520408   |
| 24 | 100.0 | 3.0     | 11.0   | 0.794872    | 0.500000    | 0.500000   |
| 25 | 101.0 | 0.0     | 3.0    | 0.756410    | 0.612245    | 0.387755   |
| 26 | 102.0 | 1.0     | 1.0    | 0.756410    | 0.642857    | 0.357143   |
| 27 | 103.0 | 2.0     | 4.0    | 0.743590    | 0.653061    | 0.346939   |
| 28 | 104.0 | 3.0     | 5.0    | 0.717949    | 0.693878    | 0.306122   |
| 29 | 105.0 | 1.0     | 2.0    | 0.679487    | 0.744898    | 0.255102   |
| 30 | 106.0 | 1.0     | 3.0    | 0.666667    | 0.765306    | 0.234694   |
| 31 | 107.0 | 2.0     | 1.0    | 0.653846    | 0.795918    | 0.204082   |
| 32 | 108.0 | 5.0     | 3.0    | 0.628205    | 0.806122    | 0.193878   |
| 33 | 109.0 | 6.0     | 4.0    | 0.564103    | 0.836735    | 0.163265   |

|    |       |     |     |          |          |          |
|----|-------|-----|-----|----------|----------|----------|
| 34 | 110.0 | 5.0 | 0.0 | 0.487179 | 0.877551 | 0.122449 |
| 35 | 111.0 | 3.0 | 1.0 | 0.423077 | 0.877551 | 0.122449 |
| 36 | 112.0 | 1.0 | 4.0 | 0.384615 | 0.887755 | 0.112245 |
| 37 | 113.0 | 5.0 | 1.0 | 0.371795 | 0.928571 | 0.071429 |
| 38 | 114.0 | 3.0 | 0.0 | 0.307692 | 0.938776 | 0.061224 |
| 39 | 115.0 | 2.0 | 1.0 | 0.269231 | 0.938776 | 0.061224 |
| 40 | 116.0 | 3.0 | 0.0 | 0.243590 | 0.948980 | 0.051020 |
| 41 | 117.0 | 1.0 | 0.0 | 0.205128 | 0.948980 | 0.051020 |
| 42 | 118.0 | 2.0 | 2.0 | 0.192308 | 0.948980 | 0.051020 |
| 43 | 119.0 | 0.0 | 1.0 | 0.166667 | 0.969388 | 0.030612 |
| 44 | 120.0 | 2.0 | 1.0 | 0.166667 | 0.979592 | 0.020408 |
| 45 | 121.0 | 3.0 | 0.0 | 0.141026 | 0.989796 | 0.010204 |
| 46 | 122.0 | 0.0 | 0.0 | 0.102564 | 0.989796 | 0.010204 |
| 47 | 123.0 | 3.0 | 1.0 | 0.102564 | 0.989796 | 0.010204 |
| 48 | 124.0 | 0.0 | 0.0 | 0.064103 | 1.000000 | 0.000000 |
| 49 | 125.0 | 1.0 | 0.0 | 0.064103 | 1.000000 | 0.000000 |
| 50 | 126.0 | 0.0 | 0.0 | 0.051282 | 1.000000 | 0.000000 |
| 51 | 127.0 | 0.0 | 0.0 | 0.051282 | 1.000000 | 0.000000 |
| 52 | 128.0 | 2.0 | 0.0 | 0.051282 | 1.000000 | 0.000000 |
| 53 | 129.0 | 0.0 | 0.0 | 0.025641 | 1.000000 | 0.000000 |
| 54 | 130.0 | 0.0 | 0.0 | 0.025641 | 1.000000 | 0.000000 |
| 55 | 131.0 | 0.0 | 0.0 | 0.025641 | 1.000000 | 0.000000 |
| 56 | 132.0 | 1.0 | 0.0 | 0.025641 | 1.000000 | 0.000000 |
| 57 | 133.0 | 0.0 | 0.0 | 0.012821 | 1.000000 | 0.000000 |
| 58 | 134.0 | 1.0 | 0.0 | 0.012821 | 1.000000 | 0.000000 |



```
a = ROC_curve0(disease, normal, lowest=75, width=5)
```

最小值 x = 76

最大值 x = 134

ROC 曲線下面積

c index = 0.75687

|    | Value | Disease | Normal | Sensitivity | Specificity | F. P. rate |
|----|-------|---------|--------|-------------|-------------|------------|
| 0  | 75    | 0.0     | 2.0    | 1.000000    | 0.000000    | 1.000000   |
| 1  | 80    | 0.0     | 4.0    | 1.000000    | 0.020408    | 0.979592   |
| 2  | 85    | 2.0     | 11.0   | 1.000000    | 0.061224    | 0.938776   |
| 3  | 90    | 7.0     | 20.0   | 0.974359    | 0.173469    | 0.826531   |
| 4  | 95    | 7.0     | 12.0   | 0.884615    | 0.377551    | 0.622449   |
| 5  | 100   | 9.0     | 24.0   | 0.794872    | 0.500000    | 0.500000   |
| 6  | 105   | 15.0    | 13.0   | 0.679487    | 0.744898    | 0.255102   |
| 7  | 110   | 17.0    | 6.0    | 0.487179    | 0.877551    | 0.122449   |
| 8  | 115   | 8.0     | 4.0    | 0.269231    | 0.938776    | 0.061224   |
| 9  | 120   | 8.0     | 2.0    | 0.166667    | 0.979592    | 0.020408   |
| 10 | 125   | 3.0     | 0.0    | 0.064103    | 1.000000    | 0.000000   |

|    |     |     |     |          |          |          |
|----|-----|-----|-----|----------|----------|----------|
| 11 | 130 | 2.0 | 0.0 | 0.025641 | 1.000000 | 0.000000 |
| 12 | 135 | 0.0 | 0.0 | 0.000000 | 1.000000 | 0.000000 |

