

# < Receiver Operating Characteristic (ROC) >

→ graph of TPR + FPR at all classification thresholds,

$$\text{True Positive Rate} = \frac{TP}{TP + FN} = \text{Recall}$$

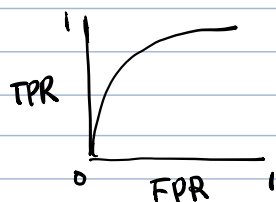
→ How many (%) true positives were captured among actual positives

$$\text{False Positive Rate} = \frac{FP}{FP + TN} \neq \text{Precision}$$

→ Among all negatives, how many were falsely categorized as positive,

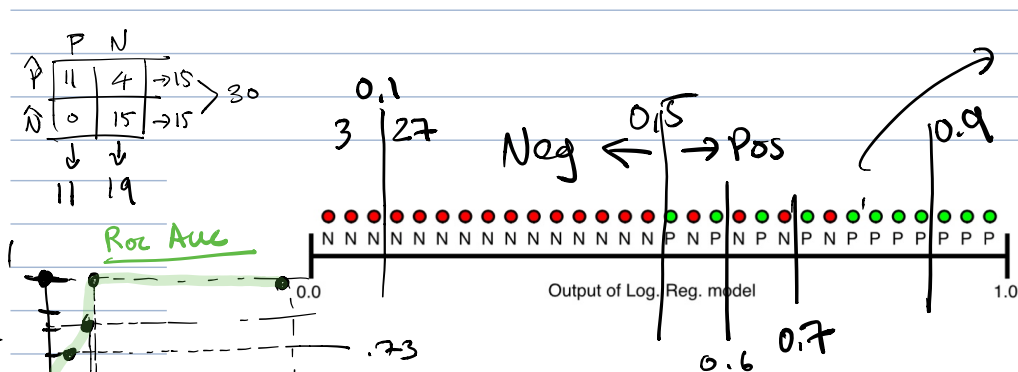
\* Confusion Matrix

		Actual	
		P	N
Predicted	$\hat{P}$	TP	FP
	$\hat{N}$	FN	TN
		↓ TPR	↓ FPR

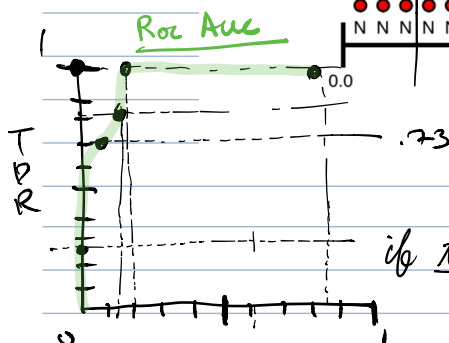


$$\text{Precision} = \frac{TP}{TP + FP}$$

	P	N	
$\hat{P}$	11	4	→ 15
$\hat{N}$	0	15	→ 15
	↓	↓	
	11	19	



$N = 30$   
 $P = 11, N = 19$

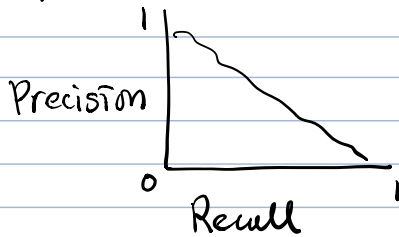


if threshold	TP	FP	FN	TN	TPR	FPR
0.5	11	15 - 11 = 4	0	15	$\frac{11}{11+0} = 1$	$\frac{4}{4+15} = 0.21$
0.1	11	27 - 11 = 16	0	3	$\frac{11}{11+0} = 1$	$\frac{16}{16+3} = 0.84$
0.9	3	0	13 = 8	19	$\frac{3}{3+8} = .27$	$\frac{0}{0+19} = 0$
0.6	9	3	2	16	$\frac{9}{9+2} = .81$	$\frac{3}{3+16} = 0.15$
0.7	8	1	3	18	$\frac{8}{8+3} = .73$	$\frac{1}{1+18} = .05$

score = 0.95

# < Precision-Recall AUC >

→ plot of precision + recall



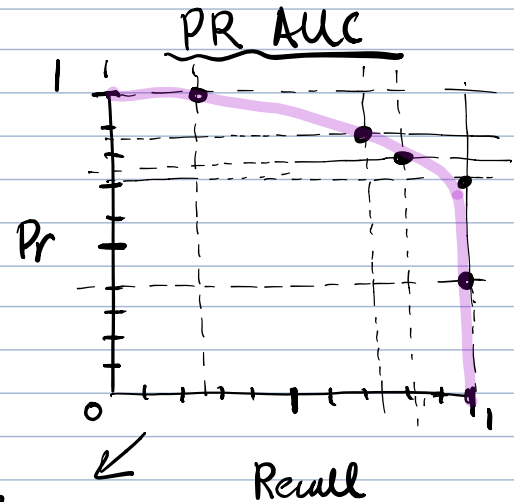
$$\rightarrow \text{Precision} = \frac{TP}{TP + FP}$$

$$\rightarrow \text{Recall} = \frac{TP}{TP + FN}$$

→ extra focus on true positives

	P	N	
$\hat{P}$	TP	FP	Precision
$\hat{N}$	FN	TN	Recall

threshold	TP	FP	FN	TN	Recall TPR	<del>FPR</del>	Precision
0.5	11	15-11=4	0	15	$\frac{11}{11+0} = 1$	<del><math>\frac{4}{4+15} = 0.21</math></del>	$\frac{1}{1+4} = .73$
0.1	11	27-11=16	0	3	$\frac{11}{11+0} = 1$	<del><math>\frac{16}{16+3} = 0.84</math></del>	$\frac{1}{1+16} = .4$
0.9	3	0	13=8	19	$\frac{3}{3+8} = .27$	<del><math>\frac{0}{0+19} = 0</math></del>	$\frac{3}{3+0} = 1$
0.6	9	3	2	16	$\frac{9}{9+2} = .81$	<del><math>\frac{3}{3+16} = 0.15</math></del>	$\frac{9}{9+3} = .75$
0.7	8	1	3	18	$\frac{8}{8+3} = .73$	<del><math>\frac{1}{1+18} = .05</math></del>	$\frac{8}{8+1} = .88$



score  
= 0.92