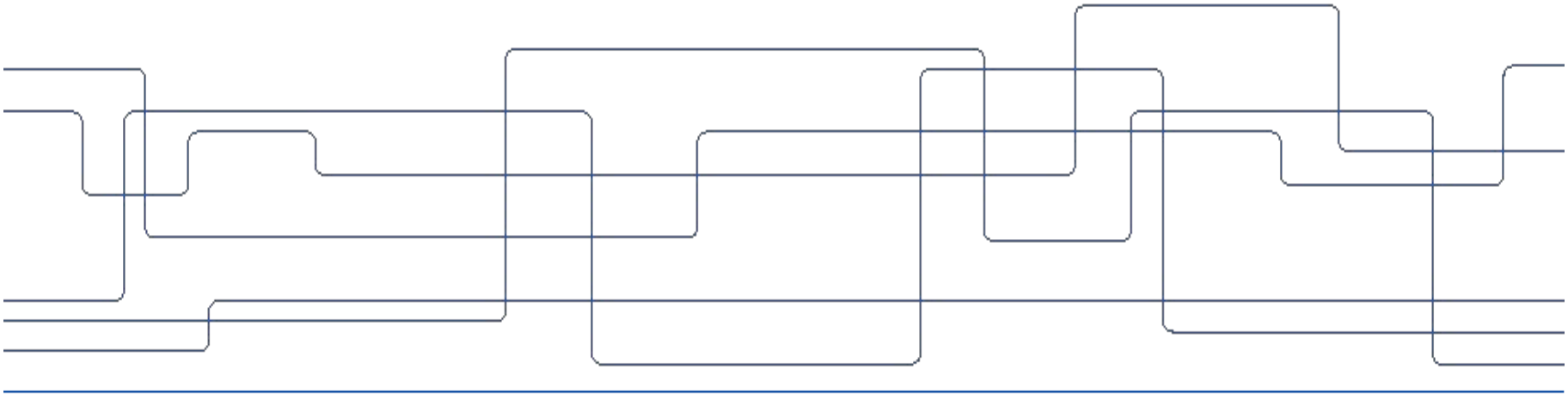
Dynamic 3D object detection and tracking on the mobile platform

Maciej Wozniak, Marko Thiel, Patric Jensfelt



Organization questions

- Weekly meetings with me
- .. and Marko (always, often, sometimes?)
- TUHH visit at KTH
- Your visit at TUHH (next semester)
- Any questions you have for Patric (or me)
- Your exams (period I)
- Access to TR14 (robot lab key) - Grace (access card number, full name, personnummer and duration of access)

	Monday	Tuesday	Wednesday	Thursday	Friday
08:00					
09:00					
10:00					
11:00					
12:00					
13:00					
14:00					
15:00					
16:00					
17:00					

Laura

- Sensors:
  - 16 channel LiDAR
  - 2 stereo cameras (front & back)
  - 4 active stereo cameras (pointing down 360°)
  - IMU & wheel odometry
- NVIDIA Jetson Xavier AGX

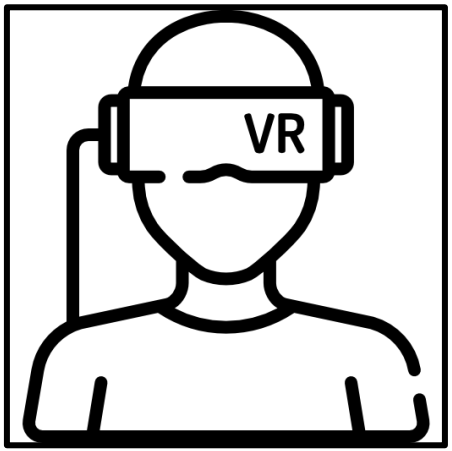
- **Approved for operation in Germany**

TUHH robot platform

Project III - Dynamic 3D object detection and tracking on mobile platform with extension to the VR environment

Online 3D objects detection, tracking and classification

One of the main questions: ***How to represent and update dynamic 3D map on the mobile platform?***



Teleoperation and interaction in VR

Timeline

- **Literature Review** - week 35 - 37 (38)
- **Trying the methods** - week 37 (38) - 40 (41)
- **Report** - week 40 (41)
- **Working with data set collected by Laura** - week 41-43
- **Data collection with Laura KTH campus (TUHH visit)** - week 43
- **Comparing the methods and their performance** - week 44-48
- **Testing solutions on NVIDIA Jetson** - week 48 - 50
- **Final presentation and demos** - week 50

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Literature Review - week 35 - 37 (38)

- Learning how to find the articles (scholar, ACM library etc.)
- Detailed literature review of SOTA and legacy methods for tracking and object detection (3D but also feasible to look at 2D)
- Identifying open source methods (git repos etc.)
- Report/presentation describing those methods

Hints:

- Don’t be afraid to ask for help
- Start by checking the top robotics/computer vision conferences from 2018/19
- Don’t just read and don’t read everything! Make notes and understand what’s going on!

Some conferences to start with

IROS, ICRA, CVPR, ICML, ECMR – European Conference on Mobile Robots

Robotics, AI, CV

https://scholar.google.com/citations?view_op=top_venues&hl=en&vq=eng_robotics

https://scholar.google.com/citations?view_op=top_venues&hl=en&vq=eng_artificialintelligence

https://scholar.google.com/citations?view_op=top_venues&hl=en&vq=eng_computervisionpatternrecognition

Another good idea is to find a **recent (‘21 - ‘22) review/survey** paper as a starting point.

What we expect to see/learn from that week

- Skills necessary to find, understand and analyze advanced academic literature
- Getting a broader overview of the field

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Trying the methods - week 37 (38) - 40 (41)

- Identifying popular data sets (most of the papers refer to which datset they use)
- Check **paperswithcode, kaggle** etc.
- Choose the methods (2-5) that are open source and that you can test
- Identify weaknesses and strengths (runtime, memory, performance etc.)
- Prepare demo/report - week 40 (41)

What we expect to see/learn from that week

- Your ability to use open source software and programming knowledge
- Your research skills
- Ability work together on a iteration of the project (report/demo)

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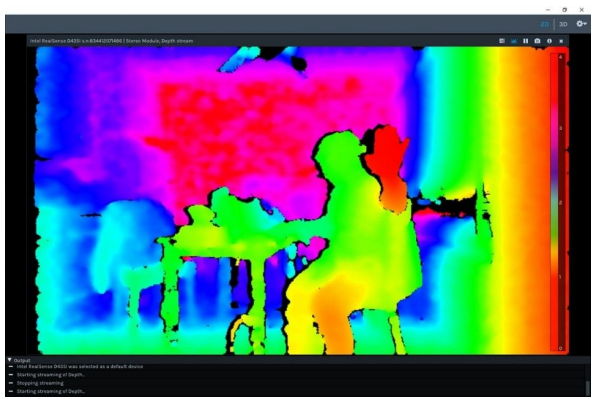
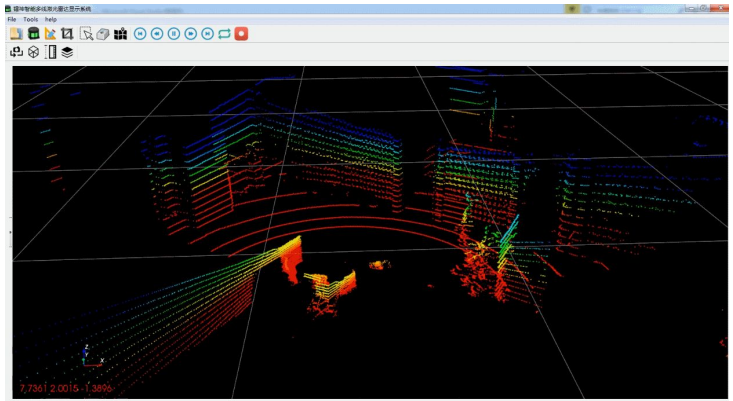
Working with data set collected by Laura - week 41-43

- You will receive *rosbags* from TUHH team with recordings of robot's movements and its sensors readings
- *Adjust* the algorithms to work with **this particular** data
- Identify, how to do it (often not as trivial as it sounds)
- Show the performance etc.
- You will still be using your own stations, so you will work on the robots data but you still will have plenty of computational resources!





What we expect to see/learn from that week

- Your ability to use open source software and programming knowledge
- Skills necessary to tweak the code and available resources so that it works for you
- Understanding the difference between available datasets and the data from the robot

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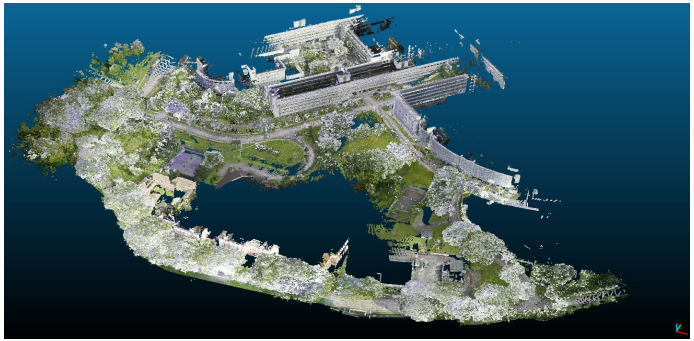

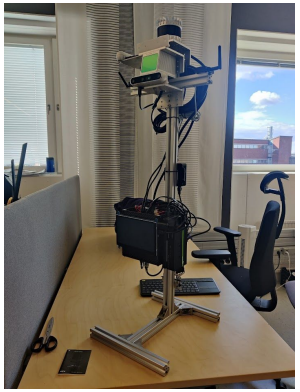

What we expect to see/learn from that week

- Getting to know the robot and the platform
- Getting to know the team you will be working with the next semester
- Learning about the data collection process

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Improving the methods and their performance - week 44-48

- Hopefully by now you identify a couple of methods that work on Laura's data,
- Now, you can use different backbones, training datasets etc. to improve the model and the predictions
- **Get creative!** You can use the data set collected by us in previous week(s) at KTH and TUHH

What we expect to see/learn from that week

- Understanding of the chosen methods and ability to build on them
- Applied ML/CV skills

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Testing solutions on NVIDIA Jetson - week 48 - 50

- Now do the same but with computational constraints!
- Adjust the methods you chose, so that they will work on the platform which you will later have to use in Hamburg
- Learn how to use TFLite (https://www.tensorflow.org/lite) or PyTorch Mobile (https://pytorch.org/mobile/home/)
- Try to keep performance at the same (or similar) level!

What we expect to see/learn from that week

- Learning how to work with limited computational resources
- Learning about extensions of the popular libraries
- Ability to acquire new skills on your own

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Final presentation and demos

- Show us what you have learnt
- Create a demo/report/website as a showcase
- Final deadline is set up for week 50th so you don’t have to work during Christmas but can be moved/discussed!