



IEEE INTERNATIONAL SYMPOSIUM ON
ROSE 2024
ROBOTIC AND SENSORS ENVIRONMENTS
June 20-21 2024 || Chemnitz, Germany

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WELCOME MESSAGE

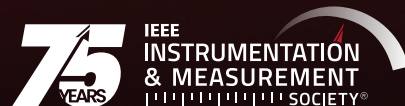
TECHNICAL PAPERS

AUTHOR INDEX



IEEE EMBC 2024
CONFERENCE PROCEEDINGS

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**2024 IEEE International Symposium on Robotic
and Sensors Environments (ROSE) Proceedings**

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Message from the Chairmen

Dear ROSE 2024 Attendees,

The organizing committee is honored to host you at the 2024 IEEE International Symposium on Robotic and Sensors Environments (ROSE), held at Chemnitz University of Technology, Germany.

ROSE is registered under the IEEE Instrumentation and Measurement Society (IMS). It addresses some of the increasing challenges faced by modern societies, such as aging populations, shortage of skilled labor, and the need for sustainable environments. The symposium brings together researchers from all over the world to reflect on these challenges and demonstrate how the latest advances in robotics and sensing technologies can play a pivotal role in solving them.

This year, we received 35 paper submissions by authors from 18 countries for technical program presentations. All the submitted papers were peer-reviewed by ROSE Editorial Board. The Technical Program Committee had to make difficult decisions to ultimately select 27 papers to be included in the final program, which is about 77% of the reviewed submissions. The decision was based on innovation, quality, clarity, and presentation.

Over two days, participants will have plenty of opportunities to present their research, exchange technical insights with their peers, network, and explore new research directions as well as future collaborations with researchers around the world. In addition to the regular sessions, the technical program includes two workshops: one on “Brain- and Bio-inspired Robotics” and another on “Potential of Multi-Modal Sensing in Smart Wearables”, along with a demo session on “Highly Sensitive Flexible Sensors Based on Nanomaterials”. The entire program is presented orally, providing optimal and timely opportunities to initiate discussions among the participants.

To further explore the potential of robots and their impacts on our lives, the program includes two keynote speeches. To that end, we are excited to have among us Dr. Bruno Siciliano, from the University of Naples Federico II, Italy, who, in his talk “Robotics Meets AI & 5G — The Future is Now!”, will highlight the advantages of complementing AI with 5G technology in today’s robotic applications. We are also fortunate to welcome Dr. Mohsen Kaboli from BMW Group, Germany, who will illuminate the groundbreaking role of tactile sensing in reshaping modern robotics and interactive intelligent systems, in his talk “Embodied Tactile Intelligence: Revolutionizing Robotics and Interactive Intelligent Systems”.

The organizing committee would like to acknowledge and emphasize the efforts of numerous contributors to the success of the conference. In particular, we would like to thank the Technical Program Committee and the Editorial Board members who volunteered their time to carefully review the manuscripts and provide constructive comments to the authors. We would like to extend our gratitude to our sponsors and technical sponsors for their support and generosity. We are immensely grateful to the Steering Committee members and volunteers whose tireless efforts have made the conference possible. Special thanks also go to IEEE Instrumentation and Measurement Society (IMS) which constantly provides support and sponsorship to the ROSE conference series, and to Julia Raabe and the rest of Conference Catalysts personnel, for their consistent and thorough assistance towards the conference organization.

Finally, we would like to also thank all the authors and participants who submitted manuscripts of excellent quality to ROSE and directly contributed to the success of this conference.

We wish all the participants a pleasant and fruitful experience, and we hope that you enjoy your time with your scientific community.

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Wail Gueaieb, University of Ottawa, Canada
Olfa Kanoun, Chemnitz University of Technology, Germany

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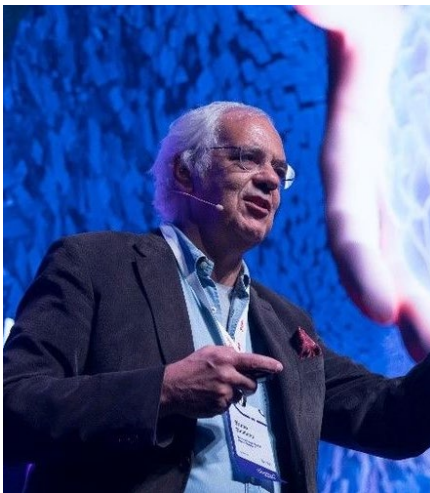
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IEEE ROSE 2024 Keynote Speakers



Bruno Siciliano

University of Naples Federico II, Italy

Robotics Meets AI & 5G — The Future is Now!

Abstract: Robotics research has advanced in the last two decades through an intensive collaboration with other disciplines and research communities. Multi-disciplinary approaches are more successful in addressing the combined issues of cognition (perception, awareness and mental models), and physical attributes (safety, dependability and dexterity) in the world of robotics. Previously separated from humans behind a fence, the new advanced robots (or cobots) are sharing our workspace and collaborating with us. Increasingly sophisticated built-in sensors enable them to see and feel the presence of humans and avoid accidental contact. The perception of robotics technology is improving, as we experience more ways it can

positively affect our lives. In particular, the social and medical benefits of robots are starting to get more attention. In this scenario, the terms artificial intelligence (AI) and robotics are liberally used, and frequently interchanged today. However, the physical nature of a robotic system distinguishes it from the pure abstraction of AI. We are experiencing a transition from Information and Communication Technology (ICT) to InterAction Technology (IAT). The fifth generation of wireless technology (5G) will pave the way for a new generation of robots, some free to roam controlled via wireless rather than wired communication links while exploiting the vast computing and data storage resources of the cloud. Armed with these capabilities, robots can be controlled dynamically in real time and be connected to people and machines locally and globally. In the near future, 5G will fully enable applications with minimal latency such as “factory of the future”, “remote surgical training” and many others that were previously beyond the capabilities of both cellular and robotics technologies.

Biography: Bruno Siciliano is professor of robotics and control at the University of Naples Federico II. He is also Honorary Professor at the University of Óbuda where he holds the Kálmán Chair. His research interests in robotics include manipulation and control, human–robot cooperation, and service robotics. Fellow of the scientific societies IEEE, ASME, IFAC, AAIA, he received numerous international prizes and awards, including the 2022 Engelberger Award for Education. He was President of the IEEE Robotics and Automation Society from 2008 to 2009. He has delivered more than 150 keynotes and has published more than 300 papers and 7 books. His book “Robotics” is among the most adopted academic texts worldwide, while his edited volume “Springer Handbook of Robotics” received the highest recognition for scientific publishing: the 2008 PROSE Award for Excellence in Physical Sciences & Mathematics. His team has received more than 20 million Euro funding in the last 15 years from competitive European research projects, including an Advanced Grant and a Synergy Grant from ERC. More details are available at <http://wpage.unina.it/siciliano/>



Dr. Mohsen Kaboli
RoboTac @ BMW Group

Embodied Tactile Intelligence: Revolutionizing Robotics and Interactive Intelligent Systems

Abstract: This presentation illuminates the groundbreaking role of tactile sensing in reshaping robotics and interactive intelligent systems. Tactile sensors, inspired by the intricate sensitivity of human touch, empower robots with the ability to perceive and interpret physical stimuli, revolutionizing their interaction capabilities across various domains.

The discourse delves into the broad spectrum of applications where tactile sensing thrives in robotics. From delicate manipulation and precise grasping to intricate object recognition and seamless human-robot interaction, tactile sensors enrich robots with a deeper understanding of their surroundings. By providing invaluable feedback on contact forces and surface textures, tactile sensing enhances robots' capabilities to manipulate objects with finesse, navigate complex environments with confidence, and collaborate seamlessly with humans.

Moreover, the presentation underscores the pivotal role of tactile sensing in autonomous systems. Through the fusion of tactile sensors and advanced machine learning algorithms, robots can autonomously gather and interpret tactile data, enabling continuous learning and adaptive behavior in dynamic environments. This adaptive prowess empowers robots to refine their skills over time, adapt to evolving conditions, and elevate their overall performance and reliability.

Furthermore, the talk explores the profound implications of tactile sensing in enhancing human-robot interaction. By integrating tactile feedback into interactive systems, robots can engage with humans in a more intuitive and natural manner, fostering harmonious collaboration and enhancing user experience. Whether in fields such as prosthetics, healthcare, or assistive robotics, tactile sensing serves as a cornerstone for fostering meaningful connections and improving quality of life for users.

In conclusion, the presentation accentuates the transformative potential of tactile sensing in robotics and interactive intelligent systems. As research endeavors and technological advancements continue to propel the field forward, the integration of tactile sensing promises to unlock unprecedented possibilities, redefining the landscape of human-robot interaction and paving the way for a more connected and responsive future.

Biography: Dr. Mohsen Kaboli is a professor specializing in Embedded AI, Robotics, and Tactile Intelligence at Eindhoven University of Technology (TU/e) in the Netherlands. Additionally, he serves as the technical lead of the AI and Robotics research and head of the RoboTac team and AI Lab at the BMW Group Center of Invention in Munich, Germany, a role he has held since 2018.

Previously, Dr. Kaboli held the position of assistant professor at the Institute for Brain and Cognition at Radboud University in the Netherlands from 2019 to 2022. His research interests lie at the intersection of Embodied Robotics, Visuo-Tactile Interactive Perception, Machine Learning, and Control, with applications ranging from Mobile Robotics to Robotic Grasping and Manipulation, and Human-Robot Interaction and Collaboration.

Dr. Kaboli has played a pivotal role as a principal investigator in numerous European-funded research projects, including PHASTRAC (Oscillatory Neural Network-based Efficient AI Edge Computing), INTUITIVE (Tactile User Interface), iNavigate (Brain-Inspired Perception for Navigation and Mobility), and SmartNets, among others.

IEEE ROSE 2024 Workshops



Dr. Florian Röhrbein

Chemnitz University of Technology, Germany

Brain- and Bio-inspired Robotics

Abstract: This workshop delves into the cutting-edge field of brain- and bio-inspired robotics, exploring how principles from neuroscience and biology can drive innovation in robotic systems. The development and use of bio-inspired sensors, which emulate the sensory capabilities of living organisms to provide robots with enhanced perception and responsiveness, will also be covered. During the workshop will have an online meeting with members of the euRobotics Topic Group on Bio-inspired Robotics. In addition, an inaugural meeting auf the Neurorobotic working group of the German node of EBRAINS is planned.



Olfa Kanoun

Chemnitz University of Technology, Germany

Potential of Multi-Modal Sensing in Smart Wearables

Abstract: The demand for wearable systems for human-human or human-machine interactions is nowadays continuously increasing. Several sensors can be adopted including biocompatible flexible sensors based on polymer carbon nanotubes composites (PCN), bio-impedance spectroscopy, surface electrical impedance myography (sEIM) and electrical impedance tomography (EIT), Electromyography (EMG) and inertial measurement units (IMU). Multi-modal systems, incorporating a variety of sensors and techniques, enhance the precision and dependability of continuously monitoring human activity, behavior, latency, and intentions. These systems ensure increased accuracy and reliability and facilitate intuitive communication.

Wearable embodied solutions offer the unique advantage of building body-attached sensor networks. These networks are designed to meet stringent requirements for compactness, accuracy, and reliability. They enable continuous monitoring and communication of body activity even in complex interaction scenarios, such as those encountered in dynamic sports environments or sophisticated human-robot collaborations. This capability is crucial for applications that require uninterrupted and precise tracking of physiological and biomechanical parameters, ensuring that users receive timely and accurate feedback for optimal performance and health management.

Technical Program: Thursday, June 20, 2024

8:00 - 8:30

Registration

8:30 – 8:45

Welcome Address

Wail Gueaieb,
Olfa Kanoun

8:45 - 10:00

Mobile Robotics

Session Chair: Wail Gueaieb

8:45

Impact of AI on the HRI Dynamic in Search and Rescue Operations Using UAV Swarms

Jordan D Morrow (Missouri University of Science and Technology, USA)

Maciej Zawodniok (Missouri University of Science and Technology, USA)

9:00

Optimizing Underwater Survey Efficiency: A Unified Approach to AUV Navigation and Wreckage Detection

Harshith Kumar M B (Drexel University, USA)

9:15

Design of a Wall Climbing Robot with a Unique Topple Prevention Mechanism

Arun Prakash Rao (DRDO, India)

9:30

Cooperative Object Transportation Using Autonomous Networked Cobots: A Distributed Approach

Md Suruz Miah (Bradley University, USA)

Zuguang Liu (Bradley University, USA)

9:45

Comparative Analysis of Odometry and Ultra-Wideband Localization Methods for Autonomous Mobile Robots

Murat Aydemir (EGE University, Turkey)

Mina Khoshrangbaf (EGE University, Turkey)

Vahid Khalilpour Akram (EGE University, Turkey)

Moharram Challenger (University of Antwerp & Flanders Make Strategic Research Center, Belgium)

10:00 – 10:30

Coffee Break and Demo Session

11:25 – 12:40

Intelligent Robotic Systems I

Session Chair: Rim Barioul

10:30 – 11:25

Keynote: Embodied Tactile Intelligence: Revolutionizing Robotics and Interactive Intelligent Systems

Dr. Mohsen Kaboli, (RoboTac @ BMW Group, Netherlands)

Session Chair: Olfa Kanoun

11:25

A brain-inspired model of reaching and adaptation on the iCub robot

Torsten Fietzek (Chemnitz University of Technology, Germany)

Christoph Ruff (Chemnitz University of Technology Germany)

Fred Hamker (Chemnitz University of Technology, Germany)

11:40

Swish-ResNet Framework for Faulty Weld Detection

Muteb Aljaseem (Bowling Green State University, USA)

Mohammad Mayyas (Professor of Robotics, USA)

Kevin Duke, Mikhail Shilov, Zahabul Islam and Mohammad Abouheaf (Bowling Green State University, USA)

Wail Gueaieb (University of Ottawa, Canada)

11:55

Information Sharing for Cooperative Robots via Multi-Agent Reinforcement Learning

Ayesha Siddiqua, Siming Liu and Razib Iqbal (Missouri State University, USA)

Logan Ross (Joplin High School, USA)

Brian Zweerink (Marshfield High School, USA)

Ryan Eskridge (Missouri State University, USA)

12:10

Redefining Robotic Engineering: Harnessing Generative Design, Additive Manufacturing, Printable Conductive Materials, and Wireless Technologies to Develop Novel Articulated Robot Arms

Thomas M. Wendt (University of Applied Sciences Offenburg & Work-Life Robotics Institute, Germany)

Thomas Weeber (BESTec-etp Freiburg GmbH, Germany)

12:25

Biomimetic Robotic Hand with Highly Sensitive Integrated Nanocomposite Force Sensors for Adaptive Grasping

Ahmed Attaoui (Chemnitz University of Technology, Germany & National Engineering School of Sousse, University of Sousse, Tunisia)

Achraf Djemal (Chemnitz University of Technology)

Bilel Atitallah (Chemnitz University of Technology & National Engineering School of Sfax, Germany)

Asma El Jaoui (Chemnitz University of Technology, Germany)

Olfa Kanoun (Chemnitz University of Technology, Germany)

12:40 – 13:45

Lunch Break

13:45 – 14:45

Workshop 1: Brain- and Bio-inspired Robotics

Florian Röhrbein, (Chemnitz University of Technology, Germany)

Session Chair: Olfa Kanoun

14:45 – 16:00

Sensors for Robotics

Session Chair: Mohsen Kaboli

14:45

Visuo-Tactile based Predictive Cross Modal Perception for Object Exploration in Robotics

Anirvan Dutta (BMW Group AG & Imperial College of Science, Technology and Medicine, London, Germany)

Etienne Burdet (Imperial College London, United Kingdom (Great Britain))

Mohsen Kaboli (BMW Group AG, Eindhoven University of Technology, Germany)

15:00

Privacy-Secured Early Detection of Smartphone Users in Danger at Stations Using Depth Sensor and Deep Learning

Hiroto Obata (Shibaura Institute of Technology, Japan)

Chinthaka Premachandra (Shibaura Institute of Technology, Japan)

15:15

Advancements in Tactile Hand Gesture Recognition for Enhanced Human-Machine Interaction

Chiara Fumelli (BMW Group, Germany)

Anirvan Dutta (BMW Group AG & Imperial College of Science, Technology and Medicine, London, Germany)

Mohsen Kaboli (BMW Group AG, Eindhoven University of Technology, Germany)

15:30

Delving into Conversion Effects in 0.5 μm Thin Film Aluminum Nitride MEMS Devices

Suhail Ahmed, SA, Carlo Trigona, Alireza Mehdi and Giuliano A. Salerno (University of Catania, Italy)

Ausrine Bartasyte (FEMTO-ST Institute, France)

Samuel Margueron (FEMTO-ST Institute University of Franche-Comte, France)

Salvatore Baglio (University of Catania, Italy)

Vincenzina Strano (Consiglio Nazionale delle Ricerche, Italy)

Quentin Micard (Institut FEMTO-ST, France)

15:45

Investigating Temperature Effects on Resonant Photoacoustic Gas Sensor: Ring-shaped Cell case study

Ada Fort, Marco Mugnaini, Enza Panzardi and Valerio Vignoli (University of Siena, Italy)

16:00 – 16:30

Coffee Break and Demo Session

16:30 – 17:30

Robot Manipulation

Session Chair: Chinthaka Premachandra

16:30

Model-Based Force Estimation of a Steerable Ablation Catheter in the Presence of the Blood Flow

Seyyede shahrzad Tabatabaei, Mojtaba Kheiri and Javad Dargahi (Concordia University, Canada)

16:45

Flexible Dual-Arm Robot in Automated Sample Preparation and Measurement Processes

Heidi Fleischer (University of Rostock, Germany)

Shalaka Joshi (Center for Life Science Automation - CELISCA, Germany)

Thomas Roddelkopf (University of Rostock, Germany)

Michael Klos (Yaskawa Europe GmbH, Germany)

Kerstin Thurow (Center for Life Science Automation - CELISCA, Germany)

17:00

Optimizing 7-DOF Robot Manipulator Path Using Deep Reinforcement Learning Techniques

Mariam Kashkash (Mohamed Bin Zayed University of Artificial Intelligence (MBZUAI), United Arab Emirates)

Abdulmotaleb El Saddik (University of Ottawa, Canada)

Mohsen Guizani (Mohamed Bin Zayed University of Artificial Intelligence, United Arab Emirates)

17:15

Wireless Control of 4 D.O.F. Robotic Arm using EMG Muscle Sensors

Dinesh Patil (Vishwakarma Institute of Technology, India)

Shilpa Sondkar (University of Pune & Vishwakarma Institute of Technology, Pune, India)

Meet Nathwani, Shivanand Nemane and Mohit Patil (Vishwakarma Institute of Technology, India)

19:00 – 21:00

Gala Dinner

SCALA Restaurant

Technical Program: Friday, June 21, 2024

8:00 - 8:30

Registration

8:30 – 8:45

Opening Remarks

Wail Gueaieb,
Olfa Kanoun

8:45 – 9:45

Human-Robot Interaction

Session Chair: Mohamed Bdiwi

8:45

Towards safety-based digital twins: A new approach of dynamic safety-related database structure

Ibrahim Al Naser (IWU Fraunhofer, Germany)

Mohamad Bdiwi (Fraunhofer Institute for Machine Tools and Forming Technology IWU, Germany)

Steffen Ihlenfeldt (Fraunhofer Institute for Machine Tools and Forming Technology, Germany & Technische Universität Dresden, Chair of Machine Tools Development and Adaptive Controls, Germany)

9:00

Exploring the Real-Time Capability of Electrical Impedance Tomography for Hand Sign Recognition in Robotic Hand Control

Bilel Ghouli (Chemnitz University of Technology Germany & National School of Electronics and Telecommunications of Sfax, Tunisia)

Bilel Atitallah (Chemnitz University of Technology & National Engineering School of Sfax, Germany)

Rim Barioul (Chemnitz University of Technology, Germany)

Salwa Sahnoun (Laboratory of Technologies for smart Systems, Tunisia)

Ahmed Fakhfakh (LT2S, Tunisia); Olfa Kanoun (Chemnitz University of Technology, Germany)

9:15

Ultra-Fast Edge Computing Approach for Hand Gesture Classification Based on EIT Measurements

Mahdi Mnif (Chemnitz University of Technology, Germany & National School of Electronics and Telecommunications of Sfax, Tunisia)

Salwa Sahnoun (Laboratory of Technologies for smart Systems, Tunisia)

Marouene Kaaniche (National Institute of Applied Sciences and Technology, Tunisia)

Bilel Atitallah (Chemnitz University of Technology & National Engineering School of Sfax, Germany)

Ahmed Fakhfakh (LT2S, Tunisia); Olfa Kanoun (Chemnitz University of Technology, Germany)

9:30

Using Unsupervised Learning to Explore Robot-Pedestrian Interactions in Urban Environments

Sebastian Zug, Georg Jäger, Norman Seyffer, Martin Plank and Gero Licht (Technische Universität Bergakademie Freiberg, Germany)

Felix Wilhelm Siebert (Danmarks Tekniske Universitet, Denmark)

9:45 – 10:15

Coffee Break and Demo Session

10:15 – 11:10

Keynote: Robotics Meets AI & 5G — The Future is Now Bruno Siciliano, University of Naples Federico II, Italy
Session Chair: Wail Gueaieb

11:10 – 11:40

Coffee Break and Demo Session

11:40 - 12:40

Workshop 2: Potential of Multi-Modal Sensing in Smart Wearables

Olfa Kanoun

Session Chair: Mohammed Abouheaf

12:40 – 13:45

Lunch Break

13:45 – 14:45

Intelligent Robotic Systems II

Session Chair: Olfa Kaonoun

13:45

A Model-Free Leader-Follower Approach with Multi-Level Reference Command Generators

Mohammad Abouheaf (Bowling Green State University, USA)

Wail Gueaieb (University of Ottawa, Canada)

Mohammad Mayyas (Professor of Robotics, USA)

Muteb Aljasem (Bowling Green State University, USA)

14:00

A No-Code Approach for Intuitive Robot Programming for Agile Welding Application

Jayanto Halim (Fraunhofer IWU, Germany)

Mohamad Bdiwi (Fraunhofer Institute for Machine Tools and Forming Technology IWU, Germany)

Steffen Ihlenfeldt (Fraunhofer Institute for Machine Tools and Forming Technology, Germany & Technische Universität Dresden, Chair of Machine Tools Development and Adaptive Controls, Germany)

14:15

A Model-Free Solution for Stackelberg Games Using Reinforcement Learning and Projection Approaches

Mohammad Abouheaf (Bowling Green State University, USA)

Wail Gueaieb (University of Ottawa, Canada)

Md Suruz Miah (Bradley University, USA)

Esam Abdelhameed (Egypt & Aswan University, Egypt)

14:30

Robust robotic search and rescue in harsh environments: An example and open challenges

Selim Solmaz and Pamela Innerwinkler (Virtual Vehicle Research GmbH, Austria); Michał Wójcik (Virtual Vehicle Research GmbH, Austria & Technical University of Denmark, Denmark)

Kailin Tong (Virtual Vehicle Research GmbH, Austria)

Elena Politi (Harokopio University, Greece)

George Dimitrakopoulos (Harokopion University of Athens, Greece)

Patrick Purucker (University of Applied Sciences Amberg-Weiden, Germany)

Alfred Höß (OTH Amberg-Weiden, Germany)

Reiner John (AVL List GmbH, Austria)

14:55 – 15:00

Closing Remarks

Wail Gueaieb,

Olfa Kanoun

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