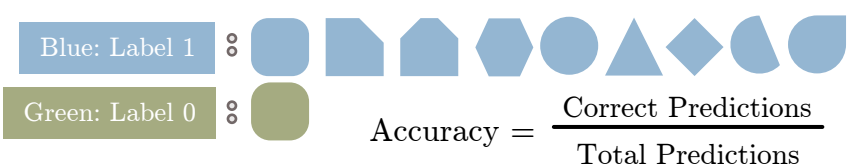
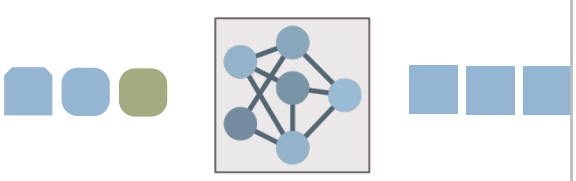
Cheat Sheet – Imbalanced Data in Classification



$$\text{Accuracy} = \frac{\text{Correct Predictions}}{\text{Total Predictions}}$$



Classifier that always predicts label blue yields prediction accuracy of 90%

Accuracy doesn't always give the correct insight about your trained model

Accuracy: %age correct prediction	Correct prediction over total predictions	One value for entire network
Precision: Exactness of model	From the detected cats, how many were actually cats	Each class/label has a value
Recall: Completeness of model	Correctly detected cats over total cats	Each class/label has a value
F1 Score: Combines Precision/Recall	Harmonic mean of Precision and Recall	Each class/label has a value

Performance metrics associated with Class 1

Predicted Labels \ Actual Labels	1	0
1	True Positive	False Positive
0	False Negative	True Negative

(Is your prediction correct?) (What did you predict)

True Negative

(Your prediction is correct) (You predicted 0)

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

$$\text{False +ve rate} = \frac{FP}{TN + FP}$$

$$\text{F1 score} = 2\text{x}\,\frac{(\text{Prec x Rec})}{(\text{Prec + Rec})}$$

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

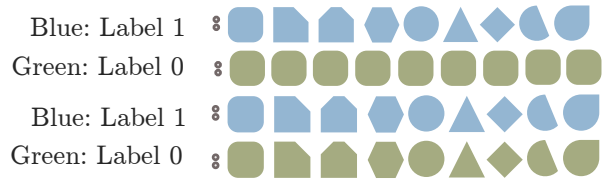
$$\text{Specificity} = \frac{TN}{TN + FP}$$

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

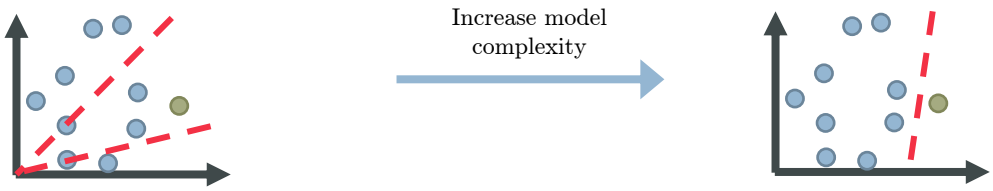
True +ve rate

Possible solutions

1. **Data Replication:** Replicate the available data until the number of samples are comparable
2. **Synthetic Data:** Images: Rotate, dilate, crop, add noise to existing input images and create new data
3. **Modified Loss:** Modify the loss to reflect greater error when misclassifying smaller sample set
4. **Change the algorithm:** Increase the model/algorithm complexity so that the two classes are perfectly separable (Con: Overfitting)



$$loss = a * loss_{green} + b * loss_{blue} \qquad a > b$$



No straight line (y=ax) passing through origin can perfectly separate data. **Best solution:** line y=0, predict all labels blue

Straight line (y=ax+b) can perfectly separate data. Green class will no longer be predicted as blue

Source: https://www.cheatsheets.aqeel-anwar.com