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**PA2: Mutli-Layer Neural Network on MNIST dataset**

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**Abstract**

[add abstract]

(a) Reading in MNST data

(b) Gradient Checker

We used epsilon = 0.01.

|  |  |  |
| --- | --- | --- |
|  | Gradient Approximation  E(w+e) – E(w-e) / 2e | Actual Gradient |
| Input to hidden weight 1 | 0.0 | -1.3771253495617533e-15 |
| Input to hidden weight 2 | -5.639302358417808e-08 | -2.194892411834406e-05 |
| Hidden bias weight | 0.0 | 1.3771253492539445e-15 |
| Hidden to output weight 1 | 0.0 | -1.3771253492539445e-15 |
| Hidden to output weight 2 | -5.639302358417808e-08 | -2.194892411834406e-05 |
| Output bias weight | -0.0005879615482928813 | -0.031112308600483817 |

All the gradients are approximately equal (within epsilon squared), except for the output bias weight gradient.

(c) Finding Optimal Number of Epochs

(d) Experimenting with Regularization

(e) Experiment with Activations

Note: found that sigmoid takes considerably longer to train than tanh

(f) Experiment with Network Topology

Individual Contributions

[add paragraph by each person of what they did]