

10.03.2015

## F O R S C H U N G S P R A X I S

for

xxx

Student ID xxx, Degree EI

### **Learning Motion Primitives from Invariant Representation**

#### Problem description:

Learning of Motion Primitives (MP), as well as their generalization to different scenarios, is of importance to increase the robot's versatility in every-day scenarios.

In this Forschungspraxis work the student has to implement an algorithm to learn MP from invariant trajectories [1]. These trajectories are not affected by affine transformations. Hence, we expect the learned MP generalize well in the space of affine transformations, without providing additional training samples. To learn MP, Gaussian Mixture Model (GMM) and Gaussian Process (GP) will be compared. A comparison with the work in [4] is required to show the benefits of our approach wrt state-of-the-art algorithms.

#### Work schedule:

- Learn motion primitives from invariant representation.
- GP implementation.
- Identify the best learning technique (GMM/GP) for the invariant features.
- Comparison with the approach in [4].

#### Bibliography:

- [1] R. Soloperto, M. Saveriano and D. Lee. A Bidirectional Invariant Representation of Motion for Gesture Recognition and Reproduction. in *International Conference on Robotic and Automation*, 2015.
- [2] D. A. Cohn, Z. Ghahramani, and M. I. Jordan. Active learning with statistical models. in *Journal of Artificial Intelligence Research*, vol. 4, no. 1, pp. 129145, 1996.
- [3] C. Rasmussen and C. Williams. Gaussian processes for machine learning. *MIT Press*, 2006.
- [4] S. Calinon, Z. Li, T. Alizadeh, N.G. Tsagarakis and D.G. and Caldwell. Statistical dynamical systems for skills acquisition in humanoids. in *International Conference on Humanoid Robots*, 2012.

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Start: xx.xx.2015  
Delivery: xx.xx.2015

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