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Assignment 1

Experimental setup:

* W1: 10 x 32
* B1: 10 x 1
* W2: 1 x 10
* B2: scalar

1. Forward pass steps:
   1. Calculate the linear combination of the input data, the weights, and then add the bias parameter:
   2. Use the ReLU activation function to calculate the output of the hidden layer:

* 1. Use the output from the hidden layer and calculate the linear combination of the output with the output weight and then add the output bias:
  2. Calculate the output of the output layer using the sigmoid activation function:

1. Binary cross entropy is calculated as follows:

The regularization factor is calculated by squaring all parameters in each weight and bias and then summing over said weight or bias, and then summing those totals. Then total loss is calculated as such: , where γ represents an l2 regularization factor.

Results

* Hyperparameters:
  + Epochs: 50
  + Number of batches: 1000
  + Number of hidden units: 10
  + Batch size: 200
  + Learning rate: 0.01
  + Momentum: 0.9
  + Regularization penalty: 0.0001

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* Hidden units experiment
  + Number of hidden units: 5

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| A graph with green line  Description automatically generated | A graph with blue lines  Description automatically generated |

* + Number of hidden units: 10

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| A graph of training loss  Description automatically generated | A graph with a line  Description automatically generated |
| A graph with green line  Description automatically generated | A graph of a graph  Description automatically generated |

* + Number of hidden units: 15

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* + Number of hidden units: 20

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* + Number of hidden units: 25

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* + Number of hidden units: 30
* Learning rate experiment
  + Learning rate: 0.001

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| A graph with green line  Description automatically generated | A graph of a graph  Description automatically generated |

* + Learning rate: 0.01

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| A graph with green line  Description automatically generated | A graph of a graph  Description automatically generated |

* + Learning rate: 0.03

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| A graph with green line  Description automatically generated | A graph with blue lines  Description automatically generated |

* + Learning rate: 0.05

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* + Learning rate: 0.1
* Batch size
  + Batch size: 10

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| A graph with green line  Description automatically generated | A graph of a graph  Description automatically generated |

* + Batch size: 50

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| A graph of training loss  Description automatically generated | A graph with a line  Description automatically generated |
| A graph with green line  Description automatically generated | A graph of a graph  Description automatically generated |

* + Batch size: 100

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| A graph of training loss  Description automatically generated | A graph with a line  Description automatically generated |
| A graph with green line  Description automatically generated | A graph with blue lines  Description automatically generated |

* + Batch size: 200

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| A graph of training loss  Description automatically generated | A graph with a line  Description automatically generated |
| A graph with green line  Description automatically generated | A graph of a graph  Description automatically generated |

* + Batch size: 500

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| A graph of training loss  Description automatically generated | A graph with a line  Description automatically generated |
| A graph with green line  Description automatically generated | A graph with blue lines  Description automatically generated |