1156-49-238 **Brian R Wall***, wallb@wit.edu. *Forward and Backward Neural Networks.* Preliminary report.

This talk explores simple feed forward and update backward neural networks on a fundamental level to investigate how they function and what their capabilities are. It goes through perceptrons, sigmoid neurons, stochastic gradient descent, the backpropagation algorithm, cross-entropy and quadratic cost functions, overfitting and regularization, and weight and bias initialization. It presents a visual proof that neural networks can abstractly approximate any continuous function. Included are also applications to the classic hand-written digit recognition problem which utilizes the MNIST database. Results of eight different neural networks are compared to see the difference in each network's accuracy as well as the run time of the program needed for learning. The networks vary in cost function, weight initialization, regularization parameter, and hidden layer architecture; while displaying the differences between each network. Using all of these discussed techniques, it is possible to produce a 98.2% accurate network with a single hidden layer of 200 neurons. (Received January 24, 2020)