BACHELOR'S THESIS ASSIGNMENT

I. Personal and study details

Student's name: **Rozsypálek Zdeněk** Personal ID number: **457216**

Faculty / Institute: **Faculty of Electrical Engineering**

Department / Institute: **Department of Control Engineering**

Study program: **Cybernetics and Robotics**

Branch of study: **Systems and Control**

II. Bachelor's thesis details

Bachelor's thesis title in English:

Active 3D mapping using laser range finder with steerable measuring rays

Bachelor's thesis title in Czech:

Aktivní 3D mapování pomocí laserového dálkoměru s řiditelnými měřicími paprsky

Guidelines:

1. Consider the problem of active 3D mapping using a laser rangefinder with steerable measuring rays [1] in reinforcement learning setting, with actions encompassing the selected rays and the current 3D map (occupancy of voxels) built from past measurements, and reward corresponding to the map accuracy.
2. Briefly review state-of-the-art reinforcement learning algorithms implemented in OpenAI Baselines [2], such as [3, 4, 5], and select suitable algorithm(s) for the problem.
3. Design, implement, and train one or more agents using these (possibly adapted) algorithms in the Lidar gym environment [6] based on the publicly available KITTI dataset [7].
4. Evaluate the trained agent(s) and discuss the results, including learning curves and ROC curves for the final predicted occupancy. Compare the results to those of [1].

Bibliography / sources:

[1] Zimmermann, K. et al. Learning for active 3D mapping. In The IEEE International Conference on Computer Vision (ICCV), Oct. 2017, pp. 1548-1556. doi:10.1109/ICCV.2017.171
[2] Dhariwal, P. et al. OpenAI Baselines. In GitHub. URL: https://github.com/openai/baselines
[3] Mnih, V. et al. Human-level control through deep reinforcement learning. In Nature 518, pp. 529-533. doi:10.1038/nature14236
[4] Wang, Z. Sample Efficient Actor-Critic with Experience Replay. In International Conference on Learning Representations (ICLR), April 2017. URL: https://openreview.net/forum?id=HyM25Mqel
[5] Schulman, J. et al. Proximal Policy Optimization Algorithms. 2017. arXiv:1707.06347. URL: https://arxiv.org/abs/1707.06347
[6] Rozsypálek, Z. Lidar gym - OpenAI gym training environment for agents controlling solid-state lidars based on Kitti dataset. URL: https://gitlab.fel.cvut.cz/rozsyzde/lidar-gym
[7] Geiger, A. et al. Vision meets robotics: The KITTI dataset. In The International Journal of Robotics Research, 32(11), pp. 1231-1237.

Name and workplace of bachelor's thesis supervisor:

Ing. Tomáš Petříček, Vision for Robotics and Autonomous Systems, FEE

Name and workplace of second bachelor's thesis supervisor or consultant:

Date of bachelor's thesis assignment: **30.01.2018** Deadline for bachelor thesis submission: **25.05.2018**

Assignment valid until: **30.09.2019**

Ing. Tomáš Petříček Supervisor's signature	prof. Ing. Michael Šebek, DrSc. Head of department's signature	prof. Ing. Pavel Ripka, CSc. Dean's signature

III. Assignment receipt

The student acknowledges that the bachelor's thesis is an individual work. The student must produce his thesis without the assistance of others, with the exception of provided consultations. Within the bachelor's thesis, the author must state the names of consultants and include a list of references.

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Date of assignment receipt

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Student's signature