# Lecture 16: Classification

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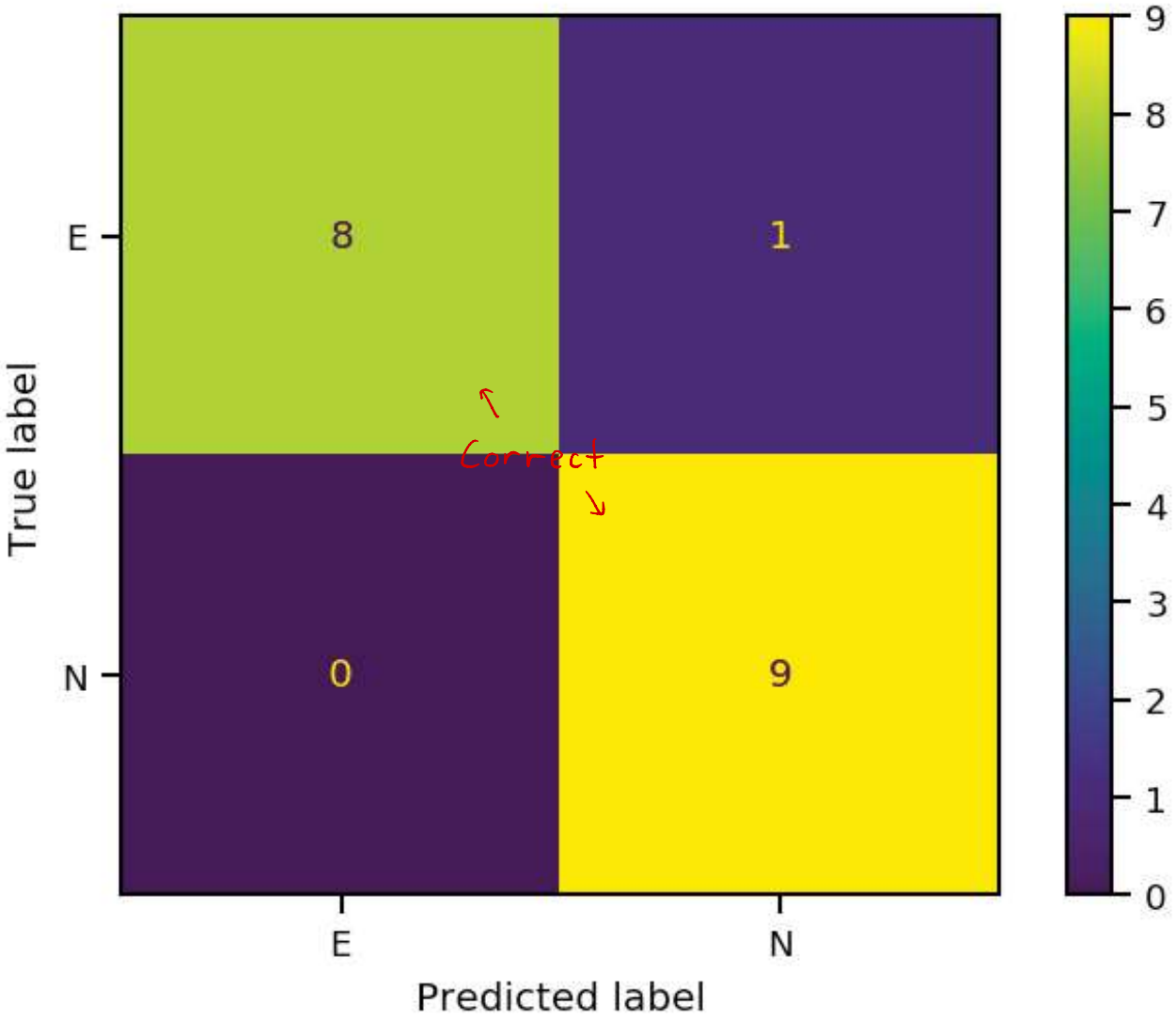
## Diagnostics for classification

How to determine if the classification is good enough

# Confusion matrix

Run diagnostics on validation data



# Accuracy score

obs / validation $\begin{cases} x_1, x_2, \ldots, x_{N^v} \\ y_1, y_2, \ldots, y_{N^v} \end{cases}$

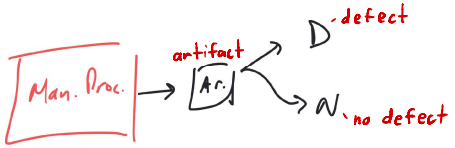
pred $\hat{y}_1, \hat{y}_2, \ldots, \hat{y}_{N^v}$

$$acc(\hat{y}_{1:N^v}, y_{1:N^v}) = \% \text{ of observations correctly predicted}$$

$$= \frac{1}{N^v} \sum_{i=1}^{N^v} 1_{\{y_i\}}(\hat{y}_i)$$

indicator function

# Imbalanced data




N N N N N N D N N N . . .

Stupid Model(x) = N with 100 % prob.
↳ 99 % accuracy because D happens only 1% of the time.

Because of imbalance between N and D.



True positives = TP = # of correctly predicted D.

True Negatives = TN = # of correctly predicted N.

False positives = FP = # of predicted D that were wrong.

False negatives = FN = # of predicted N that were wrong

$$\text{Sensitivity} = \frac{TP}{TP + FN} = \%\text{ of D that were predicted correctly.}$$

$$\text{Specificity} = \frac{TN}{TN + FP} = \%\text{ of N that were predicted correctly}$$

$$\text{balanced accuracy} = \frac{1}{2}(\text{Sensitivity} + \text{Specificity})$$

$$= \frac{1}{2}(\%\text{ of corr. pred. D's} + \%\text{ of corr. pred. N})$$

Stupid Model's balan. acc. $= \frac{1}{2}(0 + 1) = 0.5$

# More Metrics

- Cross entropy loss
- Receiver operating characteristics curve
- f1-score
- Brier score
- …