**Micro-, Macro-, and Weighted-averaged Metrics**

Table shows the (actual) class label alongside the (predicted) response values of five classifiers A-E.

|  |  |  |  |
| --- | --- | --- | --- |
| Instance | **(actual) class label** | Classifier G | Classifier H |
| 1 | **cat** | cat | cat |
| 2 | **cat** | cat | dog |
| 3 | **cat** | cat | fish |
| 4 | **cat** | dog | cat |
| 5 | **dog** | dog | dog |
| 6 | **dog** | dog | fish |
| 7 | **dog** | fish | cat |
| 8 | **fish** | fish | dog |
| 9 | **fish** | fish | fish |
| 10 | **fish** | dog | dog |

**(Q1)** Fill in each blank with the corresponding frequency value for each category for Classifier G. Also, write down the row sum or column sum in the last column and the last row, respectively.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Classifier G  Predicted class (returned) | | |  |
|  |  | cat | dog | fish |  |
| True class  (known) | **cat** | 3 | 1 | 0 | 4 |
| **dog** | 0 | 2 | 1 | 3 |
| **fish** | 0 | 1 | 2 | 3 |
|  |  | 3 | 4 | 3 | 10 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | #instances | TP | FP | FN | TN |
| cat | 4 | 3 | 0 | 1 | ? |
| dog | 3 | 2 | 2 | 1 | ? |
| fish | 3 | 2 | 1 | 1 | ? |
| total | 10 | 7 | 3 | 3 | ? |

**(Q2)** Detailed steps for individual metric

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Accuracy  =(TP+TN)/(TP+FP+FN+TN) | Precision  =TP/(TP+FP) | Recall  =TP/(TP+FN) | F1-score  =2PR/(P+R) |
| Cat | n/a | =3/(3+0)=1.0 | =3/(3+1)=0.75 | =2\*1.0\*0.75/(1.0+0.75)=0.86 |
| Dog | n/a | =2/(2+2)=0.5 | =2/(2+1)=0.67 | =2\*0.5\*0.67/(0.5+0.67)=0.57 |
| Fish | n/a | =2/(2+1)=0.67 | =2/(2+1)=0.67 | =2\*0.67\*0.67/(0.67+0.67)=0.67 |

**(Q3)** Detailed steps for micro-averaged metric

|  |  |  |
| --- | --- | --- |
| Micro-averaged Precision  =+) | Micro-averaged Recall  =+) | Micro-averaged F1-score  =2PR/(P+R) |
| =(3+2+2)/((3+2+2)+(0+2+1))  =7/10  =0.7 | =(3+2+2)/((3+2+2)+(1+1+1))  =7/10  =0.7 | =2\*0.7\*0.7/(07+0.7)  =0.7 |

**(Q4)** Detailed steps for macro-averaged metric (NOTE: *C*=#classes)

|  |  |  |
| --- | --- | --- |
| Macro-averaged Precision  = | Macro-averaged Recall  = | Macro-averaged F1-score |
| =(1.0+0.5+0.67) / 3  =0.72 | =(0.75+0.67+0.67)/3  =0.696 | =(0.86+0.57+0.67)/3  =0.7 |

**(Q5)** Detailed steps for weighed-averaged metric(NOTE: *C*=#classes, =#instances in class c, and n=)

|  |  |  |
| --- | --- | --- |
| Macro-averaged Precision  = | Macro-averaged Recall  = | Macro-averaged F1-score  = |
| =((1.0\*4)+(0.5\*3)+(0.67\*3)) / 10  =0.751 | =((0.75\*4)+(0.67\*3)+(0.67\*3))/10  =0.702 | =((0.86\*4)+(0.57\*3)+(0.67\*3))/10  =0.716 |

**(Q6)** Fill in each blank with the corresponding frequency value for each category for Classifier H. Also, write down the row sum or column sum in the last column and the last row, respectively.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  | Classifier H  Predicted class (returned) | | |  |
|  |  | cat | dog | fish |  |
| True class  (known) | **cat** | 2 | 1 | 1 | 4 |
| **dog** | 1 | 1 | 1 | 3 |
| **fish** | 0 | 2 | 1 | 3 |
|  |  | 3 | 4 | 3 | 10 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | #instances | TP | FP | FN | TN |
| cat | 4 | 2 | 1 | 2 | ? |
| dog | 3 | 1 | 3 | 2 | ? |
| fish | 3 | 1 | 2 | 2 | ? |
| total | 10 | 4 | 5 | 6 | ? |

**(Q7)** Detailed steps for individual metric

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Accuracy  =(TP+TN)/(TP+FP+FN+TN) | Precision  =TP/(TP+FP) | Recall  =TP/(TP+FN) | F1-score  =2PR/(P+R) |
| Cat | n/a | =2/(2+1)=0.67 | =2/(2+2)=0.5 | =2\*.67\*.5/(.67+.5)=0.57 |
| Dog | n/a | =1/(1+3)=0.25 | =1/(1+2)=0.33 | =2\*.25\*.33/(.25+.33)=0.29 |
| Fish | n/a | =1/(1+2)=0.33 | =1/(1+2)=0.33 | =2\*.33\*.33/(.33+.33)=0.33 |

**(Q8)** Detailed steps for micro-averaged metric

|  |  |  |
| --- | --- | --- |
| Micro-averaged Precision  =+) | Micro-averaged Recall  =+) | Micro-averaged F1-score  =2PR/(P+R) |
| =(2+1+1)/((2+1+1)+(1+3+2))  =4/10  =0.4 | =(2+1+1)/((2+1+1)+(2+2+2))  =4/10  =0.4 | =2\*.4\*.4/(.4+.4)  =.32/.8  =0.4 |

**(Q9)** Detailed steps for macro-averaged metric (NOTE: *C*=#classes)

|  |  |  |
| --- | --- | --- |
| Macro-averaged Precision  = | Macro-averaged Recall  = | Macro-averaged F1-score |
| =(.67+.25+.33)/3  =0.42 | =(.5+.33+.33)/3  =0.39 | =(.57+.29+.33)/3  =0.4 |

**(Q10)** Detailed steps for weighed-averaged metric(NOTE: *C*=#classes, =#instances in class c, and n=)

|  |  |  |
| --- | --- | --- |
| Macro-averaged Precision  = | Macro-averaged Recall  = | Macro-averaged F1-score  = |
| =((.67\*4)+(.25\*3)+(.33\*3)) / 10  =0.44 | =((.5\*4)+(.33\*3)+(.33\*3))/10  =0.4 | =((.57\*4)+(.29\*3)+(.33\*3))/10  =0.41 |