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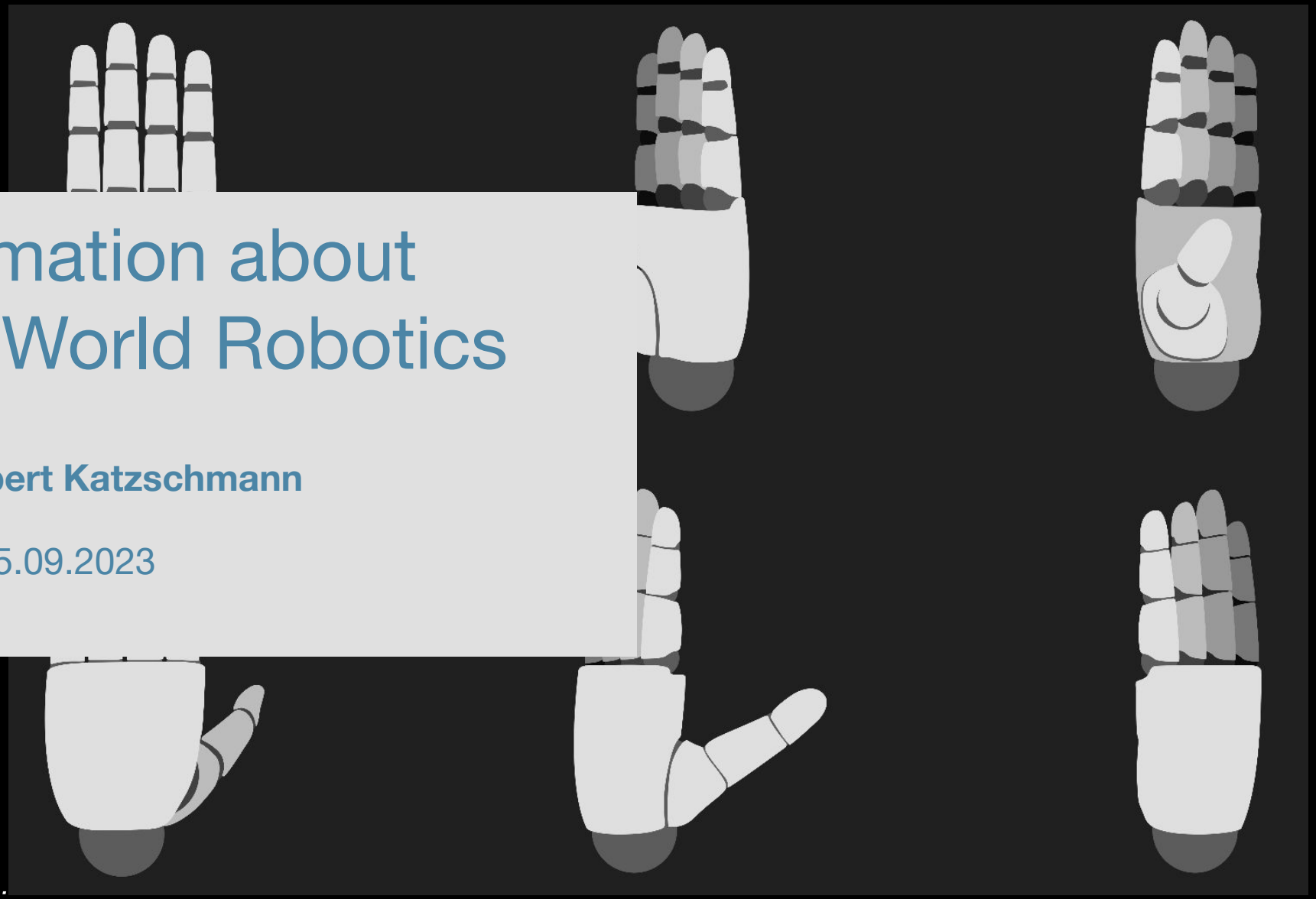


Information about Real World Robotics

Prof. Robert Katzschmann

Unit 1 - 25.09.2023

Class Structure

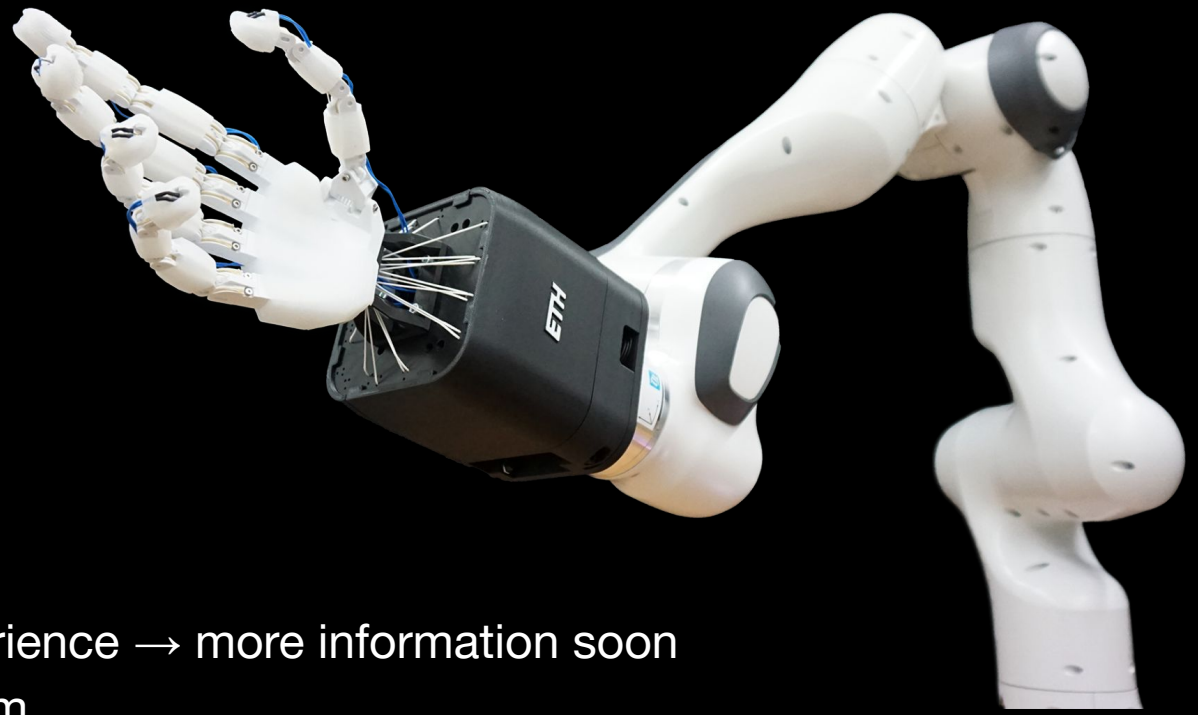
- Video Tutorials
  - → teach you theoretical basics
  - uploaded one week prior to the class
- Focus & Q&A Talk
  - → deepens your knowledge through discussions
  - post your questions on Moodle prior to the class
  - Mondays, 14:15 - 15:00
- Workshop
  - → teaches you a practical skill
  - Mondays, 15:15 - 16:00
- Moodle Quizzes
  - → tests your knowledge and asks for feedback on the class style
  - posted after the class, due one week later
- The class will be public at https://rwr.ethz.ch

Class Syllabus

Unit	Week	Tutorial	Class Day	Focus and Q&A Talk	Workshop	Quizzes
				Mondays, 14:15 - 15:00, CLA E 32.2	Mondays, 15:15 - 16:00, CLA E 32.2	
1	2		25.09.	The Challenge - Robotics Hands for Dexterous Manipulation *Robert Katzschmann*	Showcase & Design Discussion *Robert Katzschmann*	
2	3	Building and Fabricating an Articulated Robot Hand	02.10.	Design of Robotic Hands *Robert Katzschmann*	Materials and Motors *Manuel Knecht*	Design, Materials, and Motors *Yasunori Toshimitsu, Gavin Cangan, Manuel Knecht*
3	4		09.10.	Prototyping and Fabrication Technics for Robots Robert Katzschmann	3D-Printing and Silicon Casting *Stephan Gravert*	Fabrication, 3D-Printing, and Silicon Casting *Thomas Buchner, Stephan Gravert*
4	5	Simulating Robots and Soft Interaction with the World	16.10.	Methods and Challenges in Simulation *Robert Katzschmann*	Simulating with MuJoCo *Benedek Forrai*	Simulation and MuJoCo *Benedek Forrai, Andrea Nappi*
5	6		23.10.	Hardware Check-Up and Q&A *Robert Katzschmann & Ph.D.s*		
6	7	Identifying Kinematics and Dynamics of Robots	30.10.	Implementation Dynamics of Robotic Hands *Robert Katzschmann*	Interfacing & Controlling your Robotic Hand *Manuel Knecht*	Kinematics, Dynamics, and Interfacing a Robotic Hand *Gavin Cangan, Anqi Li*
7	8	Implementing Control Strategies for Manipulation	06.11.	Control Challenges for Dexterous Manipulation *Robert Katzschmann*	Interfacing & Controlling a Robotic Arm *Gavin Cangan*	Control and Interfacing a Robotic Arm *Gavin Cangan, Andrea Nappi*
8	9	Teleoperation using Machine Learning and Computer Vision	13.11.	The Benefit of Machine Learning for Robot Control *Robert Katzschmann*	Teleoperating for Manipulation *Elvis Nava*	Teleoperation and Machine Learning *Elvis Nava, Simone Nascivera*
9	10	Advancing Robust Controllers with Reinforcement Learning	20.11.	Next Steps in Machine Learning for Robotics *Robert Katzschmann*	Reinforcement Learning with Isaac Gym *Yasunori Toshimitsu*	Reinforcement Learning and Isaac Gym *Yasunori Toshimitsu*, Simone Nascivera
10	11		27.11.	Software Check-Up and Q&A *Robert Katzschmann & Ph.D.s*	Control & RL Q&A *Yasunori Toshimitsu & Benedek Forrai*	
11	12	Bringing Robots to the World	04.12.	Product Development Challenges *Mirko Meboldt & Robert Katzschmann*	Project Check-Up and Q&A *Robert Katzschmann & Ph.D.s*	Product Development and Challenges *Benedek Forrai, Anqi Li*
12	13		11.12.	The Challenge I Presentation and Hardware Showcase		
13	14		18.12	The Challenge II Teleoperation and Autonomy Showcase		

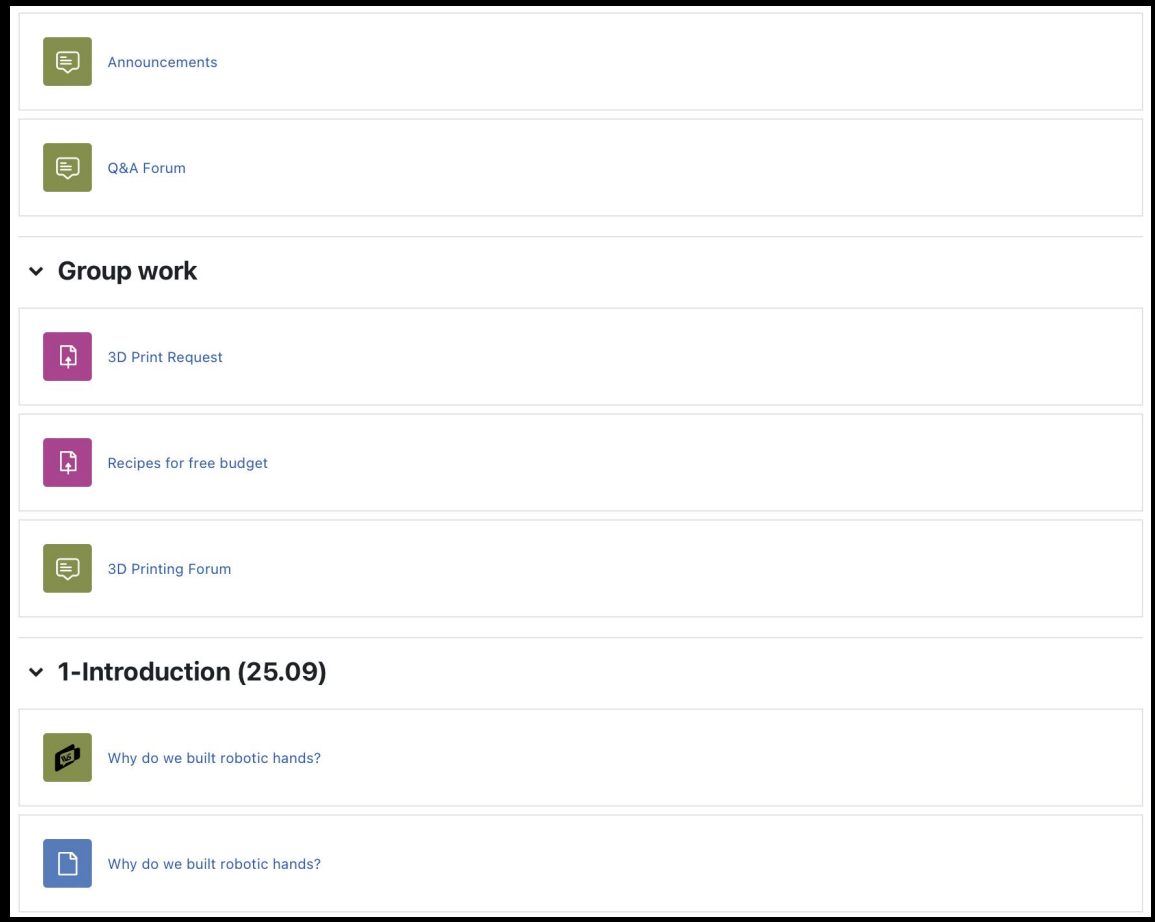
Class Project

- **Develop your own robotic hand!** – from hardware, over control, to machine learning
- Design space
  - Human-sized hand
  - 3-6 fingers
  - Up to 11 motors (Dynamixels)
  - Tendons and 3D-printed bones
  - Skin with gloves or casted
- All materials are provided
  - Additional 250 CHF free budget per group
- Group size: 4-5 students
  - Submit your preference on Moodle
  - We will then form groups based on your experience → more information soon
  - For waiting list, fill out Google Application Form
- Work in our classroom whenever you want!
  - One key per team → more information soon



Communication

- Moodle
  - Video tutorials, quizzes, …
  - Q&A forums for discussion
  - Announcements
  - Reimbursement request for free budget
  - Group forming
  - 3D printing submission
- Website: www.rwr.ethz.ch
- Email the class team: rwr@srl.ethz.ch



The Challenge

- Show your robotic hand and its capabilities!
- Task 0: Demonstrate your hardware

The Challenge

- Show your robotic hand and its capabilities!
- Task 0: Demonstrate your hardware
- Task 1: Object manipulation using teleoperation

The Challenge

- Show your robotic hand and its capabilities!
- Task 0: Demonstrate your hardware
- Task 1: Object manipulation using teleoperation
- Task 2: In-hand object rotation using reinforcement learning

The Challenge

- Show your robotic hand and its capabilities!
- Task 0: Demonstrate your hardware
- Task 1: Object manipulation using teleoperation
- Task 2: In-hand object rotation using reinforcement learning
- Task X: Show us something new
  - Not required for maximum grade

Challenge happening on 11.12. And 18.12.!

Grading

- Challenge: 40 %
  - Task 0-2, boost with task X
- Group presentation: 20 %
- Group report: 10 %
- Moodle quizzes: 20 %
- Attendance: 10 %
  - Be present at 8 out of 11 classes for maximum attendance grade

The RWR team

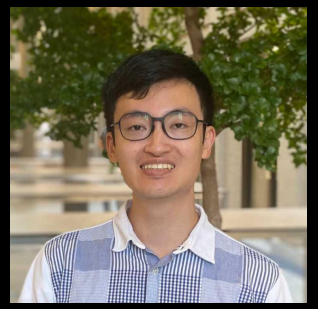
Lecturer: Prof. Robert Katzschmann

Head TA: Andrea Nappi

Teaching Supervisor: Alexander Kubler

Teaching Assistant: Yifan Zhou

Teaching Assistant: Sebastiano Oliani



Teaching Supervisor: Yasunori Toshimitsu

Teaching Supervisor: Gavin Cangan

Teaching Supervisor: Elvis Nava

Teaching Supervisor: Manuel Knecht

Teaching Supervisor: Benedek Forrai

Support Team: Anqi Li

Support Team: Simone Nascivera

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SoftRobotics Laboratory