



Special Session

Machine Learning for Localization and Navigation

Description of the proposed special session:

This special session aims to explore cutting-edge applications of machine learning (ML) and deep learning (DL) techniques in indoor localization and navigation, addressing unique challenges and opportunities in this domain. We invite research contributions that leverage novel data-driven methodologies for localization, navigation, and tracking using various sensors and hybrid systems, as well as studies integrating ML/DL with traditional tracking filters. Additionally, we welcome research focusing on the AI processing pipeline, including adapting pretrained ML models to new environments, movement patterns, and sensor systems.

Novelty and motivation:

The integration of ML/DL into indoor localization systems represents a significant advancement, addressing longstanding challenges such as non-line-of-sight (NLOS) issues, device heterogeneity, and environmental variability. This topic is of high relevance to the IPIN community as it leverages the latest AI innovations to enhance localization accuracy and reliability in complex indoor environments. The proposed special session is crucial in highlighting AI-assisted approaches and practical solutions that push the boundaries of current indoor positioning technologies, fostering new research directions and applications that are pivotal for both academic and industrial advancements.

This special session distinguishes itself from regular sessions by focusing exclusively on the innovative applications of AI in indoor localization, targeting specific challenges and opportunities within this niche. Unlike broader sessions, it emphasizes novel data-driven methodologies, hybrid systems that integrate ML/DL with conventional tracking filters, and the adaptation of pretrained models to diverse and dynamic indoor environments. This focused approach promotes deeper discussions and attracts specialized contributions, providing the IPIN community with cutting-edge insights and fostering collaboration among experts in these advanced fields.

Scope of the session:

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

- Advanced ML/DL techniques for indoor positioning: Fingerprinting, self-supervised learning, state-space models, large language models.
- Sensor integration and fusion: RF, IMUs, cameras, and hybrid systems combining ML/DL with conventional tracking filters such as Kalman Filters (KF).
- Identification and mitigation of Non-Line-of-Sight (NLOS) issues: Out-of-distribution detection, Time of Arrival (TOA) / Angle of Arrival (AOA) channel parameter estimation.
- Addressing device heterogeneity and environmental variations: Discrepancies across different devices and environments, adaptation of pretrained models to new devices and varying indoor settings.
- Accounting for diverse movement types: Movement patterns, velocities, and dynamic localization scenarios.
- Adaptation of pretrained models: Transfer learning approaches for improving localization performance across different scenarios and unexplored conditions.

Keywords:

- Machine Learning Paradigms: Supervised, semi-supervised, unsupervised, self-supervised, and reinforcement learning.
- Techniques: From SVM and K-NN to CNN, RNN, SSM, Attention, Transformer, and GPT.
- Sensor Modalities: UWB, 5G, GNSS, Wi-Fi, BLE, Light, LIDAR, Sonic, IMU, Barometer, etc.
- Applications: Indoor and outdoor localization, navigation, tracking, pedestrian dead reckoning (PDR), parameter estimation, SLAM, signal processing, anomaly detection/mitigation, and filtering techniques.

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YOU AT IPIN 2025!**





Session Chairs (Technical Program Committee):

- Tobias Feigl (Fraunhofer IIS; tobias.feigl@iis.fraunhofer.de)
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Invited Reviewers:

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