

Vision for Robotic Localization and Mapping

Matthew Johnson-Roberson and Gert Kootstra



Matt and Gert

- ▶ **Matthew Johnson-Roberson**

- ▶ Postdoctoral researcher at KTH
- ▶ Perception and sensor processing for robotic platforms
- ▶ PhD in Robotics



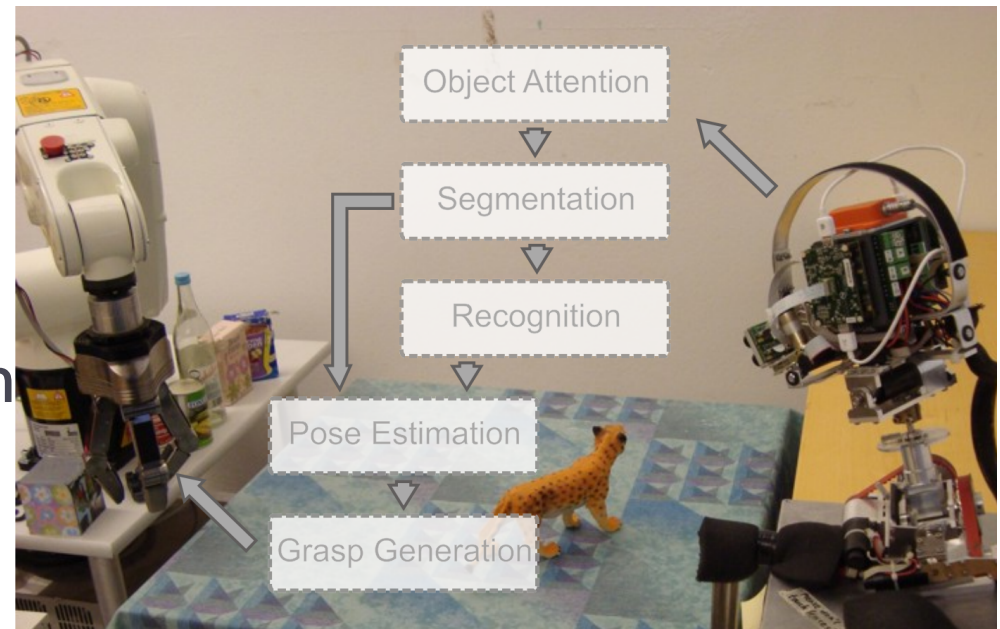
- ▶ **Gert Kootstra**

- ▶ Postdoctoral researcher at KTH
- ▶ PhD in Artificial Intelligence
- ▶ Visual attention and active vision in natural to artificial systems



CVAP / CSC @ KTH

- ▶ Computer Vision and Active Perception / Centre for Autonomous Systems
- ▶ Robotic research topics:
 - ▶ Active vision
 - ▶ Object attention
 - ▶ Object segmentation
 - ▶ Object recognition
 - ▶ Object pose estimation
 - ▶ Grasping
 - ▶ Object manipulation



Vision for Robotics

- ▶ **Robotic localization and mapping**
 - ▶ Where am I?
 - ▶ How can I represent/recognize the environment?
- ▶ Basic requirement for a robot to navigate through complex environments
- ▶ Good solutions using distance sensors (laser-range)
- ▶ Use of **vision** is currently an important research topic

Vision for Robotics

- ▶ **Advantages of vision**

- ▶ Low-cost
- ▶ Light-weight
- ▶ Passive sensor
- ▶ Important: a rich source of information

- ▶ **Challenges**

- ▶ Processing large amounts of data
- ▶ Finding good features
- ▶ Relation between image and world coordinates
- ▶ Representation of the environment
- ▶ Building and using the map

Vision for Robotics

- ▶ **This summer school**
 - ▶ Some aspects of vision
 - ▶ Some aspects of robotic localization and mapping
 - ▶ Some cues for integrating both topics

- ▶ **Program...**

Program: Monday

- ▶ **13:00-16:00**
 - ▶ Natural and Artificial Vision
 - ▶ Visual Attention

Program: Tuesday

- ▶ **9:00-12:00**

- ▶ Interest Points

- ▶ Lab: Interest Points (SIFT)

- ▶ **13:00-16:00**

- ▶ Bayesian filters for robot localization

- ▶ Simultaneous Localization and Mapping

Program: Wednesday

- ▶ **9:00-12:00**

- ▶ Premature convergence in particle filters
- ▶ Lab: Premature convergence in particle filters

- ▶ **13:00-14:00**

- ▶ Stereo vision

- ▶ **14:00-16:00**

- ▶ Lab: Simultaneous Localization and Mapping (EKF)

Program: Thursday

- ▶ 9:00-11:00
 - ▶ Applications of SLAM
- ▶ 11:00-16:00
 - ▶ Lab assignments
 - ▶ Stable interest point selection
 - ▶ Scene recognition
 - ▶ Adaptive population size in MCL
 - ▶ RANSAC filtering
 - ▶ Camera calibration
 - ▶ FastSLAM

Program: Friday

- ▶ 9:00-12:00
 - ▶ Lab presentations