

第十二届 EAI 宽带通信、网络和系统国际会议
EAI BROADNETS 2021
The 12th EAI International Conference on
Broadband Communications, Networks, and Systems

程序册
Final Program

主办单位

European Alliance for Innovation 欧洲创新联盟

承办单位

La Trobe University, Australia 澳大利亚拉筹伯大学

RMIT University, Australia 澳大利亚皇家墨尔本理工大学

Harbin Institute of Technology 哈尔滨工业大学

Guangxi University 广西大学

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哈尔滨工业大学电气工程及自动化学院

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哈尔滨云高科技有限责任公司

哈尔滨安钡达科技有限公司

2021 年 10 月 28-29 日 中国·哈尔滨

October 28-29, 2021, Harbin, China



**Invitation letter of holding EAI BROADNETS 2021
Conference with Harbin Institute of Technology**

To Harbin Institute of Technology :

EAI BROADNETS 2021 is the 12th EAI International Conference on Broadband Communications, Networks, and Systems, focusing on topics of advanced communication and network technology and application. It aims to create a forum for scientists and practicing engineers throughout the world to present the latest research findings and ideas. It will be held during October 28-31 in Melbourne, Australia and Harbin, China. The Conference is co-organized by EAI – European Alliance for Innovation, La Trobe University, RMIT University, Harbin Institute of Technology, and Guangxi University. In order to ensure the safety, comfort and quality of experience for attendees and a successful course of the event, the two formats of online conference and live conference will be held synchronously using 5G devices. You may obtain the most up-to-date information about the conference at <https://broadnets.eai-conferences.org/2021/>.

Smart buildings are the heart of smart cities in future society. With the commercialization of 5G technology and the integration with high-tech technologies such as big data, cloud computing, artificial intelligence (AI) and Internet of Things(IoT), the number of smart cities and smart buildings is increasing.

In respect to the research strength of Harbin Institute of Technology in the field of smart buildings, we invite your university to hold this international academic event together. Specially, a workshop entitled “5G-enabled Smart Building: technology and challenge” will be hosted by your university.

Thanks for your support in conference organization and reception.

Sincerely,

Natasha Onofrei
Conference Manager

A handwritten signature in blue ink, appearing to read "Natasha", written over a light blue grid background.

欧洲创新联盟(EAI)

关于邀请哈尔滨工业大学共同举办 EAI BROADNETS 2021 国际学术会议的函

哈尔滨工业大学：

第12届EAI宽带通信、网络和系统国际会议，简称EAI BROADNETS 2021，将于2021年10月28日至31日在澳大利亚墨尔本和中国哈尔滨同步举行。本次会议将由欧洲创新联盟(EAI)、澳大利亚拉筹伯大学、澳大利亚皇家墨尔本理工大学、哈尔滨工业大学和广西大学共同举办，旨在为世界各地从事先进网络和通信技术及其应用的科学家和工程师搭建一个展示最新研究成果和技术交流的平台。为了确保与会者的安全、舒适和参会质量，并兼顾现场活动的成功进行，会议将利用5G设备线上线下同步举行。关于会议的具体信息可查阅网址：<https://broadnets.eai-conferences.org/2021/>。

智慧建筑是未来社会智慧城市的核心。随着5G技术的商业化以及与大数据、云计算、人工智能和物联网等高科技技术的整合，智能城市 and 智能建筑的数量正在不断增加。

鉴于贵校在智慧建筑领域的科研实力，我方特邀请贵校共举办这次国际学术盛会，并单独设立“基于5G的智慧建筑：技术与挑战”的分论坛。

感谢贵校在会议组织和接待等方面给予的大力支持。

Natasha Onofrei

会议管理者

欧洲创新联盟

IEEE Transactions on Industrial Informatics



CALL FOR PAPERS
for Special Section on



Beyond 5G Advanced Manufacturing

Theme: Embedded sensors and actuators facilitate real-time monitoring and closed-loop control of large-scale cyber-physical systems (CPS) or Internet of Things (IoT) systems. Real-time coordination of CPS/IoT systems, from monitoring system performance, collecting and processing multi-dimensional data, to taking actions on managing all associated devices is a challenging task because the system performance varies with temperature, working environment, internal uncertainties and external disturbances in each specific industrial equipment. By taking the advantages of 5G technology, it is possible to improve real-time accuracy over geographically diverse IoT-enabled sensors and actuators.

Developing innovative data streaming mode and associated technology for managing cyber-physical systems may revolutionize the design, synthesis, production methods and manufacture processes in advanced manufacturing, such as robotics, CNC machines, contactless machining, automated vehicle, rechargeable batteries.

This special issue will call for innovative solutions to narrow the gaps between 5G and advanced manufacturing and identifying the associated challenges, and guiding researchers to bridge the gaps.

Potential topics of interest include, but are not limited to:

- 5G cloud and cloud-edge collaborative computing
- Cyber-physical systems
- Streaming data for 5G-enabled systems
- Federation Learning
- Edge Computing
- Cryptographic library
- AI and high precision technologies
- Machine learning and optimization
- 3D printing and surface reconstruction
- Real-time control of industrial systems uncertainties (both internal and external)
- High Performance Computing (HPC) for modeling, simulation and analysis
- Advanced robotics and other intelligent production systems
- Mechanical and mechatronics
- Remote sensing and applications
- Sustainable green energy and technologies
- Innovative new batteries and battery management technology
- Distributed control and distributed model predictive control
- Advanced approaches for smart actuators and data processing
- Security and dependability for communication networks
- Virtual reality and augmented reality
- Consensus

Manuscript Preparation and Submission

Follow the guidelines in “Information for Authors” in the IEEE Transaction on Industrial Informatics <http://www.ieee-ies.org/pubs/transactions-on-industrial-informatics> . Please submit your manuscript in electronic form through Manuscript Central web site: <https://mc.manuscriptcentral.com/tii> . On the submitting page #1 in popup menu of manuscript type, select: SS on **Beyond 5G Advanced Manufacturing**

Submissions to this Special Section must represent original material that has been neither submitted to, nor published in, any other journal. Regular manuscript length is 8 pages.

Note: The recommended papers for the section are subject to final approval by the Editor-in-Chief. Some papers may be published outside the special section, at the EIC discretion.

| | | |
|-------------------|--|--------------------------|
| Timetable: | Deadline for manuscript submissions | November 30, 2021 |
| | Expected publication date (tentative) | July 2022 |

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会议日程

| 10月28日 周四 | | | |
|---|-------------|--|----------------|
| 10月 28日 | 09:00-12:00 | 会议注册报到 | 电机楼 10024 |
| 分会场开幕式 主持人：哈尔滨工业大学电气工程及自动化学院 冯勇教授 | | | |
| 10月 28日 | 13:30-13:35 | EAI 组织致辞 EAI 会议组织负责人：Natasha Onofrei Michal Dudic | 学生活动 中心 214 |
| | 13:35-13:40 | 大会总组织者致辞 澳大利亚 RMIT 大学：Dr. Fengling Han | |
| | 13:40-13:45 | 学校领导致辞 哈尔滨工业大学本科生院副院长、教务处处长：刘宏伟教授 | |
| | 13:45-13:50 | 学院领导致辞 电气学院副院长：王懿杰教授 | |
| 大会特邀报告 主持人：哈尔滨工业大学电气工程及自动化学院 郑雪梅教授 | | | |
| 10月 28日 | 13:50-14:40 | 主题报告（一） Multi-Agent Systems Based Distributed Control, Optimization and Energy Management in Smart Grids 基于多智能体系统的智能电网分布式控制、优化与能量管理 欧洲科学院院士、教育部长江学者讲座教授、澳大利亚 Swinburne 大学副校长：韩清龙院士 | 学生活动 中心 214 |
| | 14:40-15:10 | 主题报告（二） 双碳目标下数据中心设计的思考 中国勘察设计协会电气分会青年专家组常务副主任、双高 专家组委员、中国计算机用户协会数据中心分会专家委 员、工信部规划司工业领域评审专家：郭利群教授级高工 | |
| | 15:10-15:40 | 主题报告（三） 计算性思维创新驱动建筑自适应表皮设计 院长助理，智慧建筑与建造教研室主任：韩昀松副教授 | |
| | 15:40-16:30 | 合影与茶歇 | |
| | 16:30-17:00 | 主题报告（四） 四轮驱动智能电动汽车底盘电子控制 长春工业大学汽车工程研究院副院长：张袅娜教授 | |
| | 17:00-17:30 | 主题报告（五） Intelligent Decision and Control for Autonomous Driving 自动驾驶智能决策与控制 华为诺亚方舟实验室高级研究员、新加坡南洋理工大学博 士后：何祥坤博士 | |
| | 17:30-19:00 | 欢迎晚宴 | |

会议日程

| 10月29日 周五 澳大利亚主会场（线上） | | | |
|-----------------------|-------------|--|---|
| 10月 29日 | 09:00-09:50 | 主题报告（六） Communication-efficient and Distributed ML Over Wireless Networks （基于无线网络的高效通信和分布式机器学习） 芬兰科学院研究员、芬兰奥卢大学无线通信中心，IEEE Fred W. Ellersick 奖获得者：Mehdi Bennis 副教授 | 学生活动中心 214 （网址： https://voovmeeting.com/ ） |
| | | 会议论坛 | |
| | 09:50-12:00 | Session1 | |
| | | Session2 | |
| | | Session3 | |
| | | Session4 | |
| | Session5 | | |

| 10月29日 周五 哈尔滨分会场（线下） | | | |
|----------------------|-------------|--|---------------------|
| 10月 29日 | 09:00-10:40 | 5G-Enabled Smart Building: Technology and Challenge 分论坛 1：5G 技术助力智慧建筑：技术与挑战 主持人 Session Chair: 薛宸，张伟琦 | 活动中心 216 |
| | 10:40-10:50 | 茶歇 | |
| | 10:50-12:00 | 5G: The Advances in Industry 分论坛 2：5G 技术赋能工业发展 主持人 Session Chair: 李光先，段广鑫 | |
| | 12:00-14:00 | 午餐及午休 | 自助午餐 （活动中心 216） |
| | 14:00-17:00 | 城市参观 1. 哈尔滨工业大学航天馆 2. 哈尔滨大剧院 | 乘车地点： 西苑宾馆 门口 |

大会组织机构

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主席 Chair:

Imrich Chlamtac (Bruno Kessler Professor, University of Trento, Italy)

成员 Members:

Prof. Honghao Gao (Shanghai University, China)

组织委员会(Organizing Committee)

大会主席 General Chair:

Prof. Wei Xiang (La Trobe University, Australia)

Dr. Fengling Han (RMIT University, Australia)

研讨会规划主席 Workshops Chair:

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Dr. Yanming Wang (Harbin Institute of Technology, China)

Prof. Niaona Zhang (Changchun University of Technology, China)

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Dr. Wencheng Pan (University of Huddersfield, UK)

Prof. Shouyi Yang (Zhengzhou University, China)

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Bing Chen (Shenzhen Benchuang Information Technology Pty Ltd., China)

哈尔滨工业大学分会场组织机构

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哈尔滨工业大学电气工程及自动化学院：王艳敏

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长春工业大学汽车工程研究院：张袅娜

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| | | | |
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| 段剑 | 葛杨 | 韩畅 | 何雨佳 |
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| 刘雨辰 | 宁佳铭 | 史英杰 | 滕昱博 |
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| 张伟琦 | 张择琨 | 张众帅 | |

大会参加人员列表

(按姓氏字母排序)

| | | | |
|----------------------------|----------------|------------------|------------------|
| Fan Bai | Andrei Kelarev | Yuchen Liu | Shimin Wu |
| Haoran Cai | Michael Kerr | Vinh Loi Chau | Qingxin Xia |
| Bing Chen | Bo Li | Junwei Luo | Wei Xiang |
| Haigiang Chen | Chaojie Li | Tian Miao | Guangfei Xu |
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| Fengling Han | Xiangcheng Li | Dawei Sun | Qianwen Zhang |
| Xiangkun He | Yingying Li | Youming Sun | Zhongshuai Zhang |
| Yujia He | Zhanzeng Li | Ron Van Schyndel | Xuemei Zheng |
| Xin Hui | Zonghao Li | Bing Wang | Chunhua Zhu |
| Mubashir Husain Rehmani | Tianyu Liu | Yanmin Wang | Kaixiang Zhu |
| Muhammad Islam | Xiaofeng Liu | Zelin Wang | |

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慕永国（哈尔滨工业大学）

刘宏伟（哈尔滨工业大学）

王懿杰（哈尔滨工业大学）

李晓东（哈尔滨工业大学建筑设计研究院）

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潘文程（英国哈德斯菲尔德大学）

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韩 畅（哈尔滨安钶达科技有限公司）

特邀报告人简介

Prof. QingLong Han



Title: Multi-Agent Systems Based Distributed Control, Optimization and Energy Management in Smart Grids

Abstract: With the widespread integration of renewable distributed energy sources such as wind generation, photovoltaic and solar panels, a traditional electrical network has been experiencing a huge revolution towards a smart grid in various terms of generation, transmission, distribution and usage, and so on. Such a revolution poses new theoretical and technical challenges in operation and management of smart grids. To address these challenges, a multi-agent system based strategy is developed to address control and optimization issues in smart grids, showcasing its strong ability in improving efficiency, reliability and scalability. In this talk, some backgrounds on smart grids from the perspective of multi-agent systems are introduced. Second, a distributed secondary control scheme with an event-triggered communication mechanism is presented to ensure frequency regulation and active power sharing of AC islanded microgrids while significantly reducing the utilization of communication resources. Third, a multi-objective distributed optimization method is provided to address current sharing and voltage regulation in DC microgrids. Furthermore, a distributed energy management issue of smart grids maximizing the total social welfare that balances generation-side expenses, user-side payments, and transmission line costs is addressed. Finally, some challenging issues are discussed for future investigation.

QingLong Han 教授, 欧洲科学院院士, 教育部国家级人才讲座教授, IEEE Fellow (电气电子工程师协会会员), FIEAust Fellow (澳大利亚工程师协会会员), 澳大利亚 Swinburne(斯威本)大学的副校长和杰出教授。分别于 2014 年, 2015 年, 2016 年, 2017 年入选全球高被引学者; 2019 年 9 月进入欧洲 Top 40 科学家, 2019-2020 年度澳大利亚电气工程与计算机科学领域五大终身成就者之一, 2021 年获得澳大利亚 M.A. Sargent 勋章。曾任澳大利亚 Central Queensland University 高等教育部副部长(研究与创新)、智能与网络化系统科学研究中心主任, 澳大利亚 Griffith University 任教授(讲座)、科学学部副部长(研究)等多个学术和管理职位。获得 2020 年 IEEE 系统、人与控制论学会 Andrew P. Sage 最佳论文奖(Best Transactions Paper Award), 2020 年 IEEE 工业电子学会 IEEE Transactions on Industrial Informatics 杰出论文奖(Outstanding Paper Award), 2019 年 IEEE 系统、人与控制论学会 Andrew P. Sage 最佳论文奖 (Best Transactions Paper Award)。曾担任 IEEE 工业电子学会网络控制系统及应用专委会主席 (2014-2017), 2021 年 6 月被 IEEE 工业电子学会理事会任命为 IEEE Transactions on Industrial Informatics 共同主编 (Co-Editor-in-Chief)。目前担任(曾担任)IEEE Transactions on Cybernetics, IEEE Transactions on Industrial Informatics, IEEE Industrial Electronics Magazine, IEEE/CAA Journal of Automatica Sinica, Control Engineering Practice 及 Information Sciences 等 12 种期刊的编委。



Assoc. Prof. Mehdi Bennis

Title: Communication-Efficient and Distributed ML
over Wireless Networks

Abstract: Breakthroughs in machine learning (ML) and particularly deep learning have transformed every aspects of our lives from face recognition, medical diagnosis, and natural language processing. This progress has been fueled mainly by the availability of more data and more computing power. However, the current premise in classical ML is based on a single node in a centralized and remote data center with full access to a global dataset and a massive amount of storage and computing. Nevertheless, the advent of a new breed of intelligent devices ranging from drones to self-driving vehicles, makes cloud-based ML inadequate. This talk will present the vision of distributed edge intelligence featuring key enablers, architectures, algorithms and some recent results.

Mehdi Bennis 副教授，芬兰奥卢大学无线通信中心副教授、芬兰科学院研究员、智能连接和网络/系统组负责人。主要研究方向是无线资源管理、异构网络、博弈论和 5G 网络及其他领域的机器学习，发表学术文章 200 余篇，获得多个著名学术奖项，包括 2015 年 IEEE 通信学会的 Fred W. Ellersick 奖，2016 年 IEEE 通信学会的最佳论文奖，2015 年 Journal of Wireless Communications and Networks(无线通讯与网络期刊)的最佳论文奖，2019 年获得 IEEE 通信委员会无线电通信委员会早期成就奖。



郭利群 教授级高工

讲座题目：双碳目标下数据中心设计的思考

摘要：城市是能源消耗的主体，以绿色低碳为方向的新一轮能源革命正在全球蓬勃兴起。2021 年是我国“十四五”的开启之年，也是我国“碳达峰”、“碳中和”能源转型的重要窗口期，深度融合城市电力、热力、天然气、太阳能等多种能源形式实现电、气、储、热、冷、可再生能源等系统的多能互补，并利用新一代信息通信技术，以数字化技术和互联网理念为驱动，构建高度协同的城市综合能源系统将成为面向智慧城市能源供给的重要发展方向，进而使得数据中心(Data Center)在“双碳”目标下的节能减排作用和意义重大。作为国内数据中心的权威专家，特邀报告人结合理论和丰富的一线工程实践经验，分析了国家及各地政府部门对于数据中心行业的政策导向，并从 IT 设备、配电、空调等多方面，贯穿系统、产品、运维等多方面对数据中心的减碳技术措施进行剖析。

郭利群，教授级高工，目前担任中国建筑研究院有限公司数据中心设计研究所所长。作为我国建筑电气与智能化领域的权威专家，特别在数据中心方面享有较高声誉，曾获得“中国建筑电气行业百名杰出青年”、“建筑电气行业百位突出贡献人物”、“2017-2018 年度中国建筑设计奖”(青年工程师奖)、“2019 云计算中心科技奖”(人才奖)等行业杰出称号。同时担任中国勘察设计协会电气分会青年专家组常务副主

任、双高专家组成员，中国计算机用户协会数据中心分会专家委员，中国电子节能技术协会数据中心节能技术委员会专家委员，全国金融标准化技术委员会 IT 基础设施标准工作组委员，DDO 数据中心设计师技术委员会副主任，工业和信息化部电子工业标准化研究院产业发展研究中心专家委员，中国建筑学会建筑电气分会节能专业委员会常委，工信部规划司工业领域评标评审专家，《智能建筑电气技术》、《中国优秀数据中心》杂志编委，LEED 数据中心顾问（中国）委员会顾问，北京照明学会设计专业委员会等职务。

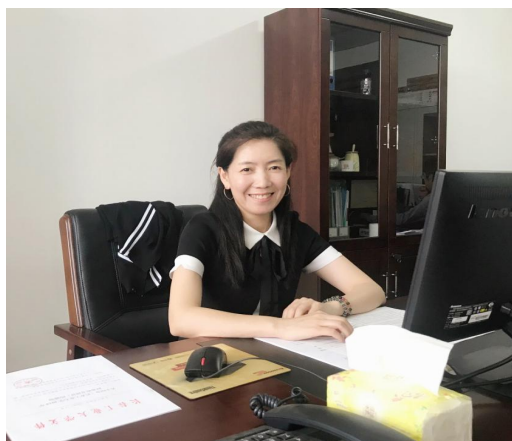


韩昀松 副教授

讲座题目：计算性思维创新驱动建筑自适应表皮设计

摘要：计算性设计基于人居环境系统科学与复杂性科学思想，应用人工智能技术，展开多性能目标耦合考虑下的设计元素自组织生成与自适应优化，其为建筑自适应表皮设计提供了新的技术支撑，也推动了人工智能时代语境下的建筑表皮智能化转型。报告将剖析计算性思维与计算性设计方法对于建筑自适应表皮设计的创新驱动作用，并结合实践案例，介绍报告人在建筑自适应表皮计算性设计方面的探索。

韩昀松，哈尔滨工业大学建筑学院副教授、博士生导师，任院长助理、智慧建筑与建造教研室主任、中国建筑学会计算性设计学术委员会副秘书长、中国青年科技工作者协会环境能源专委会委员，主要研究方向为计算性设计、绿色建筑、智慧建筑与建造。



张袅娜 教授

讲座题目：四轮驱动智能电动汽车底盘电子控制

摘要：自动驾驶、车联网的出现，使得未来的汽车电子架构需要强大的处理功率和超高的实时性能、控制算法具有较高的预测能力和鲁棒性，以有效权衡计算效率与系统性能。特邀报告人剖析四轮驱动电动汽车底盘电子控制系统的硬件连接结构、通信拓扑以及动力学耦合机理，揭示了多智能体理论与底盘电子系统的相似共性，并着重对四轮驱动智能电动汽车底盘电子的控制进行技术分享。

张袅娜，教授，博士生导师，现任长春工业大学汽车工程研究院副院长，吉林省有突出贡献专家，中国汽车工程学会汽车技术教育分会委员。吉林大学汽车仿真与控制国家重点实验室博士后，加拿大英属哥伦比亚大学访问学者，复杂机电装备技术工程研究中心主任、电动汽车整车与底盘控制关键技术研发创新团队负责人。主要研究方向：网络控制系统、电动汽车智能驱动与协同控制。



何祥坤 博士

Title: Intelligent Decision and Control for Autonomous Driving

讲座题目: 自动驾驶智能决策与控制

Abstract: With the development of emerging technologies such as 5G and artificial intelligence (AI), autonomous driving is promising and has great potential, which will lead to a dramatic breakthrough in the next generation of automobile industry. However, autonomous driving is far from being a mature technology at the current stage. When autonomous vehicles leave the research laboratory and join public traffic, they must be able to deal with the complicated decision and control tasks under diversified environment. As one of the most advanced AI algorithms, deep reinforcement learning has achieved a success in fulfilling a series of challenging decision making and control tasks (e.g., Go and robot control). In this lecture, the state-of-art techniques on decision-making and control in autonomous driving from three dimensions (vehicle engineering, control theory and AI) will be introduced, and the latest progress in this field as well as their potential will be discussed.

何祥坤博士，华为诺亚方舟实验室高级研究员，新加坡南洋理工大学机械与宇航工程学院博士后研究员。2019年1月博士毕业于清华大学车辆与运载学院，2019年3月至2021年10月任华为-2012诺亚方舟实验室高级研究员。研究方向主要包括自动驾驶、强化学习、决策与控制。发表论文30余篇，荣获清华大学优秀博士论文奖、2020 IEEE ICMA 最佳论文提名奖、华为-最挑战难题重大技术突破联合嘉奖令、华为-2012之星、华为-海思芯星奖等荣誉。担任 IEEE TII、IEEE/ASME TMECH、IEEE TVT、MSSP、VSD、CoRL 等 10 余个国际期刊和会议的审稿专家。

哈尔滨工业大学分论坛介绍

分论坛 1: 5G-Enabled Smart Building: Technology and Challenge

5G 技术助力智慧建筑：技术与挑战

Background

Smart buildings are the heart of smart cities in future society. With the commercialization of 5G technology, smart buildings have been replacing the traditional types and have played an increasing role due to their high integration among people, devices and things. In recent years, some advanced 5G-based technologies as the enhanced mobile broadband (eMBB), massive machine type communication (mMTC) and ultra-reliable and low latency communication (URLLC) have been gradually applied to the smart home, video surveillance, security system, fire system, energy related systems, etc. Therefore, these smart devices interact with each other and further the supported infrastructure using various technological advances can furnish multiple intelligent services to their users. It is worth noticing that the amount of data generated by smart buildings can be overwhelming when scaling the buildings from small, medium, large, to ultra-large. In other words, we are facing an explosion of ultra-big-data, generated, transported, processed, analyzed, and monitored in almost real-time. It is an extraordinary challenge to measure and acquire these immense computing and communication power almost instantly. Besides, how to combine 5G with artificial intelligence (AI), Internet of Things(IoT), AR, VR and other intelligent technologies is another research focus, which can benefit the smart buildings with high efficiency, high reliability and sustainable development.

The workshop aims to provide a research venue for exchanging and discussing the technical trends and challenges of 5G-enabled smart buildings. Both theory- and application-driven studies are invited for participation.

Workshop Organizers



Dr. Yanmin Wang, School of Electrical Engineering and Automation, Harbin Institute of Technology, Harbin, China, wangyanmin@hit.edu.cn.

Yanmin Wang received the B.Eng., M. Eng. and Ph. D degree from the School of Electrical Engineering and Automation, Harbin Institute of Technology (HIT), Harbin, China, in 2002, 2005 and 2009, respectively.

Since 2010, she has been working in the Research institute of Smart Building and Automation, the School of Electrical Engineering and Automation, Harbin, China. And from 2014, she is the Associate Director of the institute. From 2009 to 2011, she was a Research Fellow with the School of Astronautics, HIT, Harbin, China. From 2012 to 2016, she was a Research Fellow with the School of Instrumentation Science and Engineering, HIT, Harbin, China. From 2013 to 2014, she was a visiting scholar with the School of Computer Science and IT, RMIT University, Melbourne, Australia. From 2017, she is a member of Green Energy Professional Committee of Chinese Architecture Society. In 2019, she has visited Monash University, Melbourne, Australia supported by the Ministry of industry and information technology of China and Harbin Institute of Technology. Her research interests include networked control, smart building and information, building automation system.



Prof. Niaona Zhang, Changchun University of Technology, Changchun, China, zhangniaona@163.com

Niaona Zhang received the B.Eng. and M. Eng. Degree from the Department of Electrical Engineering, Changchun, China, in 1994 and 1999, respectively. She received the Ph.D degree from the School of Electrical Engineering and Automation, HIT, China, in 2006.

Since 1994, she has been working in the Department of Electrical Engineering, Changchun University of Technology, Changchun, China, as Assistant (1994-1999), Lecturer (2000-2005), Associate Professor (2006-2010), and Professor (2011-present). She was also a Research Fellow at the National Key Laboratory of automobile simulation and control of Jilin University. In 2019, she has visited University of British Columbia, Canada. In 2019, she was awarded as an expert with outstanding contributions in Jilin Province, and the assistant dean at the Automotive Engineering Research Institute. Her current research interests include the networked control, collaborative control and multi-agent control system.

分论坛 2: 5G: The Advances in Industry

5G 技术赋能工业发展

Background

As the novelist technology on telecommunication and networks, 5G will bring much more than just boost your speed of internet. In the fields of engineering, 5G is the foundation for more flexible and efficient activities. In the future, 5G will transform industrial works in different aspects. Specifically, the application of IoT will significantly increase the efficiency of production, and the production lines in factories can react according to the supply-demand relationship and the stock rapidly; the manipulation and operation of equipment and devices will be implemented remotely, improving safety and avoiding risks; the digital twins of the machining system will replicate the machinery, avoiding the faults of the machining in the real world; the evolved machine tools can learn from each other via logistic networks, which can work autonomously to improve the quality of products.

In this workshop, we will present new findings on the breakthrough in industry with the application of 5G, such as the application of 8K video in living broadcast, the self-learning among different CNC machines and the state-of-art technology on automatic driving. The aim of this workshop is to stimulate new conceptions and inspirations among academic areas and industries, in the age of 5G.

Workshop Organizers



Dr Guangxian Li got his doctoral research in the field of mechanical and manufacturing engineering at RMIT University in 2017. Currently, he is employed as an Associate Professor at Guangxi University. His research scope includes tool wear, CNC machining, and the dynamics in metal cutting processes.



Dr Wencheng Pan is working as a Research Fellow at the Centre for Precision Technologies (CPT) and Engineering Control and Machine Performance (ECMPG) at the University of Huddersfield. He joined the CPT in June of 2015 and is currently focusing on the research of machining optimization through system stability analysis and machining mechanism study.



Yang Shouyi, born in 1965, is currently a professor and head of the communication engineering department at Zhengzhou University, China. He received his BS at Nankai University, MS at Chongqing University, PhD at Beijing Institute of Technology, China, respectively. He has been a research fellow at Mie University in Japan. His research interests include wireless communication, Mobile Cloud Computing (MCC), and Mobile Edge Computing (MEC).

澳大利亚主会场口头报告（线上）

Session 1

Presentation 1:A Machine Learning-based Elastic Strategy for Operator Parallelism in a Big Data Stream Computing System

Dawei Sun

China University of Geosciences

Wei Li

China University of Geosciences

Shang Gao

Deakin University

Rajkumar Buyya

University of Melbourne

Abstract:Elastic scaling in/out of operator parallelism degree is needed for processing real time dynamic data streams with low latency and high stability requirements. Usually the operator parallelism degree is set when a streaming application is submitted to a stream computing system and kept intact during runtime. This may substantially affect the performance of the system due to the varying input streams and system resources. To address the problems brought by the static parallelism setting, we propose and implement a machine learning based elastic strategy for operator parallelism (named Me-Stream) in big data stream computing systems. The architecture of Me-Stream and its key models are introduced, including parallel bottleneck identification, parameter plan generation, parameter migration and conversion, and instances scheduling. Metrics of execution latency and process latency of the proposed scheduling strategy are evaluated on the widely used big data stream computing system Apache Storm. The experimental results demonstrate the efficiency and effectiveness of the proposed strategy.

Presentation 2:End-to-End Dynamic Pipelining Tuning Strategy for Small Files Transfer

Dawei Sun

China University of Geosciences

Shang Gao

Deakin University

Guangyan Zhang

Tsinghua University

Shimin Wu

China University of Geosciences

Abstract:Improving the transmission efficiency for small files over a wide area network is always challenging. Time may be wasted when waiting for transmission commands due to the design of transfer protocols, which in turn increases the Round-trip time (RTT). GridFTP is widely deployed as a transfer protocol in the grid era, where a concept of pipelining is proposed to improve the transmission efficiency for small files. Based on the GridFTP protocol, we design a smart data structure to classify files and propose a corresponding scheduling algorithm to tune the pipelining parameters, making them more reasonable and adaptive to different transmission scenarios. Bandwidth usage is optimized when a large number of small files are transferred with our strategy by combining the optimal pipelining and concurrency parameters. A method to optimizing the throughput for high-priority file transfer is also proposed. By adjusting the pipelining parameter dynamically, the throughput is increased by almost 10% compared with other methods. Moreover, our method achieves better performance even with a smaller concurrency setting. The favorable throughput is maintained when transferring highpriority files.

Presentation 3: Containers' Privacy and Data Protection via Runtime Scanning Methods

Francisco Rojo Rosales

Deakin University

Lei Pan

Deakin University

Abstract: Docker containers' privacy and data protection is a critical issue. Unfortunately, existing works overlook runtime scanning methods. This paper proposes a novel lightweight and rapid scanning model under a framework covering assertion techniques during the container's runtime. Our framework includes identifying vulnerability, scanning security exposures, conduct analysis, and call-back notifications to the requestor asynchronously. The empirical case studies demonstrate the capability of our scanning model, including standalone, CI/CD pipelines, and security containerized environment. In addition, the proposed scanning model is compared against other tools of similar and/or complementary objectives.

Session 2

Presentation 1: Digital Twin For Cybersecurity: Towards Enhancing Cyber Resilience

Lei Pan

Deakin University

Robin Doss

Deakin University

Shiva Pokhrel

Deakin University

Rajiv Faleiro

Deakin University

Abstract: Digital Twin (DT) impacts significantly to both industries and research. It has emerged as a promising technology enabling us to add value to our lives and society. DT enables us to virtualize any physical systems and observe real-time dynamics of their status, processes, and functions by using the data obtained from the physical counterpart. This paper attempts to explore a new direction to enhance cyber resilience in the perspective of cybersecurity and digital twins. We enumerate definitions of the Digital Twin concept to introduce readers to this disruptive concept. We then explore the existing literature to develop a holistic analysis of the DT's integration into cybersecurity. Our research questions develop a novel roadmap for future research validated by an extensive and systematic survey of recent works.

Presentation 2: Differential Privacy-based Permissioned Blockchain for Private Data Sharing in Industrial IoT

Muhammad Islam

Swinburne University of Technology

Jinjun Chen

Swinburne University of Technology

Mubashir Husain Rehmani

Munster Technological University

Abstract: Permissioned blockchain such as Hyperledger fabric enables a secure supply chain model in Industrial Internet of Things (IIoT) through multichannel and private data collection mechanisms. Sharing of Industrial data including private data exchange at every stage between supply chain partners helps to improve product quality, enable future forecast, and enhance management activities. However, the existing data sharing and querying mechanism in Hyperledger fabric is not suitable for supply chain environment in IIoT because the queries are evaluated on actual data stored on ledger which consists of sensitive information such as business secrets, and special discounts offered to retailers and individuals. To solve this problem, we propose a differential privacy-based permissioned blockchain using Hyperledger fabric to enable private data sharing in supply chain in

IIoT (DH-IIoT). We integrate differential privacy into the chaincode (smart contract) of Hyperledger fabric to achieve privacy preservation. As a result, the query response consists of perturbed data which protects the sensitive information in the ledger. We evaluate and compare our differential privacy integrated chaincode of Hyperledger fabric with the default chaincode setting of Hyperledger fabric for supply chain scenario. The results confirm that the proposed work maintains 96.15% of accuracy in the shared data while guarantees the protection of sensitive ledger's data.

Presentation 3:Efficient Privacy-Preserving User Matching with Intel SGX

| | |
|----------------|-----------------|
| Junwei Luo | RMIT University |
| Fengling Han | RMIT University |
| Andrei Kelarev | RMIT University |
| Xuechao Yang | RMIT University |
| Xun Yi | RMIT University |

Abstract:User matching is one of the most essential features that allows users to identify other people by comparing the attributes of their profiles and finding similarities. While this facility enables the exploration of friends in the same network, it poses serious security concerns over the privacy of the users as the prevalence of modern cloud computing services, companies outsource computational power to untrusted cloud service providers and confidential data of the users can be exposed as the data storage is transparent in the remote host server. Encryption can hide the user data, but it is difficult to compare the encrypted profiles. Solutions utilizing the homomorphic encryption can overcome such limitations, they incur significant performance overhead, which is impractical for large networks. To overcome these problems, we propose an efficient privacy-preserving user matching protocol with Intel SGX. Other techniques such as oblivious data structure and searchable encryption are deployed to resolve security issues that Intel SGX has suffered. Our construction relies on secure hardware which guarantees the integrity and confidentiality of the code execution, which enables the computation of similarities between the profiles of the users. Moreover, our protocol is designed to provide protection against several types of side-channel attacks. The security analysis and experimental results presented in this paper indicate that our protocol is efficient, secure and practical.

Session 3

Presentation 1:Developing an Online Examination Timetabling System Using Artificial Bee

Colony Algorithm in Higher Education

| | |
|--------------|---------------|
| Kaixiang Zhu | CQ University |
| Lily Li | CQ University |
| Michael Li | CQ University |

Abstract:Educational timetabling is a fundamental problem impacting schools and universities' effective operation in many aspects. Different priorities for constraints in different educational institutions result in the scarcity of universal approaches to the problems. Recently, COVID-19 crisis causes the transformation of traditional classroom teaching protocols, which challenge traditional educational timetabling. Especially for examination timetabling problems, as the major hard constraints change, such as unlimited room capacity, non-invigilator and diverse exam durations, the problem circumstance varies. Based on a scenario of a local university, this research proposes a conceptual model of the online examination timetabling problem and presents a conflict table for constraint handling. A modified Artificial Bee Colony algorithm is applied to the proposed

model. The proposed approach is simulated with a real case containing 16,246 exam items covering 9,366 students and 209 courses. The experimental results indicate that the proposed approach can satisfy every hard constraint and minimise the soft constraint violation. Compared to the traditional constraint programming method, the proposed approach is more effective and can provide more balanced solutions for the online examination timetabling problems.

Presentation 2:A Topology-Aware Scheduling Strategy for Distributed Stream Computing System

Dawei Sun

China University of Geosciences

Vinh Loi Chau

Deakin University

Bo Li

China University of Geosciences

Rajkumar Buyya

University of Melbourne

Abstract:Reducing latency has become the focus of task scheduling research in distributed big data stream computing systems. Currently, most task schedulers in big data stream computing systems mainly focus on tasks assignment and implicitly ignore task topology which can have significant impact on the latency and energy efficiency. This paper proposes a topology-aware scheduling strategy (named Ts-Stream) to reduce the processing latency of stream processing systems. We construct the data stream graph as a directed acyclic graph and then, divide it using the graph Laplace algorithm. On the divided graph, tasks will be assigned with a low-latency scheduling strategy. We also provide a computing node selection strategy, which enables the system to run tasks on the topology with the least number of computing nodes. Based on this scheduling strategy, the tasks of the data stream graph can be redistributed and the scheduling mechanism can be optimized to minimize the system latency. The experimental results demonstrate the efficiency and effectiveness of the proposed strategy.

Presentation 3:A Data Stream Prediction Strategy for Elastic Stream Computing Systems

Dawei Sun

China University of Geosciences

Atul Sajjanhar

Deakin University

Hanchu Zhang

China University of Geosciences

Rajkumar Buyya

University of Melbourne

Abstract:In a distributed stream processing system, elastic resource provisioning/scheduling is the main factor that affects system performance and limits system applications. However, in the data stream computing platform, resources are often insufficient due to the large fluctuations of the data stream rate, which creates a performance bottleneck for the cluster. In this paper, we propose a data stream prediction strategy (Dp-Stream) for elastic computing system to mitigate the resource allocation issue. First, we establish a BP neural network load forecasting model based on genetic simulated annealing algorithm to predict the trend of the data stream rate in the next time window of the cluster, second, according to the time delay, the estimation model adjusts the resources allocated to the key operations of the critical path in the DAG and finally, the resource communication cost is optimized. We evaluate the predicted load accuracy and system response time of the proposed scheduling strategy in Storm. The experimental results prove the feasibility and effectiveness of the proposed strategy.

Session 4

Presentation 1:Blockchain Enabled Integrity Protection for Bodycam Video

Michael Kerr

RMIT University

Fengling Han

RMIT University

Ron van Schyndel

RMIT University

Abstract:The prevalence of both documented incidents and anecdotal evidence perpetuate mistrust in video collected via Law Enforcement body worn recording devices. This paper examines the application of blockchain technology for the management of high volumes of video produced every day during the course of a police field officers' duties. We apply a comprehensive blockchain system developed specifically for law enforcement video collection to the body worn scenario and examine the protection level offered whilst considering the specific requirements and limitations of this mobile platform. Specific scenarios are examined and shown to offer a compelling level of assurance to mobile body worn video collection operations.

Presentation 2:Road Rage Recognition System Based on Face Detection Emotion

Qingxin Xia

North China Institute of Science and Technology

Jiakang Li

North China Institute of Science and Technology

Aoqi Dong

North China Institute of Science and Technology

Abstract:The drivers' anger caused by the influence of external environment leads to excessive aggressive driving behavior which brings great potential danger to traffic safety. This paper proposes a method using face recognition technology to design an emotional intelligence model of road rage with a high accuracy rate. Firstly, making a homemade emotion dataset of road rage according to the definition of road rage and labeling the information of road rage in the dataset. Secondly, using a sliding window combined with emotional intelligence scale to determine road rage emotion of drivers, so as to regulate driving behavior. Finally, the correctness and effectiveness of road anger emotional intelligence model were verified by the experimental scenes. It is of great practical significance to reduce the impact of road rage on road safety.

Presentation 3:A Drip Irrigation Remote Control System using 5G-IoT Technology

Chen Xue

Harbin Institute of Technology

Fan Bai

Harbin Institute of Technology

Yong Feng

Harbin Institute of Technology

Tianyu Liu

Harbin Institute of Technology

Abstract:Drip irrigation, a type of micro-irrigation system, has been applied in agriculture, forestry, and urban greening. In order to cut down the labor cost and improve agricultural efficiency, modern technology, such as communication methods, or computer science, has been used in drip irrigation for irrigating a wide area. The Internet of Things (IoT) used computing, intelligent mobiles, and mobile app to perform remote monitoring and control tasks. The 5G network is a new generation technology standard that is helpful to massive expand today's IoT technology. It can boost IoT security, privacy, network speed, and other network challenges simultaneously. This paper proposes a frame structure for a drip irrigation remote control system (DIRCS) using 5G-IoT technology and mobile app. The system can be operated by people who are anywhere in the world using a mobile device. The system consists of a water pump, a micro-controller unit(MCU), a WiFi module, and a relay. We

utilize IoT technology to realize data storage and sharing in the platform. Moreover, we design layered software architecture to the presented IoT platform as an alternative technique to manage all the systems. Therefore, the drip irrigation system can be controlled remotely to overcome the previous problems like distance problem, range problem. The prototype demonstrates the effectiveness and efficiency of the design in the result.

Session 5

Presentation 1:Multipath QUIC-Directions of the Improvements

Michal Morawski

Lodz University of Technology

Abstract:The multipath transmission becomes the recognized alternative for traditional Quality of Service architectures. Recently, the multipath version of TCP protocol and its modern replacement – QUIC – has been proposed. The paper presents the dynamic properties of the data transfer between physical systems, engaging the multipath version of QUIC protocol (MPQUIC) which inherits the properties of its predecessors. The advantages and weaknesses of the transmission are emphasized and compared to the singlepath QUIC. While QUIC is designed to convey HTTP traffic, in the paper, general-purpose networking is investigated. Based on the measurements, the use recommendations are given together with the directions of improvements.

Presentation 2:Horizontal Distance Attenuation-based Elliptical Weighting Model Combining with the Tikhonov-p-norm for Image Reconstruction in Radio Tomographic Imaging

Hua Zhu

Henan University of Technology

Zhen Shi

Henan University of Technology

Dong Yang

Henan University of Technology

Abstract:To reconstruct the target-induced attenuation image keeping consistent with the observed measurement data, this paper explores the use of a new horizontal distance attenuation-based elliptical weighting model in building an attenuation image, where a horizontal distance attenuation factor and a vertical distance attenuation factor are introduced, respectively, which is able to clear the difference of the voxel weightings perpendicular to the line-of-sight (LOS) direction, as well as the difference of the voxel weightings parallel to the LOS direction. Compared with the existing model, the proposed model can additively reflect the occlusion effect of the radio frequency signal when the target is close to the transceiver nodes. Besides, the Tikhonov- ℓ_p -norm regularization is incorporated into the image reconstruction, which makes full use of the sparse ability of the ℓ_p -norm ($0 < p < 1$) to further reduce the noise interference. The experimental studies on indoor and outdoor scenarios with radio tomographic imaging are presented to validate the effectiveness of the proposed approach.

哈尔滨工业大学分会场口头报告（线上+线下）

分论坛 1: 5G-Enabled Smart Building: Technology and Challenge

5G 技术助力智慧建筑：技术与挑战

分论坛主持人 **Session Chair:** 薛宸, 张伟琦

学生活动中心 216

Presentation 1: Accurate Estimation on the State-of-Charge of Lithium-ion Battery Packs

Mengying Chen

RMIT University

Fengling Han

RMIT University

Long Shi

RMIT University

Yong Feng

Harbin Institute of Technology

Chen Xue

Harbin Institute of Technology

Chaojie Li

The University of New South Wales

Abstract: Lithium-ion batteries have been extensively used worldwide for energy storage and supply in electric vehicles and other devices. An accurate estimation of their state-of-charge (SoC) is essential to ensure their safety and protect them from the explosion caused by overcharge. Large amounts of training data are required for SoC estimation resulting in a great computational burden. Model-based observation method can effectively estimate battery SoC with a limited amount of data. This study applied a combined model, including a one-state hysteresis model and a resistor-capacitor (RC) model, to diminish the parameter estimation errors caused by the hysteresis phenomenon, increasing the estimation accuracy. The Luenberger observer was designed based on the hysteresis RC battery model and evaluated under dynamic stress test (DST) and federal urban driving schedule (FUDS). Our simulation results have shown that the hysteresis RC model has better performance in terms of SoC estimation accuracy using Luenberger observer. Additionally, after the investigation of communication technologies, 5G cellular network offers feasibility for real-time vehicle interaction.

Presentation 2: Fire Simulation and Optimal Evaluation Based on BIM Technology

Zhanzeng Li

China Architectural Design & Research Group

Yingying Li

The Architectural Design and Research Institute of HIT

Yang Ge

Harbin Institute of Technology

Yanmin Wang

Harbin Institute of Technology

Abstract: In order to solve the problem of fire inducing and spread process with complex characteristics, this paper proposes a novel approach to realize fire dynamic simulation and evacuation optimization. Focusing on the inducing factors and spread, a fire source heat release rate and combustion model is established based on BIM technology. And the evacuation settings and building environment are further concluded for the accurate dynamic simulation. For the evacuation optimization, the time of different evacuation path corresponding to specific evacuation exit is calculated and compared to achieve the optimal choice of the path in the case of building fire with complex environment.

Presentation 3: Calculation and Numerical Simulation of Building Integrated Photovoltaic System Based on BIM Technology

Yinghao Gan

East University of Heilongjiang,

Haoran Cai

Harbin Institute of Technology

Xiaofeng Liu

The Architectural Design and Research Institute of HIT

Yanmin Wang

Harbin Institute of Technology

Abstract: With the development of photovoltaic technology, the number of building integrated photo-voltaic (BIPV) systems is increasing. Differing from the traditional design of BIPV systems based on the experience of experts, which suffers from high cost and non-maximum efficiency of equipments due to the information lack of buildings, this paper proposes a novel calculation approach based on building information modeling (BIM) technology. Taking a BIPV building located in Sanya, China as a example, the modelling process is given, which description is 1:1 to the real system. Besides, the geographic information attribute of Sanya and the thermal radiation of the building are considered, respectively. Numerical simulation validates the effectiveness of the proposed approach with advantages of high-accuracy and practicability.

Presentation 4: Discrete Sliding Mode Control of PMSM with Network Transmission

Xin Hui

Harbin Institute of Technology

Yingying Li

The Architectural Design and Research Institute of HIT

Jian Cui

Harbin Institute of Technology

Mingyang Yang

Harbin Institute of Technology

Yanmin Wang

Harbin Institute of Technology

Abstract: In this paper, a novel discrete full-order terminal sliding mode (FTSM) control approach is proposed for a permanent magnet synchronous motor (PMSM) working in network transmission environment. By utilizing the vector control technology, the decoupled model of PMSM with the structure of double closed loop can be deduced. The discretization influence of network transmission is specially investigated by comparing the control performances in continuous domain and discrete domain, following the guaranteed stability condition when working in network transmission environment. In order to simulate the network transmission environment, a test platform based on OPC technology is established. Simulations validate the proposed approach.

Presentation 5: Smart Medical and Nursing Platform Based on 5G Technology

Xiaofeng Liu

The Architectural Design and Research Institute of HIT

Ning Li

The Architectural Design and Research Institute of HIT

Yuchen Liu

Harbin Institute of Technology

Yujia He

Harbin Institute of Technology

Abstract: In order to solve the problem of aging population and to relieve the massive impact on the pension service system, a design scheme of smart medical and nursing platform based on 5G technology is proposed. The model of participants and services related to the medical and nursing systems are established. Based on the information flow in the process of service, the intelligent vital signs monitoring system, pension service management system and decision-making system are introduced into the design of the smart medical and nursing platform. Specially, by utilizing 5G technology, the health information of the elderly, disease early warning and

implementation of pension scheme are guaranteed by the perception layer, network layer and application layer, respectively. The proposed scheme can benefit the elderly health records, personalized pension plan, telemedicine diagnosis, etc.

分论坛 2: 5G:The Advances in Industry

5G 技术赋能工业发展

分论坛主持人 **Session Chair:** 李光先, 段广鑫

学生活动中心 216

Presentation 1:Rate-compatible Shortened Polar Codes Based on RM Code-aided

Chunjie Li

Guangxi University

Haiqiang Chen

Guangxi University

Zelin Wang

Guangxi University

Youming Sun

Guangxi University

Xiangcheng Li

Guangxi University

Abstract:The minimum Hamming distance is not considered for the traditional rate-compatible shortened polar (RCSP) codes, which may cause performance degradations. In this paper we propose a hybrid algorithm to construct RCSP codes based on Reed-Muller(RM) code-aided. The shortened bits and pre-frozen bits are jointly designed by the row weight property of the common generator matrix G_N for the RM/Polar code. First, the selected shortened bits are guaranteed to be uniquely depended upon the pre-frozen bits, which makes them completely be known by the decoder. Second, the proposed construction method is designed in such way, so that the minimum row weight of G_N can be maximized. More specifically, when multiple candidate positions satisfy the conditions (weight-1 column constraint), those rows having less weights are deleted to form the shortened/pre-frozen bits, which can reduce the number of rows with small weight and naturally, make the resulting RCSP codes have larger minimum Hamming distance in average. Simulation results show that the proposed RCSP codes perform better than the traditional shortened codes at low code rates. While at high code rates, the proposed RCSP codes can achieve better performance than that of the quasi uniform punctured (QUP) polar codes, especially at large signal-to-noise ratio (SNR) region. The proposed RCSP codes can find applications in future communications, such as the beyond 5th generation (B5G) and 6th generation(6G) systems.

Presentation 2:Research on Wheat Impurity Image Recognition Based on Convolutional Neural network

Hua Zhu

Henan University of Technology

Tian Miao

Henan University of Technology

Abstract:The doping rate is one of the important indexes to evaluate the quality grade and price of wheat. In order to accurately and quickly recognize impurities (wheat husk) in wheat grains, images of doped wheat were collected and Convolutional Neural Network (CNN) was used to realize the classification and recognition of grains and impurities in wheat grains. In this study, image segmentation and image enhancement were used to preprocess the acquired images to establish the image database of wheat grains and impurities. According to the characteristics of image data, the classic CNN, VGGNet and ResNet network models for wheat impurity images recognition were established. Simulation analysis shows that, compared with the classical CNN and VGGNet

network models, the ResNet network model has the best recognition performance. The recognition accuracy of the test set is 96.94%, the recognition time is 5.60ms.

Presentation 3:Based on Energy Router Energy Management Control Strategy in Micro-grid

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|------------------|--------------------------------|
| Xuemei Zheng | Harbin Institute of Technology |
| Zhongshuai Zhang | Harbin Institute of Technology |
| Haoyu Li | Harbin Institute of Technology |
| Yong Feng | Harbin Institute of Technology |

Abstract:As the key part of the Energy Internet (EI), the energy router (ER) needs to achieve the purpose of distribution and balance of power, making the entire power system more safe and stable. This paper proposes several energy management strategies for ER. Photovoltaic array is used as the basic power generation unit, wind power is used as the auxiliary unit, and energy storage unit realized the power balance through charging and recharging. At the same time, the maximum power tracking control and constant power of the photovoltaic power generation system and the wind power generation system are carried out, respectively. At last, simulation and control strategy are verified in the MATLAB simulation platform. The simulation results show the proposed management is effective and correct.

Presentation 4:Time-Domain Predictable Trajectory Planning for Autonomous Driving Based on Internet of Vehicles

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| Qiuxin Song | Changchun University of Technology |
| Haolin Li | State Grid Baishan Power Supply Company |
| Zonghao Li | Changchun University of Technology |
| Niaona Zhang | Changchun University of Technology |
| Jiasen Xu | Changchun University of Technology |

Abstract:For the polynomial lane changing method, the lane-changing trajectory is planned only at the initial time, and it cannot cope with the problem that other traffic participants enter the driving environment during the lane-changing process. This paper decomposes the polynomial lane changing method into lateral displacement planning and longitudinal velocity planning. The Pontryagin minimum principle is used to solve the optimal lane change duration meeting the requirements of different driving conditions, and the polynomial method is used to plan the lateral displacement trajectory. In the longitudinal direction, the variable acceleration motion equation is used to describe the trajectory, so as to establish a prediction model, the real-time driving environment information is obtained through the internet of vehicles to realize the speed rolling optimization, the trajectory dynamic planning is carried out during the driving process, and the slack variable is introduced to solve the problem that the vehicle suddenly increases speed beyond the constraint range. Through Matlab/Simulink and Prescan co-simulation verification, the planned trajectory meets the requirements of comfort and lane changing efficiency, has better evasion ability for other traffic participants and is easy to follow in real vehicles.

Presentation 5:Connected Autonomous Vehicle Platoon Control through Multi-Agent Deep Reinforcement Learning

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| Guangfei Xu | Shangdong University of Technology |
| Bing Chen | Bentron Information Technology Co. Ltd |

Guangxian Li
Xiangkun He

Guangxi University
Nanyang Technological University

Abstract:The rise of the artificial intelligence (AI) brings golden opportunity to accelerate the development of the intelligent transportation system (ITS). The platoon control of connected autonomous vehicle (CAV) as the key technology exhibits superior for improving traffic system. However, there still exist some challenges in multi-objective platoon control and multi-agent interaction. Therefore, this paper proposed a connected autonomous vehicle latoon control approach with multi-agent deep reinforcement learning (MADRL). Finally, the results in stochastic mixed traffic flow based on SUMO (simulation of urban mobility) platform demonstrate that the proposed method is feasible, effective and advanced.

Presentation 6:ARTI:One New Adaptive Elliptical Weighting Model Combining with the Tikhonov- ℓ_p -norm for Image Reconstruction

Chunhua Zhu
Zhen Shi
Weidong Yang

Henan University of Technology
Henan University of Technology
Henan University of Technology

Abstract:To reconstruct the target-induced attenuation image keeping consistent with the observed measurement data, this paper explores the use of a new horizontal distance attenuation-based elliptical weighting model in building an attenuation image, where a horizontal distance attenuation factor and a vertical distance attenuation factor are introduced, respectively, which is able to clear the difference of the voxel weightings perpendicular to the line-of-sight (LOS) direction, as well as the difference of the voxel weightings parallel to the LOS direction. Compared with the existing model, the proposed model can additively reflect the occlusion effect of the radio frequency signal when the target is close to the transceiver nodes. Besides, the Tikhonov- ℓ_p -norm regularization is incorporated into the image reconstruction, which makes full use of the sparse ability of the ℓ_p -norm ($0 < p < 1$) to further reduce the noise interference. The experimental studies on indoor and outdoor scenarios with radio tomographic imaging are presented to validate the effectiveness of the proposed approach.

Presentation 7:Remote Education via 5G-based High-Resolution Video System

Bing Chen

Shenzhen Bentron Information Technology Co. Ltd

Abstract:With the development of telecommunication and networks, 5G will bring much more than just boost your speed of internet. The products of Bentron Pty Ltd are high-resolution communication terminals, which aims to provide high quality service for remote education. With the application of the 5G-based 4K/8K video system, students can enjoy a flexible teach-and-learning style, ignoring the burden of traffic and distance. The devices allow the controlling of cameras and screens, both teacher/lectures and students can change their view and focus on what they are interested in remotely without any perveivable delay. Also, the detailed information on the blackboard on the teachers' side or on the textbook on the students' side can be viewed in time. All of these advances are fulfilled with the high-resolution communication terminal working in the 5G environment.

Presentation 8:Advances of Manufacturing in the Age of 5G Telecommunication

Wencheng Pan

University of Huddersfield

Abstract:The development of 5G not only boost the speed of the networks, but also stimulate the upgrade of manufacturing engineering and industry. The fast-speed transmission of large amount of data under 5G networks makes the controlling of the machine tools and devices precisely and more reliable. Digital twins of the manufacturing system and the agile manufacturing based on the internet of things (IoT) will be the key breakthrough for the manufacturing activities in the age of 5G. Also, with the development of artificial intelligence, the group control of the machining among different machine tools will be available with the assistant of 5G networks, which will significantly boost the productivity and efficiency.