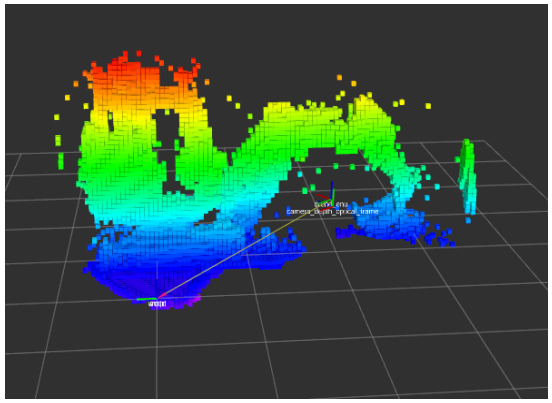
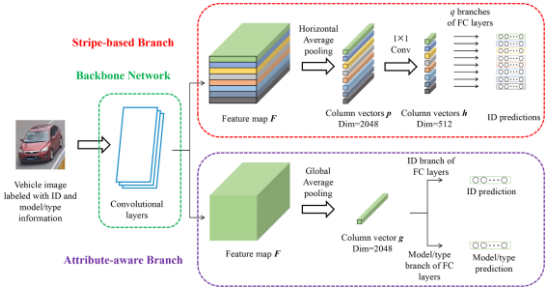
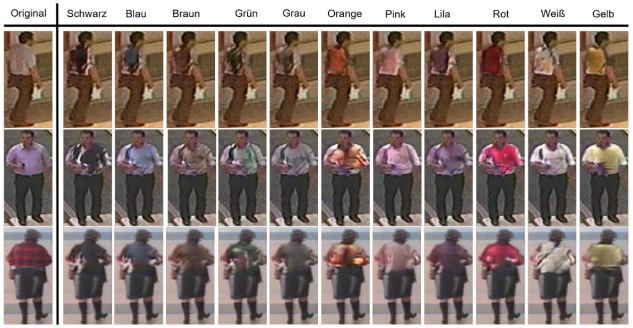
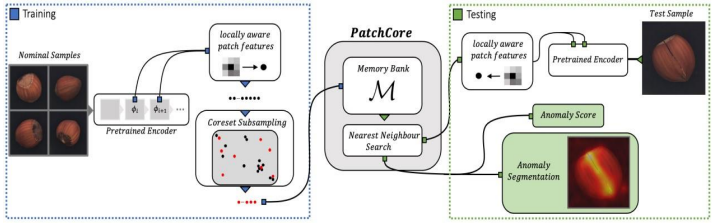
Vorstellung der Themen

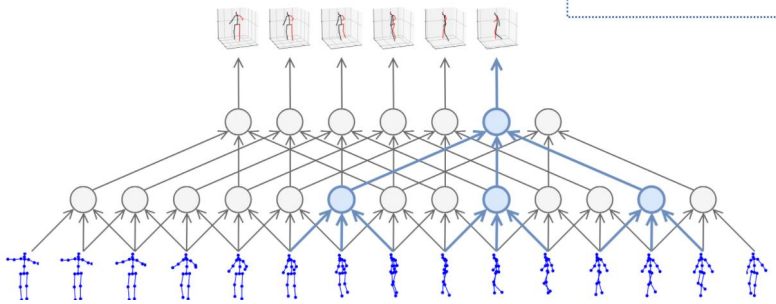
WS 2021 / 2022









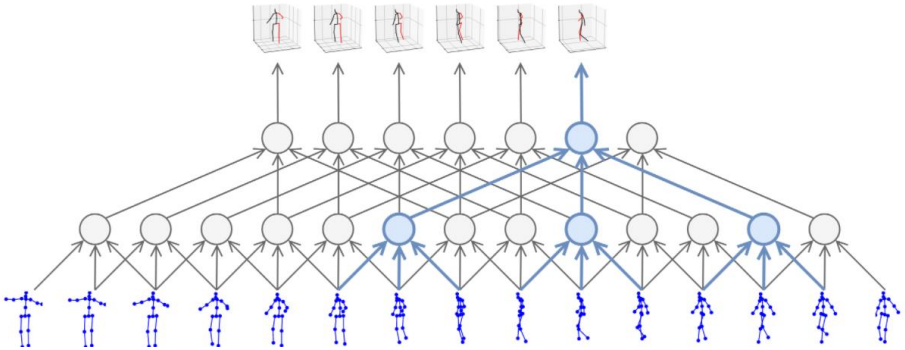


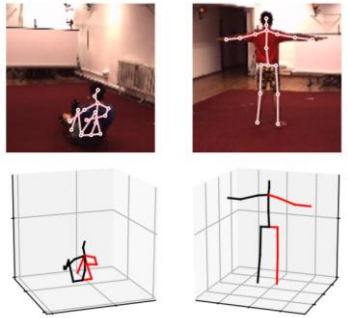
3D Crowd Pose Estimation

Description

The analysis of the behavior of individuals in crowds or groups of people in public places has gained enormously in importance last year, for example through distance bids. Human pose estimation plays here a key role to understand individuals' behavior and deep learning can be used to construct accurate state-of-the-art pose estimators. However, such models do not scale easily and are not traditionally designed for larger crowds.

The objective of this course is to implement a demonstrator with state-of-the-art 3D human pose estimation models which will be applied on crowds. Different ideas and approaches will be investigated and tested for this purpose.





Pavllo, Dario, et al. "3d human pose estimation in video with temporal convolutions and semi-supervised training." Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition. 2019.

3D Crowd Pose Estimation

Tasks (3 students)

- Investigate state-of-the-art approaches for semi-supervised 3D human pose estimation
- Adapt and apply those approaches to crowd pose estimation
- Design and implement a demonstrator with PyQt and Docker
- Evaluation

Desired requirements

- Experience in Python, Linux, PyTorch
- Knowledge of human pose estimation / computer vision

Supervisor

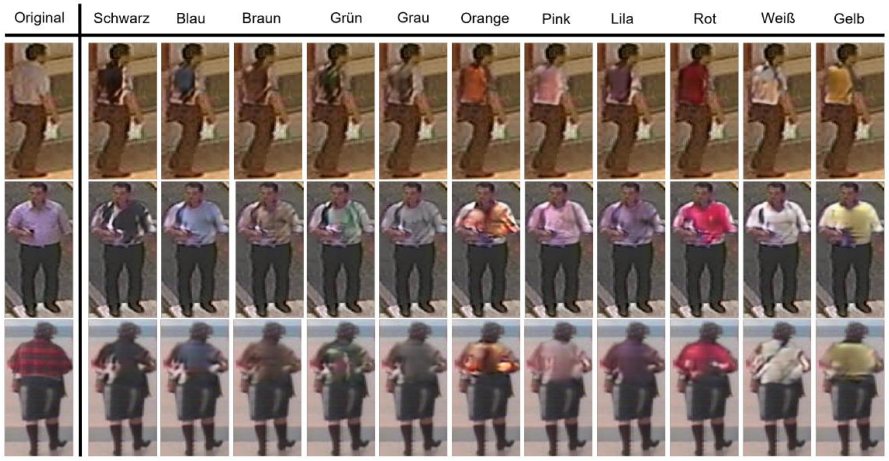
- Mickael Cormier, M.Sc. mickael.cormier@iosb.fraunhofer.de
- Thomas Golda, M.Sc, thomas.golda@kit.edu

Interactive Person Attribute Anonymization

Description

The analysis of the behavior of individuals in crowds or groups of people in public places has gained enormously in importance last year. Researchers require large datasets to perform their experiments, however the person represented a required to be anonymized. A promising approach is to manipulate soft-biometric features such as the color of the clothes in order to disturb person-re-identification networks.

The objective of this course is to implement a demonstrator using state-of-the-art generative models applied to person images to modify their appearance and thereby anonymize them.



Interactive Person Attribute Anonymization

Tasks (3~5 students)

- Investigate state-of-the-art approaches for person segmentation
- Adapt and apply an interactive segmentation tool for person segmentation
- Adapt and improve a GAN for person attribute manipulation
- Design and implement a demonstrator with PyQt and Docker
- Evaluation

Desired requirements

- Experience in Python, Linux, PyTorch
- Knowledge of deep learning / computer vision

Supervisor

- Mickael Cormier, M.Sc. mickael.cormier@iosb.fraunhofer.de
- Andreas Specker, M.Sc, andreas.specker@iosb.fraunhofer.de

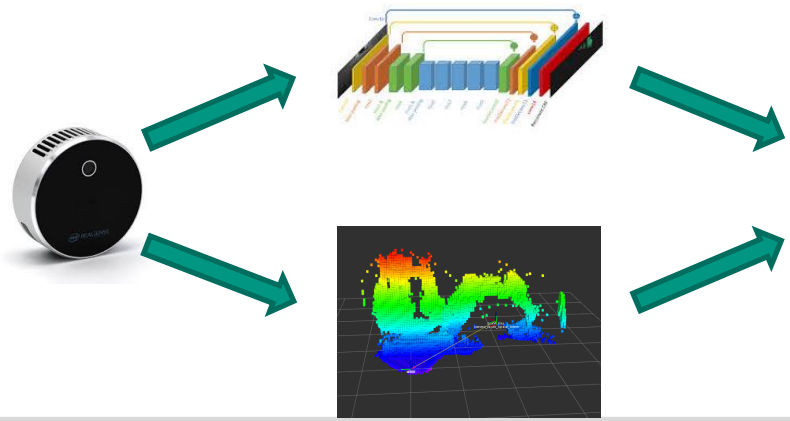
Building Efficient Semantic 3D Maps
Mobile Robotic Perception in Unstructured Environments

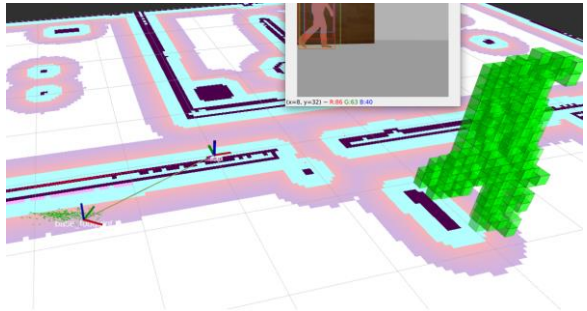
Karlsruher Institut für Technologie

Description

One of the key aspects in the field of mobile robotics is the sensing of an unknown environment in order to build a realistic 3D map representation. This process is called "Mapping" and the output is usually some simplified Voxelgrid representation as visualized below. Such representations must be efficient to compute, meaningful for a human as well as suitable for planning purposes.

Current map representations are not able to keep up with the innovations in deep learning-based segmentation and perception of raw image / point cloud data. Consequently, some of the gathered data cannot be used in further processing steps. In this practical course you will design a whole Mobile Robotic Mapping Pipeline, which is able to fuse raw sensor data with the output segmentation networks into one efficient and dynamic map representation.





Martin et. Al: Semantic 3D Mapping from Deep Image Segmentation, 2021

Building Efficient Semantic 3D Maps
Mobile Robotic Perception in Unstructured Environments

Tasks (3~4 students)

- Investigate state-of-the-art map representation (Octomap, Voxblox, OpenVDB) as well as state-of-the-art segmentation networks
- Build a ROS-based Mobile Robotics pipeline for creating a semantic 3D Map of an robot's environment
- Evaluation on real robot (e.g. Spot, Drone) / against current representations

Learning Objectives

- Development and Deployment in ROS-based environments in simulation and on real robots, understanding sensor information flow
- Efficient Data Structures and implementations for on-board low performance devices
- Current Deep Learning Architectures for Semantic Segmentation

Desired requirements

- Some Programming Experience in C++ , optional Python
- Basic Understanding of Computer Vision / Data Structures

Supervisor: Raphael Hagmanns, raphael.hagmanns@kit.edu, Dr.-Ing. Thomas Emter

Deep-learning-based image processing in Smart Farming

Description

Increasing world population pushes the use of sensor technologies in agriculture. Camera-based systems can provide real-time information on the quality and quantity of plants, allowing immediate reaction by the farmer. The exact position of each plant needs to be matched to the respective plants by georeferencing to ensure reproducible information and tracking of plants over a long period of time.

The objective of this course is to implement state-of-the-art algorithms for georeferencing of images as well as the implementation of deep-learning approaches for object detection, segmentation and classification of diseased and healthy fruits in a given set of images recorded in viticulture.

Deep-learning-based image processing in Smart Farming

Karlsruher Institut für Technologie

Tasks (3~4 students)

- Literature research
- Implementing state-of-the-art algorithms for georeferencing, object detection and classification
- Evaluation

Desired requirements

- Experience in Python
- Knowledge in computer vision and basic understanding of deep learning

Supervisor

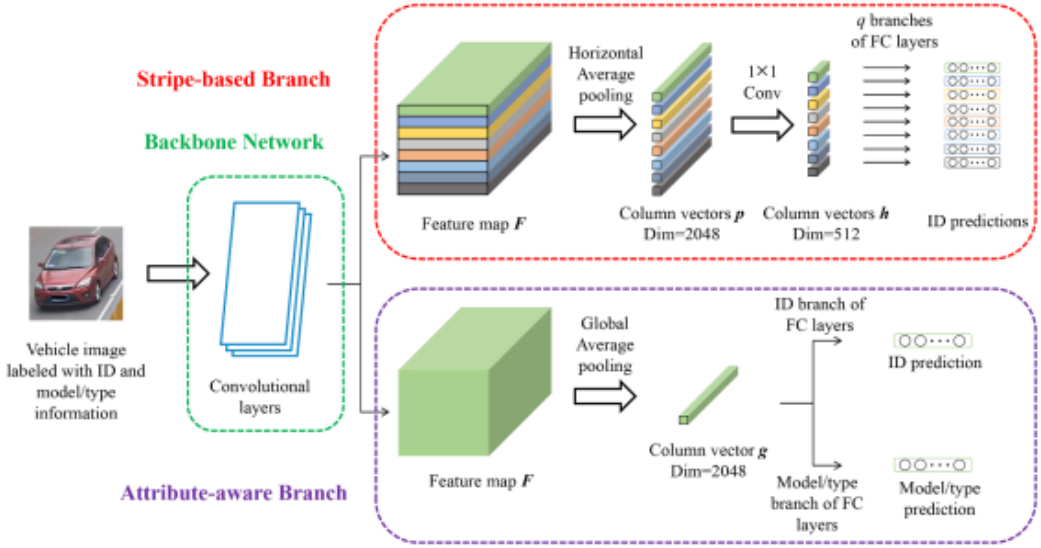
- Petra Schumacher, Petra.schumacher@iosb.fraunhofer.de
- Julius Krause, Julius.krause@iosb.fraunhofer.de

Metadata-assisted Vehicle Re-identification

Description

Rising security needs and an increasing number of cameras in recent years require automatic image analysis. Two emerging tasks in this regard are vehicle re-identification (ReID) and the recognition of vehicle metadata like brand and model. The target of this project is to combine both by using the vehicle metadata to improve the ReID accuracy.

To achieve this goal, a vehicle-make-model-recognition and a vehicle ReID method should be implemented. Afterwards, the information about the make and model of the vehicle should be used in the ReID to improve the matching of vehicles.



Qian et al. Stripe-based and attribute-aware network: a two-branch deep model for vehicle re-identification. Meas. Sci. Technol. 31

Metadata-assisted Vehicle ReID

Tasks (4~5 students)

- Investigate state-of-the-art approaches for vehicle make-model-recognition and ReID
- Train and evaluate a vehicle model recognition and a vehicle ReID
- Implement a ReID assisted by vehicle metadata like brand and model
- Evaluation

Desired requirements

- Experience in Python and PyTorch or similar frameworks
- Knowledge of deep learning / computer vision

Supervisor

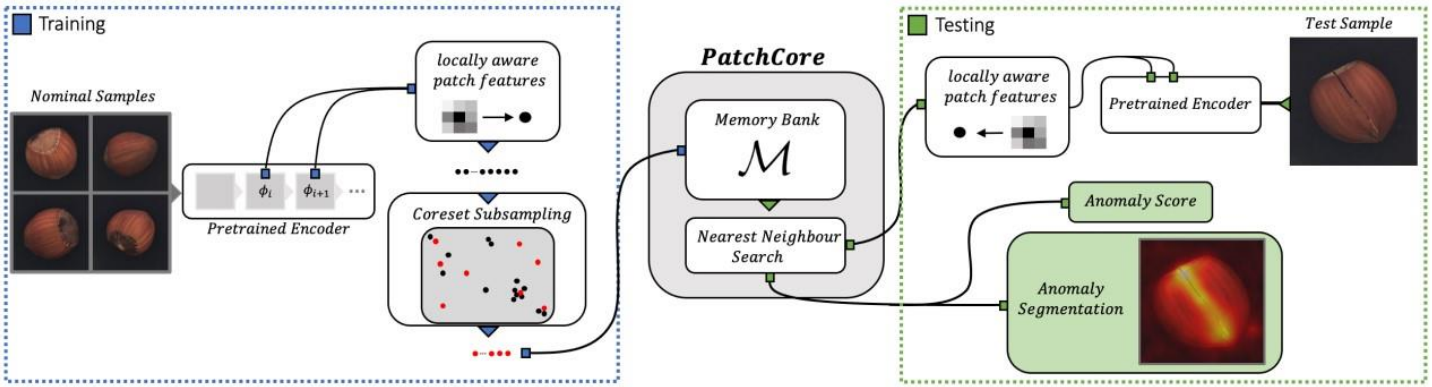
- Stefan Wolf, M.Sc. stefan.wolf@iosb.fraunhofer.de
- Andreas Specker, M.Sc. andreas.specker@iosb.fraunhofer.de

Perceptual similarity&outlier detection towards total recall in industrial anomaly detection

Description

Detecting defects of unknown types in automated industrial visual inspections is a hard problem. Recent results developments towards general algorithms have been made by combining embeddings from imagenet models and outlier detection models.

The course will take a state of the art model[1] and apply it to a multi-camera vision inspection problem. Several questions are following this approach such as for algorithms detecting and improving anomaly segmentation intersections of different camera views and effective improvements of models through new data.



[1] https://paperswithcode.com/sota/anomaly-detection-on-mvtec-ad

Perceptual similarity&outlier detection towards total recall in industrial anomaly detection

Tasks (2-6 students)

- Investigate one state-of-the-art approach and multi-view segmentation methods
- Build a multi-camera setup and gather a data set (200-300 samples)
- Evaluate performance

Desired requirements

- Experience in Python (Pytorch)
- Computer Vision

Supervisor

- Dr. Tim Zander (tim.zander@kit.edu)