

Survey of spiking neural network applications for robot motion control

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Problem description:

With the introduction of robotic systems in more and more aspects of everyday life, design paradigms for robots are shifting towards human-safety robotics. This also incorporates a change from rigid and bulky actuators that operate in a known environment devoid of humans with exact kinematic models to compliant or soft actuators that need to adapt to uncertain situations in unknown environments.

Spiking neural networks (SNNs) [1] may be an interesting learning approach to solve state-of-the-art robot motion control tasks such as controlling a robot arm without a prior knowledge of its kinematics [2] or controlling artificial muscle actuators [3].

This seminar aims to review possible applications of SNNs for robot motion control tasks, where the student should provide a comprehensive survey of existing applications and discuss their advantages and disadvantages.

Task:

- Find use cases for the application of SNNs in robot motion control tasks
- Discuss advantages and disadvantages of SNNs for different robot motion control application fields
- Documentation and report

Literature:

[1] Vreeken, Jilles. "Spiking neural networks, an introduction." *Institute for Information and Computing Sciences, Utrecht University Technical Report UU-CS-2003-008* (2002).

[2] Bouganis, Alexandros, and Murray Shanahan. "Training a spiking neural network to control a 4-dof robotic arm based on spike timing-dependent plasticity." *Neural Networks (IJCNN), The 2010 International Joint Conference on*. IEEE, 2010.

[3] Hulea, Mircea, and Constantin Florin Caruntu. "Spiking neural network for controlling the artificial muscles of a humanoid robotic arm." *System Theory, Control and Computing (ICSTCC), 2014 18th International Conference*. IEEE, 2014.

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