Impact of Noise on Boosting Methods

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The Problem

- The AdaBoost shows a good feature that it does not overfit (Schapire et al, 1998), what if noisy?
- Dietterich (2000) showed that noise can severely damage the accuracy of AdaBoost. But the noise is introduced according to **uniform distribution** over sample which seems unrealistic.
- Will DeepBoost (Cortes, Mohri, Syed, 2014) be affected by noise as badly as AdaBoost?
- Can we introduce a more realistic way of generating noise?

Margin Generation

- Margin:

$$\rho(x) = y\frac{\alpha \cdot \mathbf{h}(x)}{\|\alpha\|_2}$$

- Distribution maintained by Adaboost

$$D_{t+1}(i) = \frac{\exp(-y_i \alpha_t \cdot \mathbf{h}_t(x_i))}{m\prod_{s=1}^{t} Z_s}$$

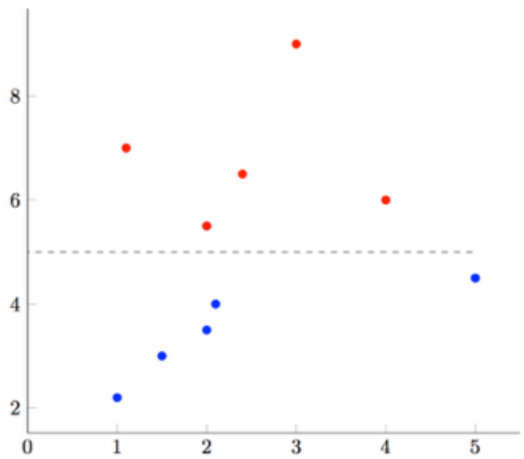


Fig. 9. Drawing noise according to uniform distribution

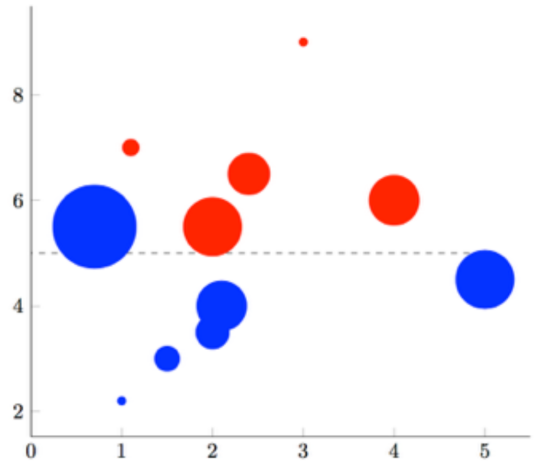
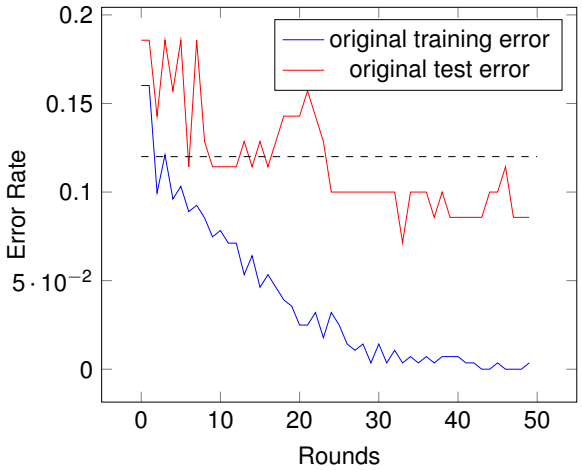


Fig. 10. Drawing noise according to margin distribution

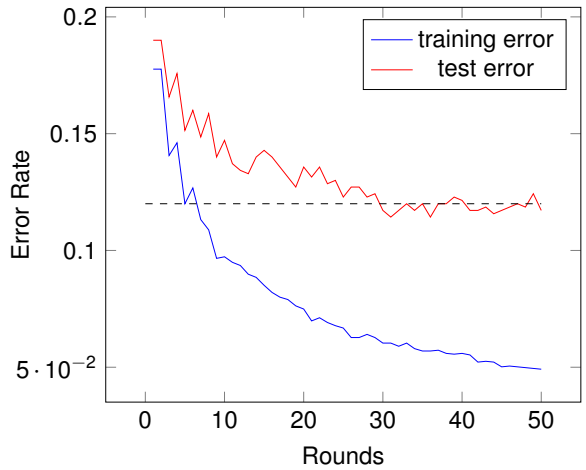
Experiment Method

- When empirical error is less than 0.05 at round t. Draw noise points according to D_{t+1}.
- Test on noise level of 5%, 10% and 20%.
- Boosting stumps as base classifier (Threshold function).
- Dataset : 80% Training, 20% Test

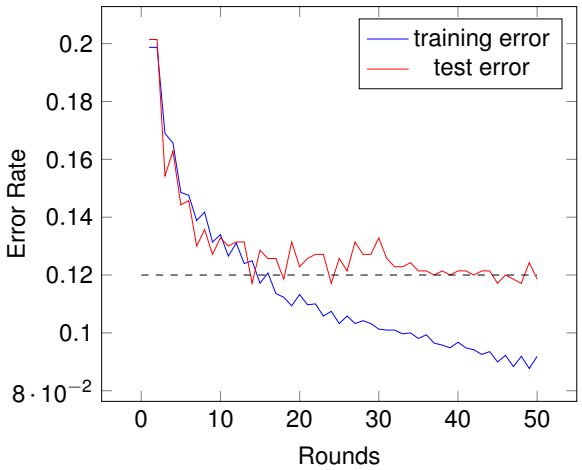
AdaBoost Experiment Result



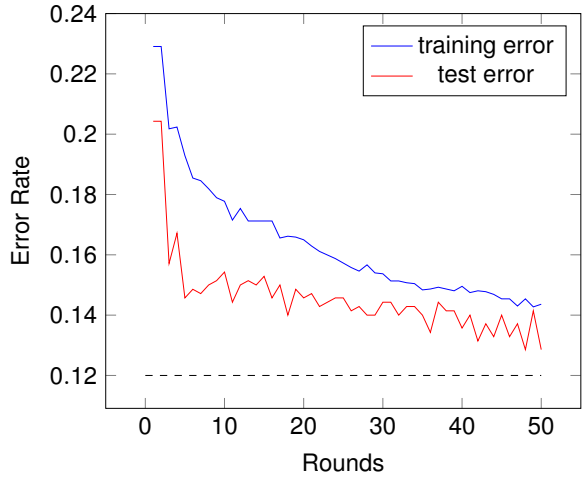
(a) Adaboost on Ionosphere.



(b) Adaboost 5% noise.

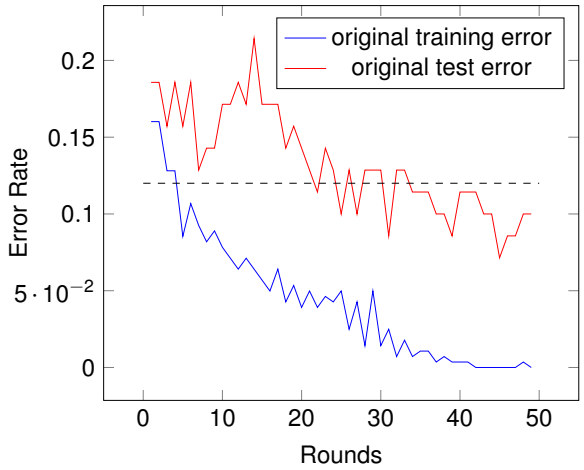


(c) Adaboost 10% noise

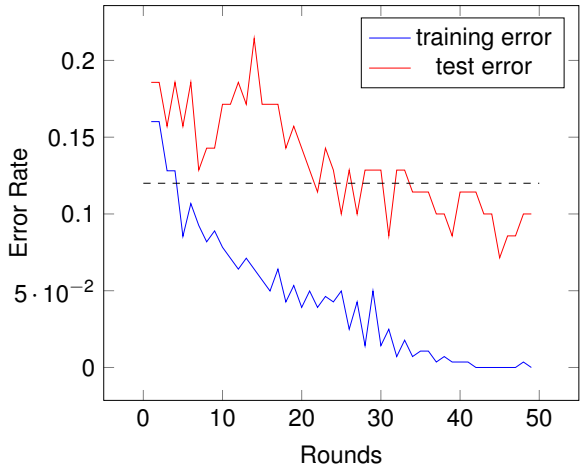


(d) Adaboost 20% noise.

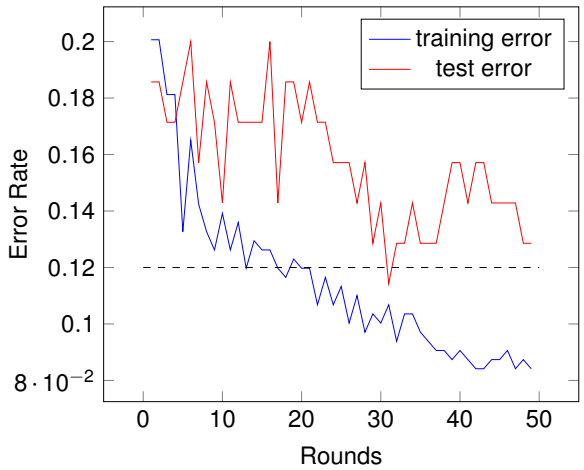
DeepBoost Experiment Result



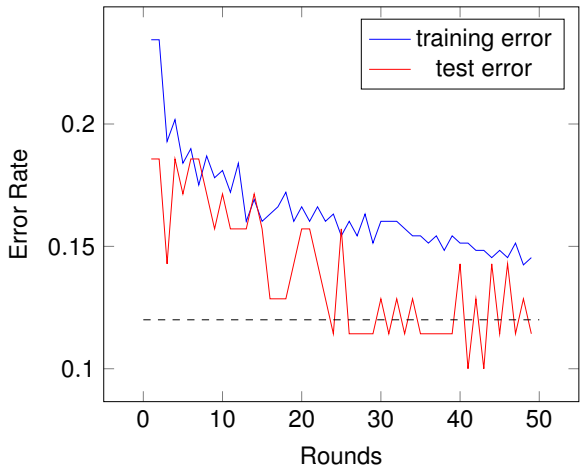
(e) Deeoboost on Ionosphere.



(f) Deepboost 5% noise.



(g) Deepboost 10% noise



(h) Deepboost 20% noise.

Thank you!