Evaluation

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Evaluation: Precision and Recall

- **Precision** is the number of correct positive results divided by the number of all positive returned by the classifier.

$$Precision(P) = \frac{TruePositive(TP)}{TruePositive(TP) + FalsePositive(FP)} \quad (1)$$

- **Recall** is the number of correct positive results divided by the number of all relevant samples (all samples that should have been identified as positive).

$$Recall(R) = \frac{TruePositive(TP)}{TruePositive(TP) + FalseNegative(FN)} \quad (2)$$

Evaluation: FScore

- The F_1**Score** is the harmonic average of the precision and recall, where an F_1**Score** reaches its best value at 1 (perfect precision and recall) and worst at 0.

$$F_1 = \frac{2PR}{P + R} \tag{3}$$

- The general formula for FScore:

$$F_\beta = \frac{(1 + \beta^2)PR}{\beta^2 * P + R} \tag{4}$$

Evaluation: FScore

- if $\beta = 2$, then

$$F_2 = \frac{(1+2^2)PR}{2^2 * P + R} = \frac{5PR}{4 * P + R} \tag{5}$$

- if $\beta = 0.5$, then

$$F_0.5 = \frac{(1+.5^2)PR}{.5^2 * P + R} \tag{6}$$

- F_2 puts more emphasis on recall than precision, where $F_{.5}$ puts more emphasis on precision than recall.

Evaluation: Confusion Matrix for two classes

Actual Class/ Gold Label $\rightarrow$

	Cat	**Dog/NonCat**
Cat	TP (5)	FP (2)
Dog	FN (3)	TN (3)

$$P = \frac{TP}{TP + FP} = \frac{5}{5+2} = \frac{5}{7} \tag{7}$$

$$R = \frac{TP}{TP + FN} = \frac{5}{5+3} = \frac{5}{8} \tag{8}$$

$$Accuracy = \frac{AllTrue}{AllData} = \frac{TP + TN}{TP + FP + FN + TN} = \frac{5+3}{5+2+3+3} = \frac{8}{13} \tag{9}$$

Evaluation: Confusion Matrix for more than 2 classes

	Gold A(ga)	**Gold B(gb)**	**Gold C(gc)**
Predicted A (pa)	30	20	10
Predicted B (pb)	50	60	10
Predicted C (pc)	20	20	80

$$Accuracy = \frac{AllTrue}{AllData} = \frac{30 + 60 + 80}{30 + 20 + 10 + 50 + 60 + 10 + 20 + 20 + 80} = \frac{170}{300} \tag{10}$$

$$Precision_A = \frac{TP_A}{TotalPredicted_A} = \frac{TP_A}{TP_A + FP_A} = \frac{30}{30 + (20 + 10)} = \frac{30}{60} \tag{11}$$

$$Recall_A = \frac{TP_A}{TotalGoldLabel_A} = \frac{TP_A}{TP_A + FN_A} = \frac{30}{30 + (50 + 20)} = \frac{30}{100} \tag{12}$$

References