Robotics II: Control, Modeling and Learning with Laboratory. Lab 7 Report

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1 Introduction

Inverse kinematics is an important problem to be solved, as it is relevant to obtaining and controlling manipulators in the desired way. In order to simplify and making this solution more robust, Neural networks were employed to solve these problems.

The goal of this laboratory was to tune Neural Network that was responsible for obtaining Inverse Kinematics without using the robot model and compare the results. The robot that was used in this lab is a 5-DOF planar manipulator. Robot was implemented in the MATLAB using Peter Corke' toolbox.

2 Neural Network

The Neural Network was modified by an addition of additional Convolution and Fully Connected Layers and Activation layers. I decided to add a pair before and after initial one. Several other activation layers were considered, however their result was lower than leaky ReLu layer. In addition, I increased network epochs from 10 to 20.

3 Results

The result showed that the mean error has been improved from 0.428 to 0.284. The Neural Network performance time was 17 seconds. Overall performance time did not exceed two minutes. My computer parameters can be seen below:

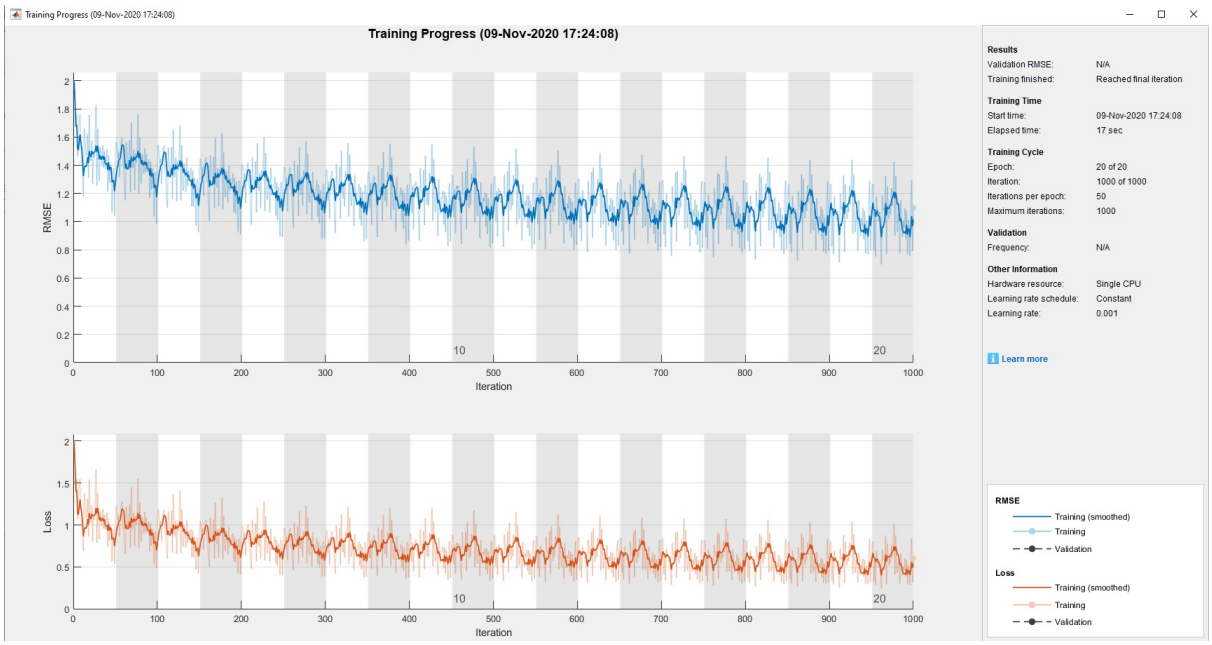

Figure 1: The Neural Network Training Progress

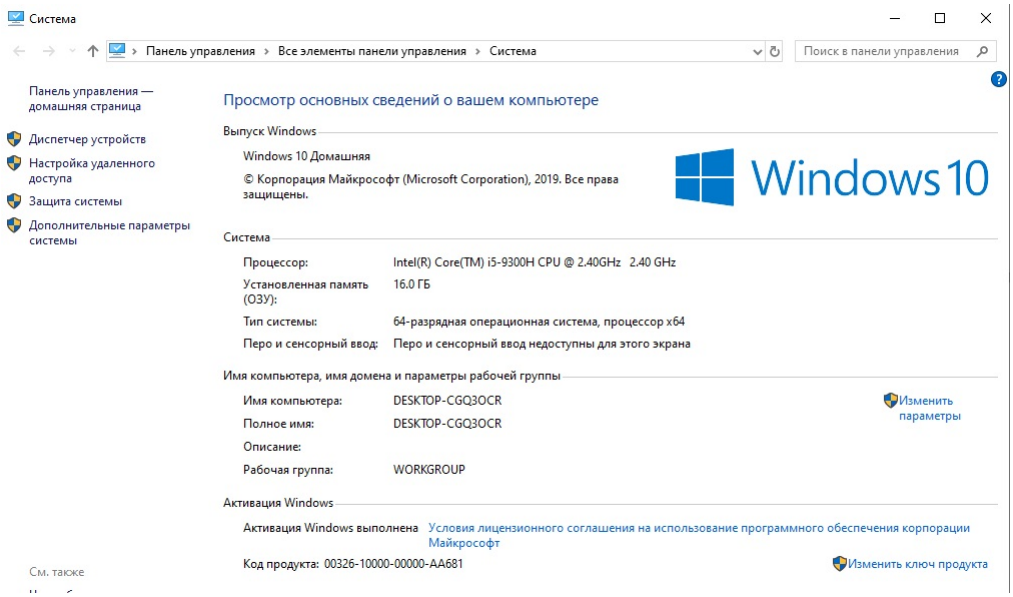

Figure 2: Computer Parameters

An example of the accuracy can be predicted by comparing real pose with the predicted one. On the figure, it can be seen that they are very similar. They are [2.8657 -0.0398 0] and [2.9492 -0.0134 0] respectively.

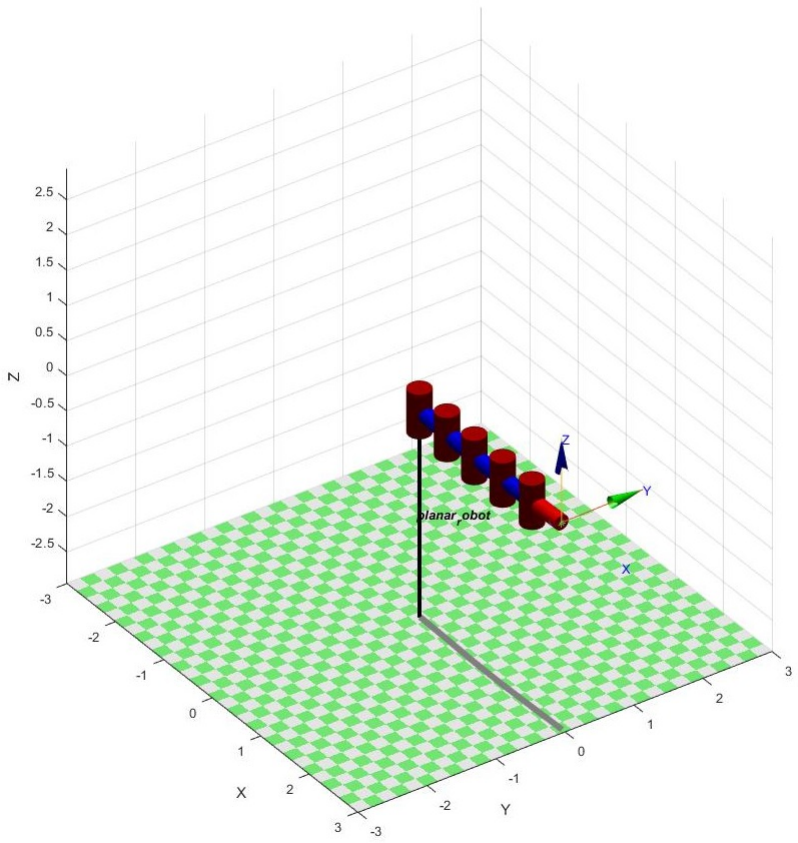

Figure 3: The Inverse Kinematics Comparison