Friday Seminar

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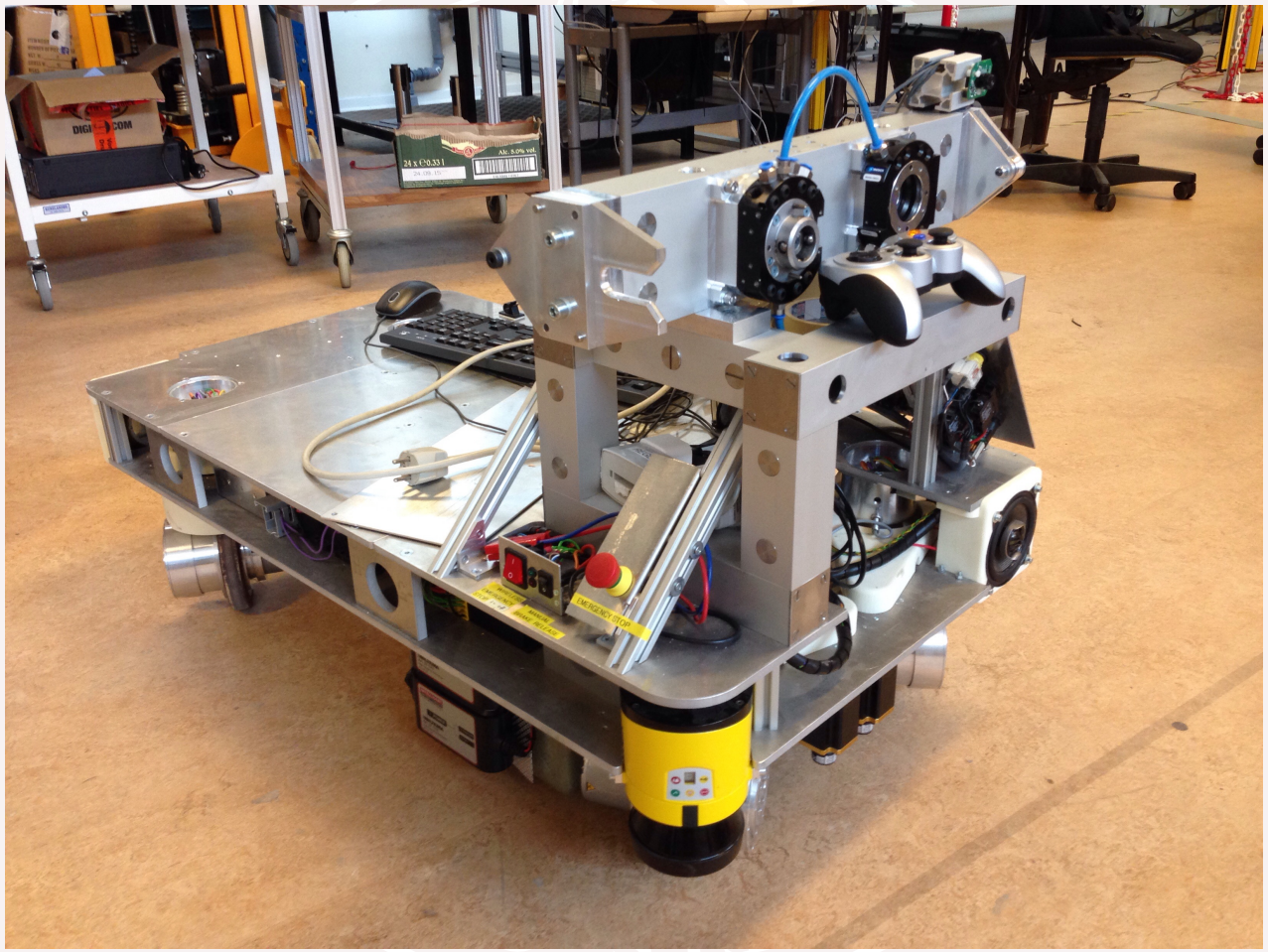
Introduction

- Here since one year
- Supervisors: Rolf Johansson and Anders Robertsson
- ENGROSS - Robot positioning
- SARAFun - Integrate assembly tasks on YuMi (FRIDA)

ENGROSS

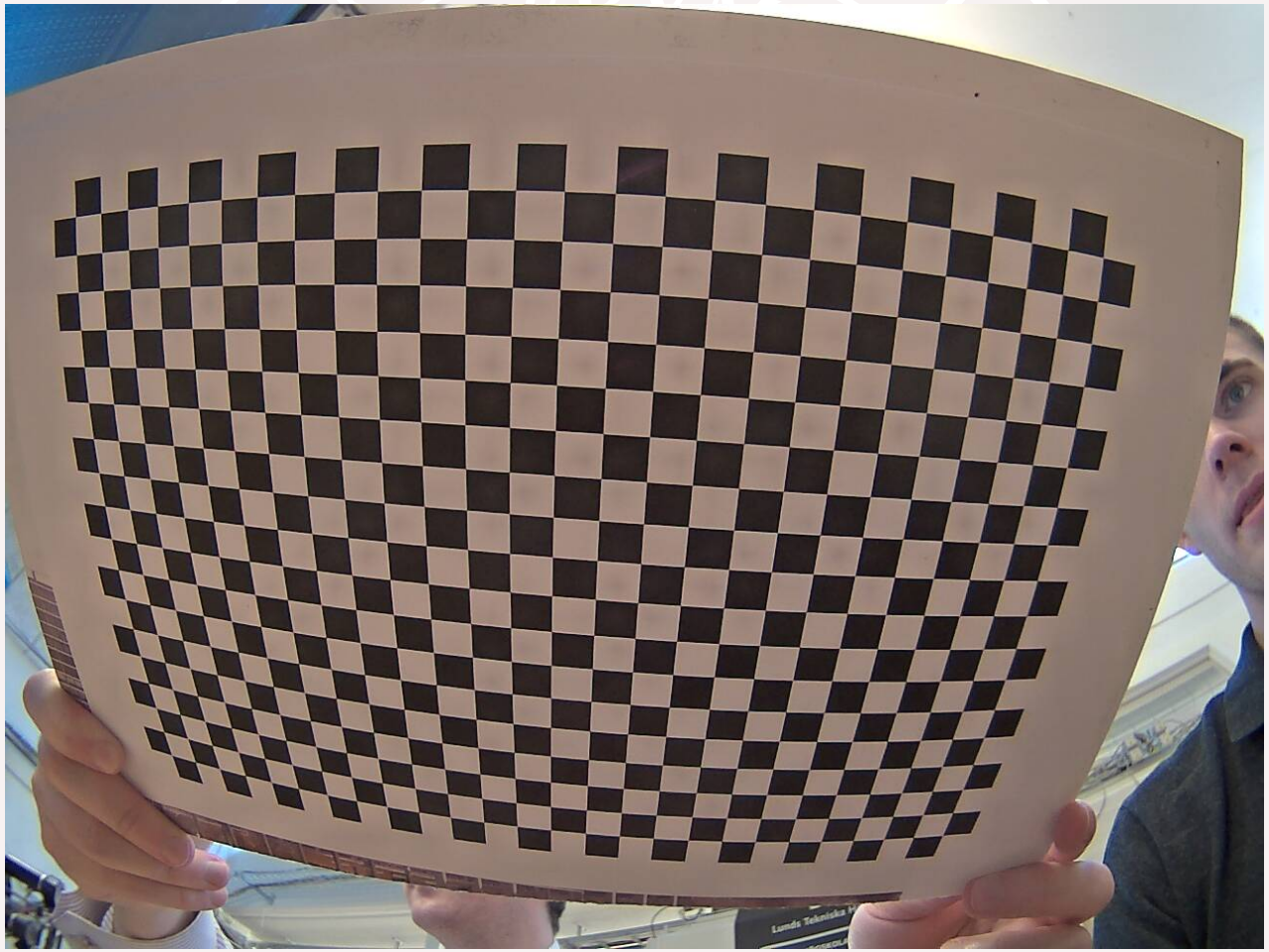
- Funding: Stiftelsen för Strategisk Forskning (SSF)
- Cooperation between CS, Maths and us
- `http://www.control.lth.se/Research/Robotics/engross.html`
- IMU-aided visual odometry
- Experiment - positioning of the end-effector of a robot arm
- Carried out together with Mårten Wadenbäck, Mathematical Imaging Group

ENGROSS



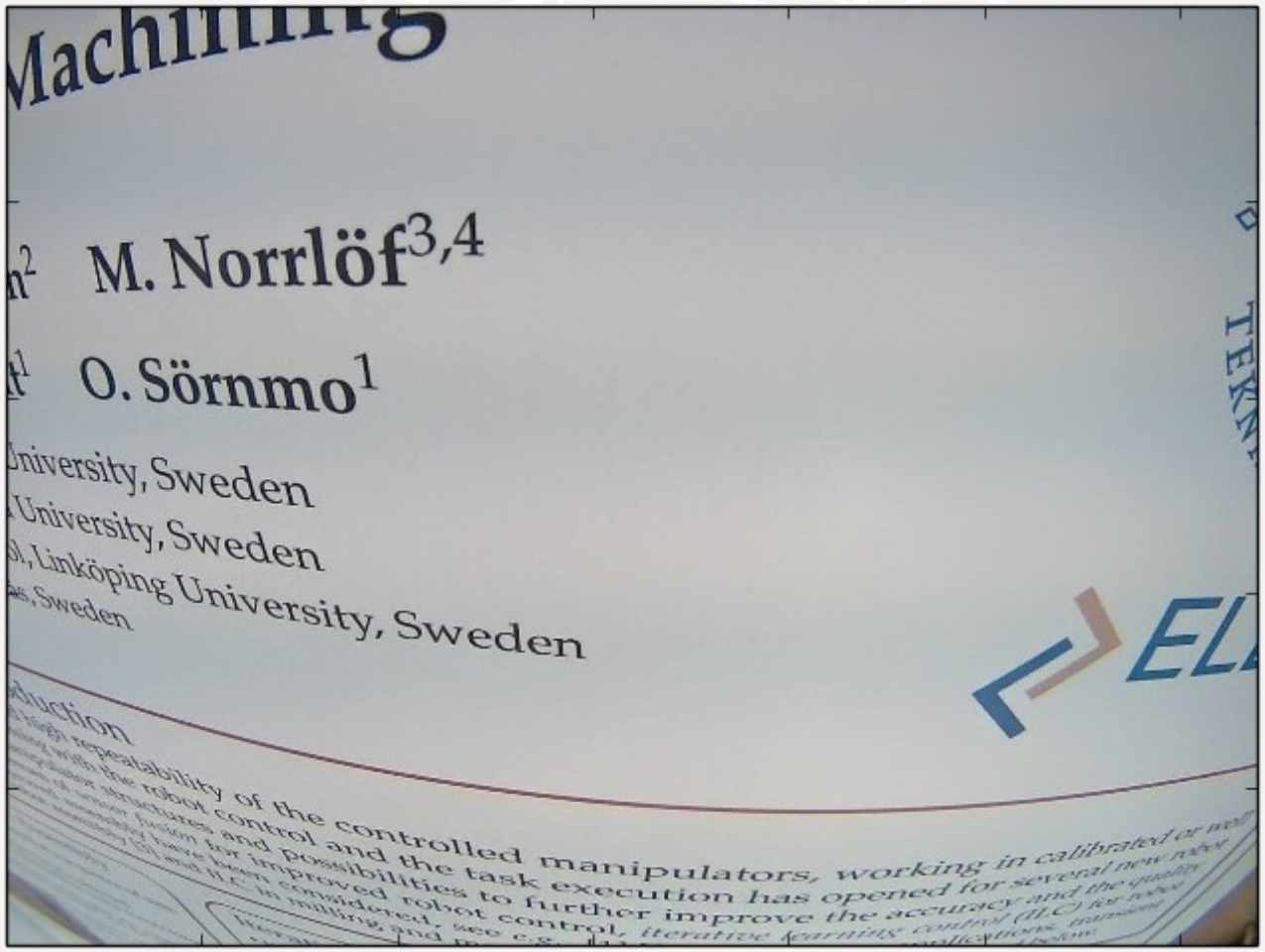
Camera calibration

Distorded "fish-eye" images due to the lens are common and must be compensated for.



Camera calibration

Undistortion - example



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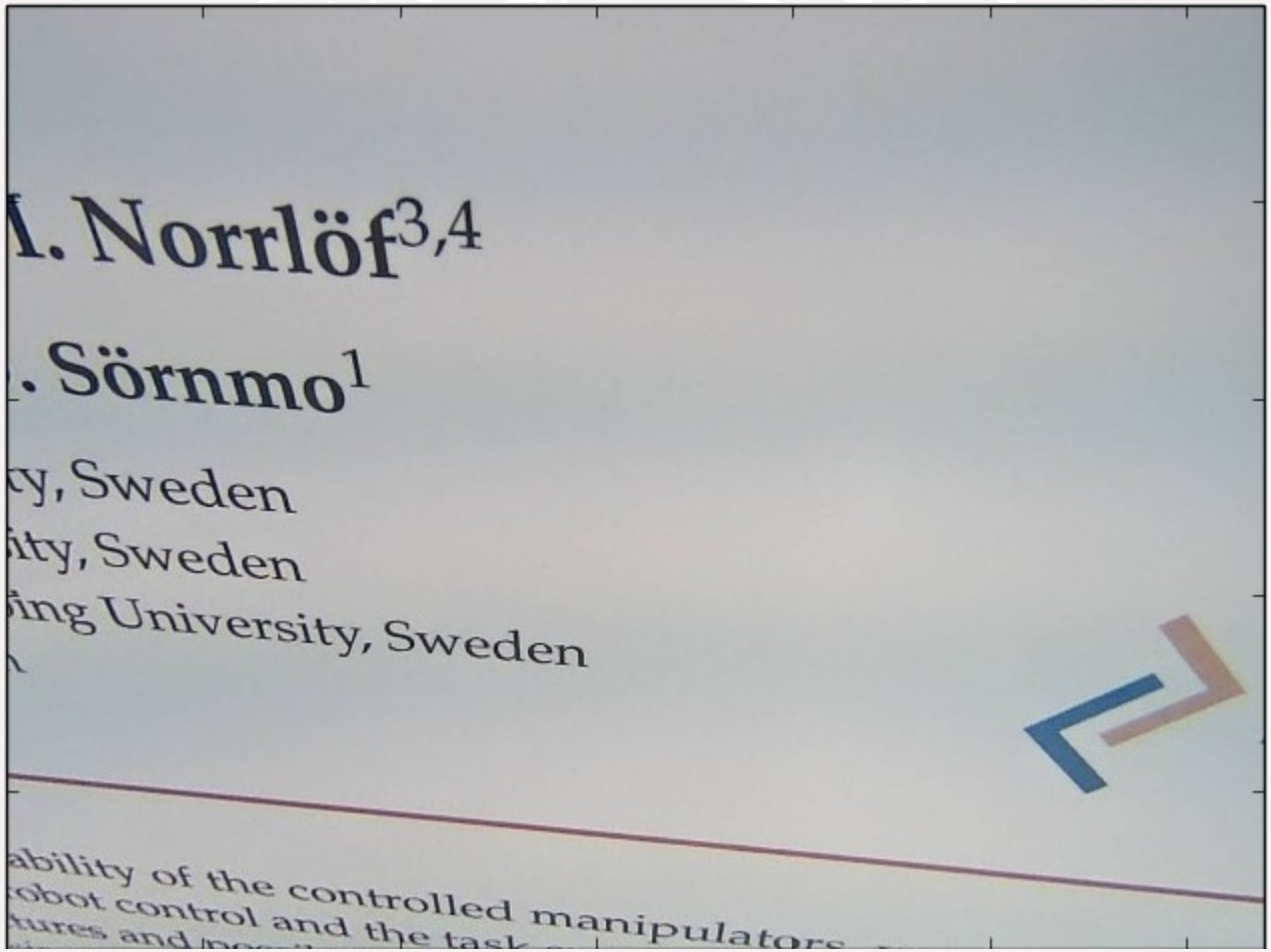
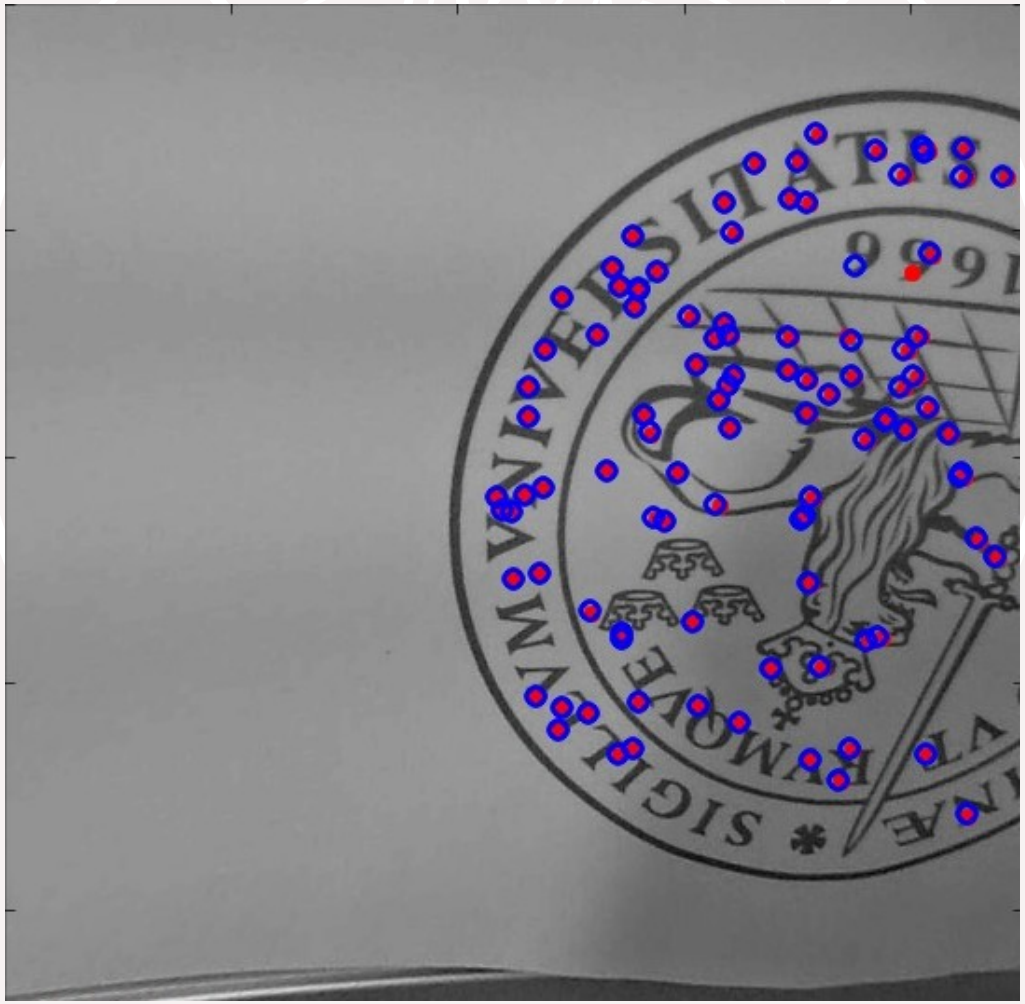


Visual Odometry (VO)

- Navigation by integration of local motion estimates from cameras
- Track movement of feature points, e.g. SURF- or SIFT-points:



Visual Odometry (VO)

Use SURF-points and RANSAC to estimate homographies.

$$P_A = R_{\psi\theta}[I|0]$$
$$P_B = R_{\psi\theta}R_{\phi}[I|-t]$$

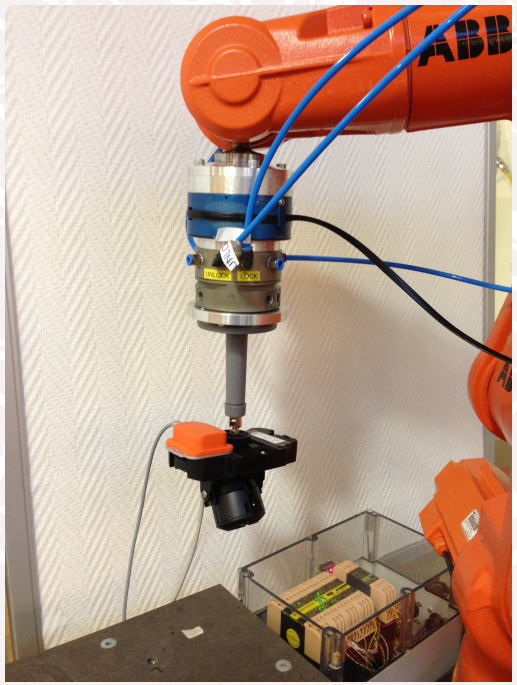
The homography H between these is

$$H = \lambda R_{\psi\theta}R_{\phi}TR_{\psi\theta}^T$$

- The tilt can be estimated by an iterative scheme
- In our case, the true tilt is constant.
- When the tilt is estimated, the translation and ϕ can be reconstructed.

Experiment

- Positioning of the end-effector of IRB140
- Images from the camera and data from the IMU
- Position data from the robot serves as ground truth. This is why we used a robot arm, and not a mobile robot.



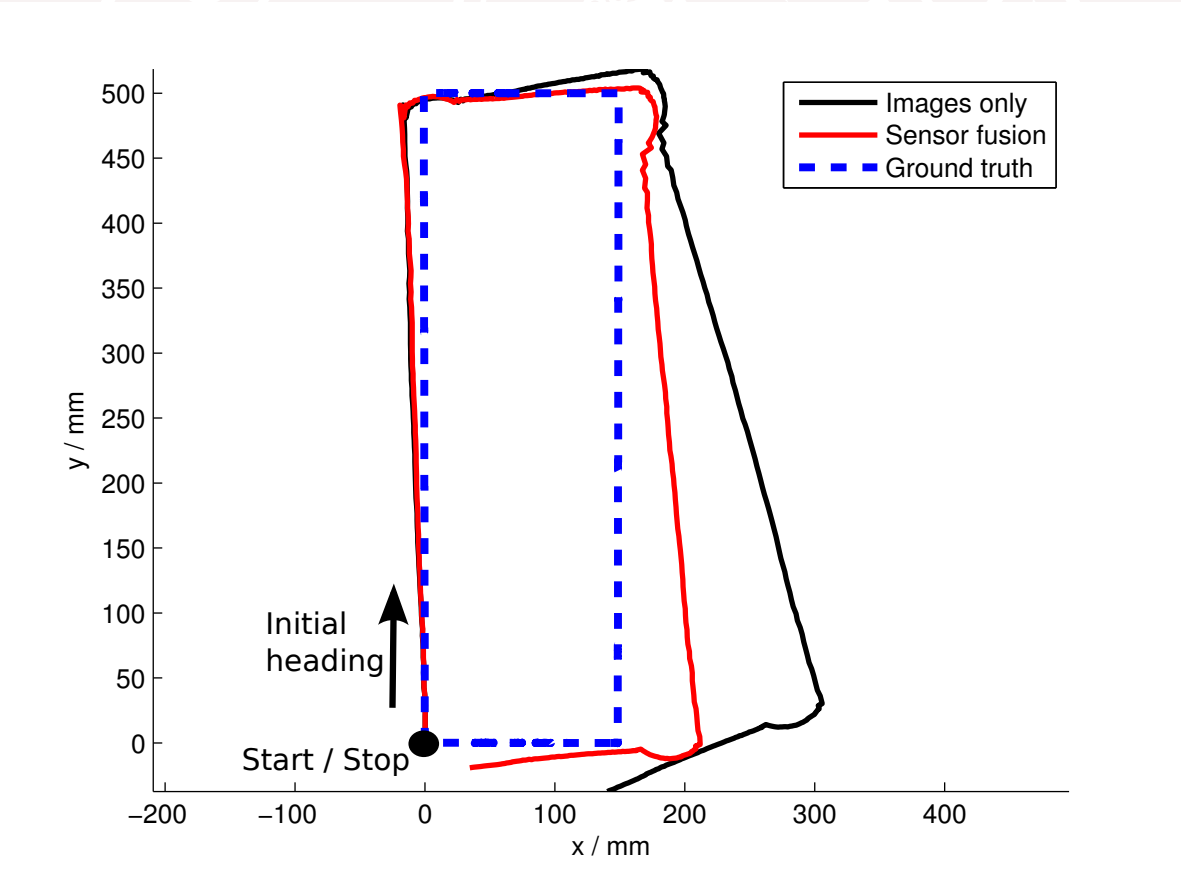
Results

Estimated tilt:

$\hat{\theta} = 42.2°$

$\hat{\psi} = 6.2°$

Duration: 60 seconds



ENGROSS - Future work

- Loop closing - recognize earlier visited spots
- Investigate how the blurry periphery affects the error

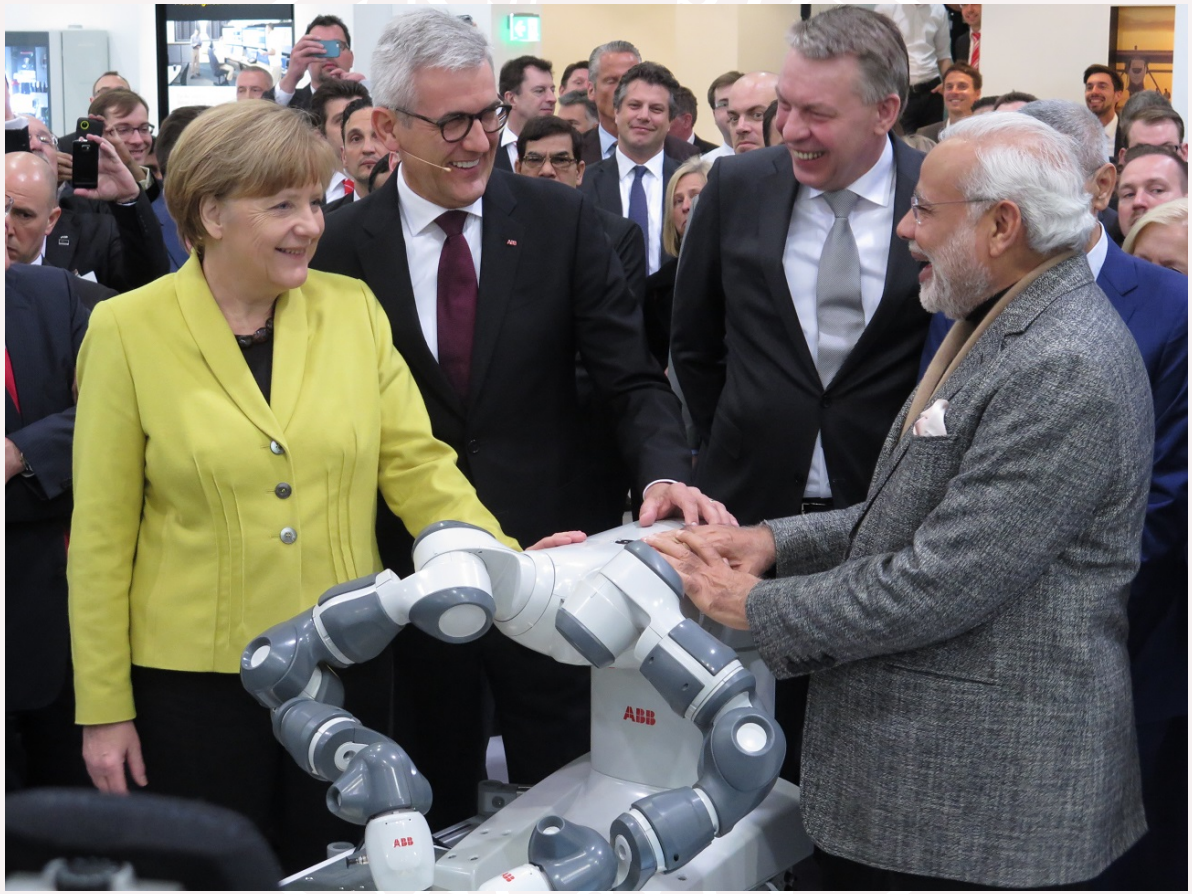
SARAFun

- **S**mart **A**ssembly **R**obot with **A**dvanced **FUN**ctionalities
- Continuation of ROSETTA
- Develop a framework for instruction of assembly tasks
- Goal: A non-expert user should be able to teach a new assembly task on YuMi in less than one day

SARAFun

- Idea: Equip the robot with sensors, and demonstrate the task
- Contact force estimation
- Vision
- Audio recognition

YuMi hanging out with Merkel



Audio recognition

- Idea: Use a pattern recognition algorithm to recognize important sounds, that e.g. indicate completion of an assembly subtask
- TBD: Use a matched filter to optimize SNR

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