Classification Metrics

Confusion Matrix

$$precision = \frac{TP}{TP + FP}$$

$$recall/sensitivity/TPR = \frac{TP}{TP + FN} = \frac{TP}{P}$$

		Predicted condition	
	Total population = P + N	Predicted Positive (PP)	Predicted Negative (PN)
Actual condition	Positive (P)	True positive (TP), hit	False negative (FN), type II error, miss, underestimation
	Negative (N)	False positive (FP), type I error, false alarm, overestimation	True negative (TN), correct rejection

https://en.wikipedia.org/wiki/Sensitivity_and_specificity

Problem 1. Given the following predictions and threshold $th = 700$ draw the confusion matrix and calculate precision and recall

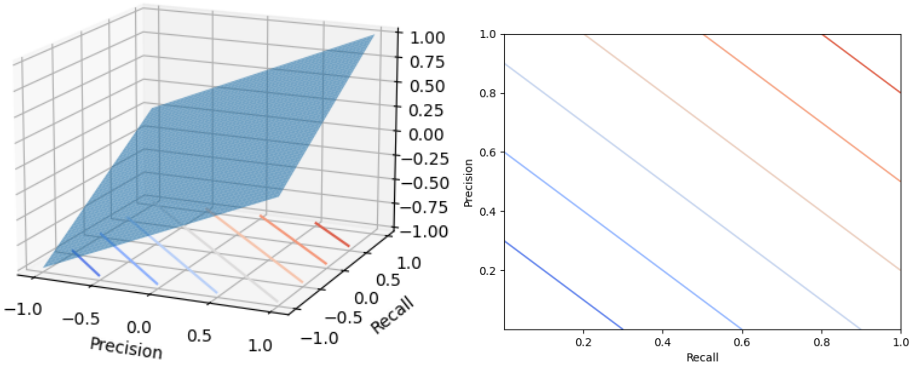
$a(x) = \langle w, x \rangle$	y	$\hat{y}$
1000	1	1
900	−1	1
800	1	1
700	1	−1
300	−1	−1
100	−1	−1
1	−1	−1
−10	1	−1
−200	−1	−1
−500	−1	−1

Problem 2. Given the following predictions and threshold $th = -200$ draw the confusion matrix and calculate precision and recall

$a(x) = \langle w, x \rangle$	y	$\hat{y}$
1000	1	1
900	−1	1
800	1	1
700	1	1
300	−1	1
100	−1	1
1	−1	1
−10	1	1
−200	−1	−1
−500	−1	−1

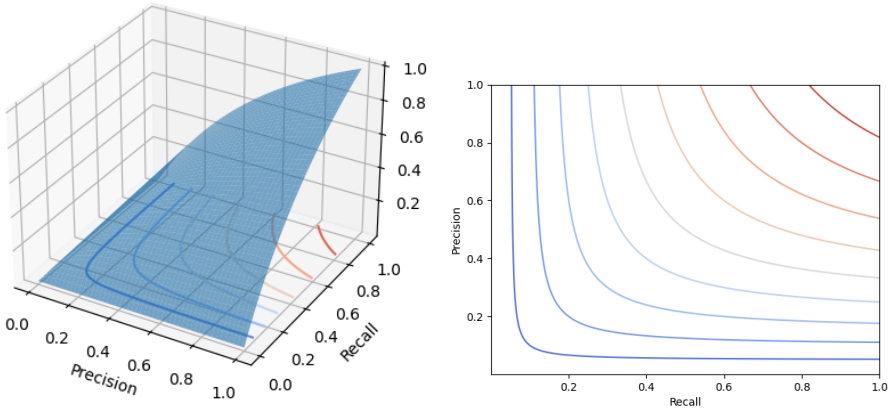
Problem 3. We can get better precision or recall by choosing the threshold. What if we want to combine them and maximize them together? Consider mean and harmonic mean. The surfaces and level curves are below. Why using mean is not a good idea?

$$\frac{1}{2}(Precision + Recall)$$



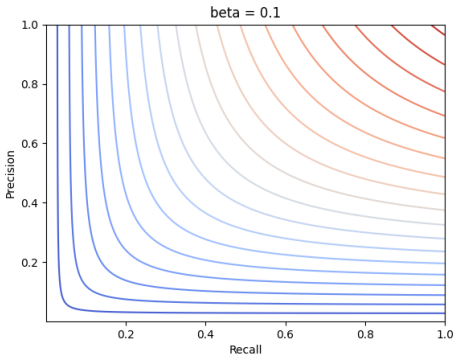
F-score

$$\frac{2(Precision \times Recall)}{Precision + Recall}$$



F_β-score. Small β optimises more Precision and larger β emphasises Recall. Recall is considered β times more important than Precision.

$$F_\beta = (1 + \beta)\frac{Precision \times Recall}{\beta(Precision + Recall)}$$



Problem 4. Calculate F_1-score for Problem 1 and Problem 2.