Week 3 – CMP9766M - Robot Learning from Demonstrations

Athanasios Polydoros

There are three main methods

* Kinaesthetic teaching: Robot is physically driven by the expert.
* Teleoperation: The robot is driven using external input (eg joystick)
* Passive Observations: Task is recorded from external sensors (eg cameras)

A picture containing text, person, indoor

Description automatically generated

Table

Description automatically generated

Learning Outcome

During demonstration, the task is recorded by sensors and the data is used to learn a desired representation.

Diagram

Description automatically generated

Graphical user interface, text, application

Description automatically generated

Policy maps a state to an action - optimum policy is the best action to take in each state given all states.

Selection of learning representation:

Low level control – torque, velocity or position commands

Is the action space continuous or discrete?

Do I need to have a compact representation ?

Do I need to plan the task multiple steps ahead ?

Does the learned task consists of subtasks ?

Table

Description automatically generated

Text

Description automatically generated

A neural network can use any regression method as a mapping policy. In case of the input, it is a time variable that is continuous from 1 – 0 and represents time, the beginning from of the demonstration to the end. An alternative to this is state, it can represent alof of things such as velocity etc., it is usually multidimensional and depends on the robotics system Diagram

Description automatically generated

It is much easier for a machine learning model to learn a model that has 1 dimension of data.

Can learning from demonstration be used to teach an AI to act unexpectedly robot to expect the un-expected?

Part B – LfD example on Industrial Assembly