Evaluation Metrics for Classification

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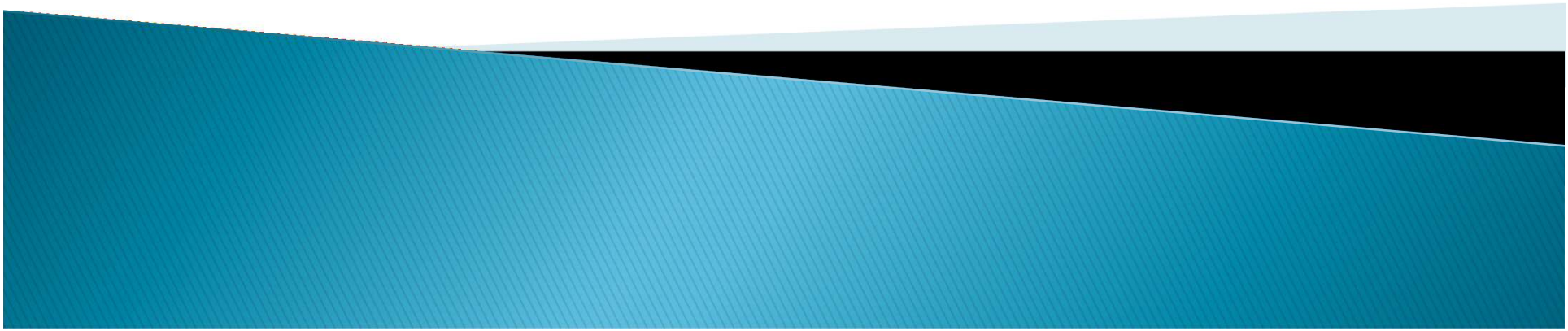
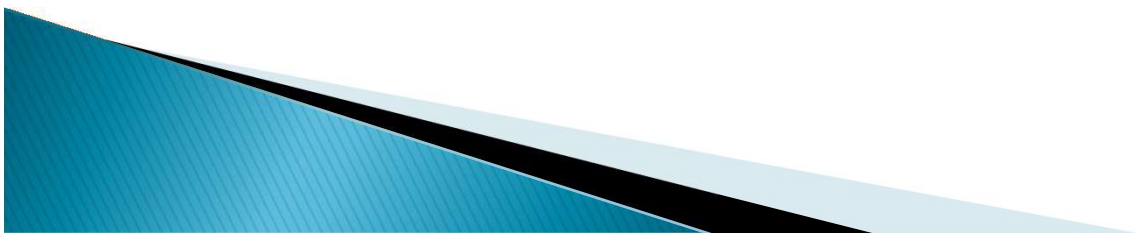
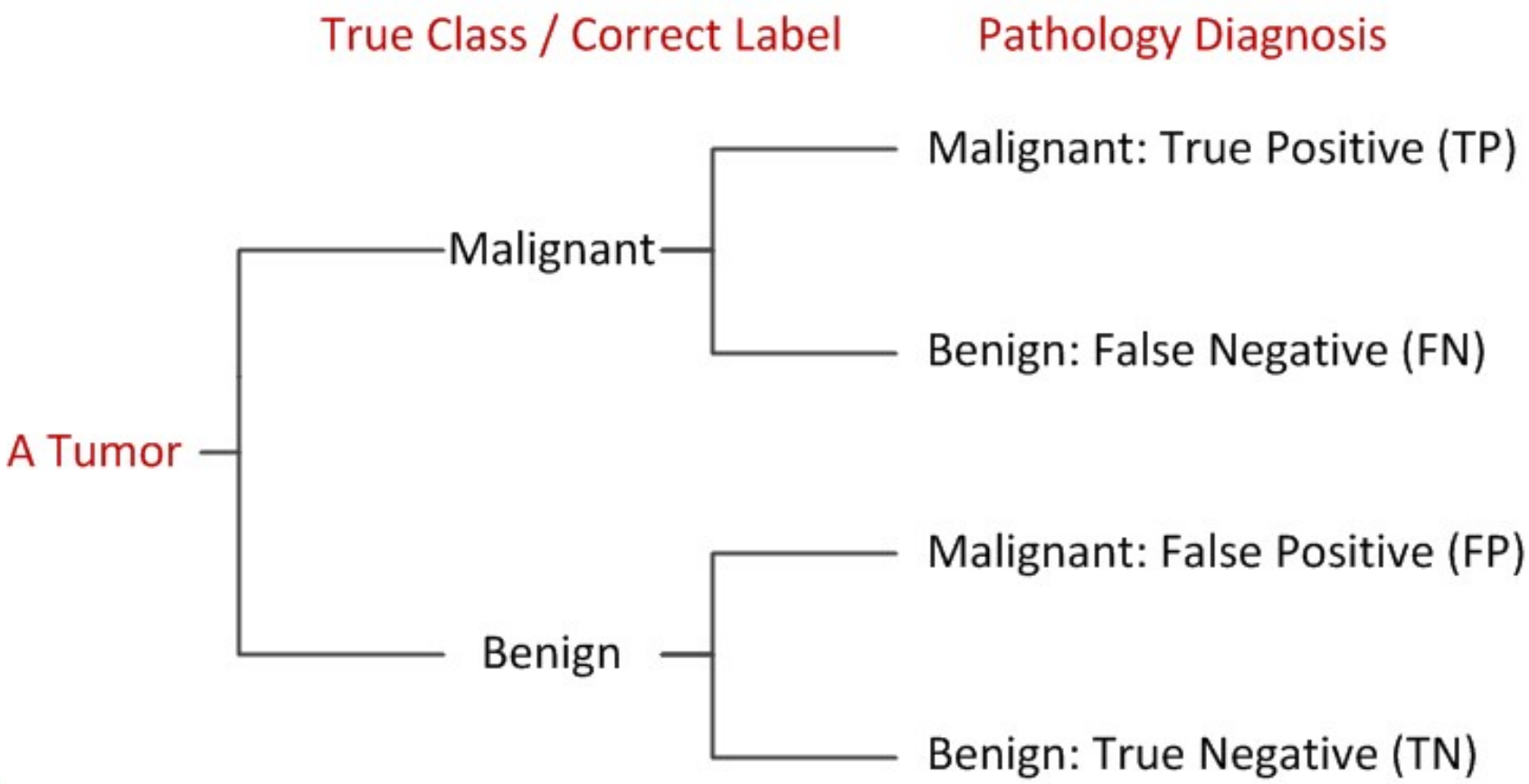


Class of Interest

- Spam Filtering → Spam (+), Legitimate (–)
- Tumor Diagnosis → Malignant (+), Benign (–)
- Activity Recognition in Smart Environments
- …



Prediction Errors: Type I, II

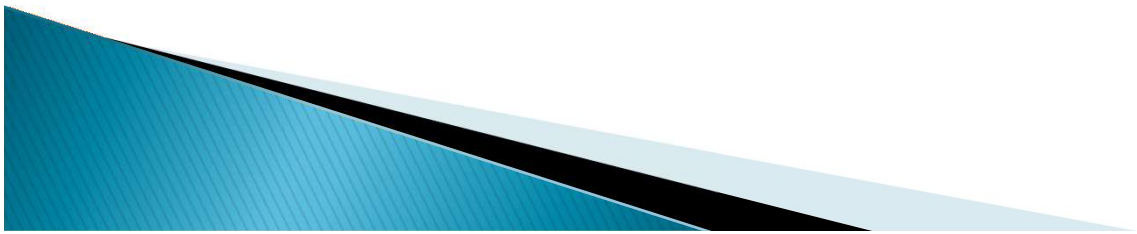


Evaluation Metrics

- $TP\ Rate = TPR = \frac{\#TP}{\#P} = \frac{\#TP}{\#TP+\#FN}$
- $TN\ Rate = TNR = \frac{\#TN}{\#N} = \frac{\#TN}{\#TN+\#FP}$
- FPR & FNR are defined similarly.
- $Accuracy = \frac{\#TP+\#TN}{\#P+\#N} = \frac{\#TP+\#TN}{\#TP+\#FN+\#TN+\#FP}$
- $Error\ Rate = 1 - Accuracy$

Evaluation Metrics (cont.)

- $TPR = \frac{TP}{TP+FN} = Sensitivity = Recall$
  - how many relevant items are selected
- $TNR = \frac{TN}{TN+FP} = Specificity$
- $Precision = \frac{TP}{TP+FP}$
  - how many selected items are relevant



Evaluation Metrics (cont.)

- $TPR + FNR = 1$
- $TNR + FPR = 1$
- $G - mean = (Precision \times Sensitivity)^{\frac{1}{2}}$
- $F\_Score = 2 \times \frac{Precision \times Sensitivity}{Precision + Sensitivity}$

Confusion Matrix

- Confusion matrix for binary classification

		predicted as	
		Positive	Negative
correct label	Positive	TP	FN
	Negative	FP	TN

Further Reading

- Imbalanced Learning
  - Cost sensitive learning
  - Oversampling/ undersampling techniques
  - SMOTE (Synthetic Minority Oversampling Technique)

- Receiver Operating Characteristic (ROC) Curves (later on in the course)

- …