

Evaluation of Classifiers

Dr François Pitié

Problem 1.

Consider a binary classifier with the following confusion matrix:

	actual: 0	actual: 1
predicted: 0	TN=16	FN=4
predicted: 1	FP=10	TP=70

Compute the accuracy and comment on the performance of the classifier.

answer:

The accuracy is 86%.

For this kind of questions, you are first expected to compute a few metrics (such as accuracy, recall, false positive rate, etc.).

First, we see that we don't have that many samples: only 100! Second, let's check the balance of the dataset:

$$(\text{no of positives}) : P = TP + FN = 74\%$$

$$(\text{no of negatives}) : N = TN + FP = 26\%$$

There is clearly a data imbalance and a non-informative classifier can achieve 74% accuracy.

$$\text{Recall} = \frac{TP}{P} = \frac{70}{74} = 94.59\%$$

$$\text{Precision} = \frac{TP}{TP + FP} = \frac{70}{80} = 87.50\%$$

$$\text{FP rate} = \frac{FP}{N} = \frac{10}{26} = 38.46\%$$

38.46% is pretty high, showing a potential problem.

Problem 2.

Consider a multiclass classifier which produce the following results

$y_{\text{true}} = [0, 0, 1, 2, 2, 2, 1, 1, 0]$

$y_{\text{pred}} = [1, 0, 1, 2, 1, 0, 1, 2, 0]$

compute the confusion matrix, the accuracy, the micro precision and the macro precision.

answer:

	actual: 0	actual: 1	actual: 2
predicted: 0	2	0	1
predicted: 1	1	2	1
predicted: 2	0	1	1

$$\text{Accuracy} = \frac{2 + 2 + 1}{9} = 55.56\%$$

$$TP_0 = 2, TP_1 = 2, TP_2 = 1,$$

$$FP_0 = 1, FP_1 = 2, FP_2 = 1$$

$$\text{micro Precision} = \frac{TP_0 + TP_1 + TP_2}{TP_0 + TP_1 + TP_2 + FP_0 + FP_1 + FP_2} \quad (1)$$

$$= \frac{2 + 2 + 1}{2 + 2 + 1 + 1 + 2 + 1} = 55.56\% \quad (2)$$

$$\text{macro Precision} = \frac{1}{3} \left(\frac{TP_0}{TP_0 + FP_0} + \frac{TP_1}{TP_1 + FP_1} + \frac{TP_2}{TP_2 + FP_2} \right) \quad (3)$$

$$= \frac{1}{3} \left(\frac{2}{2+1} + \frac{2}{2+2} + \frac{1}{1+1} \right) = 55.56\% \quad (4)$$

so, it just turns out that they are all the same in this example.