Evaluating Multiclass Classification

Lecture 3, Aug 26, 2019

Exercise 1

Compute evaluation measures for a multiclass classification problem, given the following classification results ($k = 4$ classes in total).

Doc	Actual	Pred.
1	1	1
2	1	1
3	2	1
4	2	2
5	2	3
6	3	2
7	3	3
8	3	1
9	3	3
10	4	4
11	4	2
12	4	3

Table 1: Multiclass classification results.

Step 1: Complete the confusion matrix

		Predicted			
		1	2	3	4
Actual class	1	1			
	2				
	3				
	4				

Table 2: Confusion matrix.

Step 2: Create binary confusion matrices

Create and fill out the following confusion matrix for each class i ($i \in [1..k]$).

		Pred.	
		i	$\neg i$
Act.	i	TP_i	FN_i
	$\neg i$	FP_i	TN_i

Step 3: Compute measures

It might be helpful to first copy the TP, FN, FP, TN values from the other side of the page, so as to avoid flipping back-and-forth.

Class	TP_i	FN_i	FP_i	TN_i
1				
2				
3				
4				

Compute the final evaluation metrics (the formulas are provided for your convenience)

Measure	**Formula**	**Result**
Micro-averages (μ)		
Accuracy_μ	$\frac{\sum_{i=1}^{k}(TP_i+TN_i)}{\sum_{i=1}^{k}(TP_i+TN_i+FP_i+FN_i)}$	
Precision_μ	$\frac{\sum_{i=1}^{k} TP_i}{\sum_{i=1}^{k}(TP_i+FP_i)}$	
Recall_μ	$\frac{\sum_{i=1}^{k} TP_i}{\sum_{i=1}^{k}(TP_i+FN_i)}$	
F1-score_μ	$\frac{2 \cdot P_\mu \cdot R_\mu}{P_\mu + R_\mu}$	
Macro-averages (M)		
Accuracy_M	$\frac{\sum_{i=1}^{k} \frac{TP_i+TN_i}{TP_i+TN_i+FP_i+FN_i}}{k}$	
Precision_M	$\frac{\sum_{i=1}^{k} \frac{TP_i}{TP_i+FP_i}}{k}$	
Recall_M	$\frac{\sum_{i=1}^{k} \frac{TP_i}{TP_i+FN_i}}{k}$	
F1-score_M	$\frac{2 \cdot P_M \cdot R_M}{P_M + R_M}$	