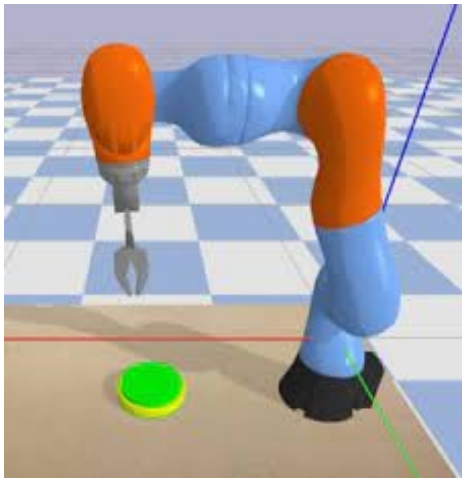
Robotics and Embedded Systems

Human Brain Project

Master Thesis

Learning adaptive target reaching with Recurrent Neural Networks

BACKGROUND



We would like to address the problem of fast adaptation for motor-control through end-to-end learning, rather than hand-designed mechanisms that perform adaptation for specific use-cases [1]. Furthermore, we are interested in doing fast adaptation for torque-controlled robots for two reasons: (a) They provide a promising technology for performing more complex and delicate tasks that emulate human dexterity and (b) Human motor control is torque driven and we wish to understand the mechanisms of fast adaptation in humans.

YOUR TASK

In this thesis, you will develop multiple RNN architectures to learn target reaching. The arm used for reaching will be simulated in the PyBullet framework and will be torque controlled. You will also test the network's ability to adapt to different arm properties (e.g. by varying masses and lengths of the arm's links).

Required Skills

- Good Knowledge of Python and Linux
- Basic Knowledge in Robotics
- Experience with Deep Learning frameworks and is preferred

References

[1] Cheah, C. C., et al. "Adaptive Tracking Control for Robots with Unknown Kinematic and Dynamic Properties." The International Journal of Robotics Research, vol. 25, no. 3, Mar. 2006, pp. 283–296

[2] Hitzler, Kevin, et al. 'Learning and Adaptation of Inverse Dynamics Models: A Comparison'. 2019 IEEE-RAS 19th International Conference on Humanoid Robots (Humanoids), 2019, pp. 491–98.

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