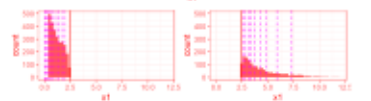
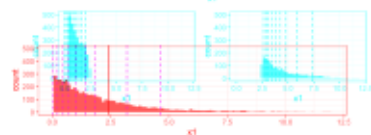
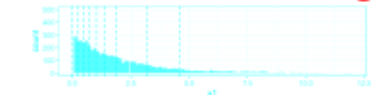


Introduction to Machine Learning



Boosting: Modern Techniques

Gradient Boosting: Modern Techniques



Learning goals

- Know extensions of XGBoost and how they differ

Learning goals

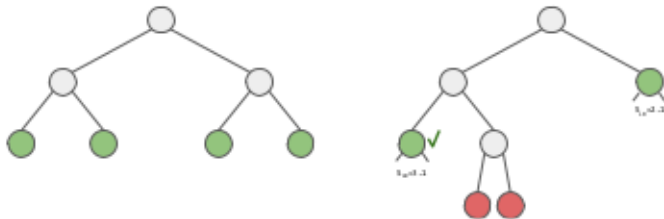
● Understand areas upon which extensions of XGBoost improve

- Know extensions of XGBoost and how they differ
- Understand areas upon which extensions of XGBoost improve

TREE GROWING EFFICIENCY

Recall: **XGBoost** grows a balanced tree of `max_depth` and prunes leaves that do not improve the risk.

Leaf-wise (Best-first) Tree Growth allows the growing of unbalanced trees by comparing improvements between all possible leaves.



Balanced tree (left) of `max_depth=3`: All 4 leaves (colored green) will be split (in order from left to right). Leaf-wise growth (right) of `max_depth=3`: From the valid leaves (green), the leaf with largest improvement will be split next (marked). Invalid leaves (red) are not considered.