



**TAL
TECH**
MECHATRONICS AND
AUTONOMOUS
SYSTEMS
RESEARCH GROUP

RESEARCH GROUP PRESENTATION

Prof Anton Rassõlkin
Head of Research Group

OUTLINE

MECHATRONICS AND AUTONOMOUS SYSTEMS RESEARCH GROUP MAIN ACTIVITIES

- Electromechanics and mechatronics, with particular emphasis on the design, integration, and control of the systems in machinery and electric vehicles
- Modeling and testing of electrical drive systems, including the development and application of Digital Twin technologies
- Industrial robotics and mobile systems, with particular emphasis on system integration, autonomy, and control using the ROS framework
- Flexible machine vision services, encompassing the entire pipeline from model training to real-world deployment, with specialized expertise in Hyperspectral Imaging (HSI)
- Design and optimization of microwave filters using machine learning techniques, with particular emphasis on their applications in signal processing and modern communication systems



MECHATRONICS AND AUTONOMOUS SYSTEMS RESEARCH GROUP



RESEARCH TEAM

LABORATORIES

- E-Vehicles laboratory (R&D)
- Industrial Robotics and Machine Vision Laboratory (EDU+R&D)
- Prototyping Laboratory (EDU+R&D)
- Mechatronics Laboratory (EDU)
- Worlds of Mechatronics (EDU)
- Autonomous systems hub (EDU)



MECHATRONICS AND AUTONOMOUS SYSTEMS RESEARCH GROUP



RESEARCH AND INDUSTRIAL PROJECTS PROJECTS IN PROGRESS

- **PRO2022 "Advanced Digital Tools to Accelerate the Development of Software-Defined Electric Vehicles"** (01.01.2025–31.12.2025); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics; Financier: Estonian Research Council
- **TPA2022 "Artificial intelligence-based adaptive drive control system"** (01.09.2025–31.08.2026); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics; Financier: State Shared Service Centre Astoria 13;



MECHATRONICS AND AUTONOMOUS SYSTEMS RESEARCH GROUP



RESEARCH AND INDUSTRIAL PROJECTS FINISHED PROJECTS

- **PRO2021 "Synthetic Performance Optimization Methodology for Electrical Motor Drivers"** (1.01.2024–31.12.2024); Principal Investigator: Anton Raskilkin; Financier: Estonian Research Council
- **PRO2021 "Self-driving car"** (01.01.2024–31.12.2024); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **TPA2021 "Challenges in development of study for hybrid electric vehicle charge development"** (01.01.2024–31.12.2024); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **PRO2021 "Electrical installation and control of MECHATRONIC open program project of power applied systems"** (01.09.2020–30.08.2021); Financier: Estonian Research Council
- **TPA2021 "Digital study of electrical engineering"** (01.09.2020–31.08.2021); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **TPA2021 "Digital study of electrical engineering"** (01.09.2020–31.08.2021); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **TPA2021 "Digital study of electrical engineering"** (01.09.2020–31.08.2021); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **TPA2021 "Digital study of electrical engineering"** (01.09.2020–31.08.2021); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **TPA2021 "Digital study of electrical engineering"** (01.09.2020–31.08.2021); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **TPA2021 "Digital study of electrical engineering"** (01.09.2020–31.08.2021); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics



MECHATRONICS AND AUTONOMOUS SYSTEMS RESEARCH GROUP

EDUCATIONAL PROJECTS PROJECTS IN PROGRESS

- **VER22001 "Capacity Enhancement in Electrical Equipment Condition Monitoring and Fault Diagnostics"** (01.01.2023–31.12.2025); Principal Investigator: Toomas Varmann; Financier: European Education and Culture Executive Agency
- **VNP24025 "Building Capacity of Future Engineers for Secure, Energy-efficient Autonomous Systems"** (01.05.2024–31.10.2025); Principal Investigator: Anton Raskilkin; Financier: Nordic Council of Ministers
- **TPA2022 "Engineering Academy"** (01.05.2023–31.08.2023); Principal Investigator: Anton Raskilkin; Tallinn University of Technology; Financier: Ministry of Education and Research
- **VNP25021 (101210919) "Career Management Services for European Talents"** (01.06.2025–31.05.2028); Principal Investigator: Jona Oja Apla; Financier: European Commission
- **VNP25022 "Advancing the Education of Engineers Through AI for Cyber-Sustainable and Energy-Efficient Union"** (01.05.2025–31.10.2026); Principal Investigator: Anton Raskilkin; Financier: Nordic Council of Ministers



MECHATRONICS AND AUTONOMOUS SYSTEMS RESEARCH GROUP



EDUCATIONAL PROJECTS FINISHED PROJECTS

- **VER2002 "Efficient cooperation in school education focused on technological development"** (01.01.2019–31.10.2019); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics (partner); Financier: Politehnika Slovakia
- **VNP2008 "Advances in Information, Automation and Electrical Engineering"** (15.05.2020–31.08.2021); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **VNP2009 "Advanced Approach for Computer Control of Electrical Technologies"** (15.05.2021–31.10.2022); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **TPA2021 "Young Engineer Programme"** (01.04.2021–31.12.2021); Principal Investigator: Anton Raskilkin; Tallinn University of Technology, School of Engineering, Department of Electrical Power Engineering and Mechatronics
- **VER2024 "Digital platform supporting remote laboratory classes in electrical engineering, mechatronics and automation"** (01.01.2024–31.12.2024); Principal Investigator: Anton Raskilkin; Tallinn University of Technology; Financier: Politehnika Slovakia
- **VNP2004 "Advanced Computer-Oriented Engineering Technologies and Adaptivity"** (15.05.2022–31.10.2022); Principal Investigator: Anton Raskilkin; Nordic Council of Ministers



MECHATRONICS AND AUTONOMOUS SYSTEMS RESEARCH GROUP



OTHER ACADEMIC ACTIVITIES ACTIVITIES IN PROGRESS

- Cooperation of Universities in Central and Eastern Europe (CUEEE), since 2000
- IEEE Estonia Section VTS Chapter
- CA22151 Cyber-Physical systems and digital twins for the decarbonisation of energy-intensive industries (WG3 – WG4)
- VA25018 "Advancing Swedish Estonian Collaboration for Sustainable Electrical Engineering Education – TalTech & Lund" (01.09.2025–31.12.2025) PI: Mahmoud Ibrahim; Swedish Estonian Collaboration



MECHATRONICS AND AUTONOMOUS SYSTEMS RESEARCH GROUP



MECHATRONICS AND AUTONOMOUS SYSTEMS RESEARCH GROUP

MAIN ACTIVITIES

- Electromechanics and mechatronics, with particular emphasis on the design, integration, and control of the systems in machinery and electric vehicles
- Modeling and testing of electrical drive systems, including the development and application of Digital Twin technologies
- Industrial robotics and mobile systems, with particular emphasis on system integration, autonomy, and control using the ROS framework
- Flexible machine vision services, encompassing the entire pipeline from model training to real-world deployment, with specialized expertise in Hyperspectral Imaging (HSI)
- Design and optimization of microwave filters using machine learning techniques, with particular emphasis on their applications in signal processing and modern communication systems





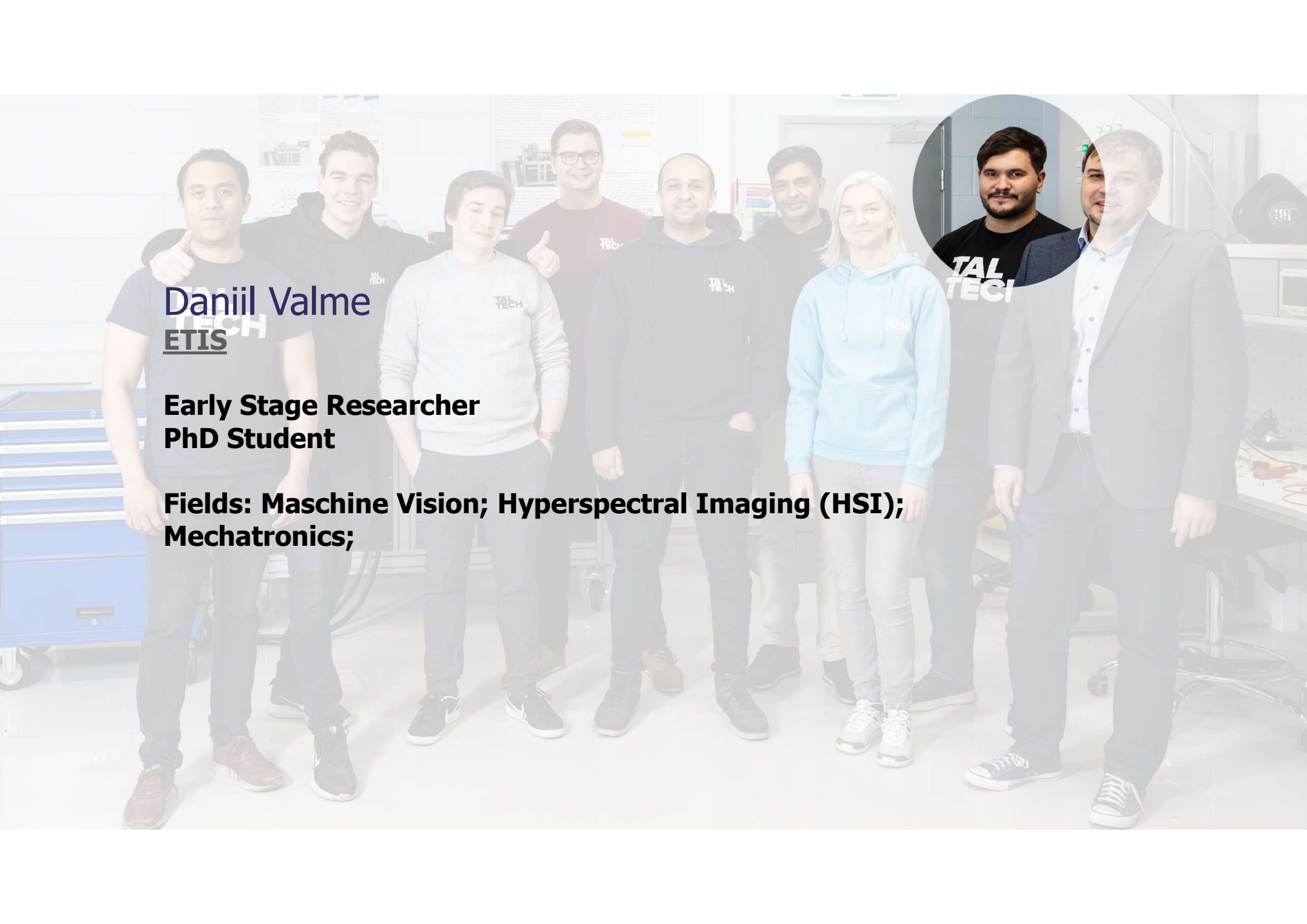
RESEARCH TEAM



Anton Rassõlkin, PhD
ETIS

Tenured Associate Professor
Head of Mechatronics and Autonomous Systems Research Group
Programme Director (Mechatronics - English)
Programme Director (Electrical Engineering and Mechatronics)

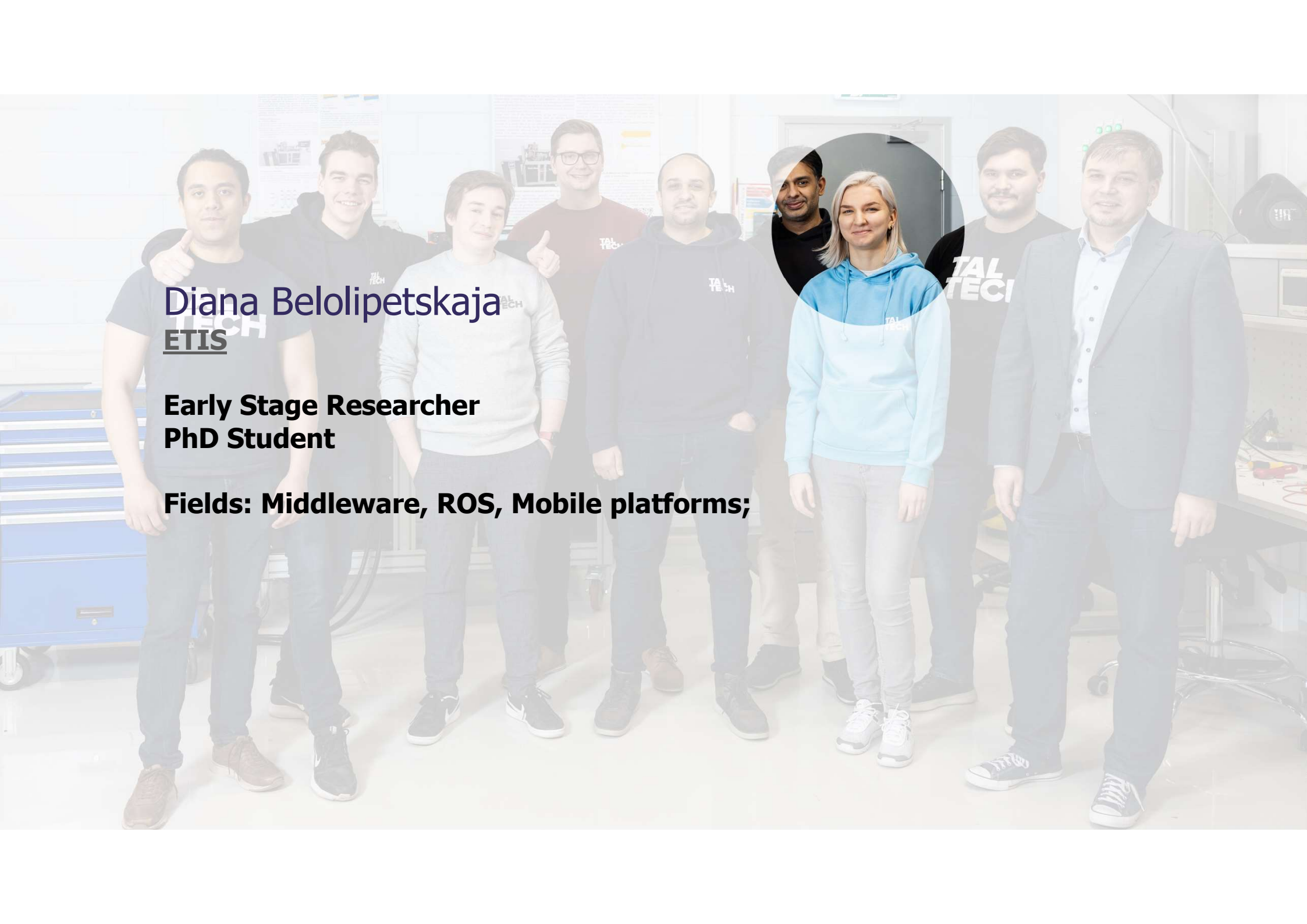
Fields: Electrical Drives; Electric Vehicles; Digital Twins;
Mechatronics;

A group of eight people, seven men and one woman, are standing in a laboratory or workshop setting. They are dressed in casual attire, with several wearing hoodies that have 'TAL TECH' printed on them. The background shows lab equipment, including a blue tool chest on the left and various instruments on the right. A circular inset in the upper right corner shows a close-up of two of the individuals: a man with a beard wearing a black 'TAL TECH' hoodie, and a man in a grey blazer over a light blue shirt.

Daniil Valme
ETIS

Early Stage Researcher
PhD Student

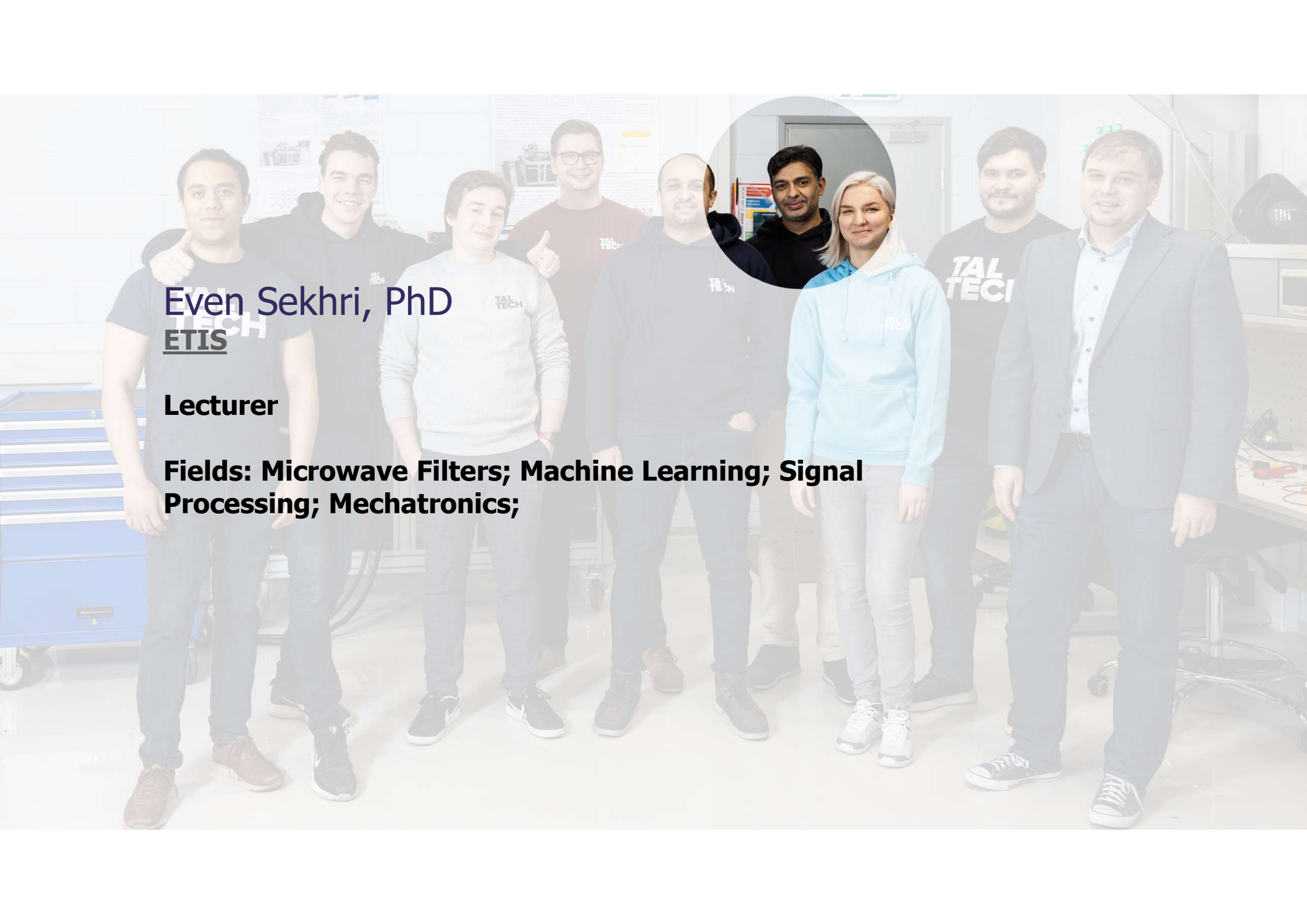
**Fields: Maschine Vision; Hyperspectral Imaging (HSI);
Mechatronics;**



Diana Belolipetskaja
ETIS

Early Stage Researcher
PhD Student

Fields: Middleware, ROS, Mobile platforms;



Even Sekhri, PhD
ETIS

Lecturer

Fields: Microwave Filters; Machine Learning; Signal Processing; Mechatronics;



Mahmoud Ibrahim, PhD
ETIS

Researcher
PhD Student

Fields: Electrical Drives; Modelling; MATLAB;



Johannes Muru
ETIS

Early Stage Researcher
PhD Student
Industrial robotics specialist

Fields: Industrial robotics;



**TAL
TECH**
Kenari Koonik

Study Assistant

Fields: Mechatronics labs; Students activities; Wokrshops;



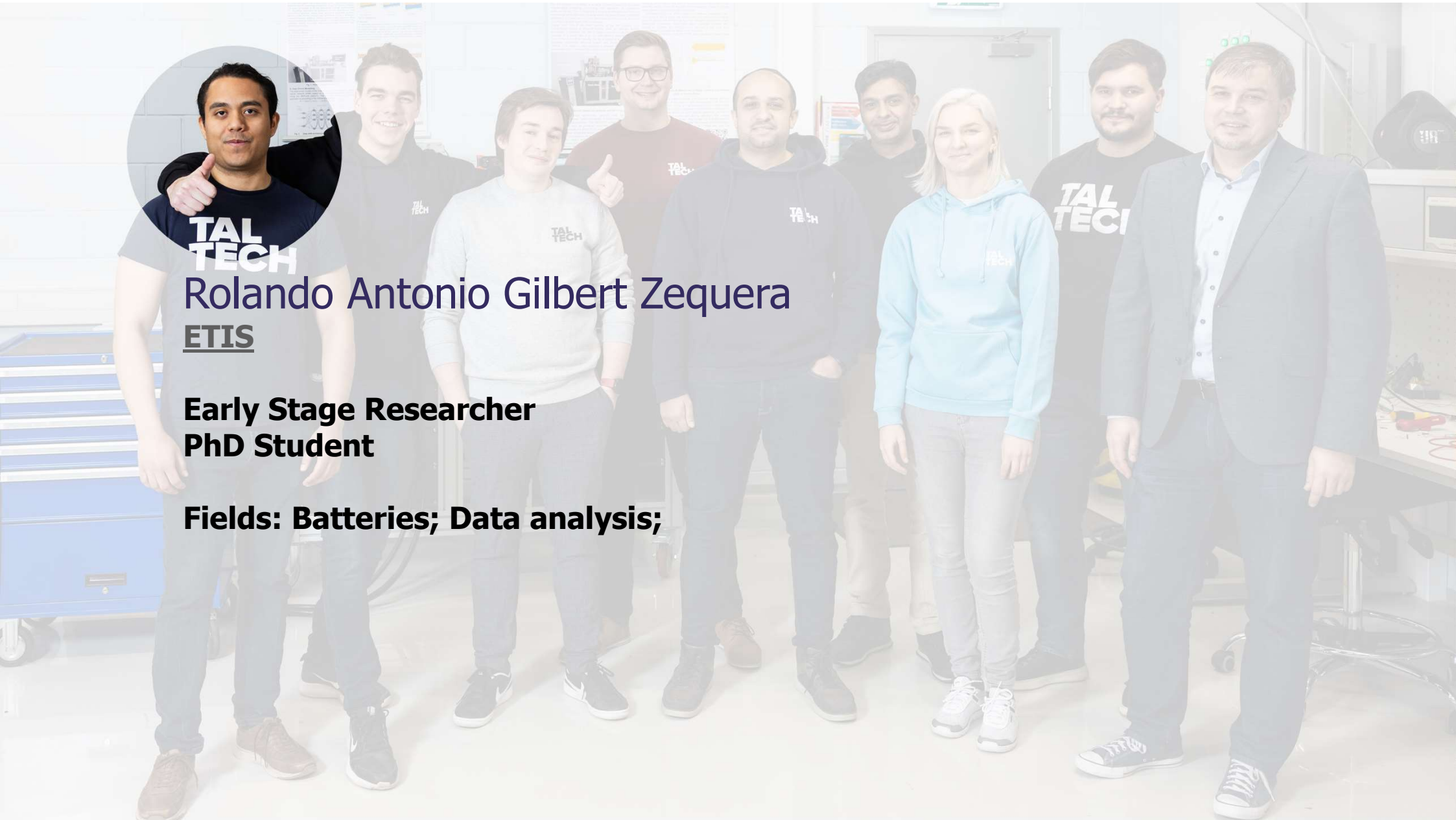


Rolando Antonio Gilbert Zequera

ETIS

**Early Stage Researcher
PhD Student**

Fields: Batteries; Data analysis;





Martin Võip

Study Assistant

Fields: E-vehicles lab; BFMC;



Kevin Lindlaan

Study Assistant

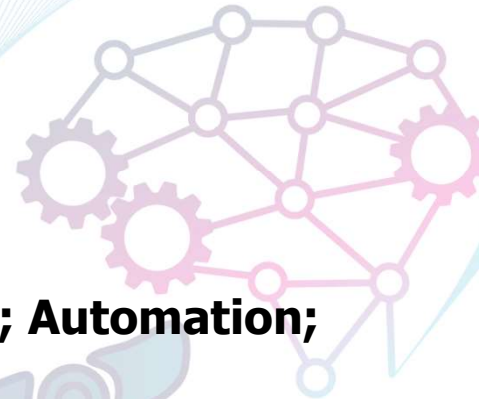
Fields: Industrial robotics; Automation;



Sven Rosenberg

Study Assistant

Fields: Electrical drives; Control of Electrical Machines;





Margus Tõnissaar, PhD

Educational Quality and Development Expert



Mobile platforms
Digital Twins
Electric Vehicles
Students activities
Data analysis
Hyperspectral Imaging (HSI)
Maschine Vision
Middleware
Batteries
Industrial robotics
Signal Processing
MATLAB
Electrical Drives
Machine Learning
Mechatronics
ROS
Modelling
Microwave Filters



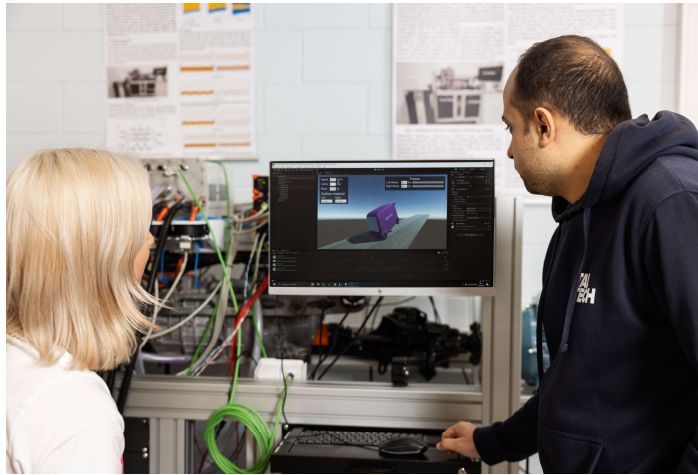
LABORATORIES

- E-Vehicles laboratory (R&D)
- Industrial Robotics and Machine Vision Laboratory (EDU+R&D)
- Prototyping Laboratory (EDU+R&D)
- Mechatronics Laboratory (EDU)
- Worlds of Mechatronics (EDU)
- Autonomous systems hub (EDU)



E-VEHICLES RESEARCH LABORATORY

NRG-103



Areas of interest of the e-Vehicles laboratory cover a wide range of electrically operated vehicles - light vehicles, electric cars, mobile platforms, water transport, drive parts of large transport vehicles, etc.

E-SÕIDUKITE LABORI LÕPUTÖÖ TEEMAD

- MATLAB-koodi arendamine mobiilirakenduse jaoks e-tõukeratta parametriseerimiseks reaajas monitooringuks ja analüüsiks
- Keskkonnatingimuste mõju elektrilise veosüsteemi töökindlusele ja jõudlusele
- Juhendaja: Prof. Anton Rassõlkin
anton.rassolkin@taltech.ee



E-SÕIDUKITE LABORI LÕPUTÖÖ TEEMAD

- Anduripõhise süsteemi arendamine rataste seisukorra monitooringuks
- Andmete kogumise ja töötlemise süsteemi arendamine rataste seisukorra hindamiseks erinevates tingimustes
- Veebipõhise juhtimise ja automaatse SQL-andmelogimise ning ohutuskontrolliga akude tühjendussüsteemi projekteerimine ja rakendamine
- Juhendaja: Diana Belolipetskaja, doktorant-nooremteadur
diana.belolipetskaja@taltech.ee



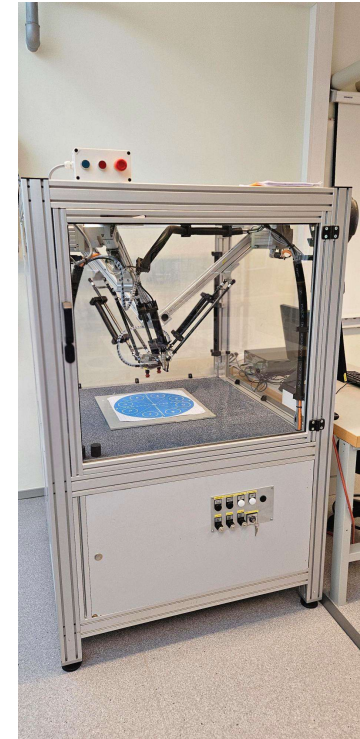
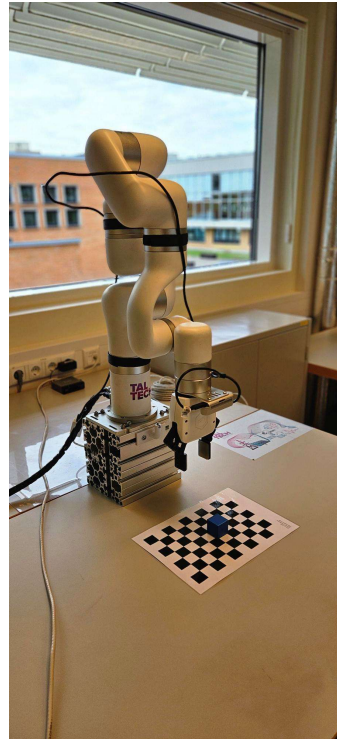
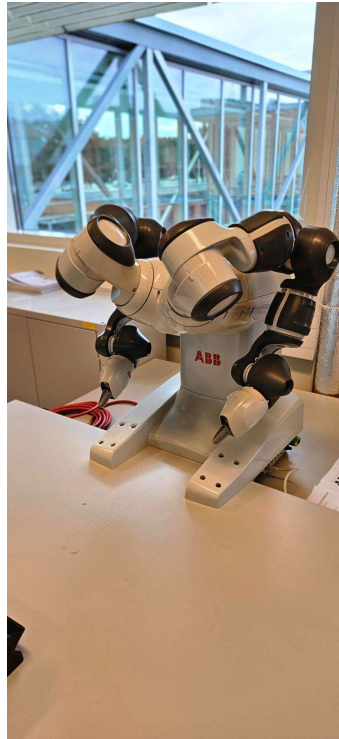
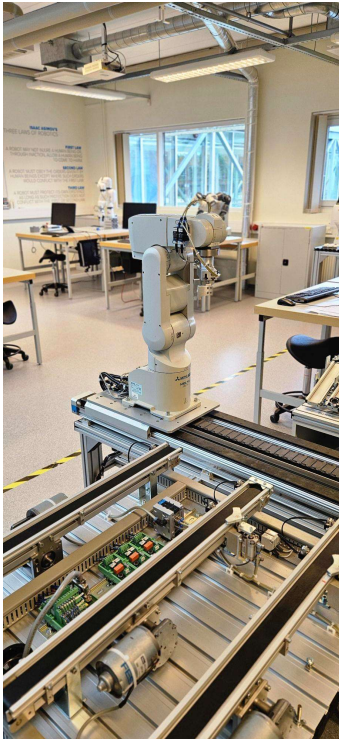
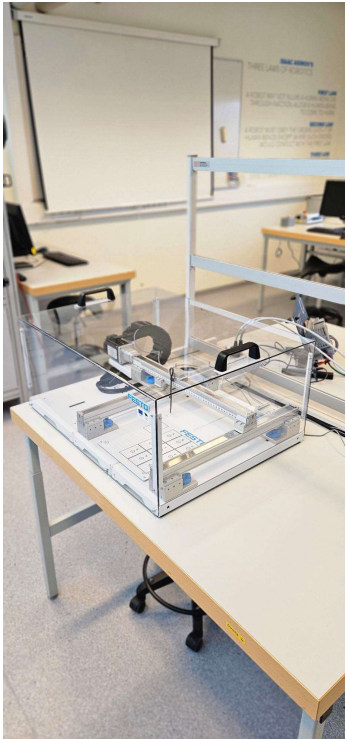
INDUSTRIAL ROBOTICS AND MACHINE VISION LABORATORY

NRG-201



INDUSTRIAL ROBOTICS AND MACHINE VISION LABORATORY

NRG-201



TÖÖSTUSROBOTIKA LÕPUTÖÖ TEEMAD

- **Tehisintellekti rakendamine kahe manipulaatoriga robotsüsteemide autonoomseks juhtimiseks**
 - ABB Yumi
 - Python
 - **Paindootmisliini energiatõhususe eksperimentaalne hindamine**
 - Festo FMS
 - PLC programmeerimine (Siemens)
 - HMI arendus (WinCC)
 - **SCARA tööstusroboti juhtimine kasutades ROS2-raamistikku**
 - KUKA KR6 R500 Z200-2
 - ROS2
- Juhendaja: Johannes Muru, doktorant-nooremteadur
johannes.muru@taltech.ee



HYPERSENSPECTRAL IMAGING AND MACHINE VISION

RESEARCH IN PROGRESS

Using Hyperspectral Imaging (HSI) onboard of unmanned ground vehicles for inspection and navigation purposes

- Unstructured terrain perception
- Implementation of embedded systems
- Developing new processing techniques

Application of board-level spectral sensors

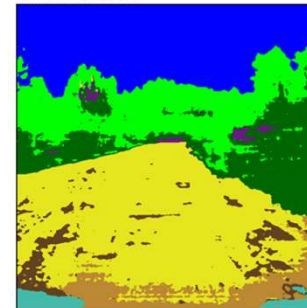
- Material detection in industrial applications



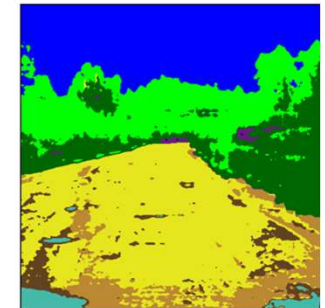
RGB colour composite image of HSI terrain dataset



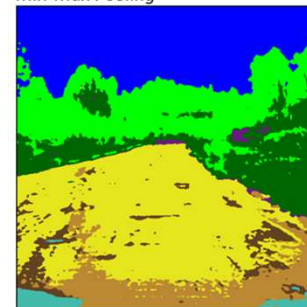
Ground truth of the dataset



Classification result for 9 bands using Min-Max Pooling



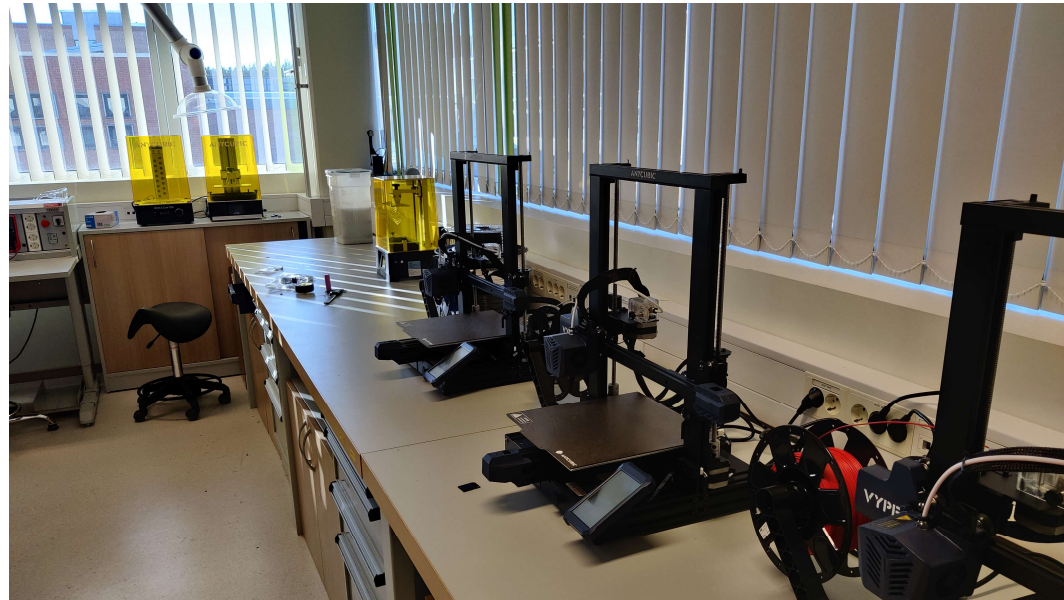
Classification result for 16 bands using Min-Max Pooling



Classification result for 25 bands using Min-Max Pooling

PROTOTYPING LABORATORY

NRG-202



The laboratory has up-to-date workplaces which students can use for both projects and thesis works

MECHATRONICS LABORATORY

NRG-211



The laboratory is equipped with TEKLAB workstations, including soldering and de-soldering stations, signal generator, digital oscilloscope, power supplies, etc.

MEHHATROONIKA LABORI LÕPUTÖÖ TEEMAD

- **ABB elektriajamite demo-süsteemi rakendamine hariduslikel eesmärkidel juhtimiseks ja monitooringuks.**
- **Eriotstarbeliste elektriajamite juhtimine – Festo samm- ja servomootorajami süsteemide jõudluse hindamine.**
- Juhendaja: Prof. Anton Rassõlkin
anton.rassolkin@taltech.ee



WORLDS OF MECHATRONICS

NRG-221

The laboratory dedicated to student activities, workshops, and the popularization of mechatronics. The lab is designed to foster collaboration, innovation, and creativity, offering a supportive environment for students to explore mechatronics concepts.

It also serves as a hub for outreach programs, promoting interest in mechatronics among young learners and the wider community.



AUTONOMOUS SYSTEMS HUB

NRG-235

The Autonomous Systems Hub is a dynamic learning environment for students to develop skills in mobile robotics and autonomous vehicles.

It provides hands-on experience with cutting-edge technology, fostering innovation and expertise in designing, programming, and testing autonomous systems.



BOSCH COMPETITION



Bosch Future Mobility Challenge is an international technical competition initiated by Bosch Engineering Center Cluj in 2017. The competition invites student teams every year to develop autonomous driving and connectivity algorithms on 1/10 scale vehicles.

- Getting experience with embedded systems (Jetson Nano, Intel RealSense, etc)
- Developing project management skills
- Team work experience
- 4 years of participation
 - TOP 10 /46 in 2021;
 - TOP8 /60 in 2024;
 - **2nd place in 2025;**





THANK YOU FOR YOUR ATTENTION!

Anton Rassõlkin, PhD
Tenured Associate Professor of Mechatronics



anton.rassolkin@taltech.ee

<https://taltech.ee/en/mechatronics-and-autonomous-systems>