



Special Session Proposal

Title: Neural Positioning with Radio and Inertial Sensors under Real-World Impairments

Description of the proposed special session:

Machine learning and deep learning are increasingly shaping next-generation positioning systems by enabling robust, data-driven estimation directly from complex sensor measurements, i.e., *neural positioning*. This special session focuses on neural positioning methods based on radio signals, including both pure learning-based approaches and hybrid approaches that combine classical estimation and filtering methods with AI. A particular emphasis is placed on systems that fuse radio measurements with inertial sensing, especially IMU-supported localization, tracking, and navigation. Relevant sensing modalities include Wi-Fi, BLE, UWB, RFID, radar, and cellular/5G/6G signals, as well as RSSI-, CSI-, CIR-, ranging-, and fingerprint-based representations. The session welcomes contributions on learning-based and hybrid methods for positioning, tracking, and navigation in challenging real-world conditions, including non-line-of-sight propagation, multipath, interference, synchronization errors, calibration drift, device heterogeneity, environmental dynamics, and motion variability.

Topics of interest include robust radio-inertial fusion, uncertainty-aware neural positioning, adaptation to unseen environments and devices, hybrid model-based and learning-based estimation, and deployment-oriented evaluations. By bringing together researchers working on algorithms, fusion architectures, datasets, and real-world validation, this special session aims to provide a focused forum for reliable neural positioning with radio and inertial sensors in realistic operating conditions.

Novelty and motivation:

This special session addresses a timely and highly relevant topic for the IPIN community: neural positioning using radio and inertial sensors under realistic operating conditions. IPIN has a strong tradition in radio-based localization, inertial navigation, sensor fusion, and robust positioning in challenging environments. At the same time, recent progress in machine learning has created new opportunities to improve positioning performance, robustness, and adaptability beyond what purely model-based methods can achieve. The distinguishing feature of this session is its clear focus on neural and hybrid positioning methods for radio-based systems, with inertial sensing as a key complementary modality. We explicitly invite contributions covering both fully learning-based approaches and hybrid methods that integrate neural models with conventional techniques such as filtering, geometric estimation, probabilistic inference, or factor-graph optimization.

The session is particularly motivated by the practical challenges that continue to limit real-world deployment of positioning systems, including non-line-of-sight conditions, multipath, interference, sensor drift, synchronization issues, hardware diversity, changing environments, and varying user motion. We therefore seek contributions that do not only improve accuracy in ideal conditions, but also advance robustness, reliability, and transferability across devices, users, and environments. Compared with broader AI-for-localization sessions, this special session is deliberately narrower and more distinctive: it centers on radio-based neural positioning, its fusion with IMU and related inertial sensing, and the role of hybrid AI-classical methods in achieving deployable positioning performance under real-world impairments.

Scope of the session:

In this Special Session, we invite authors to submit papers related (but not limited) to:

- Neural positioning and tracking based on radio signals such as Wi-Fi, BLE, UWB, RFID, radar, and cellular/5G/6G
- Learning-based ranging, fingerprinting, CSI/CIR processing, and radio representation learning for localization
- Radio-inertial fusion with IMUs for localization, navigation, and trajectory estimation

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2026!**





- Hybrid methods combining machine learning/deep learning with conventional approaches such as Kalman filters, particle filters, smoothing, or factor-graph optimization
- Robust positioning under non-line-of-sight propagation, multipath, interference, synchronization errors, and calibration drift
- Domain adaptation, transfer learning, self-supervised learning, and generalization to unseen environments, devices, and users
- Uncertainty-aware neural positioning, reliability estimation, and trustworthy localization
- Real-world datasets, benchmarks, deployment studies, and experimental validation in realistic environments

Keywords:

- Neural Positioning
- Radio-Based Localization
- Radio-Inertial Fusion
- Sensor Fusion
- Machine Learning and Deep Learning
- Wi-Fi / BLE / UWB / 5G / 6G Positioning
- Fingerprinting and Ranging
- Hybrid AI-Model-Based Localization
- Uncertainty-Aware Positioning
- Domain Adaptation and Transfer Learning
- Applications: Indoor, outdoor, and hybrid localization, digital twin, navigation, tracking, PDR, parameter estimation, SLAM, signal processing, anomaly detection/mitigation, and filtering techniques.

Session Chairs:

- Felix Ott (Fraunhofer IIS, felix.ott@iis.fraunhofer.de)
- Tobias Feigl (Fraunhofer IIS & Friedrich-Alexander University Erlangen-Nürnberg, tobias.feigl@fau.de)

Biography of the Organizers:

Felix Ott is a postdoctoral researcher at the Fraunhofer Institute for Integrated Circuits IIS, where he also manages the Signals Intelligence (SIGINT) program. His research focuses on representation learning, domain adaptation, and few-shot learning for GNSS-based interference monitoring, including interference signal classification, characterization, direction finding, source localization, and mitigation. He received his Ph.D. from Ludwig Maximilian University of Munich in 2023, where he conducted research in the Probabilistic Machine Learning and Deep Learning group. He joined the Self-Learning Systems group within the Machine Intelligence department at Fraunhofer IIS in 2019.

Tobias Feigl is Chief Scientist at the Fraunhofer Institute for Integrated Circuits IIS and Lecturer at the Department of Computer Science at Friedrich-Alexander University (FAU) Erlangen-Nürnberg, Germany. His research focuses on (radio and inertial) signal processing, artificial intelligence, and information fusion. He teaches courses on artificial intelligence and supervises related academic theses at FAU. He received his Ph.D. in Computer Science from FAU in 2021. He joined Fraunhofer IIS in 2009.

