Document Title:
# Project Design Specifications
## (Project Requirements)

Project Name:
**Revising the Back Propagation Algorithm**
(Portland State ECE Capstone 14)

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Version: 1.0

**Project Summary:** The current backpropagation algorithm, which is used for training artificial neural networks, stands to be improved or replaced. Specifically, the client is looking for an algorithm to update or entirely replace the current backpropagation algorithm. The updated version will ideally train in fewer steps, amplify less noise, and become trapped in local minima less often. The final deliverable is a Github repository containing an artificial neural network implementing the novel algorithm. The delivered artificial neural network will be able to classify images from the MNIST database. If time is available, more advanced networks handling more advanced images may be implemented.

## Individual Requirements

**System Requirements**: The network will be designed to work with any computer having a Python 3.x kernel (exact Python version is TDB) and with the correct dependencies installed. Because the final deliverable will not be performing strenuous computations there are no hardware requirements for computers made after about 2012.

**Functionality**: The revised backpropagation algorithm should show increased performance vs. a control network (the control network will be the same as the test network but will use standard backpropagation.) The following metrics will be used to verify that the requirement has been met. Training accuracy, epochs needed for training, and execution time. Training accuracy must be greater than 93% in the network using the novel algorithm.

**Usability:** A knowledgeable user should be able to use the network included in the deliverable within about 1 hour. Understanding the algorithm may take several days and will largely be dependent on the complexity of the algorithm. In terms of using the network in future applications, the documentation will be geared towards providing the knowledge needed to easily port the algorithm into other networks. In addition, documentation will be provided in the form of a wiki (embedded in the repository) which will define and describe all equations, algorithms, and software assets.