Praktikum on 3D Computer Vision

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Introduction

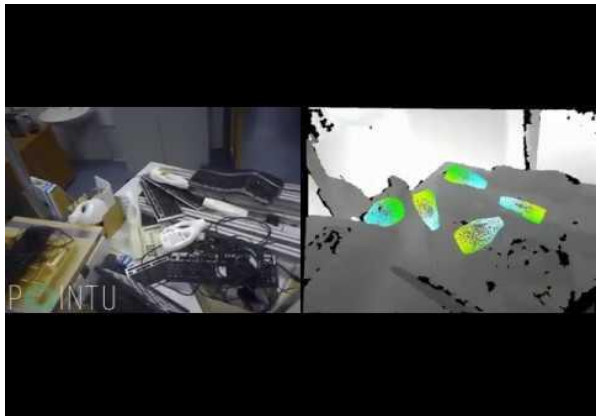
- 3D Computer Vision

  Scene understanding
  - 6D object pose estimation
  - SLAM, Structure from Motion
  - 3D reconstruction
  - Camera pose / re-localization
  - Nerf, 3D rendering
  - Semantic segmentation / understanding
  - Depth prediction, stereo

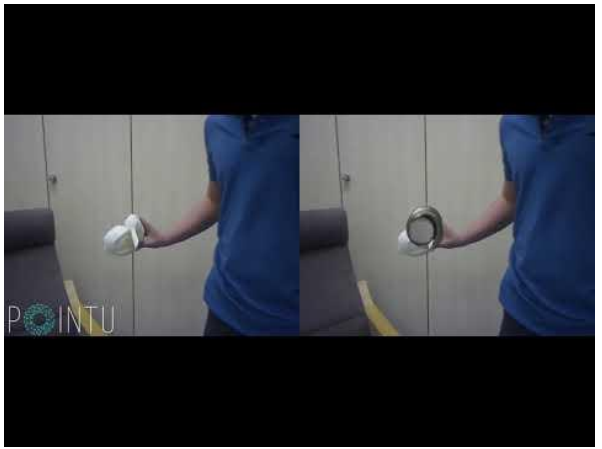
  Human understanding
  - 3D body / hand / face pose estimation
  - 3D Head / body modeling
  - ..

- Application in Robotics
  - Grasping and Manipulation
  - Navigation
  - Obstacle avoidance

- Augmented Reality
  - Render virtual/augmented content on real objects of known shape or pose



3D Object Detection and tracking



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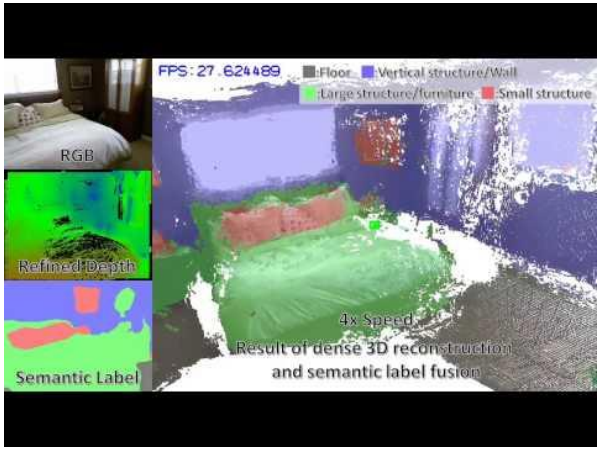
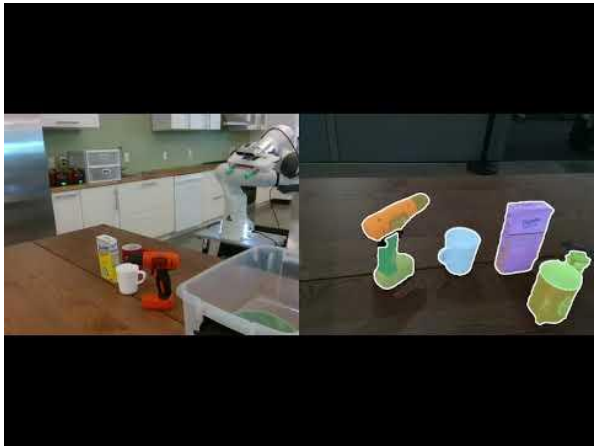


Depth Prediction, Semantics and SLAM

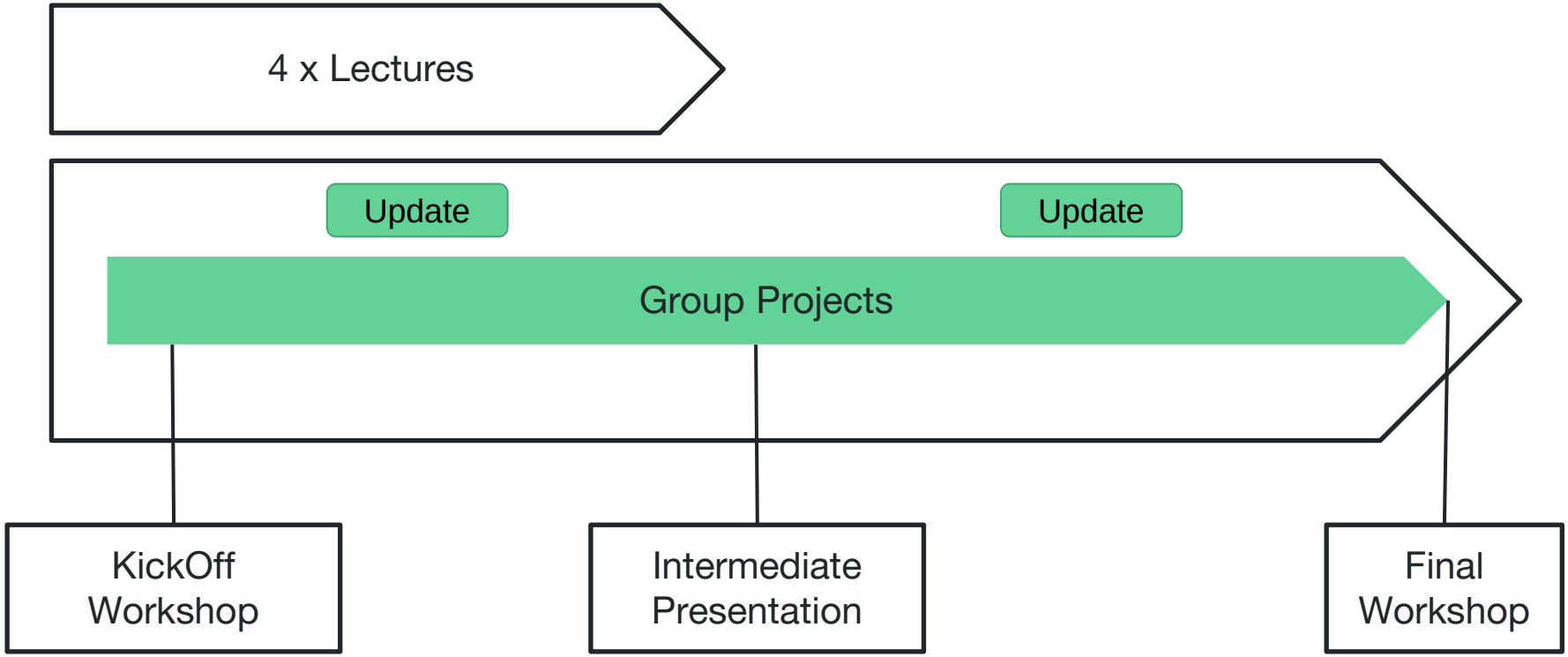


Robotics

Goals of the Praktikum

- Learn about the **state of the art in 3D computer vision**
- Familiarize with **practical aspects and use cases** of typical 3D perception tasks (3D feature extraction and learning, surface matching and 3D reconstruction, 3D object localization and pose estimation, SLAM, ..)
- **Develop an end-to-end project in a team** aiming to solve a relevant and challenging problem in 3DCV
- Learn to **explain and disseminate your work** in tech talks

Course structure



Teams

Setup

- Around 24 students are grouped into **teams of 4-5 students**
- Each team will be assigned to a project
- Each project has multiple tutors that act as expert **advisors** to assist the team during the project

Student-to-Project Matching

- Registered students can **indicate project preference** after project announcements
- Students will be assigned to a team and project that **best fits the indicated preference & background**

Tentative schedule

Lecture period: 14.10.2024 – 07.02.2025

25.10.	Introductory talk & Project presentations
01.11.	Project assignments
08.11.	Project KickOffs
	CVPR Break
22.11.	Project Update I
29.11.	Lecture I & Lecture II
06.12.	Lecture III & Lecture IV
13.12.	Mid-term Presentations
	Christmas Break
17.01.	Project Update II
07.02.	Final Workshop

Time: Fridays 14.00 - 15.30
Place: Seminar Room 03.13.010

In-person attendance in each session is mandatory. Missing more than one session without a valid excuse can lead to failing the course.

Evaluation

Project work (75 %)

- Project management
- Teamwork & communication
- Scientific understanding & depth
- Methodology, implementation & evaluation

Presentations (25%)

- Presentation style
- Structure of the presentation
- Quality of slides
- Scientific understanding & explanations
- Q&A

Prerequisites

- Required: 1+ computer vision-related course
  - Tracking and Detection in CV (IN2357)
  - Computer Vision I: Variational Methods,
  - Computer Vision II: Multiple View Geometry (IN2228)
  - Robotic 3D Vision, Convex Optimization for ML and CV, Probabilistic Graphical Models in CV
  - ...
- Required: 1+ deep-learning-related course
  - Introduction to Deep Learning (I2DL) (IN2346)
  - Machine Learning (IN2064)
  - Machine Learning for 3D Geometry (IN2392)
  - ...
- Suggested:
  - 1+ projects in the domain of CV/ML

Registration

TUM Matching System

- Send motivation letter, CV & transcript (not mandatory, but highly recommended) to: **p3dcv@mailnavab.informatik.tu-muenchen.de** (until 14.07)
- Register in Matching-System: https://matching.in.tum.de (until 16.07.)

Questions?

Web. https://www.cs.cit.tum.de/camp/teaching/practical-courses/praktikum-on-3d-computer-vision-ws-2023-24/

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