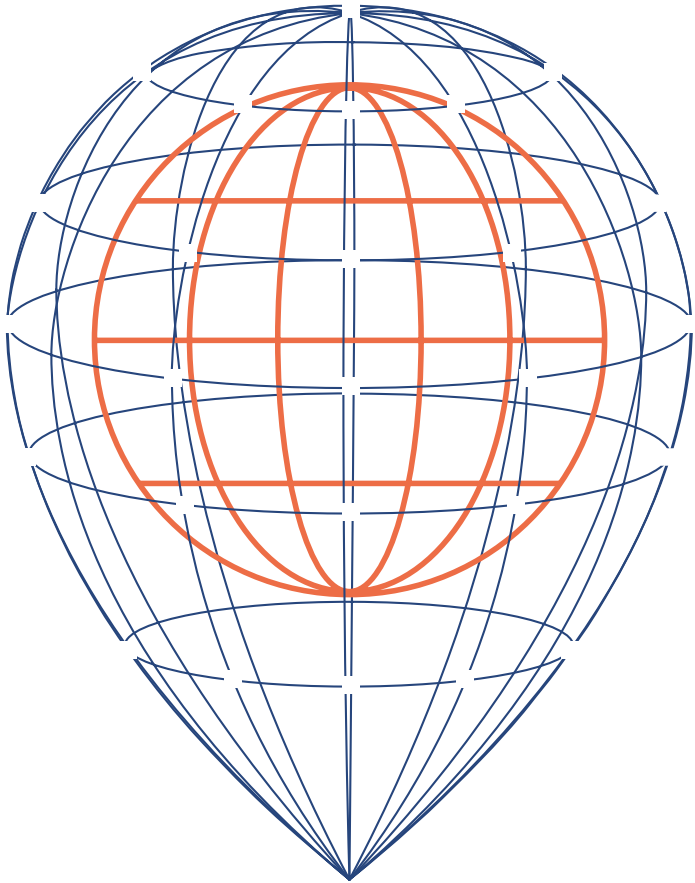


IHK



IPIN 2024

The Fourteenth International Conference on
Indoor Positioning and Indoor Navigation

Welcome to IPIN 2024

We are delighted to welcome you to Hong Kong for the fourteenth edition of the International Conference on Indoor Positioning and Indoor Navigation (IPIN). This event stands as the foremost global event centered around indoor localization technical discussion and competition. It has evolved into a worldwide platform where researchers, students, and businesses from various countries and regions come together to exchange ideas and foster collaboration. IPIN 2024 is organized by the Department of Aeronautical and Aviation Engineering, The Hong Kong Polytechnic University (<https://www.polyu.edu.hk/aae/>) and takes place at the InterContinental Grand Stanford Hong Kong, 70 Mody Road, East Tsim Sha Tsui, Kowloon, Hong Kong (<https://www.hongkong.intercontinental.com/>).

Hong Kong, often referred to as the "Pearl of the Orient," is a vibrant and dynamic metropolis located on the southern coast of China. As a Special Administrative Region, harmoniously blends Eastern traditions and Western modernity. It's globally recognized for its captivating skyline, serving as a financial and business magnet for professionals worldwide. Hong Kong's thriving tech scene is fueled by government support and innovation hubs, attracting startups and tech companies. Beyond its economic prominence, the city offers diverse experiences – from traditional markets and street food to cultural heritage sites. Nature lovers can escape to green hills, beaches, and Victoria Peak for breathtaking views, all easily accessible via efficient transportation. In essence, Hong Kong is a city of contrasts, where tradition meets modernity, and where East meets West, making it an extraordinary destination for travelers seeking a multifaceted experience.

 14 OCT - 17 OCT 2024

 **InterContinental Grand Stanford HK**
70 Mody Road, East Tsim Sha Tsui, Kowloon, hongkong

ORGANIZED BY

the Department of Aeronautical and Aviation Engineering, PolyU



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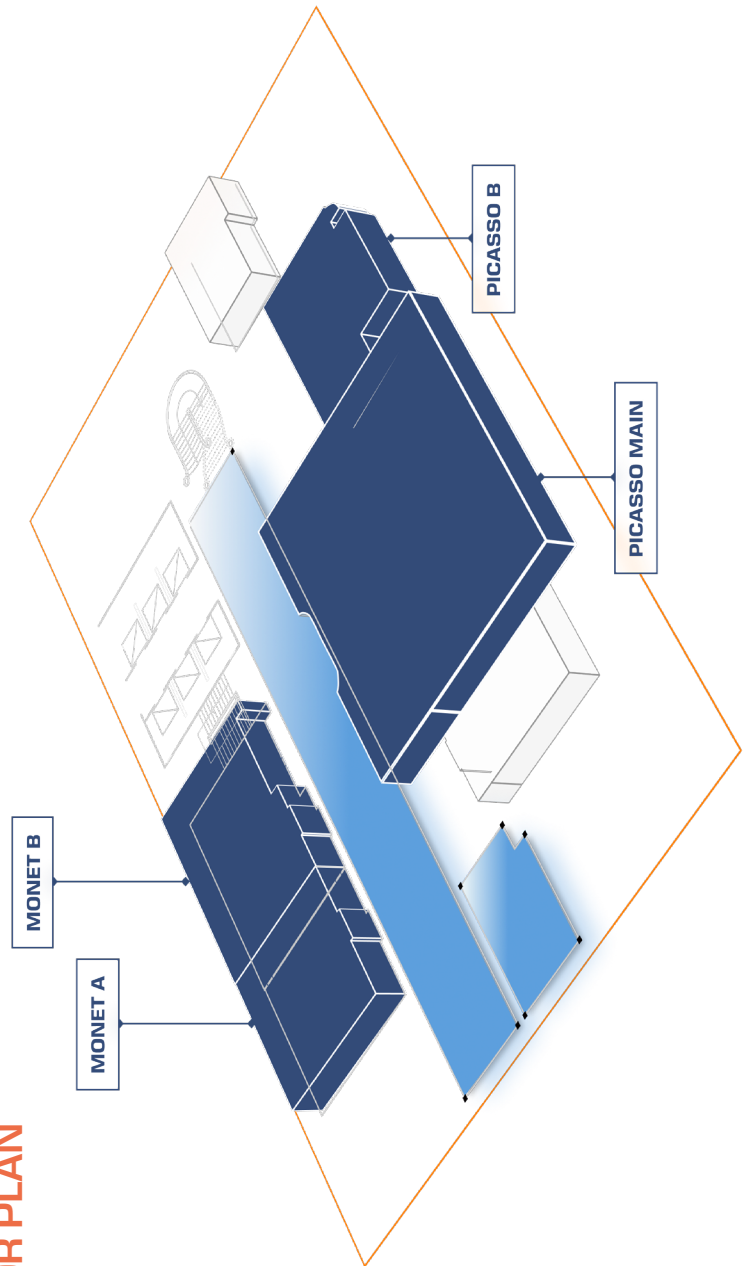
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FLOOR PLAN



🕒 Monday,14 OCT.

7:30a.m.-9:00a.m.

Registration Starts
Picasso Main

9:00a.m.-12:00p.m.

P8-9 ⌕ **Tutorial on Quantum Computing for Indoor Positioning and Navigation**
Picasso Main

P10-13 ⌕ **Tutorial on Autonomous Pedestrian Indoor Positioning: From Theoretical Exploration to Application**
Monet A & Monet B

12:00p.m.-2:00p.m.

Lunch

1:30p.m.-2:00p.m.

Opening Session
Picasso Main

2:00p.m.-3:00p.m.

P14 ⌕ **Keynote I: Navigating the Data Frontier: Scaling Indoor Positioning Solutions from Research to Big Data**
Picasso Main

3:00p.m.-3:30p.m.

Coffee Break

3:30 p.m.-5:00 p.m.

P20 ⌕ **PM 1: Machine Learning Aided Radiolocation**
Picasso Main

P21 ⌕ **MA 1: Acoustic and Ultrasound systems**
Monet A

P22 ⌕ **MB 1: The Open Research Data Way: Replication Studies, Efficient Data Reuse and Metaresearch**
Monet B

P23 ⌕ **PB 1: Advanced and Future Applications**
Picasso B

Evening Event

Ice Breaker Event

🕒 Tuesday,15 OCT.

9:00a.m.-10:00a.m.

P15 ⌕ **Keynote II: Indoor Positioning Systems in Hospitals and in Emergency Scenarios**
Picasso Main

10:00a.m.-10:30a.m.

Coffee Break

10:30a.m.-12:00p.m.

Poster Session
Monet A and Monet B

12:00p.m.-2:00p.m.

Lunch

1:00p.m.-2:30p.m.

P18 ⌕ **HUAWEI Project and Challenge Presentation Session**
Picasso Main

2:30 p.m.-5:00 p.m.

P24 ⌕ **PM 2: Machine Learning for Localization and Navigation**
Picasso Main

P25 ⌕ **MA 2: Visual and Optical System**
Monet A

P26 ⌕ **MB 2: Mapping, Simultaneous Localization and Mapping (SLAM)**
Monet B

P27 ⌕ **PB 2: Inertial Measurement Units**
Picasso B

Evening Event

Social Event

🕒 Wednesday, 16 OCT.

9:00a.m.-10:00a.m.

P16 📍 **Keynote III: Positioning Indoors Using Acoustic Signals**
Picasso Main

10:00a.m.-10:30a.m.

Coffee Break

10:30a.m.-12:00p.m.

P28 📍 **PM 3: Advanced Fusion Technologies Based On Heterogeneous Data For Indoor Positioning**
Picasso Main

P29 📍 **MA 3: Non-linear and non-Gaussian Sensor Fusion**
Monet A

P30 📍 **MB 3: Multi-sensor Integration**
Monet B

P31 📍 **PB 3: Radio Signal Processing**
Picasso B

12:00p.m.-2:00p.m.

Lunch

1:00p.m.-3:00p.m.

📍 **TPC Meeting**
Picasso Main

1:00p.m.-2:30p.m.

P18 📍 **HUAWEI Interactive Tutorial Session**
Monet A and Monet B

2:30 p.m.-5:00 p.m.

P32 📍 **PM 4: Smartphone and Wearable Devices**
Picasso Main

P33 📍 **MA 4: UWB and Wi-Fi**
Monet A

P34 📍 **MB 4: Fingerprinting**
Monet B

P35 📍 **PB 4: Indoor/Outdoor Seamless PNT with GNSS and Multi-Source Sensors**
Picasso B

Evening Event

Gala Dinner

🕒 Thursday, 17 OCT.

9:00a.m.-10:00a.m.

P17 📍 **Keynote IV: The Golden Age of Indoor Positioning**
Picasso Main

10:00a.m.-10:30a.m.

Sponsor Speech
Picasso Main

10:30a.m.-11:00a.m.

Coffee Break

11:00a.m.-12:30p.m.

IPIN Competition
Picasso Main

12:30p.m.-1:00p.m.

IPIN Awards
Picasso Main

1:00p.m.-1:30p.m.

Closing Session
Picasso Main

✦ Tutorial on Quantum Computing for Indoor Positioning and Navigation

🕒 9:00 a.m. - 12:00 p.m. 14 OCT

📍 Picasso Main



Prof. Moustafa Youssef
American University in Cairo

Moustafa Youssef is a professor at the American University in Cairo. His research interests include mobile wireless networks, mobile and pervasive computing, location determination technologies, and quantum computing. He is an Associate Editor for ACM TSAS and the IEEE TMC, served as the Lead Guest Editor of the IEEE Computer Special Issue on Transformative Technologies and an Area Editor of ACM MC2R as well as on the organizing and technical committees of numerous prestigious conferences. He is the recipient of the 2003 University of Maryland Invention of the Year award, the 2010 TWAS-AAS-Microsoft Award for Young Scientists, the 2013 and 2015 COMESA Innovation Award, the 2013 ACM SIGSpatial GIS Conference Best Paper Award, the 2017 Egyptian State Award, multiple Google Research Awards, among many others. He is also an AAS, IEEE, and ACM Fellow.

Quantum computing is an emerging field at the intersection of computer science, quantum mechanics, and mathematics. It offers a novel approach to problem-solving, enabling efficient solutions for problems that are intractable on classical computers. With researchers globally demonstrating quantum supremacy and the increasing availability of cloud-based quantum computers, quantum computing is transitioning from theory to practical reality.

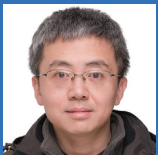
This tutorial aims to delve into the applications of quantum computing for indoor positioning and navigation problems. The tutorial is structured into three parts. Part 1 will provide an essential background on quantum computing concepts and algorithms, laying the foundational knowledge required for understanding the following parts. Part 2 will present specific examples of how quantum computing can be utilized to solve location tracking problems, highlighting algorithms for both general-purpose quantum processors and quantum annealing machines. Part 3 will discuss the various software and hardware research challenges and opportunities, offering insights into the potential for further exploration and development in this exciting new domain.

Participants will gain a thorough understanding of the principles of quantum computing and its practical applications in indoor positioning and navigation. They will also be introduced to the current state of research, tools, and platforms available for developing quantum computing solutions. This tutorial is designed for researchers, practitioners, and enthusiasts who are interested in exploring the cutting-edge advancements and future prospects of quantum computing in solving complex real-world problems

✦ Tutorial on Autonomous Pedestrian Indoor Positioning: From Theoretical Exploration to Application

🕒 9:00 a.m. - 12:00 p.m. 14 OCT

📍 Monet A & Monet B



Xiaoji Niu
Wuhan University

Dr. Xiaoji Niu is a Professor at GNSS Research Center in Wuhan University, China. He got his Ph.D. and bachelor degrees (with honors) by the Department of Precision Instruments at Tsinghua University in 2002 and 1997, respectively. He performed post-doctoral research at the University of Calgary, Canada, and worked as a senior scientist at SIRF Technology Inc. His research interests focus on GNSS/INS integration, low-cost navigation sensor fusion, and relevant new applications. Dr. Niu has published 200+ academic papers and owns 50+ patents.

Lecture 1:

Towards Accurate and Reliable Indoor Pedestrian Positioning Using Foot-mounted Inertial Navigation System: From Fundamental to Application

Speaker: Dr. Tao Liu, Wuhan University

Lecture 2:

Principle and Trend of Indoor Magnetic Field Matching Positioning

Speaker: Dr. Jian Kuang, Wuhan University

GNSS is the dominant solution for outdoor navigation. People have looked for “indoor GNSS” technique for decades. But any indoor positioning based on base-station/node/tag deployments won't be scalable for indoor environment. The self-contained dead-reckoning based on inertial sensors and database-matching positioning based on indoor Signal of Opportunity (SoP) have to be applied, so as to form an autonomous solution.

This tutorial will introduce such an autonomous pedestrian indoor positioning solution composed of pedestrian dead-reckoning (PDR) and ambient magnetic feature matching (as an example of indoor SoP). The importance and role of the PDR will be analyzed; and the unique advantages and challenges of indoor magnetic feature matching will be discussed.

Typical PDR algorithms, esp. foot-mounted PDR as example, will be presented in details. And a complete solution of indoor magnetic feature matching positioning will be described. To make the solution scalable, the indoor magnetic field mapping has to be feasible and better to be self-maintained. Therefore the magnetic field mapping based on crowd-sourcing data from smart phone users will be explored.

The proposed autonomous pedestrian indoor positioning has potential to reach general indoor positioning, with possibility of extending to outdoor and vehicles.

Some champion solutions of previous IPIN competitions will be briefly described in the tutorial too.



Dr. Tao Liu
Wuhan University

Dr. Tao Liu received the B.S. degree in Geographic Information System and the M.S. degree in Surveying and Mapping from Liaoning Technical University, Fuxin, China, in 2015 and 2018, respectively, and the Ph.D. degree in Geodesy and Surveying Engineering from Wuhan University, Wuhan, China, in 2022. From 2023 to 2024, he was a research assistant at the Integrated and Intelligent Navigation (i2Nav) Laboratory of the GNSS Research Center, Wuhan University. He is currently a lecturer at the School of Software, Jiangxi Normal University, Nanchang, China. He is also a member of Jiangxi Distributed Computing Engineering and Technology Research Center, Nanchang, China. His research interests focus on inertial navigation, multi-sensor fusion, IMU-based body sensor network, pedestrian navigation, and indoor positioning.



Dr. Jian Kuang
Wuhan University

Dr. Jian Kuang received the B.Eng. degree and Ph.D. degree in Geodesy and Survey Engineering from Wuhan University, Wuhan, China, in 2013 and 2019, respectively. He is currently an Associate Research Fellow with the GNSS Research Center in Wuhan University. His research interests focus on magnetic field positioning, wearable pedestrian positioning and smartphone-based pedestrian & vehicle positioning. Dr. Kuang has published more than 20 SCI academic papers and owns more than 10 patents.

Lecture 1

Towards Accurate and Reliable Indoor Pedestrian Positioning Using Foot-mounted Inertial Navigation System: From Fundamental to Application

This tutorial introduces the fundamentals and applications of indoor pedestrian positioning technology using the foot-mounted inertial navigation system (Foot-INS). First, this tutorial introduces the fundamental theories of Foot-INS, including sensor calibration, inertial navigation algorithm, zero-velocity update algorithm (ZUPT), and Kalman filter-based state estimation. Then, we will introduce several constraint methods to improve the performance of Foot-INS in typical indoor scenarios (e.g., indoor office buildings and multistory shopping malls), including zero angular rate update (ZARU), straight-line walking constraint algorithm, up and down stairs constraint algorithm, and constraint methods for elevator and escalator scenarios. In addition, this tutorial will present the potential of Foot-INS for practical applications in several indoor scenarios. Finally, this tutorial will summarize and look forward to the development trend of Foot-INS-based pedestrian positioning technology

Lecture 2

Principle and Trend of Indoor Magnetic Field Matching Positioning

This tutorial introduces the challenges, technologies, and opportunities of indoor pedestrian magnetic field matching (MFM) positioning methods. The challenges of MFM to achieve accurate positioning are discussed from the perspective of observing magnetic field signal characteristics in different dimensions. A rapidly deployable indoor pedestrian MFM positioning solution is presented to tackle the inefficiencies in constructing magnetic fingerprint databases and the instability in matching-based positioning. Additionally, as a forward-looking perspective on MFM positioning, state-of-the-art crowdsourcing-based fingerprint construction technologies are introduced, addressing how to overcome the high-cost barriers of traditional methods to enable large-scale indoor pedestrian positioning.

Keynote Day 1

🕒 2:00 - 3:00 p.m. 14 OCT

📍 Picasso Main

⊕ Navigating the Data Frontier: Scaling Indoor Positioning Solutions from Research to Big Data

Ensuring ubiquitous availability of location-based services (LBS) across consumer devices, including wearables and smartphones, is of paramount importance. However, achieving high availability and seamless positioning—both indoors and outdoors—poses significant challenges due to scale, complexities, and reliance on infrastructure. Join us as we explore the intersection of data-driven approaches and resilient LBS solutions, opening up new possibilities for location-aware applications.

Would recent data modelling techniques, help us to achieve robust and seamless positioning? Let us delve into recent advancements that leverage multi-modality and graph representation to enhance LBS availability.



Dr. Firas Alsehly
*Positioning & Navigation Lab |
Huawei Edinburgh Research Centre*

Firas is a Huawei scientist and the Chief Architect for Indoor Positioning data-driven location-based services (LBS) for smartphones and wearables. He is the leader of Positioning and Navigation Lab at Huawei's Edinburgh Research Center in the United Kingdom. Before joining Huawei, Firas held leadership positions in startups and small enterprises, guiding the transition from academic research to industry R&D projects. Additionally, he served as a technologist in the Fin-Tech sector until 2020, overseeing data automation for high availability and seamless operations. He sums 15 years of experience in the field of geospatial data, with numerous patents and research papers to his name.

Keynote Day 2

🕒 9:00 - 10:00 a.m. 15 OCT

📍 Picasso Main

⊕ Indoor Positioning Systems in Hospitals and in Emergency Scenarios

In this talk I will share experiences and lessons learnt from developing indoor positioning systems in two very different settings. I will start with the challenges of deploying infrastructure-free indoor location systems in hospital environments, as well as the benefits of using them for workflow optimisation and improved cross-team coordination. Moving from benign to emergency response settings, I will present new and unique challenges faced, including lack of signal maps and in certain cases physical maps, lack of representative training data, sensor failure, and limited visibility and connectivity. I will then present recent research directions that we have pursued in the area of robust multi-modal sensing to address the challenging problems of localization, mapping and semantic scene understanding.



Prof. Niki Trigoni
*Department of Computer Science,
University of Oxford*

Niki Trigoni is Professor at the Oxford Department of Computer Science, heading the Systems theme. She is also the Fellow of the Royal Academy of Engineering, United Kingdom. Her interests lie in the tight integration of sensing and machine intelligence for context inference, control and human-machine interaction. She has applied her work to a number of application scenarios, including mobile autonomy, asset monitoring, and localisation systems for emergency situations, as well as workforce safety and efficiency. Trigoni has founded and served from 2014-2019 as Director of the Centre for Doctoral Training on Autonomous and Intelligent Machines and Systems. Driven by her passion for research translation, in 2015, she founded Navenio Ltd, a deep tech Oxford spinout on infrastructure free indoor positioning, and a 2020 KPMB Best British Tech Pioneer. In 2020, she won the CTO of the Year award at the UK's Women in IT Awards, demonstrating impact from translating positioning tech to improve efficiency in the healthcare sector.

Keynote Day 3

🕒 9:00 - 10:00 a.m. 16 OCT

📍 Picasso Main

⊕ Positioning Indoors Using Acoustic Signals

Indoor positioning is a core technology enabling artificial intelligence (AI) applications and playing a pivotal role in AI solutions. Currently, various indoor positioning technologies are appealing in the market, such as the Ultra-Wideband (UWB), WiFi Round-Trip-Time(RTT), Bluetooth Angle of Arrival (AoA), Bluetooth Channel Sounding (BTCS) and AR-based localization et.al. This presentation will introduce an indoor positioning technology based on acoustic signals. It utilizes the microphone built-in wearable devices and smartphones as receivers, and offers a ranging accuracy of 0.12 meters and a positioning accuracy of better than 0.5 meters for smartphones and wearable devices without changing their hardware. This precise ranging technology has also been implemented in a single chip to support positioning tag development. It has been commercially deployed in airports, railway stations, convention centres in China. Together with GNSS technology, it enables a seamless indoor/outdoor navigation service.



Prof. Ruizhi Chen
Wuhan University

Dr. Ruizhi Chen is a member of the Finnish Academy of Science and Letters. He is currently a Professor at the State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing (LIESMARS) at Wuhan University, China. He used to be the director of LIESMARS, an Endowed Chair Professor at Texas A&M University Corpus Christ, US, and the Head & Professor of the Department of Navigation and Positioning at the Finnish Geodetic Institute, Finland. He also worked in Nokia as an Engineering Manager during 1998-2001. Dr. Chen's research interests include indoor positioning and location-based services. He has published two books and 203 SCI papers. His research results were selected as cover stories two times in "GPS World".

Keynote Day 4

🕒 9:00 - 10:00 a.m. 17 OCT

📍 Picasso Main

⊕ The Golden Age of Indoor Positioning

We are living at a time when technology development to support indoor positioning, and proximity ranging, is reaching an inflection point for adoption. With multiple standards being developed for accurate ranging through WiFi (IEEE 802.11mc/az/bk), Bluetooth Channel Sounding (BTCS), and UWB (IEEE 802.15.4a/z/4ab) we are already seeing implementations that enable effective indoor positioning solutions with less than 1 meter of error. This is a breakthrough, enabling aisle-level navigation in retail stores and public venues using our smartphones. This talk will describe the various positioning technologies, and our experience with early implementations. It will provide a comparison of their wireless characteristics, and make predictions about future adoption.



Prof. Roy Want
Google Inc.

Dr. Roy Want received his doctorate from Cambridge University, England in 1988, and is currently a Senior Research Scientist at Google. Previous positions include Sr. Principal Engineer at Intel Corporation, and a Principal Scientist at Xerox PARC. He holds the grade of ACM and IEEE Fellow. His research interests include mobile and ubiquitous computing, context-aware applications, and electronic identification. He has more than 30 years' experience working in the field of mobile computing. He served as: Editor-in-chief for IEEE Pervasive Computing from 2006-2009, Chair of the ACM SIGMOBILE executive committee from 2009-12, and received the ACM SIGMOBILE Outstanding Contributions Award (OCA) in 2019. He has authored or co-authored more than 85 publications, with 100+ issued patents in this area. For more information about Dr. Want's academic and industrial achievements see: https://en.wikipedia.org/wiki/Roy_Want.

Session host: Dr Bertrand Perrat

HUAWEI Project And Challenge Presentation Session: From Research Lab to Product Deployment - Opportunities for Collaboration

🕒 1:00 - 2:20 p.m. 15 OCT

📍 Picasso Main

Take home

- Challenges for research community to address
- Potential projects for collaborations
- How to work with Huawei

Presentation topics:

📍 Innovative Applications of Huawei 3D Indoor Positioning
Mr. Howy Shu
Huawei Scientist

📍 **Top Challenges in Huawei Indoor Positioning Solution**
Dr. Guosheng Huang
Huawei LBS Chief Expert

📍 **Evolution of PDR Algorithm and
Prospect of Future Cooperation**
Dr. Mouyan Wu
Huawei LBS Algorithm Leader

Dr Francisco Zampella (Principal Research Engineer)

HUAWEI Interactive Tutorial Session (Micro Hackathon): Data-Driven Signal Processing for LBS

🕒 1:00 - 2:20 p.m. 16 OCT

📍 Picasso Main

Take home

- Feature engineering
- Automated Z estimation & data labelling
- Graphs data modelling
- Clustering and classification

📍 **Where is my phone?**

Data annotation for floor classification can be very tricky when the target is mass deployment. This session aims to demonstrate how we can start from zero annotation of smartphone data and build a data pipeline from scratch.

PM 1 Machine Learning Aided Radiolocation

Monday, 14 OCT

Picasso Main

- ✦ **Beyond Convolutions: Transformer Networks for Improved UWB CIR-based Fingerprinting**
3:30 p.m. Dieter Coppens, Adnan Shahid and Eli De Poorter
Ghent University - IMEC
- ✦ **CSI-fingerprinting Based Human Indoor Localization in Noisy Environment using Time-Invariant CNN**
3:53 p.m. Hyogo Hiruma, Yuki Inoue, Takuto Sato and Hiroshi Ohashi
Hitachi, Ltd.
- ✦ **Non-Line-of-Sight Detection for Radio Localization using Deep State Space Models**
4:16 p.m. Leon Brasseler¹, Maximilian Stahlke², Tobias Feigl², Thomas Robert Altstid¹, Christopher Mutschler²
1/Friedrich-Alexander-Universität Erlangen-Nürnberg, 2/Fraunhofer Institute for Integrated Circuits (IIS)
- ✦ **An Enhanced TDoA Method for 5G Real-Time Indoor Localization with Clustering**
4:39 p.m. Longxing Hu¹, Ti Wang¹, Tie Niu², Shan Yang¹, Haina Ye¹ and Qiyuan Zhang¹
1/China Unicom Smart City Research Institute, 2/Chinese Academy of Science Computer Network Information Center

MA 1 Acoustic and Ultrasound systems

Monday, 14 OCT

Monet A

- ✦ **Information-Aware Joint Calibration of Microphone Array and Sound Source Localization**
3:30 p.m. Xiaoyang Li, Haowen Deng, Jiang Wang, Linya Fu and He Kong
Southern University of Science and Technology
- ✦ **wav2pos: Sound Source Localization using Masked Autoencoders**
3:53 p.m. Axel Berg^{1,2}, Jens Gulin^{2,3}, Mark O'Connor⁴, Chuteng Zhou¹, Kalle Åström² and Magnus Oskarsson²
1/ARM, 2/Lund University, 3/SONY, 4/Tenstorrent
- ✦ **Geometric Sound Profile: Multipath-Time-of-Flight Fingerprint for High-Accuracy Acoustic Localization**
4:16 p.m. Yukiya Mita, Hiroaki Murakami, Takuya Sasatani and Yoshihiro Kawahara
The University of Tokyo
- ✦ **Position Dependent Anchor Selection for Scalable Hybrid RF-Acoustic Indoor Positioning**
4:39 p.m. Daan Delabie, Bert Cox, Thomas Feys, Liesbet Van der Perre and Lieven De Strycker
KU Leuven

MB 1

The Open Research Data Way: Replication Studies, Efficient Data Reuse and Metaresearch

Monday, 14 OCT

Monet B

Evaluating Open Science Practices in Indoor Positioning and Indoor Navigation Research

3:30
p.m.

Grigorios G. Anagnostopoulos¹, Paolo Barsocchi²,
Antonino Crivello², Cristiano Pendao^{3,4},
Ivo Silva⁴ and Joaquín Torres-Sospedra⁵

1/HES-SO, 2/CNR-ISTI, 3/University of Trás-os-Montes and
Alto Douro, 4/University of Minho, 5/University of Valencia

Exploring the Feasibility of Automated Data Standardization using Large Language Models for Seamless Positioning

3:53
p.m.

Max Jwo Lem Lee, Ju Lin and Li-Ta Hsu
The Hong Kong Polytechnic University

The SUG-UAV Multirotor Dataset with Multi- sensor Integration in Indoor and Urban Areas

4:16
p.m.

Naigui Xiao¹, Weisong Wen¹, Jiahao Hu¹,
Peiwen Yang¹, Jiaqi Zhao¹, Chunjun Wu²

1/The Hong Kong Polytechnic University,
2/MEITUAN Academy of Robotics Shenzhen

Efficient Fingerprint Augmentation Evaluation on the Antwerp LoRaWAN Setting

4:39
p.m.

Grigorios G. Anagnostopoulos
Geneva School of Business Administration, HES-SO

PB 1

Advanced and Future Applications

Monday, 14 OCT

Picasso B

Ubiquitous and Low-Cost Generation of Elevation Pseudo Ground Control Points

3:30
p.m.

Chen Gu¹, Etienne Le Grand¹ and Moustafa Youssef²
1Google, 2American University in Cairo

Distributed Ultra-Precise Time-Synchronization with Minimized Synchronization Data Traffic

3:53
p.m.

Sebastian Klob¹, Thomas Maul² and Joerg Robert²
*1/Friedrich-Alexander Universität Erlangen-Nürnberg (FAU),
2/Technische Universität Ilmenau*

Enhanced Accessibility for Mobile Indoor Navigation

4:16
p.m.

Johannes Wortmann¹, Bernd Schaeufele¹, Konstantin
Klipp¹, Ilja Radusch¹, Katharina Bläß² and Thomas Jung²
1/Fraunhofer FOKUS, 2/HTW Berlin

The Growing Importance of Alternative Indoor and Seamless Positioning and Navigation in Response to Escalating GNSS Attacks

4:39
p.m.

Valerie Renaudin and Frederic Le Bourhis
University Gustave Eiffel

PM 2

Machine Learning for Localization and Navigation

Tuesday, 15 OCT

Picasso Main

- ✦ **MAPIN: Mobility Adapted Pedestrian Inertial Navigation Using Smartphones for Enhanced Travel of the Visually Impaired**
2:30 p.m. Hanyuan Fu, Valerie Renaudin, Thomas Bonis and Ni Zhu
Université Gustave Eiffel
- ✦ **Comparative Analysis of Pedestrian Dead Reckoning Algorithms for Indoor and Outdoor Localization**
2:52 p.m. Gaetano Luca De Palma¹, Antoni Perez-Navarro¹ and Raúl Montoliu Colás²
1/Universidad Oberta de Catalunya, 2/Universitat Jaume I
- ✦ **Data Collection and Alignment Algorithms for Data-driven Inertial Navigation**
3:14 p.m. Ziheng Zhou, Qi Zhang, Shanshan Zhang, Zhiyu Cai, Guanze Lin, Lingxiang Zheng, Ao Peng and Xuemin Hong
Xiamen University
- COFFEE BREAK
- ✦ **Radio Foundation Models: Pre-training Transformers for 5G-based Indoor Localization**
3:55 p.m. Jonathan Ott, Jonas Pirkel, Maximilian Stahlke, Tobias Feigl and Christopher Mutschler
Fraunhofer Institute for Integrated Circuits IIS
- ✦ **Physics-Inspired Gaussian Processes Regression for RSS-based Visible Light Positioning**
4:17 p.m. Fan Wu, Nobby Stevens, Lieven De Strycker and François Rottenberg
Kuleuven
- ✦ **A Privacy-Preserving Indoor Localization System based on Hierarchical Federated Learning**
4:39 p.m. Masood Jan, Xun Zhang and Wafa Njima
Institut supérieur d'électronique de Paris (ISEP)

MA 2

Visual and Optical System

Tuesday, 15 OCT

Monet A

- ✦ **GGAS: Ground Guiding Assistant System for Interactive Indoor Wayfinding**
2:30 p.m. Tobias Schulz¹, Pedram Babakhani², Moritz Heine¹, Finn Harms¹, Marc Guerreiro Augusto² and Sahin Albayrak²
1/GT-ARC, 2/TU Berlin
- ✦ **Plane Prior for RGB-D based Visual Odometry**
2:52 p.m. Niclas Joswig¹, Aiden Morrison², Nadezda Sokolova² and Laura Ruotsalainen¹
1/University of Helsinki, 2/SINTEF Digital
- ✦ **Fusing Visuals with Magnetic Signals to Improve Indoor Localization Using Vision Transformers**
3:14 p.m. Hamaad Rafique, Davide Patti, Maurizio Palesi and Gaetano Carmelo La Delfa
University of Catania
- COFFEE BREAK
- ✦ **Effective Methods to Improve the Accuracy of False Light Source Recognition in Visible Light Indoor Positioning**
3:55 p.m. DeYue Zou¹, Linna Yan¹, Siyu Gao² and Yunfeng Liu³
1/Dalian University of Technology, 2/Dalian Neusoft University of Information, 3/Beijing Institute of Control and Electronic Technology
- ✦ **Stability Optimization of Visible Light Indoor Positioning Algorithm Based on Single LED and Camera: Using Attention Mechanism Convolutional Neural Network**
4:17 p.m. Wenjie Ji¹, Xun Zhang², Zefeng Wang¹, Jongnan Lou¹ and Lianxin Hu¹
1/Huzhou University, 2/Institut Supérieur d'Électronique de Paris
- ✦ **Over 8kfps Ultra Fast 3D Visible Light Positioning Based on Photodiodes**
4:39 p.m. Tongli Yang, Bingcheng Zhu and Zaichen Zhang
Southeast University

MB 2

Mapping, Simultaneous Localization and Mapping (SLAM)

Tuesday, 15 OCT

Monet B

- IBLI-SLAM: Intensity-Based LiDAR-Inertial SLAM for Dynamic Environments
2:30 p.m. Liuyin Ju, Hang Zhao, Xinchun Ji and Dongyan Wei
Aerospace Information Research Institute, Chinese Academy of Sciences
- Plane-based Loop Correction for LiDAR Inertial SLAM
2:52 p.m. Wangfang Li, Yi Sun and Long Zhao
Beihang University
- LIOP: Tightly Coupled LiDAR-Inertial Odometry and Prior Information System for Long-term Localization
3:14 p.m. Zeyuan Zhao, Jichao Jiao, Ning Li and Min Pang
Beijing University of Posts and Telecommunications
- COFFEE BREAK
- Improving the Performance of the ORB-SLAM3 with Low-Light Image Enhancement
3:55 p.m. Bing Han¹, Tuan Li¹, Zhixin Wang² and Chuang Shi²
1/Beijing Institute of Technology, 2/Beihang University
- DSP-SLAM: A Robust Semantic Visual SLAM for Dynamic Environments
4:17 p.m. Licheng Wei, Zhongliang Deng, Boyang Lou and Yuhui Gao
Beijing University of Posts and Telecommunications
- OPPCON: An Accurate, Efficient Algorithm for Dynamic Feature Extraction
4:39 p.m. Feifan Zha
Harbin Engineering University

PB 2

Inertial Measurement Units

Tuesday, 15 OCT

Picasso B

- Crosswalk Detection from Inertial Data for Visually Impaired People
2:30 p.m. F. Serhan Danis, Min Wang and Valerie Renaudin
University Gustave Eiffel
- A Pedestrian Dead Reckoning Method with Heuristic Motion Direction Estimation for Multiple Gaits
2:52 p.m. Quzhao Zheng, Pin Lyu, Jizhou Lai, Cheng Yuan, Zhimin Li and Yao Shan
Nanjing University of Aeronautics and Astronautics
- Robust Indoor Pedestrian Backtracking Using Magnetic Signatures and Inertial Data
3:14 p.m. Chia Hsuan Tsai and Roberto Manduchi
University of California, Santa Cruz
- COFFEE BREAK
- Context aware transformer network and in-situ IMU calibration for accurate positioning
3:55 p.m. Hossein Shoushtari¹, Firas Kassawat² and Harald Sternberg¹
1/HafenCity University, 2/Bonn University
- Drift Correction of Inertial Indoor Tracking using Peer Collaboration and Strategic Beacons Placement
4:17 p.m. Alpha Diallo and Benoît Garbinato
University of Lausanne
- Exploring the Impact of Heading Prediction at Different Time Scales on xDR Indoor Positioning
4:39 p.m. Yonglei Fan¹, Qiqi Shu¹, Guangyuan Zhang² and Stefan Poslad¹
1/Queen Mary University of London, 2/Peking University

PM 3

Advanced Fusion Technologies Based on Heterogeneous Data for Indoor Positioning

📍 Wednesday, 16 OCT

📍 Picasso Main

- ⊕ **uFindMe: A UWB-Based Robotic Package Finder**
10:30 a.m. Nicholas Cich, Rishabh Singhal and Ashutosh Dhekne
Georgia Tech.
- ⊕ **Obtaining Parking Information Without Prior Knowledge in Underground Parking Lot**
10:53 a.m. Weichang Xu, Jiaxiang Wang, Jian Li, Wei Li, Yongliang Wang and Shengyang Chen
Huawei Technologies Co., Ltd
- ⊕ **Indoor Positioning Error Analysis Using a Cooperative Multi-Technology Simultaneous Localization and Signal Mapping in a Vehicular Environment**
11:16 a.m. Luigi D'Alfonso, Mauro Tropea, Giuseppe Fedele and Floriano De Rango
University of Calabria
- ⊕ **Saying Goodbyes to Rotating Your Phone: Magnetometer Calibration During SLAM**
11:39 a.m. Ilari Vallivaara, Yinhuan Dong and Tughrul Arslan
University of Edinburgh

MA 3

Non-linear and non-Gaussian Sensor Fusion

📍 Wednesday, 16 OCT

📍 Monet A

- ⊕ **Robust Single-point Localization Technique Using Downlink TDOA-AOA Fusion**
10:30 a.m. Penghao Liu, Zhen Wu, Zheng Yao, Tengfei Wang and Mingquan Lu
Tsinghua University
- ⊕ **Vector Field-based Autonomous Navigation in a Tunnel-like Environment**
10:53 a.m. Licheng Feng¹, Jianjun Bao², Binghao Li and Liao Wu¹
1/University of New South Wales, 2/Tiandi (Changzhou) Automation Co., Ltd,
- ⊕ **Refinement of Sparsely Tagged Ground Truth Paths Using PDR and Particle Filter Smoothing**
11:16 a.m. Steffen Kastner¹, Markus Bullmann¹, Markus Ebner^{1,3,4}, Toni Fetzer², Frank Deinzer¹ and Marcin Grzegorzec^{3,4}
1/Technical University of Applied Sciences Würzburg-Schweinfurt, 2/cronn GmbH, 3/University of Lübeck, 4/German Research Center for Artificial Intelligence
- ⊕ **Asynchronous Particle Filter with Pedestrian Graph Integration for Visually Impaired Navigation**
11:39 a.m. Min Wang¹, F. Serhan Danis¹, Valerie Renaudin¹ and Myriam Servières²
1/University Gustave Eiffel, 2/ECN-AAU

MB 3

Multi-sensor Integration

🕒 Wednesday, 16 OCT

📍 Monet B

- ✦ **An Observability-Constrained Magnetic-Field-Aided Inertial Navigation System**
10:30 a.m. Chuan Huang¹, Gustaf Hendeby¹ and Isaac Skog²
1/Linköping University, 2/KTH Royal Institute of Technology
- ✦ **On the Feasibility of Phase-based BLE Ranging for Accurate Pedestrian Tracking**
10:53 a.m. Cedric De Cock¹, Emmeric Tanghe¹ Chris Marshall², Nikos Kouvelas² and David Plets¹
1/IMEC-WAVES/Ghent University, 2/Imec-Netherlands
- ✦ **3D Indoor Localization via Universal Signal Fingerprinting Powered by LSTM**
11:16 a.m. Zhanpeng Zhang¹, Ming Xia¹, Jiale Wang¹, Weisong Wen², Chuang Shi¹, Yunfeng Shan¹ and Xinqi Tian¹
1/Beihang University, 2/The Hong Kong Polytechnic University

PB 3

Radio Signal Processing

🕒 Wednesday, 16 OCT

📍 Picasso B

- ✦ **Feasibility Analysis of Self-oriented Antennas for Indoor Positioning based on Direction-of-Arrival and Bluetooth-Low-Energy**
10:30 a.m. Teodor Constantin Din¹, Joaquín Huerta¹, Sergi Trilles¹ and Joaquín Torres-Sospedra²
1/Universitat Jaume I, 2/University of Valencia
- ✦ **A Robust Tracking Loop Using Adaptive H ∞ Unscented Kalman Filter in GNSS Receivers**
10:53 a.m. Ning Gao, Xiyuan Chen, Yuetong Wang, Zhiyuan Jiao, Chunfeng Shi and Zhe Yan
Southeast University
- ✦ **Performance Bounds of UWB TOA Estimation in Presence of Wi-Fi 6E Wideband Interference**
11:16 a.m. Stefan Hechenberger¹, Stefan Tertinek² and Holger Arthaber¹
1/TU Wien, 2/NXP Semiconductors
- ✦ **Single Epoch Carrier Phase Positioning for Indoor Pseudolite Systems**
11:39 a.m. Xinchun Zhang, Zheng Yao, Tengfei Wang and Mingquan Lu
Tsinghua University

PM 4

Smartphone and Wearable Devices

🕒 Wednesday, 15 OCT

📍 Picasso Main

- ⊕ **Precise Near-Ultrasonic Tilt Determination for Smartphones**
2:30 p.m. Jan Grottke, Daniel Grottke and Jörg Blankenbach
RWTH Aachen University
- ⊕ **Exploiting Auxiliary Information for Indoor Smartphone User Tracking**
2:52 p.m. Shuai Sun¹, Yan Li², Xuezhi Wang³ and Bill Moran³
1/Dalian Maritime University, 2/Macquarie University, 3/University of Melbourne
- ⊕ **State and Transition Recognition of Ventilation-induced Barometric Disturbance during Indoor Altitude Estimation**
3:14 p.m. Yuki Hirayama¹, Takuzo Ikuta¹, Kota Tsubouchi² and Nobuhiko Nishio¹
1/Ritsumeikan University, 2/LY Corporation
- ☕ COFFEE BREAK
- ⊕ **Improving Coverage and Accuracy in Visible Light Positioning through Ceiling Reflection Modeling**
3:55 p.m. Shota Shimada¹, Hiroaki Murakami², Ryo Tabata³, Kota Tsubouchi¹, Takuya Sasatani², Yoshihiro Kawahara² and Masanori Sugimoto³
1/LY Corporation, 2/The University of Tokyo, 3/Hokkaido University
- ⊕ **PALMS: Plane-based Accessible Indoor Localization Using Mobile Smartphones**
4:17 p.m. Yunqian Cheng and Roberto Manduchi
University of California, Santa Cruz
- ⊕ **An Adaptive Step Detection Algorithm for Smartwatch with Deep Learning-based Human Activity Recognition**
4:39 p.m. Sohee Park, Jae Hong Lee and Chan Gook Park
Seoul National University

MA 4

UWB and Wi-Fi

🕒 Wednesday, 15 OCT

📍 Monet A

- ⊕ **UWB NLOS Identification and Mitigation based on Bidirectional Encoder Representations from Transformer(BERT) Deep Learning**
2:30 p.m. Hongchao Yang¹, Yunjia Wang¹, CheeKiat Seow², Meng Sun¹ and David Plets³
1/China University of Mining and Technology, 2/University of Glasgow, 3/Ghent University
- ⊕ **3D Millimeter-Wave Sensing vs Ultra-Wideband Positioning**
2:52 p.m. Andrey Sesyuk, Stelios Ioannou and Marios Raspopoulos
UCLan Cyprus
- ⊕ **Enhancing Drone Localization with Joint UWB and Radar Measurements Using CIR Processing**
3:14 p.m. Christophe Villien
Université Grenoble Alpes
- ☕ COFFEE BREAK
- ⊕ **Real-Time Location Landing Autonomous System Using WiFi Antennas for UAVs**
3:55 p.m. José Antonio López-Pastor¹, Alejandro Gil-Martinez², Guillermo Inglés Muñoz² and José Luis Gómez-Tornero²
1/University Center of Defense, 2/Technical University of Cartagena
- ⊕ **Improving Wi-Fi Indoor Positioning Based on Matching Visibility with Virtual Simulation**
4:17 p.m. Zhen Lyu, Lin Li and Guohao Zhang
The Hong Kong Polytechnic University

MB 4

Fingerprinting

🕒 Wednesday, 15 OCT

📍 Monet B

- ⊕ **Semi-supervised Indoor Positioning with Masked Crowdsourcing Fingerprints**
2:30 p.m. Yu Han and Zan Li
Jilin University
- ⊕ **Towards Ubiquitous IPS: Leveraging Crowdsourced Data Accumulation Over Time to Alleviate Reliance on External Sources in Initial Fingerprinting Map Generation**
2:52 p.m. Ahmed Mansour and Wu Chen
The Hong Kong Polytechnic University
- ⊕ **WiLoc: Encoding-based WiFi Long-Term Localization**
3:14 p.m. Zhao Huang¹, Mikko Valkama², Juan Zhang¹, Meng Xu³, Cunyi Yin⁴ and Minglei Guan⁵
1/Northumbria University, 2/Tampere University, 3/University of International Business and Economics, 4/Centre for Intelligent Multidimensional Data Analysis Limited Hongkong, 5/Shenzhen Polytechnic University

COFFEE BREAK

- ⊕ **An Efficient Quantum Binary-Neuron Algorithm for Accurate Multi-Story Floor Localization**
3:55 p.m. Yousef Zook¹, Ahmad Shokry² and Moustafa Youssef²
Alexandria University, The American University in Cairo
- ⊕ **Optimization-Based Wi-Fi Radiomap Construction for Multifloor Indoor Positioning**
4:17 p.m. Bertrand Perrat, Francisco Zampella, Miltiadis Chrysopoulos, Zhuo Wang and Firas Alsehly
Edinburgh Research Centre, Huawei
- ⊕ **Performance Evaluation of Fingerprint-Based Indoor Positioning Using RSSI in 802.11ah**
4:39 p.m. Takuya Matsunaga¹, Ismail Arai¹, Yutaro Atarashi², Arata Endo¹ and Kazutoshi Fujikawa¹
1/Nara Institute of Science and Technology, 2/Hitachi Zosen Corporation

Regular Paper Session: DAY3

PB 4

Indoor/Outdoor Seamless PNT with GNSS and Multi-Source Sensors

🕒 Wednesday, 15 OCT

📍 Picasso B

- ⊕ **An Adaptive Weighted GNSS/VINS/Wi-Fi RTT-based Seamless Positioning System for Smartphone**
2:30 p.m. Meiling Su¹, Bing Wang¹, Sugata Ahad¹, Xinyue Huang², Guohao Zhang¹ and Li-Ta Hsu¹
1/The Hong Kong Polytechnic University, 2/The Hong Kong University of Science and Technology
 - ⊕ **Optimizing GNSS Indoor Outdoor Detection: Balancing Observation Window and Sampling for Accuracy and Responsiveness**
2:52 p.m. I-HAO LU and Dongsoo Han
KAIST
 - ⊕ **Improving GNSS Positioning in Challenging Urban Areas by Digital Twin Database Correction**
3:14 p.m. Jiarong Lian, Jiayi Zhou, Guohao Zhang and Li-Ta Hsu
The Hong Kong Polytechnic University
- COFFEE BREAK
- ⊕ **Map Assisted Post-Processing for Looped Running Trajectories Captured by Smartwatches**
3:55 p.m. Xiao Zhao, Yiheng Guo, Hong Li, Zhi Li, Jian Li, Yongliang Wang and Shengyang Chen
Huawei Technologies Co., Ltd.
 - ⊕ **Enhanced Pedestrian Trajectory Reconstruction Using Bidirectional Extended Kalman Filter and Automatic Refinement**
4:17 p.m. Yinhan Dong, Kiros Kwan and Tughrul Arslan
University of Edinburgh
 - ⊕ **Analysis of GNSS/Pseudolite Integrated Positioning Accuracy in Urban Canyon Environment**
4:39 p.m. Wenjie Tang¹, Junping Chen¹, Yize Zhang¹ and Junsheng Ding²
1/Shanghai Astronomical Observatory, Chinese Academy of Sciences, 2/The Hong Kong Polytechnic University

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