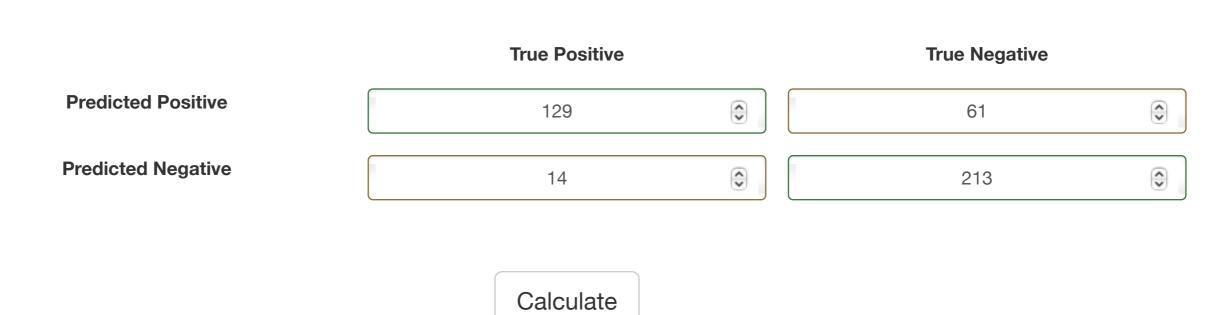
Matthews Correlation Coefficient

Confusion Matrix

Online Calculator



Measure	Value	Derivations
Sensitivity	0.9021	TPR = TP / (TP + FN)
Specificity	0.7774	SPC = TN / (FP + TN)
Precision	0.6789	PPV = TP / (TP + FP)
Negative Predictive Value	0.9383	NPV = TN / (TN + FN)
False Positive Rate	0.2226	FPR = FP / (FP + TN)
False Discovery Rate	0.3211	FDR = FP / (FP + TP)
False Negative Rate	0.0979	FNR = FN / (FN + TP)
Accuracy	0.8201	ACC = (TP + TN) / (P + N)
F1 Score	0.7748	F1 = 2TP / (2TP + FP + FN)

0.6476

TP*TN - FP*FN / sqrt((TP+FP)*(TP+FN)*(TN+FP)*(TN+FN))

About

A **Confusion Matrix** is a popular representation of the performance of classification models. The matrix (table) shows us the number of correctly and incorrectly classified examples, compared to the actual outcomes (target value) in the test data. One of the advantages of using confusion matrix as **evaluation tool** is that it allows more **detailed analysis** (such as if the model is confusing two classes), than simple proportion of correctly classified examples (accuracy) which can give misleading results if the dataset is unbalanced (i.e. when there are huge differences in number of between difference classes).

The matrix is n by n, where n is the number of classes. The simplest classifiers, called **binary classifiers**, has only two classes: positive/negative, yes/no, male/female... Performance of a binary classifier is summarized in a confusion matrix that cross-tabulates predicted and observed examples into four options:

- True Positive (TP): Correctly predicting a label (we predicted "yes", and it's "yes"),
- True Negative (TN): Correctly predicting the other label (we predicted "no", and it's "no"),
- False Positive (FP): Falsely Predicting a label (we predicted "yes", but it's "no"),
 False Negative (FN): Missing and incoming label (we predicted "no", but it's "yes").

Measures

Sensitivity
Sensitivity or True Positive Rate (TPR)

Specificity
Specificity (SPC) or True Negative Rate (TNR)

Precision

Precision or Positive Predictive Value (PPV)

Negative Predictive Value

Negative Predictive Value (NPV)

False Positive Rate

Fall-out or False Positive Rate (FPR)

False Discovery Rate

False Discovery Rate (FDR)

False Negative Rate

False Negative Rate
Miss Rate or False Negative Rate (FNR)

Accuracy
Accuracy (ACC)

F1 Score

F1 Score (F1)

Matthews Correlation Coefficient

Matthews Correlation Coefficient (MCC)

Example *Evaluating Spam Classifier*

How can we use those metrics and what we can read from the confusion matrix? For instance, let's consider a

classical problem of **predicting spam and non-spam email**, by using binary classification model. Our dataset consists of 50 emails that are Spam, and 105 emails that are Not Spam. In order to evaluate the performance of our developed model, which labels emails as Spam or Not Spam, we can use confusion matrix, where the outcome is formulated in a 2×2 **contingency table** or a **confusion matrix**:

• Altogether, the classifier made **100 predictions** (100 emails were classified in Spam or Non-Spam class)

• Out of 100 emails, our model **correctly classified** 95 emails: 85 were correctly classified as Non-Spam, and

- Out of 100 emails, our model correctly classified as Non-Spain, and 10 of them were correctly classified as Spain. This result to 95% accuracy.
 Further, 5 out of 100 emails were classified falsely: 5 emails, which were actual Spain, were not predicted as
- is very desired in this case.
 We can observe that our model is very conservative when it comes to predicting Spam. Therfore, the precision of this of this model is very high: 1.0.

• By computing additional measures (also called rates) from the classification matrix, we can get additional

Spam (False Negative). And more important, no email was falsely predicted as Spam (False Positive), which

Try it out!

insight about our model.

Name:

Contact

Your Email Address:

First & Last Name	your.name@email.com
Your question or comments	

If you have any question, suggestion or feedback, we would love to hear from you!

Please use the *contact form* bellow to send us a message.

Send