



INTUITIVE

INnovative Network for Training in ToUch InteractIve Interfaces

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Description:

Report on the research schools, workshops, & tutorials organized the third year of the project

Deliverable text:

Third year research schools, workshops, & tutorials

Shortly after the start of the Intuitive project with a kick-off meeting in Lund 2019, the Covid-19 pandemic struck. This had a major impact on the INTUITIVE project during the start-up of the project, and therefor covered Deliverable D6.2 the first two years of the project and Deliverable D6.3 covered M25 to M37.

This deliverable will report the activities that were arranged for the ESRs from M38 to M45.

Workshop on PhD and Future, 24-28 January 2023, Munich

During Research School 2, a few questions about “what happens after the project” came up, and INTUITIVE PIs thought that it would be good to discuss these questions with the ESRs together with input from the PIs. The discussion ended up with the suggestion to arrange a workshop between RS2 and RS3. This was arranged as an in-person meeting in Munich and the topic was: **What is behind a PhD/an ESR and how can it continue?**

Thus, the focus of the event was on:

- To capture the ideas around ESR's advanced scientific training.
- Why a PhD at all?
- What achievements does one hope to achieve?
- What skills and competences could be developed so far?
- What are the reasons and thoughts for doing a secondment?
- What career options can arise after the doctorate.

This theme was further deepened in subsequent workshops.

The program included discussions about how to present oneself, what possibilities there are to get funding and how to write grant applications or what topics must be considered when writing applications. This was accompanied by guest speakers from higher education, industry and people who look at both sides or the transitions in both directions.

The workshop was rounded off by group work to prepare mini workshops for the upcoming Research School 3 and insights into BMW's research labs.

In the end, the ESRs gave feedback that this workshop was an all-round productive and profitable event. Many questions were discussed and clarified. And they got a new perspective on scientific work in both academic and industrial research.

The agenda for the workshop is found in appendix 1.

Research School 3, 17-21 April 2023, Malta

The third Research School took place in Malta in April 2023. It was arranged by the INTUITIVE partners ICL, BMW, IVO, KIT and ULUND. The theme of this Research School was applications of biomimetic tactile skin in robotics, prosthetics, haptics, and rehabilitation. It included invited lectures on sensory systems in robotics and prosthetics, virtual reality, rehabilitation for blind, evolution of robotics/prosthetics and future directions.

The agenda of the Research School is found in appendix 2. In the following we give a short presentation from a selection of the invited lecturers and tutorials performed during the Research School. We paid attention to a mix of formats and allowing active participation of the ESRs. We also invited external applicants to participate in the Research School.

Tutorials

ML algorithms - Machine Learning

This tutorial focused on the implementation of machine learning algorithms in haptic research. Participants learned how to use machine learning algorithms and analyse haptic data provided by Patrick Van Der Smagt who taught basic machine learning implementation with Python notebook. This tutorial extended the morning lectures.

Haptics measurement devices - Slip Detection Tutorial

This tutorial covered the basics of haptic measurements, included the use of force sensors, acceleration sensors, and other types of sensors. The sensors were contributed by Anirvan Dutta, ESR from BMW. Anirvan led a tutorial on robotic slip detection and data simulation for training a classifier, and participants learned about the different types of sensors and their specific applications in haptics research. The participants were able to try and compare the different sensors and learned to use them efficiently.

Viscoelastic measurement with wearables and EMG - Muscle Stiffness Measurement

This tutorial compared the muscle visco-elasticity measurement during specific actions enabled by wearables and electromyography (EMG). Participants learned how to conduct simple viscoelastic measurements and analyse the results. Pakorn Uttayopas, Xiaoxiao Cheng and Alexis Devillard (ESR) from Imperial College conducted this tutorial using a portable device that Alexis have developed for muscle stiffness measurement and modelling.

Haptic illusions - Hands-On Demonstrations

This session showcased different types of haptic and visuo-haptic illusions that had been collected and created by Vincent Hayward. Participants learned to understand the different types of illusions and what they tell about the mechanisms of haptic information processing in the brain. Also, it was possible to explore haptic interfaces for visually impaired individuals, with a focus on navigation systems. Participant learned about the challenges of designing haptic interfaces for this population and discussed different approaches to overcome these challenges.

Several ESRs showcased their work:

1. Mark Alea, The Katholieke Universiteit Leuven: Electronics chips, showcasing the hardware aspects of tactile feedback.
2. Yerkebulan Massalim, Actronika: Finger haptic feedback device simulating different textures sliding under a user's finger.
3. Aruna Ramasamy, Actronika: Music-to-haptic setup segmenting some instrument from an audio file and transforming them into vibration feedback. She also brought and demo Actronika haptic vest.
4. Gaspar Ramôa, Inventivio: demonstrated his work on the Tactonom reader for blind people.
5. Kaan Kesgin, Lund University: presented the prototype he and Alexis did to better understand texture discrimination strategy.
6. Alexis Devillard, Imperial College presented the University's e-Skin sensor, and an EMG recording device he had designed.

Lectures (by selection)

Dr. Patrick van der Smagt is director of the open-source Volkswagen Group Machine Learning Research Lab in Munich, focusing on probabilistic deep learning for time series modelling, optimal control, reinforcement learning robotics, and quantum machine learning. He is also research professor in the CS faculty at Eötvös Loránd University Budapest. He did his PhD and MSc at Amsterdam's universities and was then leading the Assistive Robotics and Bionics Lab at the DLR Oberpfaffenhofen and Professor at TUM. He is founding chairman of a non-for-profit organisation for Assistive Robotics for tetraplegics and co-founder of various tech companies. In 2018, he started a for-good initiative 10toGO by supporting teams using machine learning for the UN SDGs. Also then, he initiated etami, an initiative on Ethical and Trustworthy Artificial and Machine Intelligence, creating an organization with almost 20 multinationals and universities.

Dr. Harold Soh is an Assistant Professor in the Department of Computer Science at the National University of Singapore (NUS), where he directs the Collaborative Learning and Adaptive Robots (CLeAR) group. Harold completed his Ph.D. at Imperial College London on online learning for assistive robots. Harold's current research focuses on machine learning and decision-making for trustworthy collaborative robots. His work spans cognitive modeling (e.g., human trust) to physical systems (e.g., tactile perception with novel e-skins). He is an Associate Editor of the ACM Transactions on Human Robot Interaction, International Journal of Robotics Research (IJRR), and Robotics Automation and Letters (RA-L).

Dr. Lucia Seminara is an Associate Professor in the Department of Naval Engineering, Electrical, Electronics and Telecommunications of Università di Genova. Her research goal is to develop electronic systems to artificially restore the sense of touch. Her interests relate to closing the sensorimotor control loop in different applications (e.g., prosthetics) and for neurorehabilitation, developing innovative human-machine haptic interfaces to measure touch (e-skin) and give back intuitive touch information to the subject non-invasively (e.g., electrotactile stimulation). Lucia studied Physics until the MSc at the Università di Genova and then obtained a Ph.D. in physics from EPFL, Switzerland.

Dr. Lilian Hsiao is Assistant Professor in Chemical and Biomolecular Engineering at the NC State University in USA. She studied at the University of Wisconsin-Madison and completed a PhD in Chemical Engineering at the University of Michigan, followed by a postdoc at MIT. Lilian and her research group use an interdisciplinary approach that combines experiments and models from materials science, chemical engineering, physics, and mechanical engineering to understand the roles of structure and dynamics in soft materials and complex fluids. In particular, they use microscopy and triborheology to identify the frameworks used to engineer the mechanical properties of soft surfaces. The results can be applied to many fields: understanding of nanoscale forces in non-spherical particulate systems, revealing the biomechanics of lubricated joints that make movement possible, and developing new types of materials with directional properties that are not found in nature.

Dr. Stephen Redmond is an Associate Professor at the School of Electrical and Electronic Engineering at University College Dublin (UCD). Dr. Redmond and his group use signal processing and pattern recognition techniques, combined with novel sensing hardware solutions, to bring longitudinal health monitoring into the home. He also has a research stream on tactile sensing, spanning from the study of human tactile physiology, through to the development of friction-sensing tactile sensors for robotic grippers. He completed his undergraduate studies and Ph.D. at UCD, then spent 10 years as an Academic at the University of New South Wales in Sydney, before returning to UCD in 2018 to lead a Science Foundation Future Research Leaders Award project on tactile sensing. He is also a co-founder of the tactile sensor company Contactile.

Dr. Firat Güder is a principal investigator in the Department of Bioengineering at Imperial College London. Firat and his team, work in the interface of material science, electronics, chemistry and biology, focusing on the development of intelligent interfaces to connect complex chemical and biological systems with machines. Firat is passionate about solving problems concerning animal and human health, agriculture and food systems. In addition to his scholarly activities, he has also co-founded multiple startups to translate his research to address real world problems.

Dr. Thorsten Schwarz is directing the Accessibility Lab of the Center for Digital Accessibility and Assistive Technologies (ACCESS@KIT) at the Karlsruhe Institute of Technology (KIT) and is responsible for digital accessible literature preparation for students with visual impairments. His research focusses on digital accessibility and new access to information for all e.g., using artificial intelligence. In order to anchor the topic of digital inclusion more firmly in everyday (university) life, he is also involved in the "Digital Accessibility" working group of the Higher Education Forum on Digitization and the European Network of Excellence in the field of "Social inclusion". In addition, he has been giving lectures on the topic of "Digital Accessibility and Assistive Technologies" in both master's and teaching degree programs at KIT since 2012.

Dr. Andre Seyfarth and his Laulabor Locomotion Lab at TU Darmstadt in Germany are doing

research in the biomechanics and neuromechanics of human gait and running and develop new measurement and analysis methods for studying movement. André Seyfarth studied physics and has a Ph.D. in biomechanics from Friedrich-Schiller Universität in Jena, Germany. He subsequently was an Emmy Noether fellow at University of Zurich and at MIT. He currently is a professor of sports biomechanics with the Department of Human Sciences, TU Darmstadt.

INTUITIVE Workshop

PhD and Future

Seehotel Schlierseer Hof, south of Munich
25-27 January 2023

	January 24	January 25	January 26	January 27	January 28
		Personal Motivations	Career Preparation	Career Industry	
07.30		Organized trip to BMW site			Breakfast and Departure
09.00			Pitch presentation workshop (H. Jörntell) - Pitch presentations - Feedback sessions - Topic motivations, what are the longer term goals that are made possible - Exploitation opportunities?	From Academia to Industry (P. van der Smagt, VW)	
09.30		Why a PhD? (T. Schwarz) - What skills/competence? - Career options after PhD - Advantage of secondments			
10.00			Coffee	Coffee	
10.30				Science (Parick van der Smagt) Deep Bayes variational filter	
			Career Academia	Career Options	
11.30		Lunch, BMW	Grant proposal writing (H. Jörntell, P. van der Smagt) EU grant families	Approaching (T. Schwarz, H. Jörntell) - Academia - Industry - Start-up	
12.00			Lunch	Lunch	
12.30					
13.00		BMW Museum			
15.00		BMW lab tours	Free Activities	Joint Hiking	
17.30	Arrival and check-in	Trip to City Center Munich			
19.00					
19.30		Train to Schliersee	Dinner	Dinner	
20.30	Dinner	Dinner			

INTUITIVE Research School 3
Malta, April 17 – April 21, 2023
Program

April 2023					
	Mon 17	Tue 18	Wed 19	Thu 20	Fri 21
08:00 - 09:15	Arrival	Asgeir Alexandersson	Stephen Redmond	Lilian Hsiao	Damien Faux
09:30 - 10:45		Lucia Seminara	Alexander Hars	Thorsten Schwarz	Experiment of haptic illusions
11:00 - 12:15		Andre Seyfarth	Firat Guder	Harold Soh	
12:15 - 14:00		Lunch	Lunch	Lunch	Lunch
14:00 - 15:15		Tutorial: ML algorithms for haptics	Tutorial: Comparison of haptic measurement devices	Tutorial: Impedance estimation with wearable and EMG	
15:15 - 17:00					
17:00 - 18:15	Patrick vd Smagt	Activity 1	Activity 2	Activity 3	
18:15 - 20:00					