**定位技术与空间信息挖掘**

**Localization Technologies and Spatio-Temporal Data Mining for LBS**

摘要：由于智能移动设备的广泛应用以及在大型复杂建筑中的应用挑战，人们的室内环境精确位置信息在现代社会中发挥着重要作用。本课程将介绍室内外融合定位技术，包括以GPS、北斗和伽利略为核心的室外卫星定位系统，以及基于WIFI、声学和磁场的室内定位系统。同时本课程还介绍了基于到达时间(ToA)、到达时间差(TdoA)、到达角(AoA)的距离测距理论与基于指纹的定位技术。将这些定位技术与基于惯导传感的导航技术、实时地图技术集成的融合方法也将在本课程中进行介绍。在定位技术的基础上，将研究空间信息数据挖掘技术，用来提供个性和和精确的基于位置的服务(LBS)。此外，本课程还探索了定位技术与LBS技术在现代社会的应用，包括定位制图与建筑信息模型(BIM)、定位与导航、基于位置的大数据分析与其隐私、安全与道德问题、典型无人驾驶导航系统（无人车、移动机器人和无人机），以及机场、商场、工业安全控制与管理中的定位技术应用。

Abstract：Owing to wide use of smart mobile devices and facing the challenges of large and complex buildings, precise localization of human beings in indoor environment plays an important role in the modern society. In this module, the converged indoor and outdoor localization technologies will be introduced, including outdoor satellite positioning systems of GPS, Beidou, and Galileo, and indoor positioning systems based on Wi-Fi, sound, and magnetic fields. The theories of distance ranging based on Time of Arrival (ToA), Time Difference of Arrival (TDoA), and Angle of Arrival (AoA), and fingerprinting based localization are introduced. The method of converging these localization technologies with inertial sensing-based navigation, and simultaneous mapping will also be introduced. On top of the localization technologies, the spatio-temporal data mining technologies will be studied to provide personalized and precise location-based services (LBS).In addition, applications of the localization technologies and LBS in the modern society are explored, including localization, mapping and Building Information Modeling (BIM); localization and navigation; location based big data analytics and its privacy, security and ethical issues; typical unmanned navigation systems (unmanned cars, mobile robots and UAVs)，and applications of localization in airports, shopping malls, industry safety control and management.

·Schedule

Class: 24（地点：教四-411）

* 模型介绍 3
* 定位技术基础 3
* 小组讨论1
* 基于测距的定位 3
* 基于指纹的定位 3
* 小组讨论1
* 基于位置信息的数据分析 3
* 位置隐私 3
* 小组讨论 1
* 小组展示 3
* Module Introduction 3
* Basic technologies of Localization 3
* Group discussion 1
* Distance Ranging based Localization 3
* Fingerprinting based localization 3
* Group discussions 1
* Location based Data Analytics 3
* Localization Privacy 3
* Group discussions 1
* Presentation 3

Labs: 8

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| --- | --- | --- | --- | --- | --- | --- | --- |
| 日期/星期 | 周一 | 周二 | 周三 | 周四 | 周五 | 周六 | 周日 |
| 开课第一周 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
| 开课第二周 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| 开课第三周 | 31 | 1 | 2 | 3 | 4 | 5 | 6 |

·Teaching group

**Xinhheng Wang**Prof. Wang is currently a professor of computing at University of West London, UK. He is also coordinating the research and enterprise activities for School of Computing and Engineering. After obtaining his bachelor and master degrees in electrical engineering from the best electrical engineering department in China at Xi’an Jiaotong University, he joined the State Key Laboratory of Electrical Insulation and Power Equipment as a lecturer. During his visit to Southampton University in the UK, he received a full studentship from National Grid UK to conduct his PhD research in condition monitoring for power systems at Brunel University. After completing his study in three years, he continued his research as a postdoctoral research fellow at Brunel University and started his academic career in the UK.

Prof. Wang has broad working experience in England, Wales and Scotland, where he has gained some deep knowledge of local life and culture in the UK.His research experience is also broad. He has worked on power system conditioning monitoring, mobile healthcare, wireless networking, indoor positioning and big data analytics. Along with more than 20 research projects he has investigated, his research in each area has led to an industrial product. For example, his methodology in cable fault detection and location has resulted in a device used in South Korea; his research and development in wireless mesh and sensor networks has been commercialized in the UK; currently he is working with an IT pioneer to develop the first smart trolley in the world used for intelligent airport services, which is being used by more than ten airports in China.

Prof. Wang is an IEEE senior member. He is also serving as a member of EPSRC Peer Review College and an expert to review and monitor EU projects. Over the years, he has published more than 70 referred journal papers and dozens of conference papers. He has 11 granted patents in the area of indoor positioning, networking, and big data analytics. He has also received four technical awards.

Apart from research, Prof. Wang is very keen in developing and promoting research-informed teaching. One of his modules developed in the UK was commented as “an innovative module approach to facilitate inclusion of contemporary smart networking issues based on an innovative approach to module design” by the review panel.

**ZhiWang**Prof. Wang is a PhD Advisor at College of Control Science and Engineering, Zhejiang University. His research areas including sound signal and array signal processing, mobile positioning and tracking, compressed sensing and deep learning, data fusion of multiple sensingsystems, mobile computing, and industry Internet of Things (IoT). As a principal investigator, and co-investigator, he has investigated more than 20 international collaboration and national research grants, including 9 China-Germany, China-France, China-UK, and China Portugal collaboration projects, 8 National Natural Science Foundation of China projects and 1 China 863 High-Tech scheme. He has authored/coauthored 100+ SCI/EI indexed journal papers, including 20+ IEEE Transactions and Journals (IEEE TMC, IEEE TPDS, IEEE TSP, IEEE TIM, IEEE IoT, IEEE TII, IEEE Access), 20+ top international conference papers (IEEE INFORCOM, IEEE SECON). He has also published a book “Wireless Sensor Networks”. Currently he is preparing two books titled “Initial Investigation of Mobile Phone Positioning Technology” and “Sound Sensing and Localization Technologies. He was also the winner of 2018 Microsoft Indoor Localization Competition in sound group.

**·Shibo ·He**Dr. Heis currently a research professor with at College of Control Science and Engineering, Zhejiang University. His research interests include Internet of Things, Data analysis and Network science.He is on the editorial board of IEEE Transactions on Vehicular Technology, Springer Peer-to-Peer Networking and Application and a guest editor of Elsevier Computer Communications and Hindawi International Jounral of Distribted Sensor Networks. Dr. He served as the Technical Program Chair of International Symposium on Pervasive Systems, Algorithms and Networks 2018, International Conference on Scalable Computing and Communications (ScalCom), the Program Vice Co-chair for the International Conferences on Ambient Systems, Networks, and Technologies (ANT) 2013 and 2014. He also served as the Track Co-chair for the International Conference on Communications 2017, the Pervasive Algorithms, Protocols, and Networks track of the International Conference on Emerging Ubiquitous Systems and Pervasive Networks 2013, as the Web Co-Chair for the IEEE International Conference on Mobile Ad hoc and Sensor Systems 2013, as the Publicity Co-chair for the IEEE International Workshop on Wireless Sensor, Actuator, and Robot Networks 2010 and the International Conference on Future Networks and Communications 2014.

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