Robot Learning

Assignment 09

Ramesh Kumar
Roberto Cai Wu

July 18, 2017

1 Question 9.1

- **What kind of information is required from the demonstrator?**

1.1 Answer

Demonstrations are required to teach the robot about the task, and using them humans can easily communicate any manipulation tasks such as picking, placing and grasping of objects to the robot. Apart from this, demonstrations also provide clues about the specific motor skills required to perform the task.

2 Question 9.2

- **How are actions generated?**

2.1 Answer

Actions are generated with the help of multi-layer perceptron(MLP) network. The paper describes two examples; Particle Reaching and Block Stacking.

In Particle Reaching task, by using Plain LSTM architecture with 512 hidden units, first demonstration trajectory is read, after than its output is added with the current state fed to a multi-layer perceptron(MLP) to produce the action.

On the other hand, for the task of Block Stacking, by using manipulation network information from the source and target blocks is extracted and by using multi-layer perceptron network actions are computed.

3 Question 9.3

- **Which parameters are adjusted by learning?**

3.1 Answer

- Attention weight and learned weight vector are adjusted by learning.

4 Question 9.4

- **How can demonstrations be transferred to novel situations?**

4.1 Answer

The proposed system is consisted by two neural networks; a vision network and an imitation network. Firstly, imitation network learns from the distribution of training examples, where it is trained for different tasks with thousands of demonstrations for each task. Each training example is a pair of demonstrations that perform the same task.

In order to solve novel situation of task, initially network is provided with entirety of the first demonstration and a single observation from second demonstration. After that, supervised learning is used in order to predict what action demonstrator took at that observation. To predict the action effectively, robot has to learn how to deduce the relevant portion of the task from the first demonstration. Furthermore, imitation network also uses soft attention module over the demonstration trajectory to deal with demonstrations of variable length.

5 Question 9.5

- **What is the role of the attention mechanisms??**

5.1 Answer

Attention mechanisms help robot to identify the source and target blocks in block stacking environment with the help of weights assigned by soft attention in the demonstration. Standard soft attention is applied to produce fixed dimensional vectors, where memory content include positions of each block in block stacking environment. In order to do manipulation, position of each block from memory content and robot's state are passed to the network.