

TUTORIAL #1: NOVEL WEARABLES FOR MONITORING OF HEALTH-RELATED BEHAVIOURS

Presenter: Prof. Edward Sazonov - The University of Alabama (USA)

Date: April 7, 2026, 9:00 - 12:00



IEEE
Medical
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Applications

Montevideo, Uruguay
April 7-10, 2026



Abstract: This tutorial focuses on novel wearable technologies for the objective monitoring of health-related behaviors, including diet, physical activity, sedentary behavior, tobacco use, vaping, and screen exposure. The wearable systems presented include the Automatic Ingestion Monitor (AIM-2) for monitoring diet, nutrition, and ingestive behavior; the Screen Time Tracker (STT) for quantifying screen exposure in children aged 2–5 years; SmartStep, an insole-based sensor for monitoring physical activity and gait, and its successor, Smart LaceLock; the Personal Automatic Cigarette Tracker (PACT) for monitoring combustible cigarette consumption; and the Flexible Robust Instrumentation of Electronic Nicotine Delivery Systems (FRIENDS) for monitoring vaping behavior.

The tutorial will address sensor design considerations, embedded processing, data acquisition, and power management, as well as signal processing and ML/AI pipelines for behavior recognition and event detection. Lessons learned from real-world deployments will be discussed, with demonstrations of selected sensor systems.

Instructor biography: Edward Sazonov (IEEE M'02, SM'11) received the Diploma of Systems Engineer from Khabarovsk State University of Technology, Russia, in 1993 and the Ph.D. degree in Computer Engineering from West Virginia University in 2002. He is currently a James R. Cudworth Endowed Professor in the Department of Electrical and Computer Engineering at The University of Alabama and heads the Computer Laboratory of Ambient and Wearable Systems (CLAWS).

His research spans wearable devices, sensor-based behavioral informatics, and biomedical signal processing and pattern recognition. His research has been supported by the National Institutes of Health, National Science Foundation, and other federal and state agencies, industry, and foundations, and has received multiple awards, including best paper awards and the University of Alabama President's Research Award. He has published over 100 journal papers and 150 conference papers/abstracts and holds seven issued patents.

Dr. Sazonov served as a Fulbright Distinguished Chair at the University of Newcastle, Australia, in 2020. He currently serves as Associate Editor for IEEE Journal of Biomedical Health Informatics and IEEE Sensors, and as Chief Section Editor (Wearable Electronics) for Frontiers in Electronics.

TUTORIAL #2: CAN SIGN LANGUAGE BE MEASURED? TECHNOLOGIES AND AI METHODS FOR QUANTITATIVE ANALYSIS AND RECOGNITION

Presenter: Dr. Juri Taborri - University of Tuscia (Italy)

Date: April 7, 2026, 9:00 - 12:00



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Abstract: This tutorial addresses the fundamental question of whether sign language can be quantitatively measured and analyzed using modern sensing technologies and AI techniques. The tutorial provides an overview of state-of-the-art hardware solutions for sign language data acquisition, including wearable sensors, vision-based systems, depth cameras, and inertial measurement units, with a focus on their metrological characteristics and limitations. From a methodological perspective, the tutorial reviews algorithmic approaches for sign language analysis, covering feature extraction, signal preprocessing, classification, and machine learning pipelines commonly adopted in AI-based recognition systems. Particular attention is devoted to the role of data quality, repeatability, and uncertainty, highlighting how metrological aspects directly influence the performance and reliability of AI models.

A hands-on session is included, where participants will work with pre-acquired datasets to explore supervised classification techniques using MATLAB's Classification Learner toolbox. Through practical examples focused on the recognition of sign language alphabet letters, participants will gain insight into model training, validation, performance evaluation, and the critical impact of dataset quality before AI training.

Instructor biography: Juri Taborri is a tenure-track Researcher at the University of Tuscia (Italy). His research interests focus on measurement methodologies, sensor-based systems, signal processing, and AI applied to experimental biomechanics and human movement analysis in clinics and sports. He has authored numerous peer-reviewed publications and regularly contributes to interdisciplinary research bridging engineering, accessibility, and social impact.

He serves as the University of Tuscia's delegate for equal opportunities and international relations and is engaged in national and European initiatives on inclusive education, including the Erasmus+ ISENSE project. He is also co-founder of Tech4All and CEO of HuMoving, two startups developing digital solutions for inclusive education and human movement digitalization.

TUTORIAL #3: E-HEALTH AND ARTIFICIAL INTELLIGENCE

Presenter: Prof. Eros Pasero – Politecnico of Turin (Italy)

Date: April 8, 2026, 15:30 – 18:30



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Abstract: Medicine today has the availability of advanced technologies and new devices for diagnosis. Telemedicine gives a new scenario that allows remote diagnosis, control and treatment of patients at home without physical contact with the doctor.

Today the elderly are more than the young but the funds for the health system are decreasing. The medicine paradigm must be rethought. E-Health can be the solution to support for the delocalization of some medical services, The ability to combine the power of AI algorithms and data from different sensors and databases can greatly increase the reliability of the final choice of the right therapy. This is the new Medicine 4.0. The digitalization of the processes and the improvement of technology allow interfacing the human body with computers and Artificial Intelligence allows you to work with a large amount of data (big data) and identify unknown correlations between the parameters to allow a new diagnosis. Several new perspectives will be discussed in this presentation. We will investigate both new technologies showing wearable devices that can be used both to monitor patients at home (this topic was very important with the Covid 19) and Artificial Intelligence applied to medical image processing to perform remote diagnoses (once again used to distinguish pneumonia from lung problems due to Covid 19).

Instructor biography: Eros G. Pasero is Professor of Electronics at the Politecnico of Turin since 1991. He was also Visiting Professor at ICSI, UC Berkeley, CA in 1991, Professor of digital electronics and electronic systems at Tongji University, Shanghai, China in 2011, 2015 and 2017, and Professor of digital electronics and electronic systems at TTPU (Turin Tashkent Politechnic University), Tashkent, Uzbekistan since 2012 to 2014 where he was also vice rector in the first period of 2014.

Prof. Pasero was President of SIREN, the Italian Society for Neural Networks; he was v. General Chairman of IJCNN2000 in Como, General Chairman of SIRWEC2006 in Turin, general Chairman of WIRN2015, WIRN2016 and WIRN2017, WIRN 2018 and WIRN 2019 in Vietri. He holds 6 international patents and is author of more than 100 international publications.

Together his group he was awarded with the 1982 CILEA-Sperry award for complex application systems and local distributed architecture”, with the ASSIPE Design-In-Award in 2003 and 2004, with premio “Innova S@alute2017” at the “forum dell’innovazione per la salute” on September 2017.

TUTORIAL #4: BIOMECHANICAL ANALYSIS IN NEUROMUSCULAR RESEARCH USING IMUS

Presenter: Dr. Eduardo Palermo – Sapienza University of Rome (Italy)

Date: April 9, 2026, 15:30 – 18:30



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Abstract: Human motion analysis plays a fundamental role in biomechanics and neuroscience, constituting an invaluable tool in both clinical and research settings. Inertial Measurement Units (IMUs) are wearable sensors for conducting human motion capture in any environment, drastically widening the effectiveness of the biomechanical analysis. The opportunity of using this technological solution in daily life can have an enormous impact on many aspects of neuromuscular diseases, from the early diagnosis to the evaluation of intervention outcome, up to the monitoring of rehabilitation treatments. However, the use of these sensors requires basic knowledge on multi-body dynamics, human biomechanical models, and sensor-to-segment calibration.

In the first part of this tutorial, an in-depth analysis of the altered kinematic patterns of some neuro-muscular pathologies is presented. An experimental-based computational model of the motor control function of the brain is explained. Finally, some real examples of kinematic analysis conducted on pathological populations, such as Parkinson's, Multiple Sclerosis, Cerebral Palsy, or Stroke, are presented.

In the second part, attendees will be guided through the creation of a biomechanical model in MATLAB, fed with anonymized IMU data of patients with neuromuscular disease, up to the extraction of the kinematic quantities of interest for the analysis of intervention outcome.

Instructor biography: Eduardo Palermo (Member, IEEE) received the Ph.D. degree in industrial and management engineering from Sapienza University of Rome, in 2014. He is currently an Associate Professor of Mechanical and Thermal Measurements and Biomechanics, with the Department of Mechanical and Aerospace Engineering, Sapienza University of Rome. His main research interests include the design, implementation, validation of innovative technologies in experimental biomechanics, wearable robotics, inertial sensors, machine learning algorithms, mechatronics, human-computer interactions, and bio-signal processing. The studies he conducted included in-vivo experiments in cooperation with clinical research partners.