Artificial Intelligence

Machine learning

Performance metrics

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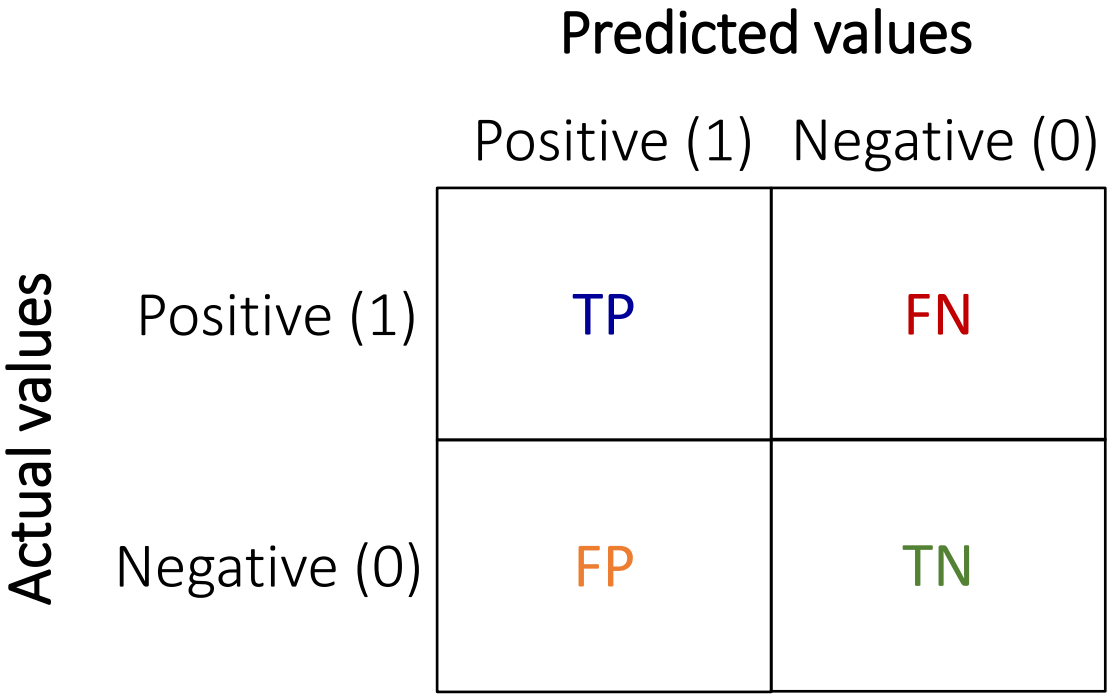
Classification problems performance metrics

Confusion matrix

- A confusion matrix is a tool used to evaluate the performance of a model and is visually represented as a table
- It displays the number of:
  - True positives: number of times the model correctly predicts the positive class
  - True negatives: number of times the model correctly predicts the negative class
  - False positives: number of times the model incorrectly predicts the positive class
  - False negatives: number of times the model incorrectly predicts the negative class

Confusion matrix



TP – True positives

TN – True negatives

FP – False positives

FN – False negatives

Accuracy

- Accuracy - fraction of correctly classified samples:

$$Acc = \frac{TP + TN}{TP + TN + FP + FN}$$

- Alternative view:

$$Acc = \frac{Number\ of correctly\ classified\ samples}{Total\ number\ of\ samples}$$

- It should be used for balanced datasets only

Precision

- Precision - proportion of positive class predictions that actually belong to that class

$$P = \frac{TP}{TP + FP}$$

- Alternative view:

$$P = \frac{Number\ of\ times\ the\ model\ correctly\ classifies\ a\ sample\ as\ positive}{Number\ of\ samples\ the\ model\ classifies\ as\ positive}$$

Recall

- Recall - proportion of positive predictions for a given class out of all actual instances of that class:

$$R = \frac{TP}{TP + FN}$$

- Alternative view:

$$R = \frac{Number\ of\ times\ the\ model\ correctly\ classifies\ a\ sample\ as\ positive}{Number\ of\ actual\ positive\ samples}$$

- It is also known as sensitivity or true positive rate (TPR)

Specificity

- Specificity - proportion of correct negative predictions out of actual non-instances of a given class:

$$S = \frac{TN}{TN + FP}$$

- Alternative view:

$$S = \frac{Number\ of\ times\ the\ model\ correctly\ classifies\ a\ sample\ as\ negative}{Number\ of\ actual\ negative\ samples}$$

- It is also known as true negative rate (TNR)

F1 score

- F1 score - harmonic mean of precision and recall; it combines precision and recall to represent a model's total class-wise accuracy:

$$F1\ score = \frac{2 * Precision\ * Recall}{Precision + Recall}$$

- It is also known as F-measure or F-score

F1 score

- Precision and recall can share an inverse relationship at times
- That is, as a model increases recall by returning more actual class samples (i.e. true positives), the model will inevitably misclassify non-samples (i.e. false positives) as well, thereby decreasing precision
- The F1 score attempts to combine precision and recall to resolve this tradeoff

References

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- https://www.evidentlyai.com/classification-metrics/accuracy-precision-recall