F-score

The F-score, or F1-score, is a metric used in classification problems to evaluate the performance of a model. It is especially useful when dealing with imbalanced datasets, where one class is much more frequent than the other.

What is the F1-score?

The F1-score is the harmonic mean of **precision** and **recall**. It combines both metrics into a single number to provide a balanced measure, especially when the distribution between classes (like diabetic and non-diabetic patients) is uneven.

- **Precision**: The proportion of true positive predictions (correct positive predictions) out of all positive predictions made by the model. It answers the question: *Of all the patients the model predicted as diabetic, how many actually were?*

$$\text{Precision} = \frac{\text{True Positives}}{\text{True Positives} + \text{False Positives}}$$

- **Recall** (or Sensitivity): The proportion of true positive predictions out of all actual positive cases. It answers the question: *Of all the actual diabetic patients, how many did the model correctly identify?*

$$\text{Recall} = \frac{\text{True Positives}}{\text{True Positives} + \text{False Negatives}}$$

The F1-score balances both precision and recall, providing a single score that considers both. This is particularly useful when you want to minimize both false positives and false negatives.

$$\text{F1-score} = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

Why is the F1-score important?

In medical predictions like diabetes detection, you care about both false negatives (missing a diabetic patient) and false positives (wrongly predicting a healthy person as diabetic). The F1-score gives you a way to balance between precision and recall, depending on the problem's requirements.

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- If **precision** is too low, you'll wrongly label many non-diabetic people as diabetic.
- If **recall** is too low, you might miss a lot of diabetic cases.

When to use F1-score?

The F1-score is particularly important when:

- **Class distribution is imbalanced**: For example, if there are many more non-diabetic patients than diabetic ones in your dataset.
- **Both false positives and false negatives are costly**: In health care, for example, diagnosing a non-diabetic person as diabetic (false positive) or missing a real diabetic person (false negative) both carry serious consequences.

The F1-score provides a comprehensive way to assess your model's quality, especially in critical scenarios like medical diagnoses.