Active Bias: Training a More Accurate Neural Network by Emphasizing High Variance Samples

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Main Idea

NN accuracy often gained by techniques such as momentum, dropout, batch normalization, distillation. We propose a compatible "sibling": Weight more informative training examples using variance based active learning.

Methods and Related Work

Example: Logistic Regression

Obj func: \[ -\log(p(Y=W|X)) = -\sum \log(p(y_i|x_i, w)) - \frac{\mathbb{E}[|w|^2]}{2\eta} \]

Assumption 1: \[ P_Y(W = w | Y, X) \propto \mathcal{N}(w | w_N, S_N) \]

Assumption 2: \[ p(y_i|x_i, W) \approx p(y_i|x_i, w) + g_i(w)^T (W - w) \]

\[ \text{Var}(p(y_i|x_i, W)) \approx g_i(w)^T S_N g_i(w) \]

Weighting more uncertain examples (with high prediction variance or close to decision boundary) reduces classifier uncertainty.

Experimental setup

Table: The average of the best testing error rates for different sampling methods and datasets (%).

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Modal</th>
<th>SGD-Uni</th>
<th>SGD-SW</th>
<th>SGD-AD</th>
<th>SGD-LB</th>
<th>SGD-SC</th>
<th>SGD-TP</th>
<th>SGD-WP</th>
<th>SGD-WC</th>
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<td>CIFAR 10</td>
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<td>6.18%</td>
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Figure 3: MNIST error rate (%)

Figure 4: MNIST error rate (%)

Conclusion and Future Work

Lightweight supervised training trick motivated by active learning.

References