Classification Error Metrics

Choosing the Right Error Measurement

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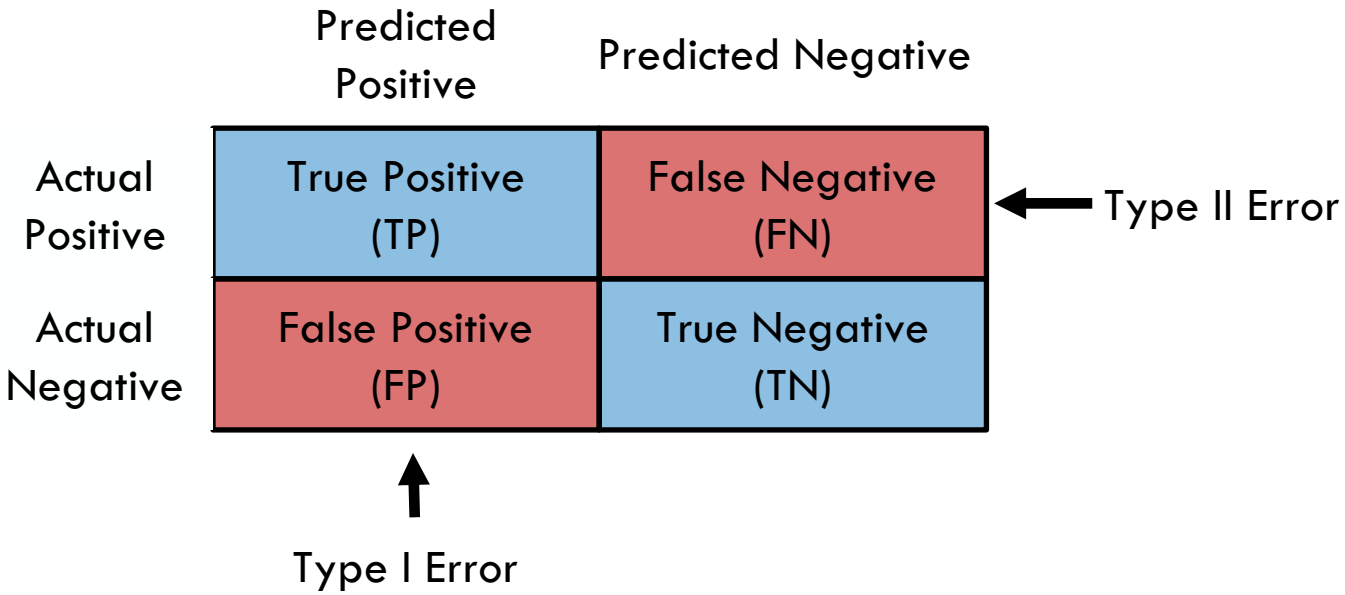
- **Measure accuracy:** total % of predictions that are correct
- Build a simple model that always predicts "healthy"
- Accuracy will be 99%...

Confusion Matrix

	Predicted Positive	Predicted Negative
Actual Positive	True Positive (TP)	False Negative (FN)
Actual Negative	False Positive (FP)	True Negative (TN)

Confusion Matrix

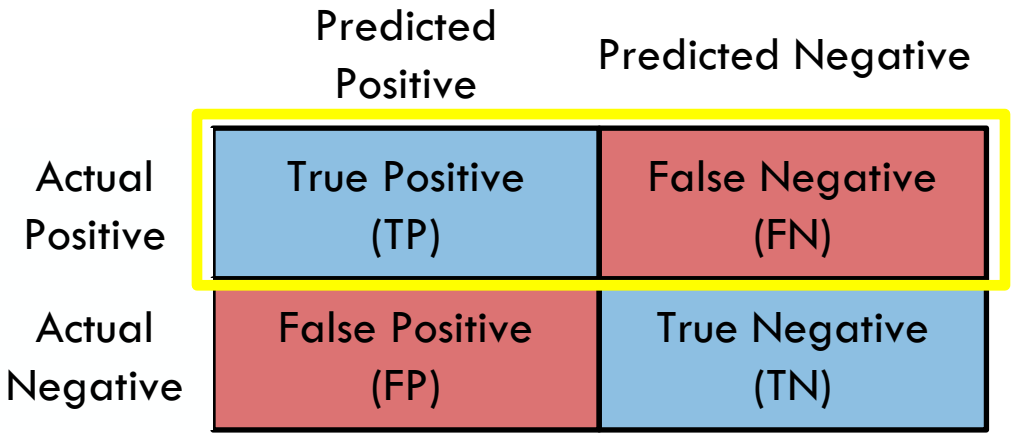


Accuracy: Predicting Correctly

	Predicted Positive	Predicted Negative
Actual Positive	True Positive (TP)	False Negative (FN)
Actual Negative	False Positive (FP)	True Negative (TN)

$$\text{Accuracy} = \frac{TP + TN}{TP + FN + FP + TN}$$

Recall: Identifying All Positive Instances



$$\text{Recall or Sensitivity} = \frac{TP}{TP + FN}$$

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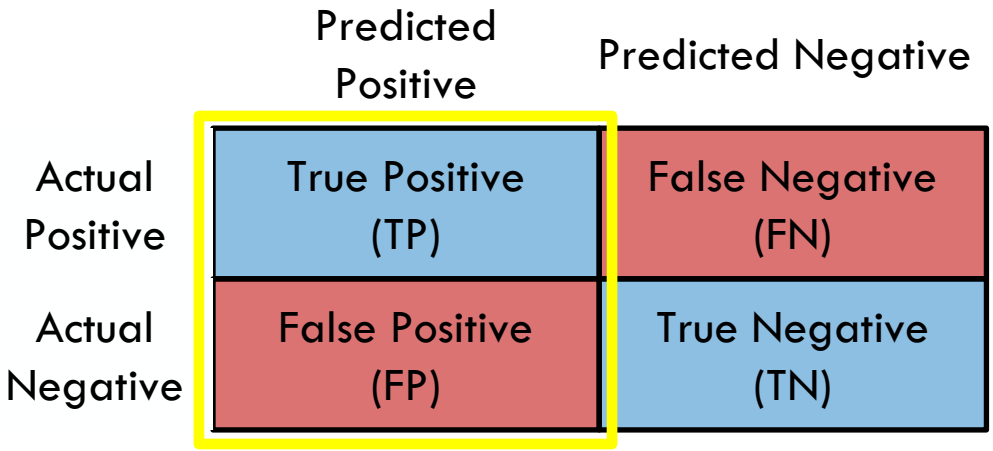
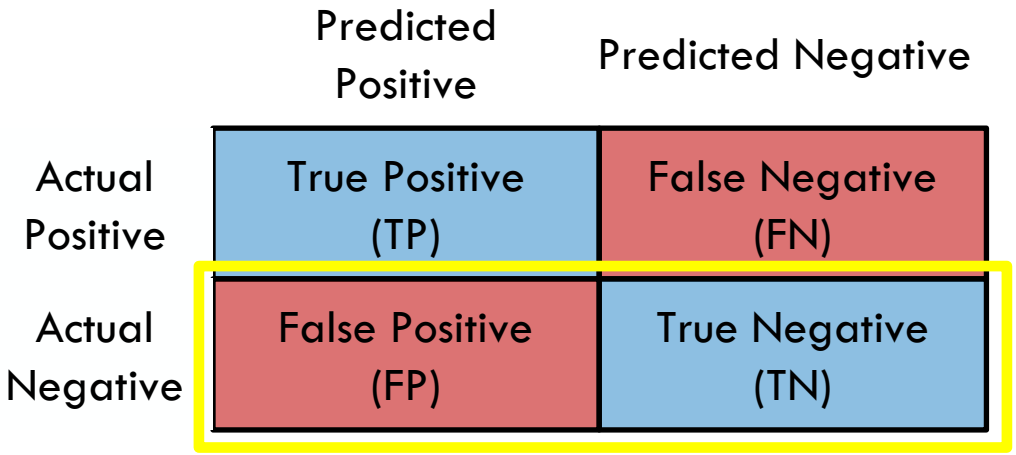
Precision: Identifying Only Positive Instances



$$\text{Precision} = \frac{TP}{TP + FP}$$

Specificity: Avoiding False Alarms



$$\text{Specificity} = \frac{TN}{FP + TN}$$

Error Measurements

	Predicted Positive	Predicted Negative
Actual Positive	True Positive (TP)	False Negative (FN)
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$$\text{Accuracy} = \frac{TP + TN}{TP + FN + FP + TN}$$

$$\text{Precision} = \frac{TP}{TP + FP}$$

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$$\text{Accuracy} = \frac{TP + TN}{TP + FN + FP + TN}$$

$$\text{Recall or Sensitivity} = \frac{TP}{TP + FN}$$

$$\text{Precision} = \frac{TP}{TP + FP}$$

$$\text{Specificity} = \frac{TN}{FP + TN}$$

Error Measurements

	Predicted Positive	Predicted Negative
Actual Positive	True Positive (TP)	False Negative (FN)
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$$\text{Accuracy} = \frac{TP + TN}{TP + FN + FP + TN}$$

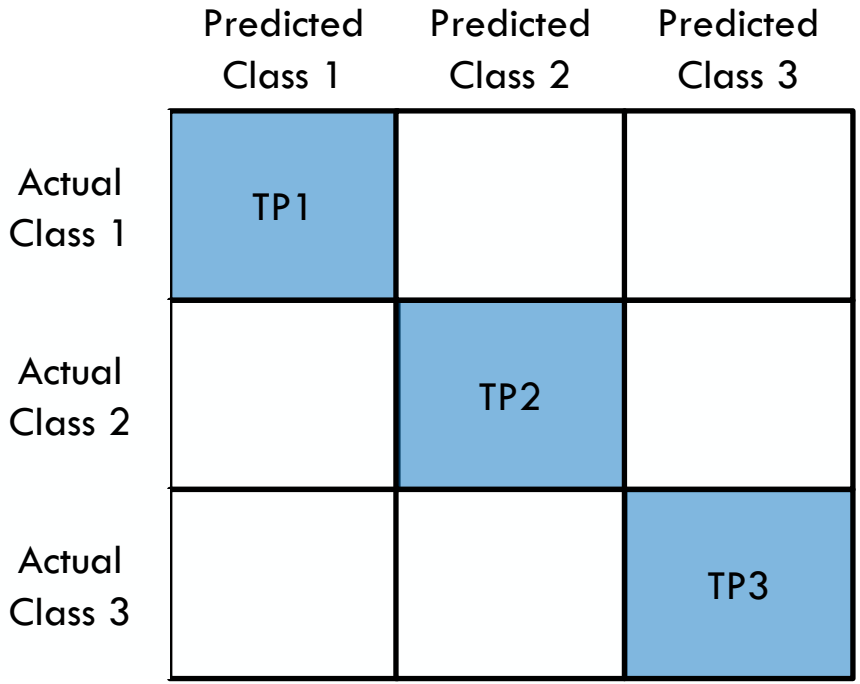
$$\text{Precision} = \frac{TP}{TP + FP}$$

$$\text{Recall or Sensitivity} = \frac{TP}{TP + FN}$$

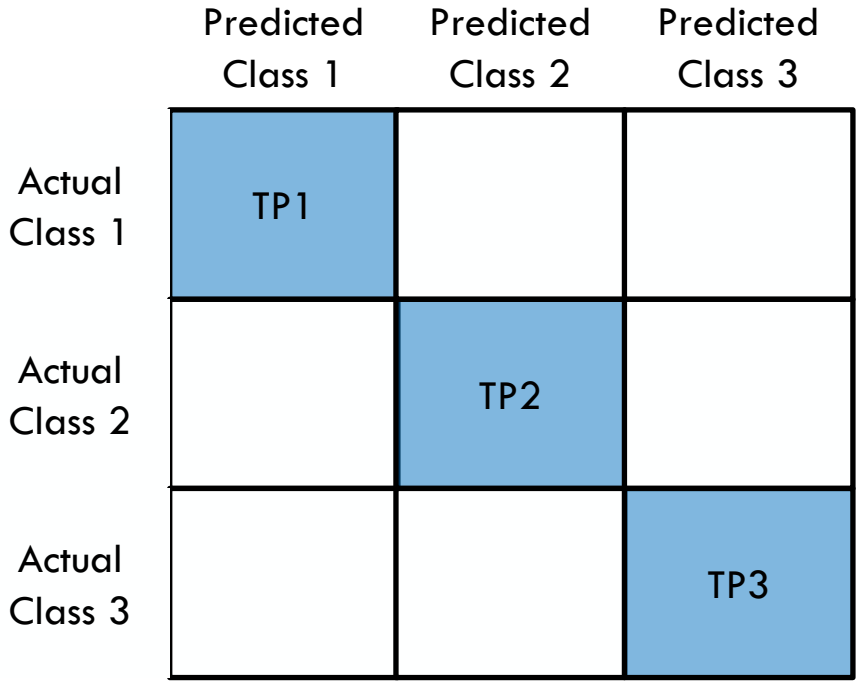
$$\text{Specificity} = \frac{TN}{FP + TN}$$

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

Multiple Class Error Metrics

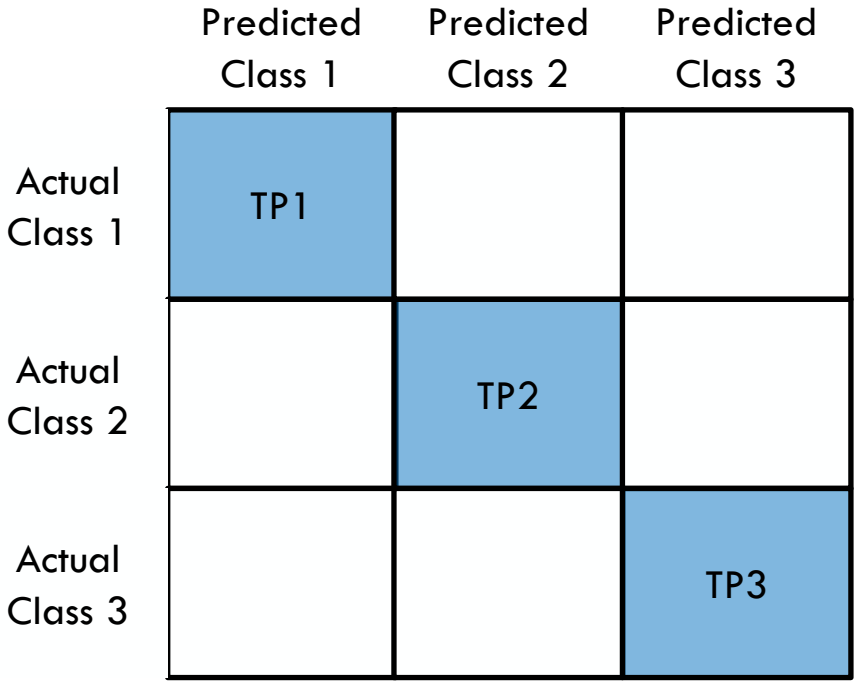


Multiple Class Error Metrics



$$\text{Accuracy} = \frac{TP1 + TP2 + TP3}{\text{Total}}$$

Multiple Class Error Metrics



$$\text{Accuracy} = \frac{TP1 + TP2 + TP3}{\text{Total}}$$

Most multi-class error metrics are similar to binary versions—just expand elements as a sum

Classification Error Metrics: The Syntax

Import the desired error function

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from sklearn.metrics import accuracy_score
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accuracy_value = accuracy_score(y_test, y_pred)
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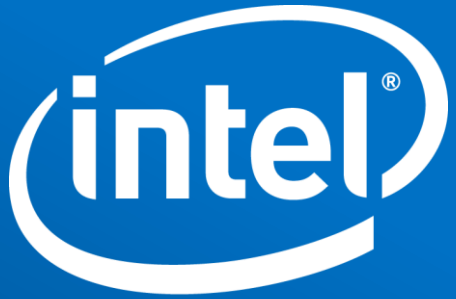
Lots of other error metrics and diagnostic tools:

```
from sklearn.metrics import precision_score, recall_score,
                            f1_score, roc_auc_score,
                            confusion_matrix, roc_curve,
                            precision_recall_curve
```



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