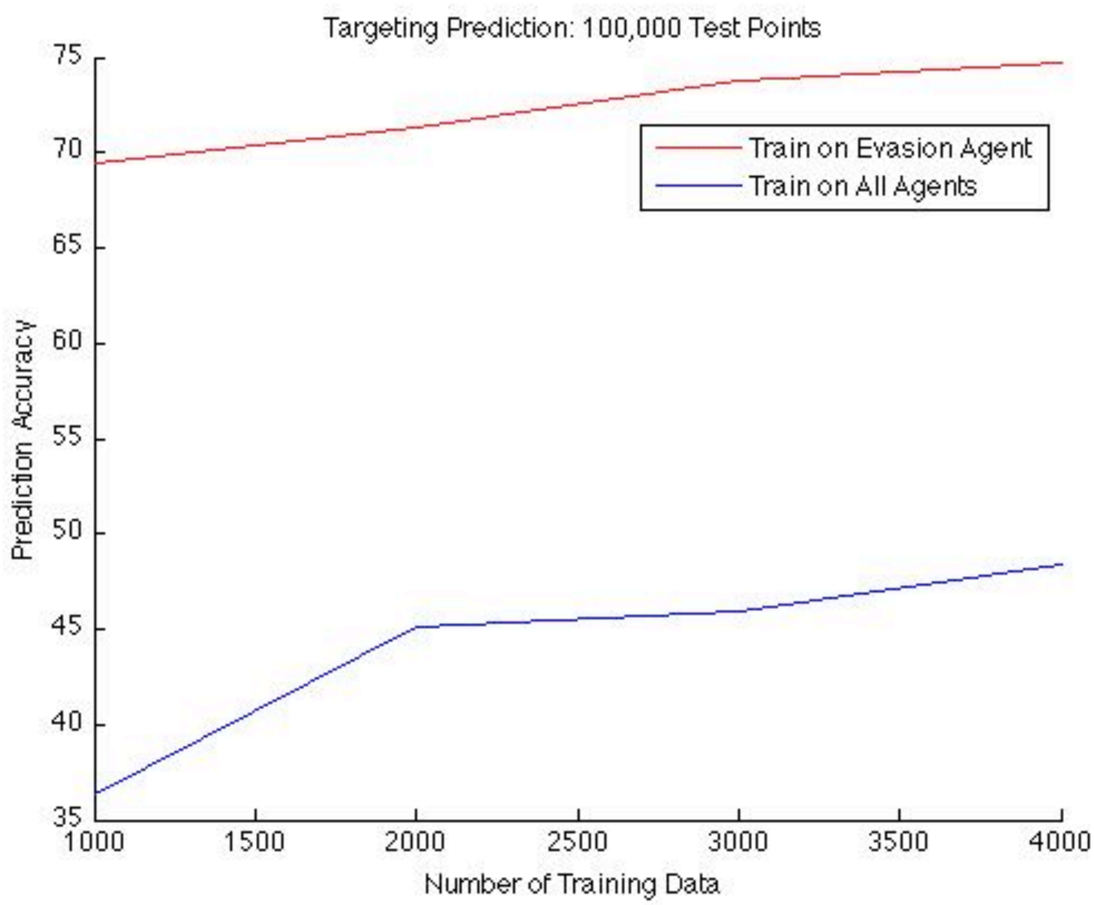
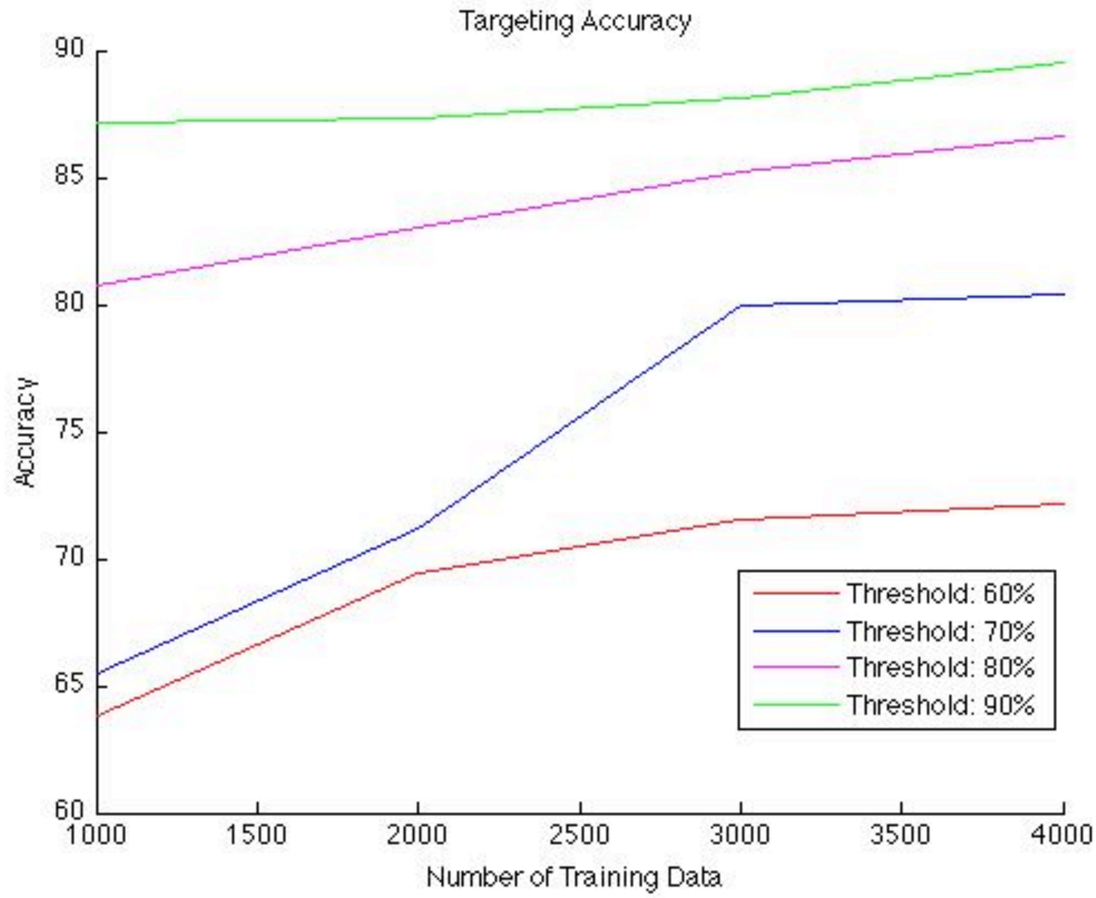
Targeting Strategy Results Explained

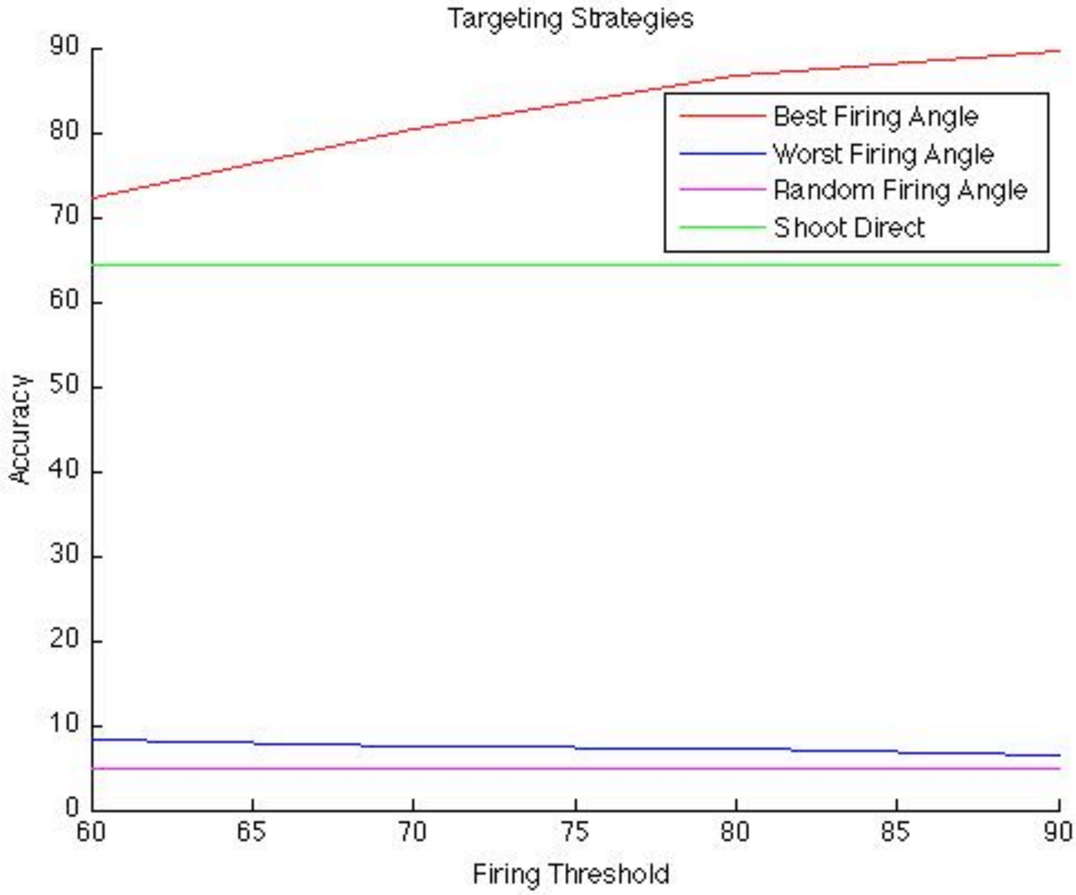
In order to gather training data for targeting, the agents cannon was constantly kept aligned towards the enemy. The enemy was engaged by randomly picking one of 21 different firing angles (-20° to positive 20° in 2° increments relative to the heading of the cannon), firing according to the angle, and using the firing angle as an additional environmental feature. An SVM model was then trained using an RBF kernel with a 5-fold cross validation grid search to optimize the hyper-parameters (slack penalty and kernel bandwidth). Two different subsets of models were trained: one set of models using only data generated by our best evasion agent, and another set of models using data generated from firing upon 10 additional agents. Overall, eight models were trained using 1,000, 2,000, 3,000, and 4,000 training points. A test data set, comprised of 100,000 data points was then used to test the SVMs for accuracy:



As the chart indicates, as the number of training data points increases, so does the accuracy of the SVMs. However, this increase tends to increase less gradually as the number of training data points increases. Furthermore, training by collecting data from multiple agents provides better models for prediction. Ultimately, what we are truly interested in is the accuracy based on the employment of these predictions to target the enemy. Using probability SVM models, collected testing data by firing at the opponents whenever their was a greater than 60% chance of hitting the enemy. This data was then broken down to observe the accuracy of hitting the enemy at differing thresholds. Testing occurred different enemies for a total of 1,000 battles for four different models according to the number of training points gathered from training against multiple agents:



We can see from this chart that as the probability threshold increases, so does the accuracy of hitting the enemy when firing upon them. Furthermore, the more data used to train the SVM model, the high the accuracy is as well. Lastly, we can look at these results compared with different firing strategies. In the chart below, an SVM model was trained from 4,000 data points drawn from differing opponents. The accuracy from the best firing angle according to the SVM is compared with the accuracy from the worst firing angle. As expected, choosing the worst firing angle has extremely low targeting accuracy when compared with employing the best firing angle. In additional, the accuracy of shooting directly at the opponent, as well as shooting at a random firing angle is shown. Overall, our SVM model is able to perform better at targeting the opponent, and we are capable of achieving ~90% accuracy using these models.



From visual observation, the SVM models have learned that the best time to fire at an opponent is when they are near by, or close to a corner / wall. When the enemy is near a wall / corner, the firing angle is often times chosen such that it will strike the enemy if they move away from the wall, or if they do nothing. Thus, similar to the evasion strategies that were learned, proximity to walls and corners plays a large part in an enemy being struck by fired bullets, as is to be expected.