

CMPE591 Homework 1

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In this homework, I trained a multi-layer perceptron-based artificial neural network to predict the resulting position of an object after its interaction with a robot arm. There are four possible actions of the robot arm, and the object can have one of the two types: a sphere or a box. As the shape of the object is of critical importance to the resulting position of the object, I decided to use it as input. To feed the neural network with one of the four possible actions, I used four binary valued inputs, with one meaning the corresponding action is taken while zero means some other action is taken. My neural network had 5 inputs (1 object type and 4 action inputs) and 2 outputs (two-dimensional resulting position of the object). I included a hidden layer with 4 neurons.

I created five datasets varying in size, using 5, 25, 50, 100, and 200 simulations. Object types and actions are stored in files named 'state_actions_<number of sims>.pt'. Resulting positions are stored in files named 'positons_<number of sims>.pt'. These are used in training.

The model is trained over the datasets for 1000 epochs, splitting %20 of the datasets for testing and using the remaining portion for training. Adam is used to determine step size with mean squared error loss. Loss over epochs for the dataset with 200 simulations can be seen in Figure 1. It can be seen that the losses are settled approximately around epoch 300.

Resulting losses for each dataset can be seen in Table 1. I observed a significant gap between training and testing losses when datasets with 5 and 25 simulations were used. This indicates a generalizability issue. I haven't observed a decreasing loss with increasing dataset size after dataset size of 50.

Dataset size (#Sims)	Train Loss	Test Loss
5	0.0001	0.0189
25	0.0095	0.0171
50	0.0005	0.0006
100	0.0018	0.0024
200	0.0028	0.0026

Table 1: Mean squared error losses for datasets

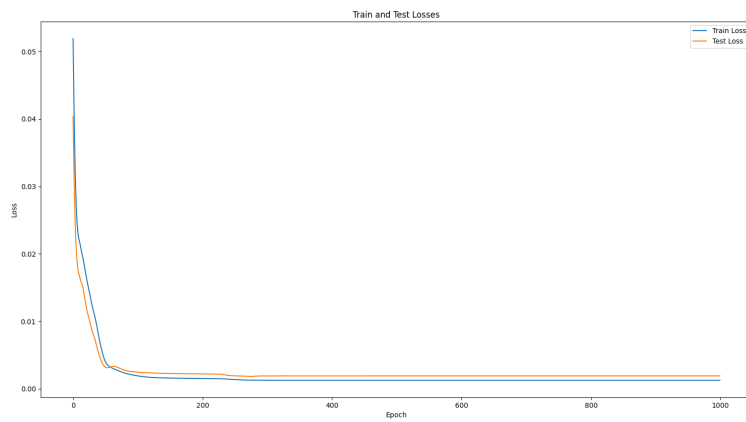


Figure 1: Test and train losses over epochs