UTS:CAS

CENTRE FOR AUTONOMOUS SYSTEMS

41014 Sensors and Control for Mechatronic Systems

Dr. **Liang Zhao**

Centre for Autonomous Systems
University of Technology, Sydney

UNIVERSITY OF TECHNOLOGY SYDNEY

1.1 About the Subject: STAFF

UNIVERSITY OF TECHNOLOGY SYDNEY

Dr Liang Zhao

- Subject Coordinator

- CB11.09.310
- Telephone (02) 9514 1223
- Email: Liang.Zhao@uts.edu.au

1.1 About the Subject: STAFF

UNIVERSITY OF TECHNOLOGY SYDNEY

- Mr Maleen Jayasuriya
  - Tutor
  - Email: DaluwatumullagamageMaleen.N.Jayasuriya@student.uts.edu.au

1.5 About the Subject: Description

UNIVERSITY OF TECHNOLOGY SYDNEY

- The objectives of this subject are
- To develop the student's theoretical and practical understanding on active and passive **sensing** and feedback **control techniques**;
- Ability to select and evaluate sensors, process the sensor data, and apply computer-based tools for practical control system design using the sensory information.

1.5 About the Subject: SLOs

UNIVERSITY OF TECHNOLOGY SYDNEY

❖ Subject learning objectives

1. Implement sensors and processing techniques and control strategies;
2. Apply knowledge of image processing and active sensor processing;
3. Apply knowledge of advanced control techniques;
4. Design sensors, signal processing and control solutions to practical problems.

1.5 About the Subject

UNIVERSITY OF TECHNOLOGY SYDNEY

Course Information

- All information will be available in UTSOnline
- Lecture slides and tutorials will be uploaded during the week
- There is a significant portion of hands on exercise
- Generally the first half (90 minutes) is used for the lectures and the second half (90 minutes) is used for tutorial and lab classes

1.5 About the Subject

UNIVERSITY OF TECHNOLOGY SYDNEY

Lectures will cover

- Introduction to sensors
- Camera and image processing
- RGB-D sensors
- TOF sensors
- Feature detection and tracking
- Feedback control techniques
- Integrating image processing and control

Tutorial will cover

- Log data from different sensors
- Introduction to Matlab©
- Image processing in Matlab©
- Laser data processing and visualization
- RGBD data processing and visualization
- Group project

1.5 About the Subject

UNIVERSITY OF TECHNOLOGY SYDNEY

- **Quiz, Group project and Exam**
- Quiz 1: 5%, On Week 3
  - Short Written Answers + Computer Experiments
- Quiz 2: 15%, On Week 9
  - Short Written Answers + Computer Experiments
- Group Project: 30%, due on Week 12
  - Proposal + Presentation + Report
- Final Exam: 50%
  - 2 hours
  - Short Written Answers + Long Written Answers
  - Restrict Open Book: 2x A4 hand writing papers

1.5 About the Subject

UNIVERSITY OF TECHNOLOGY SYDNEY

- **Moderation of marks**
- A pass in this subject is 50% provided the following conditions are met:
- A reasonable attempt has been made at all design projects and assignments;
- ~~Mark of at least 50% of the final exam is obtained~~.

UTS:CAS

CENTRE FOR AUTONOMOUS SYSTEMS

41014 Sensors and Control for Mechatronic Systems

Lecture-1: Introduction and Camera

Dr. **Liang Zhao**

Centre for Autonomous Systems
University of Technology, Sydney

UNIVERSITY OF TECHNOLOGY SYDNEY

Lecture-1

UNIVERSITY OF TECHNOLOGY SYDNEY

- **Lecture:**
  - Introduction
  - Different sensors
- **Active hands on:**
  - “Play” with cameras
  - Read/Show/Save images in Linux
  - Write your code to convert RGB image to greyscale

2.1 Sensors and Control: Example 1

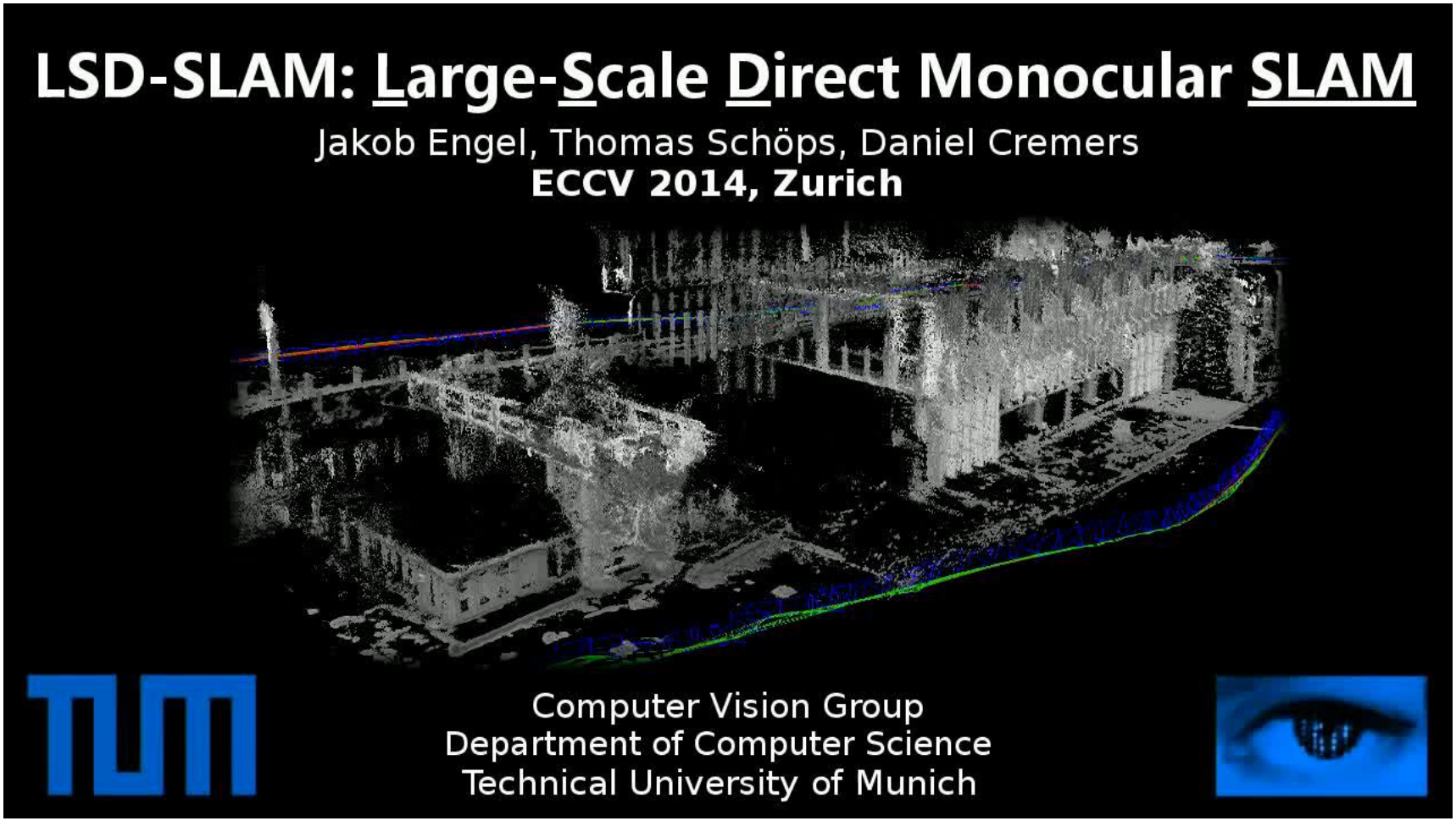
UNIVERSITY OF TECHNOLOGY SYDNEY

- Robocup soccer

2.1 Sensors and Control: Example 2

UNIVERSITY OF TECHNOLOGY SYDNEY

- LSD-SLAM

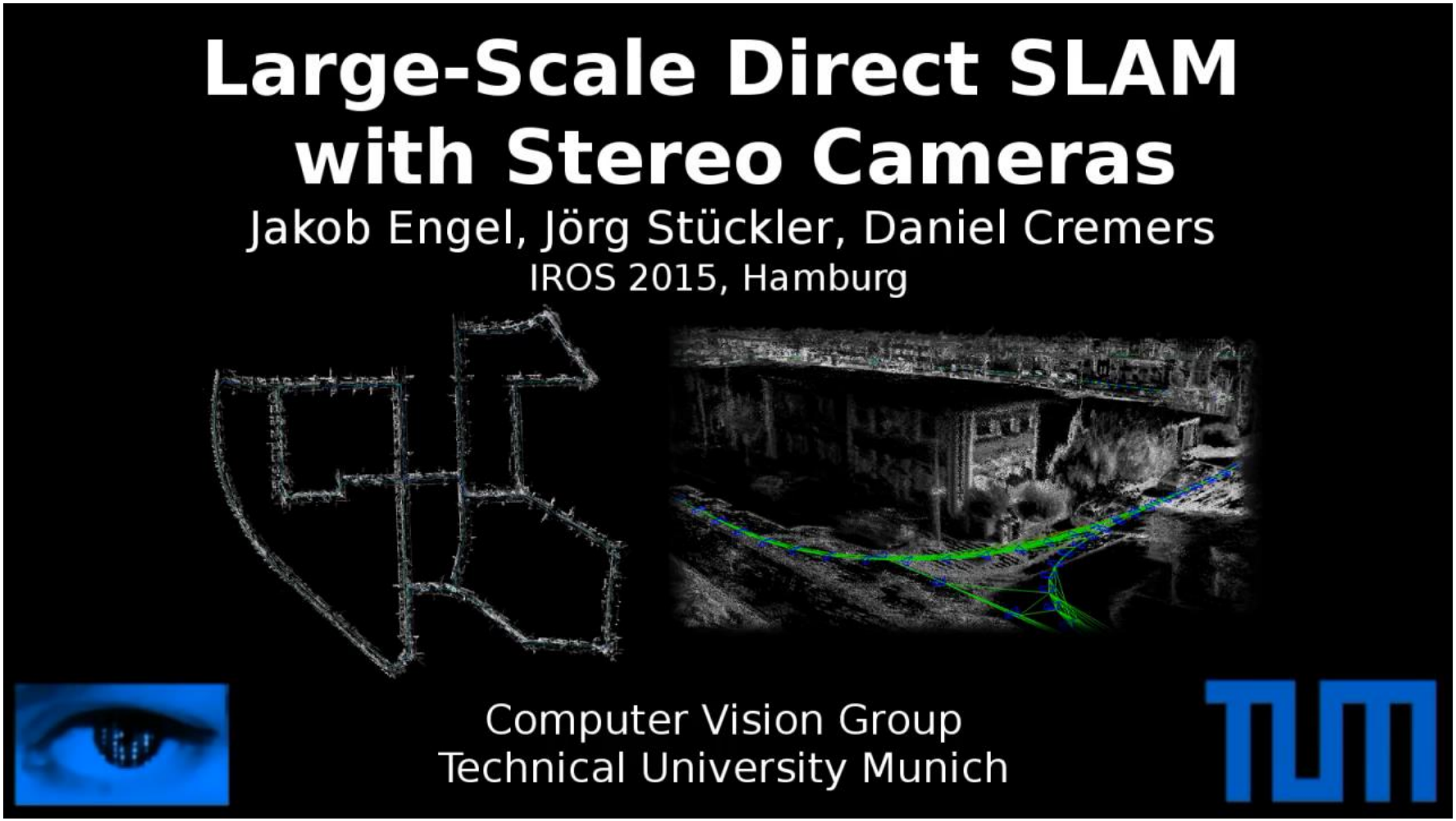


https://www.youtube.com/watch?v=GnuQzP3gty4

2.1 Sensors and Control: Example 3

UNIVERSITY OF TECHNOLOGY SYDNEY

- LSD-SLAM



https://www.youtube.com/watch?v=oJt3Ln8H03s

2.1 Sensors and Control: Example 4

UNIVERSITY OF TECHNOLOGY SYDNEY

- Building Rome in a Day

https://www.youtube.com/watch?v=qYaU1GeEiR8&list=PLDFDB5B8C80DB3AD6

2.1 Sensors and Control: Example 5

UNIVERSITY OF TECHNOLOGY SYDNEY

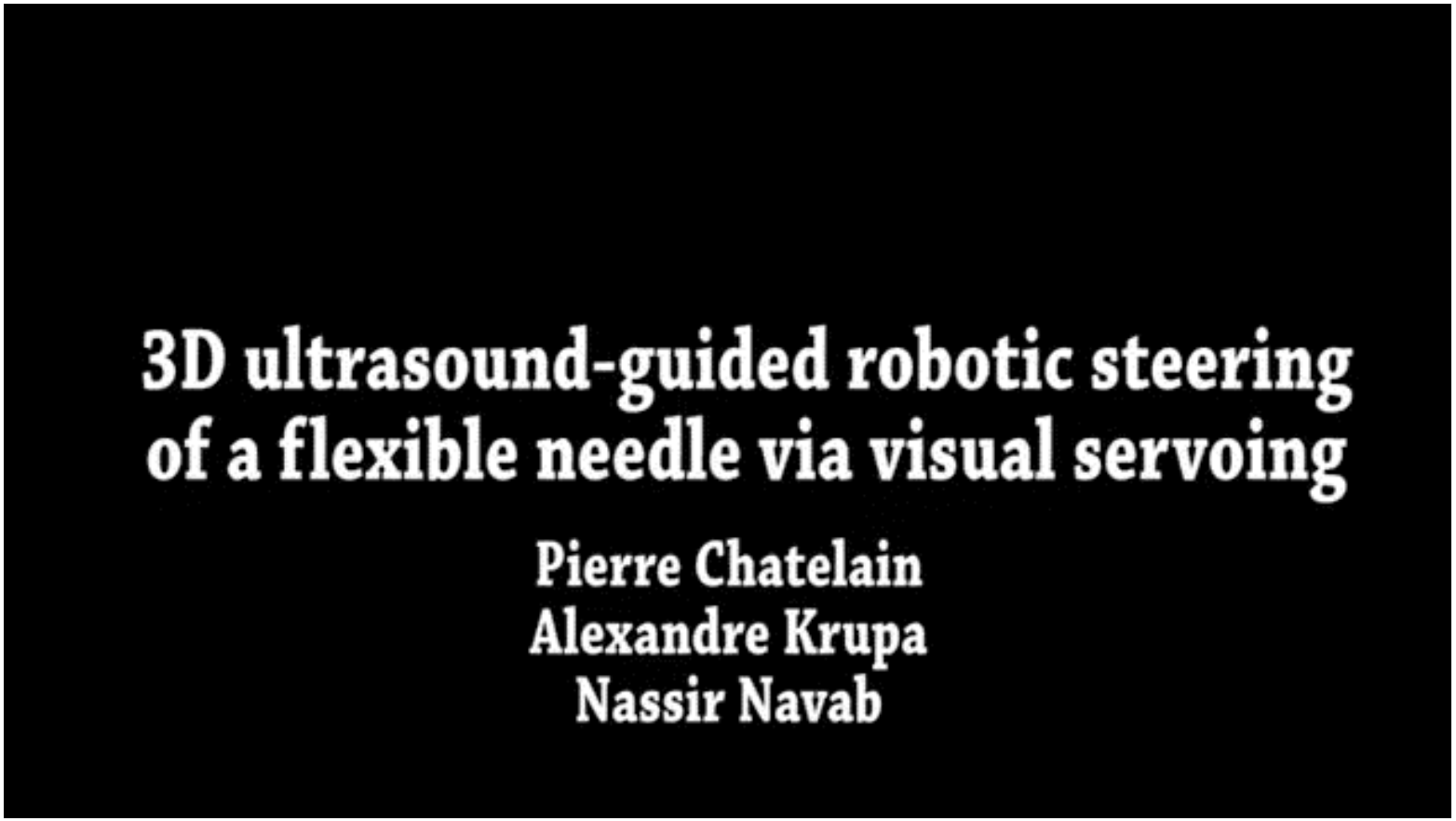
ROBOTIC ARM: VISUAL SERVOING (GEORGIA TECH)

https://www.youtube.com/watch?v=nLq9xbTuBpI

2.1 Sensors and Control: Example 6

UNIVERSITY OF TECHNOLOGY SYDNEY

ULTRASOUND-GUIDED ROBOTIC STEERING OF A NEEDLE



https://www.youtube.com/watch?v=8IyknL44n5s

2.2 Activity 1

UNIVERSITY OF TECHNOLOGY SYDNEY

Group discussion

- Group 1: Example 1
- Group 2: Example 2-4
- Group 3: Example 5-6

Questions

- What sensor(s) is/are used?
- What can the system achieve based on the sensor/control?
- How can it be done?

2.3 Activity 2

UNIVERSITY OF TECHNOLOGY SYDNEY

❖ Group discussion

- Fetch Robot Navigation and Grasping

2.3 Activity 2

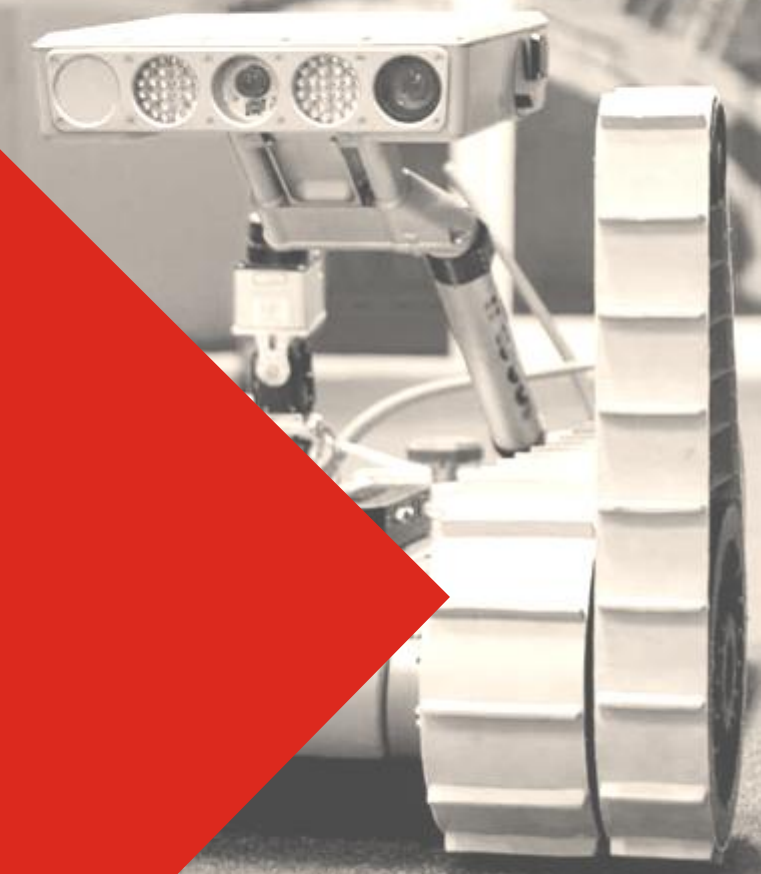
UNIVERSITY OF TECHNOLOGY SYDNEY

- How many problems involved in this application?

- What sensors and control methods are used in each problem?

UTS:CAS

CENTRE FOR AUTONOMOUS SYSTEMS



THANK YOU

Questions?

UNIVERSITY OF TECHNOLOGY SYDNEY