

Classification Report - SVM_kernel Classifier

(Questions & Answers)

Q1. What is the precision for class 0, and what does it mean?

A1. The precision for class 0 is **0.76**, meaning that out of all the samples predicted as class 0, 76% were actually class 0. It reflects how many of the positive predictions for class 0 were correct.

Q2. What is the recall for class 0, and what does it indicate?

A2. The recall for class 0 is **0.96**, indicating that 96% of all actual class 0 instances were correctly identified. The model is highly effective in capturing class 0 examples.

Q3. What is the F1-score for class 0, and why is it useful?

A3. The F1-score for class 0 is **0.85**, which balances precision and recall. It's particularly helpful when there's an uneven class distribution.

Q4. What does the precision of class 1 suggest about the model's predictions?

A4. The precision for class 1 is **0.88**, meaning the model is quite accurate when it predicts class 1, with relatively few false positives.

Q5. Why is the recall for class 1 significantly lower than for class 0?

A5. The recall for class 1 is **0.47**, indicating that the model only correctly identifies 47% of actual class 1 cases. This suggests it misses more than half of the class 1 instances — a high false negative rate.

Q6. What is the F1-score for class 1, and what does it tell us?

A6. The F1-score for class 1 is **0.61**, which is much lower than class 0's. It reflects the trade-off between good precision (0.88) and poor recall (0.47), signaling imbalance in performance across classes.

Q7. What is the overall accuracy of the model?

A7. The model's accuracy is **0.78**, meaning it correctly classified 78% of the total 134 samples.

Q8. What does the macro average tell us in this case?

A8. The **macro average** for precision, recall, and F1-score is **0.82**, **0.72**, and **0.73**, respectively. Since it treats both classes equally, it highlights the disparity in recall and F1 between the two classes.

Q9. How does the weighted average differ from macro average in interpretation?

A9. The **weighted average** (precision: 0.81, recall: 0.78, F1: 0.76) accounts for the number of samples in each class. Because class 0 has more samples, its higher recall skews the overall metrics upwards compared to the macro average.

Accuracy

- **Q10. In what type of datasets can accuracy be misleading, and why?**

A10. Accuracy can be misleading in imbalanced datasets because it may reflect the majority class performance while ignoring poor detection of minority classes.

- **Q11. How would you explain accuracy to a non-technical stakeholder using a real-world analogy?**

A11. Accuracy is like a student answering a test: if they got 78 out of 100 questions right, their accuracy is 78%. It shows overall correctness but not what kinds of questions they struggled with.

Precision

- **Q12. Why might a high precision be preferred in spam email detection?**
A12. Because you want to minimize false positives (e.g., marking important emails as spam). High precision ensures that most predicted spam messages are actually spam.
- **Q13. If a model has low precision, what does it indicate about the false positives?**
A13. It suggests the model is frequently predicting the positive class incorrectly — it has a high number of false positives.

Recall

- **Q14. Why is high recall crucial in disease detection models?**
A14. Because missing a positive case (false negative) can be dangerous. High recall ensures most actual disease cases are correctly identified.
- **Q15. What does a recall of 0.47 for class 1 imply about the model's sensitivity?**
A15. It implies the model only identifies 47% of actual class 1 instances — it's not very sensitive to this class.

F1-Score

- **Q16. When should you rely on the F1-score instead of accuracy?**
A16. When the dataset is imbalanced or when both false positives and false negatives carry significant cost. F1 balances precision and recall into one metric.
- **Q17. What does a low F1-score indicate even if precision or recall is high?**
A17. It suggests there's an imbalance between precision and recall. If one is much lower than the other, the F1-score reflects the weaker link.

Q18. what macro averaging means in the context of classification metrics?

A18. Macro averaging calculates the metric independently for each class and then takes the average. It treats all classes equally, regardless of how many samples each class has. This is useful for evaluating performance on imbalanced datasets, as it doesn't allow the majority class to dominate the score.

Q19. Your model has high accuracy, but a low macro average F1-score. What could this indicate?

A19. It suggests that while the model performs well overall, it might be biased toward the majority class. The low macro average F1-score means it's likely performing poorly on one or more of the minority classes, even though the accuracy looks good.

Q20. How does weighted averaging differ from macro averaging when evaluating classification metrics?

A20. Weighted average also computes metrics per class, but instead of treating each class equally, it weights them by the number of instances in each class. So, metrics from more frequent classes have more influence on the final score. This gives a more realistic sense of overall model performance, especially in imbalanced datasets.

Q21. In a classification report, when would you prefer to look at the weighted average instead of the macro average?

A21. When you're interested in understanding the overall effectiveness of the model across the entire dataset, especially when class imbalance exists. Weighted average reflects the real distribution of predictions, so it gives a better idea of overall performance.

Q22. If the weighted F1-score is high but the macro F1-score is low, what does that suggest about your model's behavior?

A22. That the model performs well on the majority class but poorly on one or more minority classes. The weighted average is pulled up by the good performance on the larger class, while the macro average reveals the disparity in performance across classes.