Boosting

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Resources

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1 Weak learners to Good one

1.1 Simple learners

- E.g. naive Bayes, logistic regression, decision stumps (or shallow decision trees)

- Good: low variance (loosely: are very close to their expectation)

- Bad: high bias (loosely: their expectation is far away from the truth), cannot solve hard learning problems.

1.2 Voting (Emsemble Methods)

Wisdom of the crowds:

- Instead of learning a single (weak) classifier, learn many weak classifiers that are good at different parts of the input space.

- Output class is the vote of each classifier.

1.3 Boosting

- Idea: given a weak learner, run it multiple times on (reweighted) training data, then let learned classifiers vote.

- On each iteration t:

  - weight each training example by how incorrectly it was classified. (focus on incorrectly classified training data)

  - learn a weak hypothesis: h_t

- – A strength fo this hypothesis: α_t
- Final classifier:

$$H(X) = sign(\sum \alpha_t h_t(X))$$

1.4 Learning from weighted data

1.5 AdaBoost

$$D_{t+1}(i) = D_t(i) \exp(-\alpha_t y_i h_t(x_i))/Z_t$$