

DIPLOMA THESIS ASSIGNMENT

Student: Bc. Martin B u r i a n

Study programme: Open Informatics

Specialisation: Computer Vision and Image Processing

Title of Diploma Thesis: Haptic Terrain Exploration with Robotic Arm

Guidelines:

Outdoor terrain robots must be able to traverse various rough terrains. To achieve high traversability the robots often have a complex locomotion morphology like articulated tracks. In order to control the morphology the robot needs to measure its own state (interoceptive sensing) and the surrounding terrain (exteroceptive sensing). However, exteroceptive sensing is failing in many Urban search and rescue (USAR) scenarios, like in the presence of dense smoke. Certain level of robot motion control is possible even in case of missing data but there are situations when additional tactile sensing by using a robot-mounted robotic arm is unavoidable [1]. Recent methods [2,3] bypass time-consuming arm motion planning by a heavy off-line learning from simulations as well as from real rollouts. The goal of this work is to design an efficient exploration policy for the robotic arm. The motion control method [1] produces a tactile sensing request. The arm should explore a free space for its own motion and then get the tactile measurement. The sought policy should minimize the arm movement, it should exploit the arm morphology.

Bibliography/Sources:

- [1] M. Pecka, K. Zimmermann, M. Reinsten, and T. Svoboda. Controlling Robot Morphology from Incomplete Measurements. In IEEE Transactions on Industrial Electronics, accepted May 2016.
- [2] Levine, S., Wagener, N., and Abbeel, P. (2015). Learning Contact-Rich Manipulation Skills with Guided Policy Search. In IEEE International Conference on Robotics and Automation (ICRA).
- [3] Kupcsik, A., Deisenroth, M. P., Peters, J., Poh, L. A., Vadakkepat, P., and Neumann, G. Model-based contextual policy search for data-efficient generalization of robot skills. In Artificial Intelligence. 2014 (on-line, in press).

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