The goal of this project is to predict the location of a Wi-Fi transmitter unit with respect to a Wi-Fi receiver unit. Using a transmitter with one antenna and a receiver with three evenly spaced antenna, channel state information (CSI) data with amplitude and phase information were collected. These data were fed into a neural network for training so that we could predict the distance and angle of arrival between transmitter and receiver. We hypothesized that there would be a relationship between amplitude data and phase difference data (phase pattern for one distance shown above). We ran a regression with same hidden layer configuration as used for the AoA case.

**Results and Discussion**

There was no observed dependence between the distance and amplitude of the received signal. However, through neural networks, we were able to observe a dependence between Phase Difference and Distance and Angle of Arrival.

**Discussion**

We did not find any correlation between amplitude and distance as we initially predicted; however, we found that phase difference data was sufficient to make both AoA and distance predictions. Intuitively, our neural network learns a phase difference “fingerprint” or specific pattern for each AoA and distance and makes predictions based on which “fingerprint” the new data point matches best. We were able to predict distance almost with 0.5 m and classify AoA with ~14% error. While both of these are less accurate than the MUSIC algorithm used in SpotFi, our method makes predictions much faster that MUSIC does. So while we have taken a small hit in accuracy, we obtained a large increase in speed. Furthermore, we expect accuracy to improve if the receive chain phase-bias update procedure. The only caveat is that we do not know to what extent these results are can be generalized without further research.

**References**

