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BACHELOR THESIS
for
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Human Movements Prediction using On-line Gaussian Processes

Problem description:

A promising strategy for the rehabilitation of patients with impaired body balance consists in providing a “light touch” balance support, for example by lightly resting a hand on the back of a patient without taking patient’s weight. If a robotic caregiver is asked to provide this light touch, Cartesian impedance control strategies [1] can be adopted to guarantee a soft interaction. Cartesian control approaches require high frequency ($\approx 1ms$) control loops and the current human tracking systems are not able to provide references at the required frequency.

In this Bachelor Thesis work the student has to implement an algorithm, based on on-line Gaussian process regression [2, 3], to predict human’s body part movements in real time given their current state. These predictions will be used as references for a Cartesian impedance controller providing robotic light touch.

Tasks:

- Literature overview on on-line Gaussian processes
- Movements prediction algorithm implementation in C++
- Comparison with state-of-the-art approaches (on-line support vector machines)
- Experimental evaluation with a Kuka LWR IV+ robot (optional)

Bibliography:

- [1] C. Ott. Cartesian Impedance Control of Redundant and Flexible-Joint Robots, in *Springer Tracts in Advanced Robotics (STAR)*, 2008.
- [2] C. E. Rasmussen and C. K. I. Williams. Gaussian processes for machine learning *MIT Press*, 2006.
- [3] L. Csató. Gaussian Processes - Iterative Sparse Approximations *Aston University - PhD dissertation*, 2002.

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