

Control of a pneumatic humanoid robot by reinforcement learning

Master Thesis Proposal in Automatic Control



The RAI-LTU upper-body humanoid [1],[2]

Human-inspired robots are attracting increasing interest since they can be utilized as a research tool in several scientific areas, such as medicine and space. However, controlling these robots to have smooth, fast and accurate movements is still a challenging task.

The upper body humanoid robot presented in the top figure, developed in the Field Robotics Laboratory, is actuated with Pneumatic Artificial Muscles (PAMs) and reproduce the human movements. The goal of this thesis is to implement a control system for the movement of the arms by means of reinforcement learning. Besides, this thesis will study the differences between model-based and model-free reinforcement learning approaches for the desired robot.

- Number of participants: 1 to 2 Students
- The controller needs to be tested in simulations and finally extended on real experiments.
- Knowledge in programming and use of various software packages (Matlab, Python, LabVIEW etc.) is suggested.
- Knowledge in machine learning is a plus.
- The participant has a weekly discussion with her\his supervisors to be guided.

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References:

- [1] Andrikopoulos, G., Nikolakopoulos, G., Kominiak, D., & Unander-Scharin, Å. (2016, June). Towards the development of a novel upper-body pneumatic humanoid: Design and implementation. In *Control Conference (ECC), 2016 European*(pp. 395-400). IEEE.: Design and implementation.
- [2] Andrikopoulos, G., & Nikolakopoulos, G. (2017, July). Design, development and control of a human-inspired two-arm robot via Pneumatic Artificial Muscles. In *Control and Automation (MED), 2017 25th Mediterranean Conference on* (pp. 241-246). IEEE.