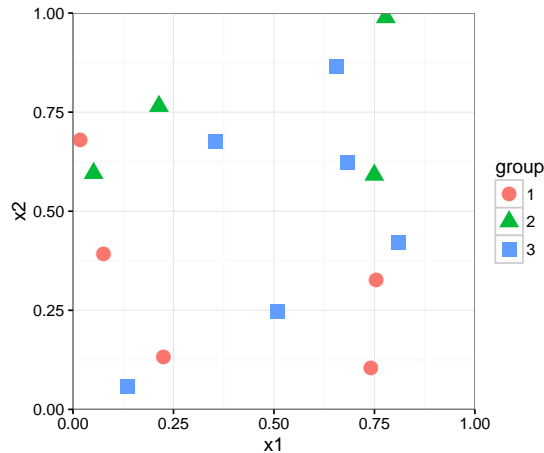


1. The plot below represents the predictor space (on  $X_1$  and  $X_2$ ) with a training data set plotted and the class of their response variable indicated by the color.



- (a) If we consider this a classification tree without any splits yet (i.e. only one region), what would be the prediction for *every* new observation?

- (b) What is the (training) misclassification rate?

- (c) What is the GINI index?

- (d) What is the cross-entropy?

2. Add a straight line, parallel to one of the axes, that splits the predictor space into two regions. Choose the split in a way that you think will lead to the best overall improvement in the metrics above. Label the new regions  $R_1$  and  $R_2$  and calculate the metrics for each.

$R_1$

$R_2$

- (a) What is the predicted class?

- (a) What is the predicted class?

- (b) What is the misclassification rate?

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- (c) What is the GINI index?

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- (d) What is the cross-entropy?

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3. To decide if the split in Q2 was optimal, we need to evaluate how much the metrics in Q1 have improved. This requires combining the metrics across  $R_1$  and  $R_2$  in Q2. Please do so in a sensible way so that you can answer: what was the overall decrease each metric going from one region/node to two?

Misclassification:

GINI:

Cross-entropy:

4. On the back of this page, please draw the (very simple) tree corresponding to your partition.