AUC-ROC curve

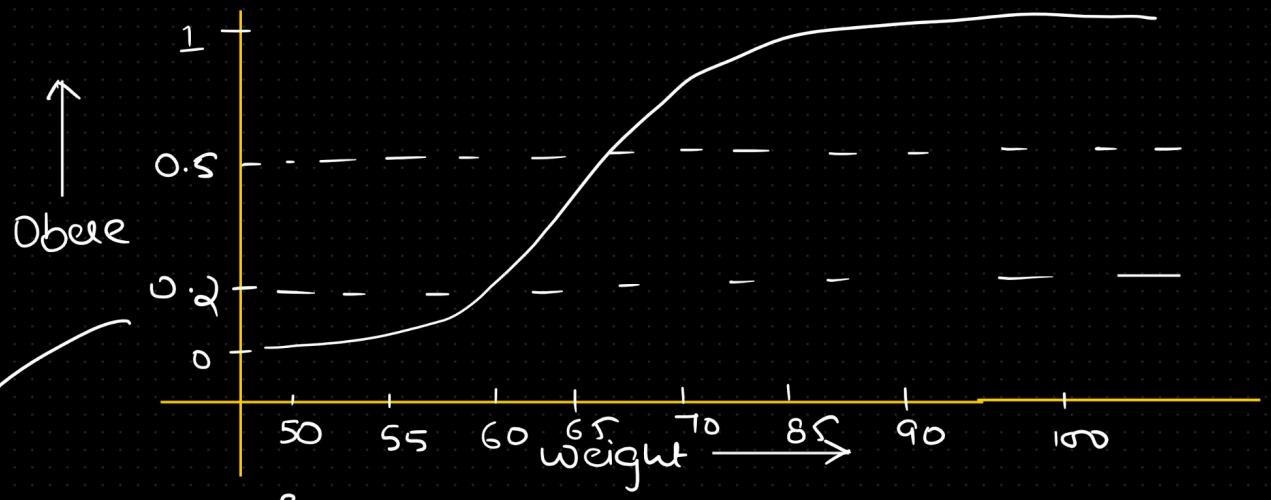
```
weights = np.array([50, 55, 60, 65, 70, 85, 90, 100]).reshape(-1, 1)
obese = np.array([0, 0, 0, 1, 0, 1, 1, 1])
```

target

classification task

return (Probabilities)

sigmoid function



correctly classify obese

Logistic Regression Model → Probabilities

< 0.2 → 0 — not obese

(0.5) (Threshold)

> 0.8 → 1 — obese

Recall → reduce FN (Healthcare)

AUC-ROC curve

Healthcare Problem

Reduce FN & Increase FP

Lower threshold

$\frac{TP}{TP+FN}$ ↑

TPR (True Positive Rate)

$\frac{FP}{FP+TN}$ → FPR (False Positive Rate)

Confusion Matrix

(Predicted) \ (Actual)	0	1
0	TN	FN
1	FP	TP

$$TPR = \frac{TP}{TP + FN}$$

$$FPR = \frac{FP}{FP + TN}$$

thresholds = [0.2, 0.4, 0.5, 0.6]

Predicted

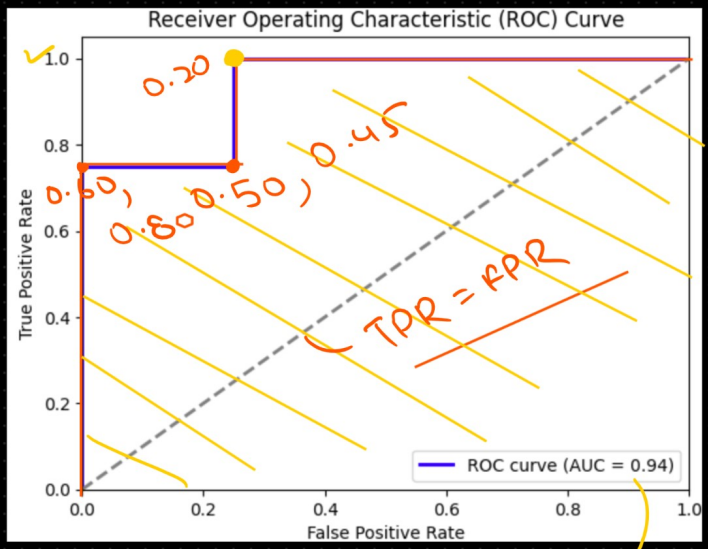
Actual \ Predicted	0	1
0	3 (TN)	1 (FP)
1	0 (FN)	4 (TP)

Threshold: 0.20
Confusion Matrix:
[[3 1]
 [0 4]]
True Positives (TP): 4
False Positives (FP): 1
True Negatives (TN): 3
False Negatives (FN): 0
True Positive Rate (TPR): 1.00
False Positive Rate (FPR): 0.25

$< 0.20 \rightarrow 0$

$\geq 0.20 \rightarrow 1$

Threshold: 0.40
Confusion Matrix:
[[3 1]
 [1 3]]
True Positives (TP): 3
False Positives (FP): 1
True Negatives (TN): 3
False Negatives (FN): 1
True Positive Rate (TPR): 0.75
False Positive Rate (FPR): 0.25



AUC = 0.94

Threshold: 0.50
Confusion Matrix:
[[3 1]
 [1 3]]
True Positives (TP): 3
False Positives (FP): 1
True Negatives (TN): 3
False Negatives (FN): 1
True Positive Rate (TPR): 0.75
False Positive Rate (FPR): 0.25

Higher AUC ↑

↳ Better model

Threshold: 0.60
Confusion Matrix:
[[4 0]
 [1 3]]
True Positives (TP): 3
False Positives (FP): 0
True Negatives (TN): 4
False Negatives (FN): 1
True Positive Rate (TPR): 0.75
False Positive Rate (FPR): 0.00

Decrease threshold

Threshold: 0.80
Confusion Matrix:
[[4 0]
 [1 3]]
True Positives (TP): 3
False Positives (FP): 0
True Negatives (TN): 4
False Negatives (FN): 1
True Positive Rate (TPR): 0.75
False Positive Rate (FPR): 0.00