Depth estimation on laparoscopic Images

Project Management and Software Development for Medical Applications

General Info

Project Title: Depth estimation on laparoscopic Images

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Project Abstract

Depth estimation of RGB images has been broadly developed in the last years. This intuitive task for humans is, however, very challenging for a machine. Furthermore, this gets even harder for some setups like laparoscopic imaging. The huge amount of deformations and changes in light and tissue property hinder depth estimation for this setup. The use of Deep Learning has shown to work for this task. The main requirement, the huge amount of labeled data, will be addressed on this project by the generation of artificial data using BlenderProc. This tool allows the creation of artificial RGBD images given a textured mesh. These texture meshes will be created using industrial software to reconstruct a 3D structure from laparoscopic videos.

Student’s Tasks Description

- Familiarization with BlenderProc
- Familiarization with AliceVision
- Reconstruction of several 3D meshes from laparoscopic videos
- Generation of a dataset for depth estimation on laparoscopic images
- Training of CNN to estimate depth on the aforementioned dataset

Technical Prerequisites

Python

Tensorflow or Pytorch

References

BlenderProc. Maximilian Denninger, Martin Sundermeyer, Dominik Winkelbauer, Youssef Zidan, Dmitry Olefir, Mohamad Elbadrawy, Ahsan Lodhi, Harinandan Katam

Dense Depth Estimation in Monocular Endoscopy with Self-supervised Learning Methods. Xingtong Li, Ayushi Sinha, Masaru Ishii, Gregory D. Hager, Fellow, IEEE, Austin Reiter, Russell H. Taylor, Fellow, IEEE, and Mathias Unberath

Please send the completed proposal to beatrice.demiray@tum.de, javier.esteban@tum.de and hendrik.burwinkel@tum.de. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.