Precision and Recall Analysis for Loan Risk Assessment

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1 Introduction

In this section, we analyze the performance of the perceptron and Naive Bayes models for classifying loan risk by computing precision and recall metrics. Given the previous classifications, we provide a detailed step-by-step calculation in LaTeX to ensure rigor and clarity.

2 Definitions and Metrics

Precision and recall are defined as:

$$\text{Precision} = \frac{TP}{TP + FP}, \tag{1}$$

$$\text{Recall} = \frac{TP}{TP + FN}. \tag{2}$$

where:

- TP (True Positives) are correctly classified High-Risk cases,
- FP (False Positives) are incorrectly classified Low-Risk cases,
- FN (False Negatives) are incorrectly classified High-Risk cases.

3 Computing Precision and Recall

Given the results from the perceptron and Naive Bayes models, we determine the confusion matrices.

3.1 Perceptron Model

Assume the perceptron predicted:

- $TP = 3$, $FP = 1$, $FN = 2$.

Using Eq. (1) and (2):

$$\text{Precision}_{\text{Perceptron}} = \frac{3}{3+1} = 0.75, \tag{3}$$

$$\text{Recall}_{\text{Perceptron}} = \frac{3}{3+2} = 0.6. \tag{4}$$

3.2 Naive Bayes Model

Assume Naive Bayes predicted:

- $TP = 4$, $FP = 2$, $FN = 1$.

Using Eq. (1) and (2):

$$\text{Precision}_{\text{Naive Bayes}} = \frac{4}{4+2} = 0.67, \tag{5}$$

$$\text{Recall}_{\text{Naive Bayes}} = \frac{4}{4+1} = 0.8. \tag{6}$$

4 Importance of Precision vs. Recall in Loan Risk Assessment

For loan risk assessment, recall is more crucial than precision because failing to detect a high-risk borrower (false negative) can lead to significant financial loss. A high recall ensures that most risky borrowers are flagged, minimizing defaults and improving risk management.

5 Conclusion

While precision is important for minimizing false alarms (incorrectly rejecting safe borrowers), recall takes precedence in ensuring financial security. Therefore, models with high recall should be prioritized in loan risk assessments.