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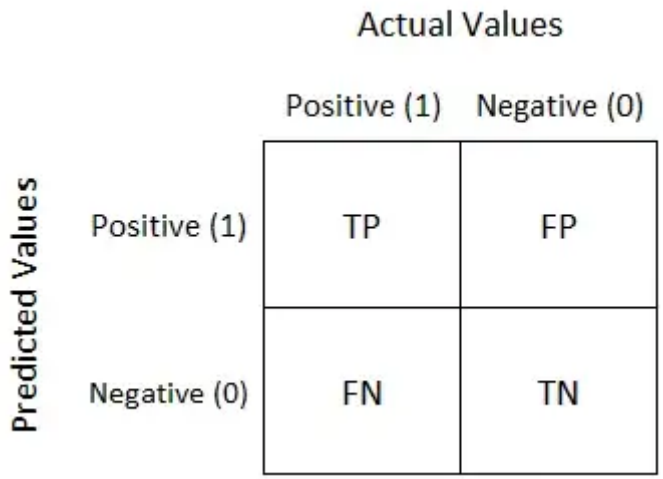
Confusion Matric(TPR,FPR,FNR,TNR), Precision, Recall, F1-Score

Cofusion matrix is used to measure the performance of the classification model. Checking our model performance by accuracy sometimes it's misleading when we have imbalanced data. You can read more about accuracy here.

So **what is a Confusion matrix?**

It is performance matrics to measure classification models where output is binary or multiclass. It has a table of 4 different combinations.



There are two things to noticed in the above image

- Predicted values- Values that are predicted by the model.
- Actual Value- Values that are actually in a dataset.

Here, we are taking binary classification for understanding the model. Positive points belong to a positive class and Negative points to negative class. So it can be understood by these 4 points.

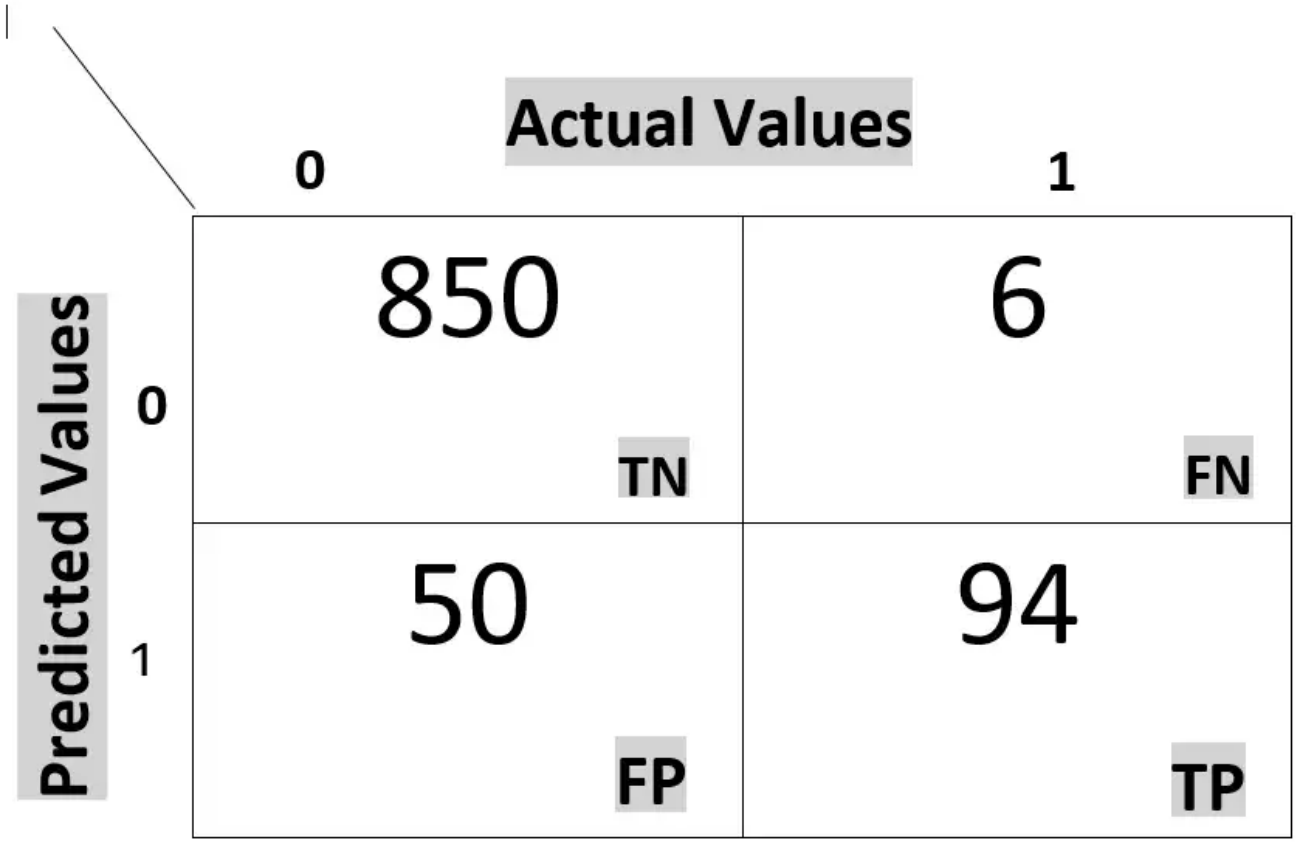
1. **True Positive(TP):** Values that are actually *positive* and predicted *positive*.
2. **False Positive(FP):** Values that are actually *negative* but predicted to *positive*.
3. **False Negative(FN):** Values that are actually *positive* but predicted to *negative.*
4. **True Negative (TN):** Values that are actually *negative* and predicted to *negative.*

Rate is a measure factor in a confusion matrix. It has also 4 type TPR, FPR, TNR, FNR

> True Positive Rate(TPR): True Positive/positive
>
> False Positive Rate(FPR): False Positive /Negative
>
> False Negative Rate(FNR): False Negative/Positive
>
> True Negative Rate(TNR): True Negative/Negative

For better performance, ***TPR, TNR*** should be high *and* ***FNR, FPR*** should be low.

Suppose we have 100 n points and our model's confusion matric look like this.



Now,

$$TPR = TP/P = 94/100 = 94\%$$

$$TNR = TN/N = 850/900 = 94.4\%$$

$$FPR = FP/N = 50/900 = 5.5\%$$

$$FNR = FN/p = 6/100 = 6\%$$

Here, TPR, TNR is high and FPR, FNR is low. So our model is not in underfit or overfit.

Precision

It is used in information retrieval, pattern recognition. *Precision is all the points that are declared to be positive but what percentage of them are actually positive.*

$$Precision = True\ Positive/Predicted\ Positive$$

Recall

It is all the points that are actually positive but what percentage declared positive.

$$Recall = True\ Positive/\ Actual\ Positive$$

F1-Score

It is used to measure test accuracy. It is a weighted average of the precision and recall. When F1 score is 1 it's best and on 0 it's worst.

$$F1 = 2 * (precision * recall) / (precision + recall)$$

- Precision and Recall should always be high.

References:

sklearn.metrics.f1_score - scikit-learn 0.22.1 documentation

scikit-learn: machine learning in Python

scikit-learn.org

https://en.wikipedia.org/wiki/Precision_and_recall

Confusion matrix

In the field of machine learning and specifically the problem of statistical classification, a confusion matrix, also...

en.wikipedia.org