Vorstellung der Themen: WS 2022 / 2023
Recognizing pen markings on 2D and 3D objects.

**Description**

- Pen markings are used as a tool for inter human communication in many areas such as industrial production. Hence digitalization of this information would be useful for many computerized applications. However there seem to be no general method available for this. The goal of this project is to develop such a solution.
- One possible path for such a solution is to use a fluorescent or anti-Stokes color pen together with lamps and filters to extract markings from the background. Although a more general solution could also be additionally pursued and evaluated.

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**Betreuer**
Dr. Tim Zander tim.zander@kit.edu
3D Personenkartierung für mobile Roboter in unstrukturierten Umgebungen

**Themenbeschreibung**
Das Erkennen gefährlicher Situationen ist ein wesentlicher Aspekt in der mobilen Robotik. In diesem Projekt soll eine Pipeline entwickelt werden, bei der LiDAR Sensordaten verwendet werden, um ein semantische Hinderniskarte der Umgebung zu generieren. Dazu soll die generierte Punktwolke des Roboters mit einem aktuellen Verfahren zur semantischen Segmentierung verarbeitet werden, sodass der Roboter gewarnt werden kann, falls dynamische Hindernisse in seinen Arbeitsbereich eindringen.

**Aufgaben**
- Erarbeiten einer 3D semantischen Segmentierungspipeline für mobiler Roboter mit ROS.
- Vergleich verschiedener Methoden zur Segmentierung, Evaluierung am echten Roboter.

**Literatur**
- Jiang et al.: RELLIS-3D Dataset: Data, Benchmarks and Analysis, 2020
- Qi et al.: Object Semantic Grid Mapping with 2D LiDAR and RGB-D Camera for Domestic Robot Navigation, 2020

**Vorkenntnisse**
C++ Kenntnisse, (optional) Python Kenntnisse, ROS Vorkenntnisse hilfreich

**Betreuer**
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Vehicle Keypoint Detection

Description

- Localization of vehicle keypoints has a variety of use cases, e.g. locating important parts for make and model recognition or estimating the viewpoint of the camera. However, this task has received only small attention in research. Instead, most research in keypoint detection targets human pose estimation. While recent state-of-the-art human pose estimation methods can be applied for vehicle keypoint detection, their accuracy is still to be evaluated.

- The objective of this course is to compare different methods for vehicle keypoint detection. Specialized methods for vehicle keypoint detection will be tested as well as recent human pose estimation approaches. Additionally, own ideas for improvements, e.g. using the rigid structure of cars, will be implemented and evaluated.

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Vehicle Keypoint Detection

- **Tasks**
  - Evaluate specialized vehicle keypoint detection methods
  - Compare them to human pose estimation methods applied to vehicle keypoint detection
  - Integrate new ideas for improvement
  - Design and implement a demonstrator with a web-based UI

- **Desired Requirements**
  - Experience in Python, Linux, PyTorch
  - Knowledge of keypoint detection / human pose estimation / computer vision

- **Supervisor**
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