东南大学国际暑期学校

智能与先进控制

开课院系：自动化学院

开课时间：2022 7.5~8.8

1. 项目介绍

1.1 项目主题：智能与先进控制国际暑期学校

SEU International Summer School on Intelligence and Advanced Control

1.2 开课院系：自动化学院

School of Automation

1.3 项目简介：

自动化学院 2022 年智能与先进控制国际暑期学校，针对自动化及机器人专业开设全英文专业课程，包括数据挖掘（1.5 学分）、实时优化与先进控制（1.5）、网络与信息编程（1 学分）。在教授专业知识的基础上，结合相关方向的研究进展进行教学扩展，邀请国际权威知名学者开展学术讲座。此外，还与海内外一流高校及知名企业的研究学者共建“云 Lab”开展“云实习”，共同指导暑期实习学生开展科研课题。暑期学校不仅面向本专业本科学生，还开放课程和资源，接收了其他专业、其他院校的学生选课和旁听或申请科研实习训练。

The School of Automation has conducted the 2022 International Summer School on Intelligence and Advanced Control. Aiming at the undergraduate programs of automation and robotics, three courses are offered by teaching in English completely, which are *Data Mining* (1.5 credits), Real-Time *Optimization and Advanced Control* (1.5 credits), and *Network and Information Programming* (1 credit). As the expansion learning of these courses, five world-class scholars in the areas of control science, artificial intelligence and robotics are invited to give academic lectures on the frontiers of these areas. In addition, "Cloud Labs" are built with researchers from top universities and famous enterprises from China and abroad, which offer "Cloud Internships" opportunities for students to do short-term research projects under joint instruction. The summer school is not only for the undergraduate students of SEU School of Automation, but also opens courses and resources to the students from other schools or other universities.

2. 课程介绍

2.1 Data mining 数据挖掘

This course provides the overall principle of data mining technology, reviews the main applications of data mining and discusses the hot research topics in this field. Some extension contents are presented in the lectures to state the applications of the data processing methods in automatic control and intelligent systems.

2.1.1 课程目标

After the course, students can:

1) grasp the techniques of data pre-processing, including the understanding of data types, data quality, and data, similarity and similarity measures;
2) Grasp the techniques of data classification and prediction, including the basic concepts of classification, decision trees and models, and other classification techniques;
3) Grasp the basic concepts and algorithms for correlation analysis;
4) Grasp the basic concepts and techniques of clustering analysis, including the K means, aggregate hierarchical clustering, DBSCAN algorithm and etc.

2.1.2 教学日历

Date	Sections	Hours	Contents	Teaching Place
8. 23	2-5	4	Basic principle, process and tasks of data mining	腾讯会议：95377519663
8. 24	2-5	4	Data structure and data transformation	腾讯会议：95377519663
8. 26	2-5	4	Data source and some platforms for the big data	腾讯会议：95377519663
8. 28	2-5	4	Supervised learning process and data classification	腾讯会议：95377519663
8. 29	2-5	4	Unsupervised learning process and data clustering	腾讯会议：95377519663
8. 30	2-5	4	Algorithms about data	腾讯会议：

			clustering	95377519663
9. 02	2-5	4	Algorithms and applications of association rule mining	腾讯会议：95377519663
9. 04	2-5	4	Data mining algorithms in artificial intelligence and machine learning	腾讯会议：95377519663

2.1.3 外教介绍

Prof. Hai Wang,
Saint Mary's University, Canada

汪海教授现为加拿大圣玛丽大学商学院金融信息系统管理科学系正教授（终身教授）。他至今发表了超过 80 篇学术期刊论文、5 本专著与教科书，荣获了 7 项加拿大国家自然科学与工程研究基金项目、1 项加拿大国家社会科学和人文研究基金项目、美国 Decision Sciences Institute 和 Alpha Iota Delta 颁发的 2011 年度最佳教学论文奖。汪海的主要研究方向包括大数据，商业分析学，商务智能，数据管理，数据挖掘，机器学习，知识管理。

Prof. Hai Wang is a tenured professor in the Department of Finance, Information Systems and Management Science, Sobey School of Business, Saint Mary's University, Canada. He has published more than 80 journal papers, 5 monographs and textbooks, and has won 7 Canadian National Natural Science and Engineering Research Fund Projects, 1 Canadian National Social Science and Humanities Research Fund Project, and the 2011 Best Teaching Paper Award by Alpha Iota delta in the United States. Hai Wang's research areas include Big Data, Business Analytics, Business Intelligence, Data Management, Data Mining, Machine Learning and Knowledge Management.

2. 2 Real-time optimization and advanced control

实时优化与先进控制

This course provides appropriate principles and methods to enable the designed system to be self-adaptive to changing environment. The fundamental theory and methods of model predictive control and intelligent optimization are introduced to solve the automation concerned complex problems.

2.2.1 课程目标

After the course, students can

1) Have a good understanding on the characteristics of complex systems, and the concept, principle, and algorithms of model predictive control.
2) Have a general understanding on the necessity and significance of developing advances control methodologies.
3) Have a good understanding on intelligent optimization methods and their implementation using MATLAB.
4) Have general knowledge of the applications of advanced control and optimization techniques into practical problems.
5) Have transferable skills of literature reviews, critical thinking and course work writing.

2.2.2 教学日历

Date	Sections	Hours	Contents	Teaching Place
8. 8	6-9	4	Course Overview, Concepts and Principle of Model Predictive Control	Online
8. 11	2-5	4	System Prediction, Control System Optimization	Online
8. 12	2-5	4	Receding Horizon Control	Online
8. 12	10-13	4	Observer design and implementation, Predictive Control based on State Estimation, Overview of Intelligent Optimization Algorithms	Online
8. 22	6-9	4	The Basic Concept of Constraint Control, Quadratic Programming 1, Seminar on Intelligent Optimization Algorithm and Its Application I	Sipailou Zhongshan 414
8. 25	2-5	4	Quadratic Programming 2, Seminar on Intelligent Optimization Algorithm and Its Application II	Sipailou Zhongshan 414

8. 29	6-9	4	Constrainted Model Predictive Control, Seminar on Intelligent Optimization Algorithm and Its Application III	Sipailou Zhongshan 414
9. 1	2-5	4	Continuous-time Predictive Control, Seminar on Intelligent Optimization Algorithm and Its Application IV	Sipailou Zhongshan 414

2.2.3 教师介绍

Prof. Xiaokai Nie,
Southeast Univeristy, China

聂晓凯博士毕业于英国谢菲尔德大学自动控制与系统工程系，获自动控制与系统工程专业博士学位，后分别在英国华威大学、利兹大学从事博士后，在曼彻斯特大学任职研究员，负责和承担了多项英国国家级科研项目。现任职于东南大学自动化学院，获得江苏省“双创博士”及南京市留学人员科技创新项目择优资助。研究方向包括非线性动态系统辨识与控制。

Prof Nie Xiaokai obtained his PhD degree from the Department of Automatic Control and Systems Engineering of the University of Sheffield in the UK. After that, he worked as a Research Fellow at the University of Warwick, and the University of Leeds subsequently, and then moved to the University of Manchester as a research scientist. He is now an associate professor at the School of Automation, Southeast University. Dr Nie's research interests include nonlinear dynamic system identification and control.

2. 3 Network and information programming

网络与信息编程

This course will teach the basic tools of network programming such as HTML, ASP.net, JavaScript, etc. Students will be required to complete the design and programming of a small and medium-scaled network system. The programming ability will be great improved through practical projects of site construction, etc.

2.3.1 课程目标

After the course, students can：

1) Grasp the basic techniques of Web programming, including the Web site structure and HTTP protocol.
2) Grasp the tools and programming of HTML, JavaScript, VBScript, C# and etc.
3) Grasp the design and programming for ASP and ASP.net.
4) Grasp the basic concepts and techniques of database access.

2.3.2 教学日历

Date	Sections	Hours	Contents	Teaching Place
8. 08	2-5	4	Principle of model predictive control	Online
8. 11	2-5	4	System prediction and control system optimization	Online
8. 15	2-5	4	Receding horizon control and closed-loop control system	Online
8. 18	2-5	4	Design and implementation of observer	Online
8. 22	2-5	4	Predictive control based on state estimation	Online
8. 25	2-5	4	Fundamental concepts of constrained optimization	Online
8. 29	2-5	4	Quadratic programming algorithms	Online
9. 01	2-5	4	Model predictive control with constrained variables	Online

2.3.3 外教介绍

Prof. Hai Wang,
Saint Mary's University, Canada

汪海教授现为加拿大圣玛丽大学商学院金融信息系统管理科学系正教授（终身教授）。他至今发表了超过 80 篇学术期刊论文、5 本专著与教科书，荣获了 7 项加拿大国家自然科学与工程研究基金项目、1 项加拿大国家社会科学和人文研究基金项目、美国 Decision Sciences Institute 和 Alpha Iota Delta 颁发的 2011 年度最佳教学论文奖。汪海的主要研究方向包括大数据，商业分析学，商务智能，数据管理，数据挖掘，机器学习，知识管理。

Prof. Hai Wang is a tenured professor in the Department of Finance, Information Systems and Management Science, Sobey School of Business, Saint Mary's University, Canada. He has published more than 80 journal papers, 5 monographs and textbooks, and has won 7 Canadian National Natural Science and Engineering Research Fund Projects, 1 Canadian National Social Science and Humanities Research Fund Project, and the 2011 Best Teaching Paper Award by Alpha Iota delta in the United States. Hai Wang's research areas include Big Data, Business Analytics, Business Intelligence, Data Management, Data Mining, Machine Learning and Knowledge Management.

3. 学术报告

暑期学校期间，我们按照原计划举办了四场报告，听众都在百人以上，鉴于同学们及国外导师的交流热情，我们又临时补加了一场报告。

报告 1：

方飞，卡内基梅隆大学，计算机学院软件研究所助理教授

方飞于清华大学获得学士学位，美国南加州大学计算机科学系获得博士学位。在加入 CMU 之前，她是哈佛大学的博士后研究员，师从 David Parkes 和 Barbara Grosz。她曾获得 William F. Ballhaus, Jr. 研究生工程研究卓越奖、IJCAI'15 计算可持续发展领域的杰出论文奖、IAAI'16 的创新应用奖、IFAAMAS-16 Victor Lesser 杰出论文奖亚军、IJCAI-ECAI'18 杰出论文、AAAI'21 最佳论文亚军。她被提名为 2020 年 IEEE Intelligent Systems 的 “AI ‘s 10 to watch”， 是 IJCAI-21 计算机与思想奖的获得者，并于 2021 年获得 NSF CAREER AWARD，于 2022 年获得斯隆研究奖。她的研究领域是人工智能和多智能体系统，专注于将机器学习与博弈论相结合，其研究工作已经在安全和可持续发展领域得以应用，在 AI for Social Good 主题下做出诸多贡献。

报告题目：

Challenges in Machine Learning and Game Theory for Social Impact

报告摘要：

Many real-world challenges we face involve multiple self-interested decision-makers who interact with each other in an environment full of uncertainty. This talk covers our work on machine learning and game theory that can be used to tackle such challenges in security, environmental sustainability, and food security domains. One of our early works has been

deployed by the US Coast Guard for protecting the Staten Island Ferry in New York City since April 2013. Another work has led to the deployment of PAWS (Protection Assistant for Wildlife Security) in multiple conservation areas around the world, which provides predictive and prescriptive analysis for anti-poaching efforts. In addition, our recent work has been used by 412 Food Rescue, a non-profit volunteer-based food rescue platform to improve their operational efficiency. The talk will also cover some of our attempts in addressing the fundamental challenges at the intersection of machine learning and game theory.

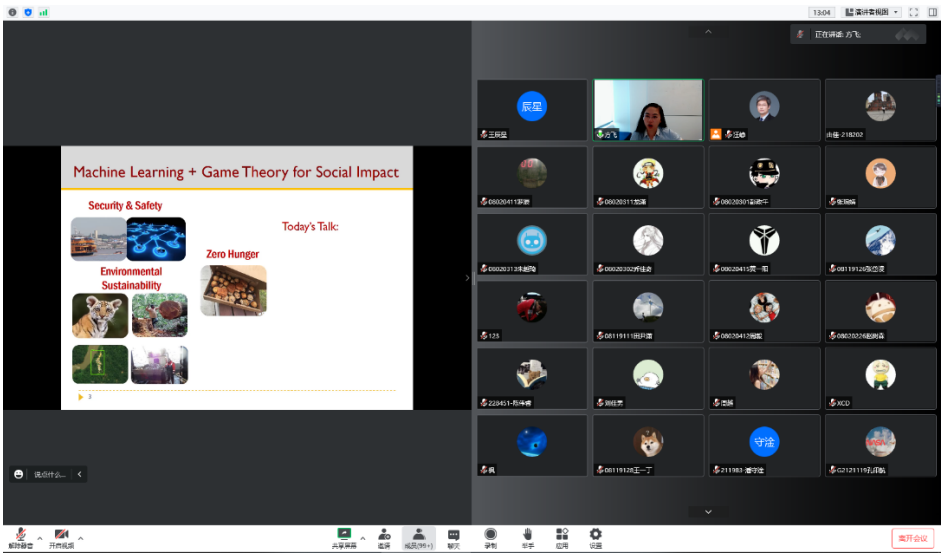
报告时间：

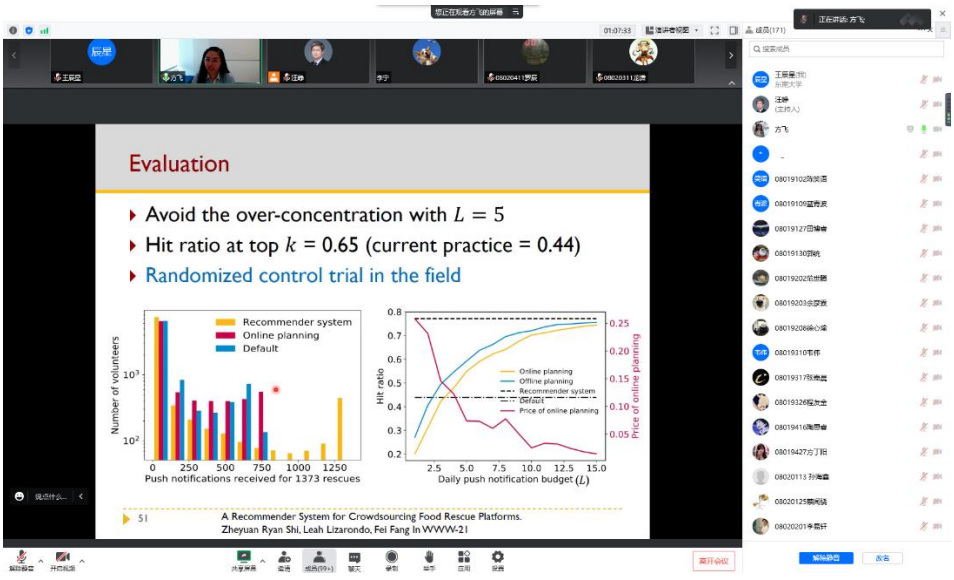
2022 年 8 月 10 日晚 9：00

报告方式：

线上，腾讯会议号：676 311 265

报告现场：





报告 2：

Christos G. Cassandras
波士顿大学，电气与计算机工程学院教授

Christos Cassandras 分别在耶鲁大学、斯坦福大学和哈佛大学获得学士、硕士和博士学位，目前是电气与计算机工程学院教授，系统工程系主任，是波士顿大学信息系统工程（CISE）中心的创始人，被评为波士顿大学工程学院杰出教授。他主要从事离散事件和混合系统、联合控制、随机优化和系统仿真等领域的研究工作，在这些领域发表了大量论文，出版六本书。曾担任 IEEE Transactions on Automatic Control 的主编和 IEEE Control Systems Society 主席。他是 IEEE Fellow 和 IFAC Fellow，获得多个奖项，包括 2011 IEEE 控制系统技术奖、CSS 杰出成员奖、1999 Harold Chestnut 奖、2014 BU 工程杰出学者奖等。

报告题目：

An Introduction to Cyber-physical System

报告摘要：

Cyber-Physical Systems (CPS) combine physical components governed by time-driven dynamics and computer-based components with event-driven dynamics. They are an instance of the class of hybrid dynamic systems. We will start by providing the motivation for CPS, examples we encounter in everyday life, and then overview the main technical challenges when one formulates control and optimization problems in a unifying multi-agent network system framework. We will then concentrate on Smart Cities viewed as CPS and, in particular, the development of autonomous driving through Connected Automated Vehicles (CAVs). The “Internet of Cars” refers to the CPS consisting of CAVs whose ultimate goal includes automating all aspects of mobility. A decentralized optimal control framework will be presented to show how CAVs can operate to achieve the goals of guaranteeing safety requirements, reducing congestion and energy consumption, and ensuring passenger comfort. We will also discuss the role of learning and AI in addressing these challenging problems.

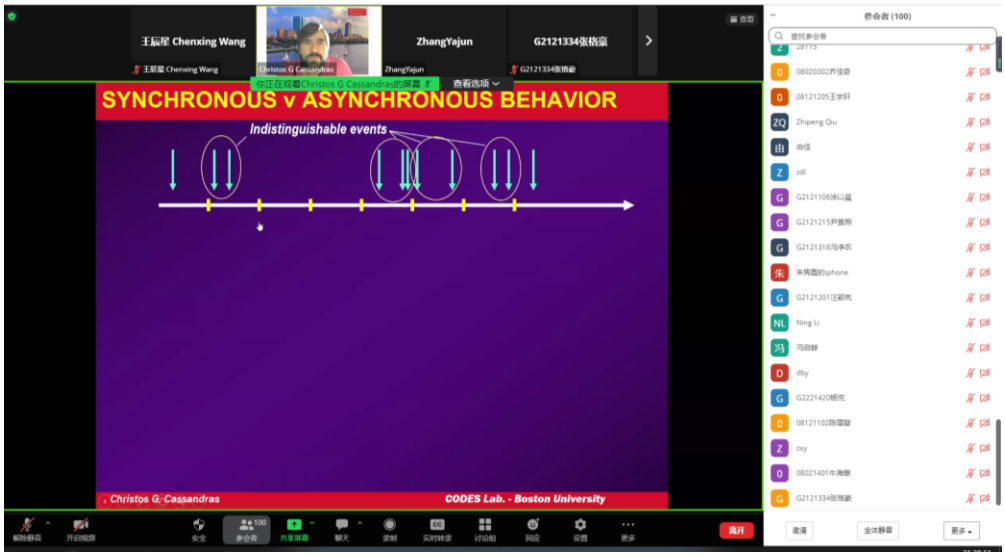
报告时间：

2022 年 8 月 12 日晚 9：00

报告方式：ZOOM 线上

浏览器 https://ntu-sg.zoom.us/j/87841050436

报告现场：



报告 3：

Danica Kragic Jensfelt

瑞典皇家理工学院，计算机科学与通信学院教授

Danica Kragic 是 KTH 皇家理工学院计算机科学与通信学院的教授，自治系统中心的主任，IEEE Fellow。她于 2001 年获得 KTH 计算机科学博士学位，曾在哥伦比亚大学、约翰霍普金斯大学、布朗大学和 INRIA Rennes 担任访问研究员。她是瑞典皇家科学院、瑞典皇家工程科学院和瑞典青年科学院的成员，担任 IEEE RAS 计算机和机器人视觉技术委员会主席，并担任 IEEE RAS AdCom 成员。Danica 获得了 2007 年 IEEE 机器人与自动化学会早期

学术生涯奖，其研究得到了欧盟、Knut 和 Alice Wallenberg 基金会、瑞典战略研究基金会和瑞典研究委员会的支持，是 ERC 启动和高级资助的获得者。她的研究领域是机器人、计算机视觉和机器学习。

报告题目：Representation learning in robotics

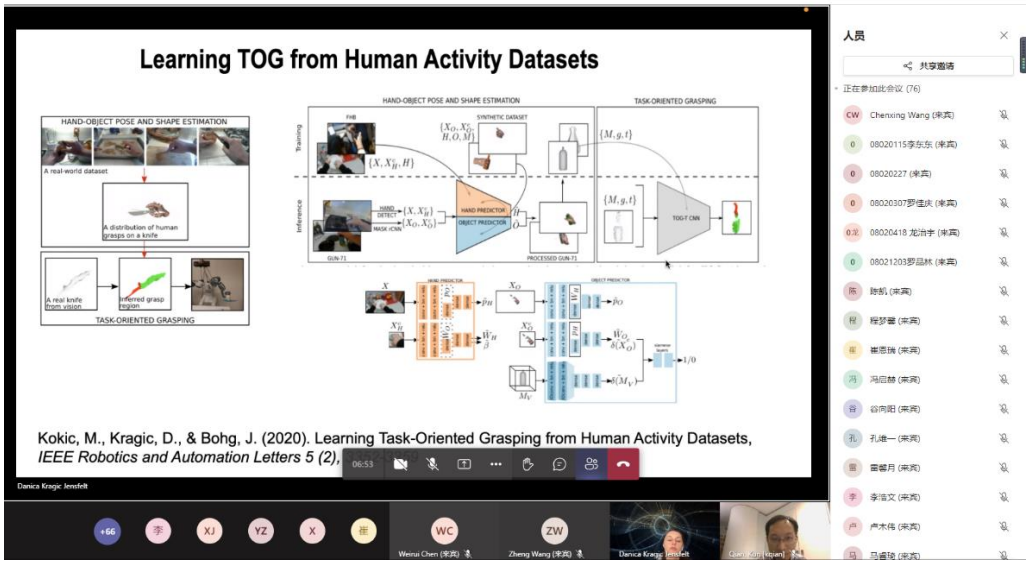
报告摘要：

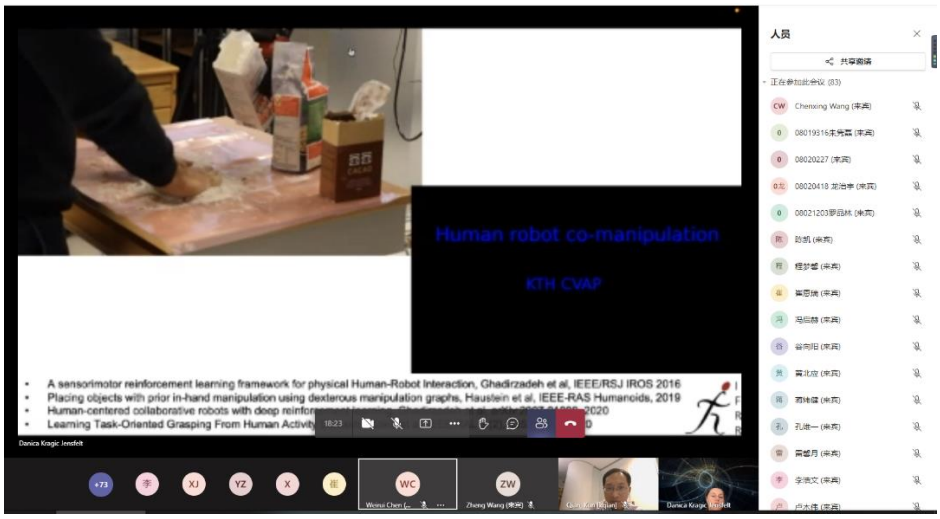
All day long, our fingers touch, grasp and move objects in various media such as air, water, oil. We do this almost effortlessly – it feels like we do not spend time planning and reflecting over what our hands and fingers do or how the continuous integration of various sensory modalities such as vision, touch, proprioception, hearing help us to outperform any other biological system in the variety of the interaction tasks that we can execute. Largely overlooked, and perhaps most fascinating is the ease with which we perform these interactions resulting in a belief that these are also easy to accomplish in artificial systems such as robots. When interacting with objects, the robot needs to consider various objects' properties. The focus in our work is on physical interaction with deformable objects using multimodal feedback, generative models and address stability in contact rich tasks. In this talk, we will focus on how to create new informative and compact representations of deformable objects that incorporate both analytical and learning-based approaches. We will do this in the context of challenging multimodal, bimanual object interaction tasks.

报告时间：2022 年 8 月 **17** 日晚 **8**：00

报告方式：线上。TEAMS 会议号：347 564 473 323，密码：PBegqj

报告现场：





报告 4：

Alessandro Astolfi
帝国理工学院，电气与电子工程学院教授

Alessandro Astolfi 教授于意大利罗马大学获得学士学位，苏黎世联邦理工学院获得硕士学位和博士学位。他是 IEEE Fellow 和 IEEE Transactions on Automatic Control 的主编，曾获得 IEEE TAC 最佳论文奖、IEEE CSS 杰出会员奖等。他的研究方向包括非线性控制理论、混合控制系统、电力控制系统等。

报告题目：

Trends in Nonlinear Control

报告摘要：

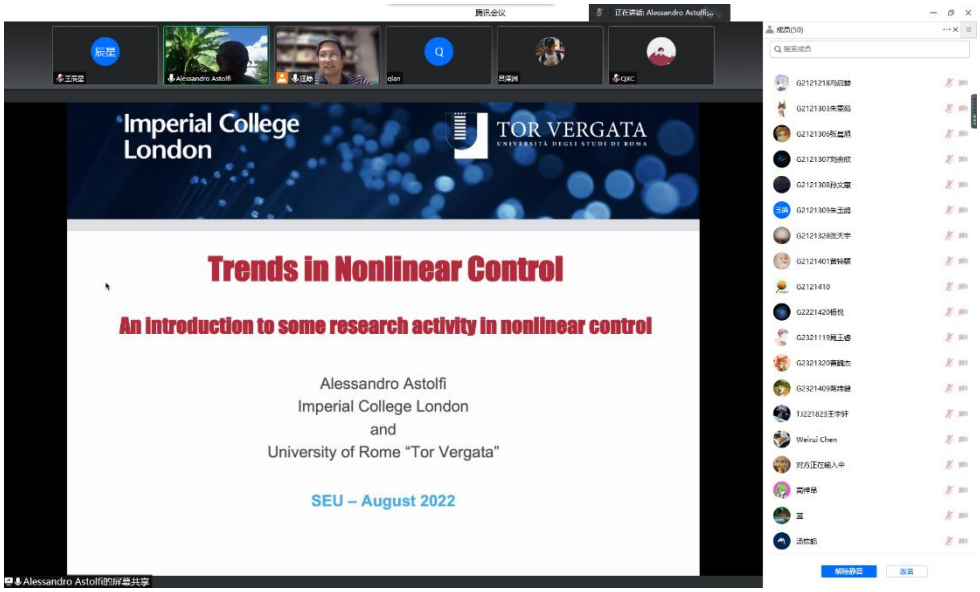
This seminar discusses a few areas in which the use of advanced control ideas and tools allow to solve complex theoretical and technological problems. These includes illustrating the use of energy based control for microsurgery; discussing model reduction methods for nonlinear systems; presenting novel curse-of-dimensionality free methods for the solution of optimal control problems; the study of complex neuronal systems; the definition of a new graph- based small gain theorem; and the study of Hamiltonian systems in a sampled-data setting.

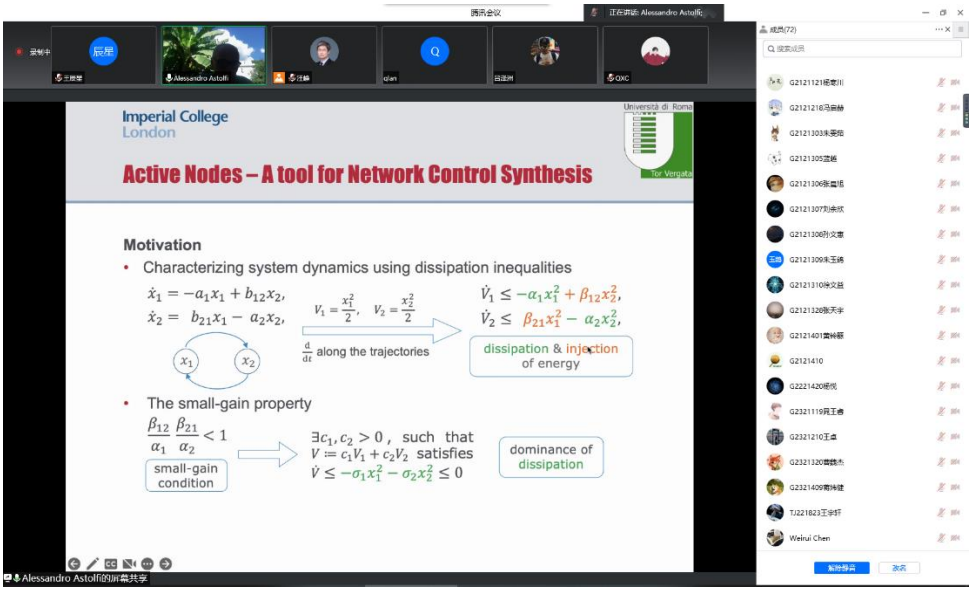
报告时间：2022 年 8 月 **22** 日晚 **8**：00

报告方式：

腾讯会议：252-149-824

报告现场：





报告 5：

韩波
香港浸会大学，计算机系助理教授

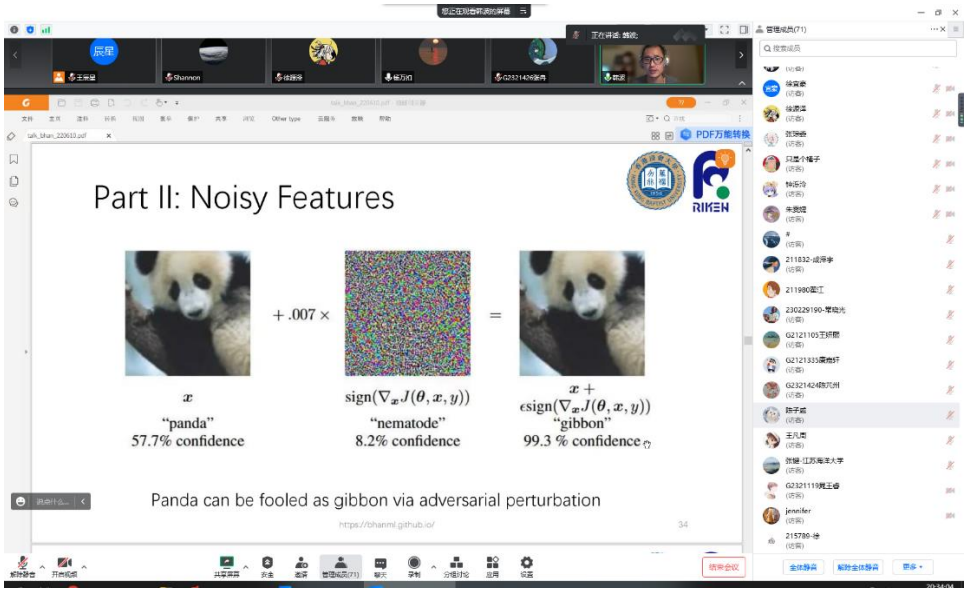
韩波，香港浸会大学计算机系助理教授，领导 TMLR 研究组，同时兼任 RIKEN 人工智能项目梅峰访问科学家，并曾兼任 Microsoft 研究院访问科学家。他于 2019-2020 年博士后于 RIKEN 人工智能项目；2019 年博士毕业于悉尼科技大学。他的研究得到众多政府和业界资金支持，并获得众多奖项，包括三项政府研究奖（RGC CAREER, NSFC Young Scientist, RIKEN BAIHO），和五项企业研究奖（Microsoft, Nvidia, Huawei, Tencent, Alibaba）。他重点研究机器学习的诸多理论和实践领域，目前关注重点包括可信赖表示学习、因果表示学习等方法及它们在自然科学和交叉学科中的应用。

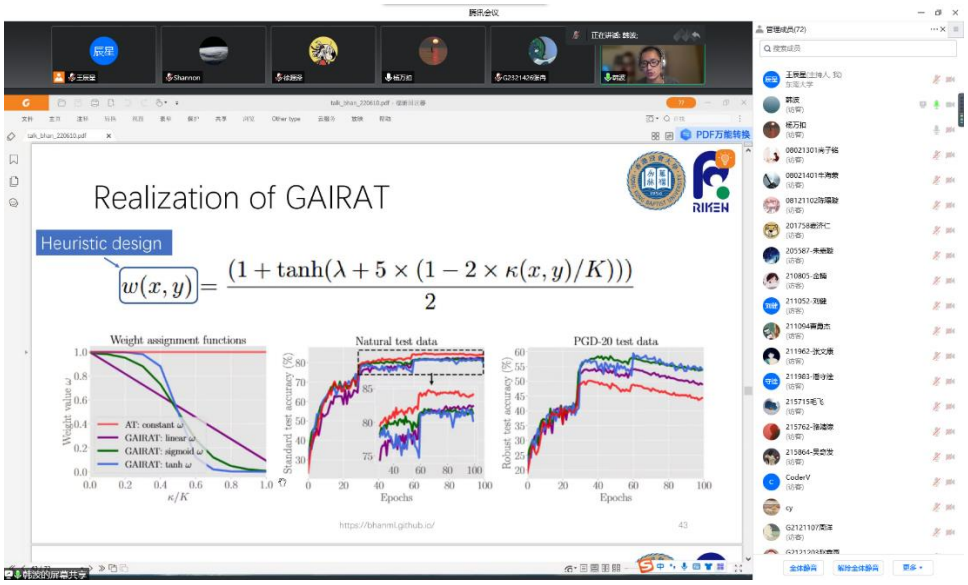
报告题目：
Towards Trustworthy Learning and Reasoning under Noisy Data
报告摘要：
Trustworthy learning and reasoning are the emerging and critical topics in modern machine learning, since most real-world data are easily noisy, such as online transactions, healthcare, cyber-security, and robotics. Intuitively, trustworthy intelligent system should behave more human-like, which can learn and reason from noisy data. Therefore, in this talk, I will introduce trustworthy learning and reasoning from three human-inspired views, including reliability, robustness, and interaction. Specifically, reliability will consider uncertain cases, namely deep learning with noisy labels. Meanwhile, robustness will discuss adversarial conditions, namely deep learning with noisy (adversarial) features. Then, interaction will focus on the dynamic interaction between noisy labels and noisy features. Besides labels and features, I will discuss other noisy data, such as noisy domains, noisy demonstrations, and noisy graphs. Furthermore, I will introduce the newly established Trustworthy Machine Learning and Reasoning (TMLR) Group at Hong Kong SAR and Greater Bay Area.

报告时间：
2022 年 8 月 24 日晚 8：00

报告方式：
线上，腾讯会议号：606-276-567

报告现场：





4. “云 Lab”暑期“云”实习

在本次国际暑期学校中，经过官方发布、师生双选，一共确定了 8 组实习项目，每一组均由自动化学院专职教师与海外名校导师联合指导。双方在确认选题、交流讨论、实践操作等各个方面，跨越了空间、时间、文化的差异，头脑风暴、交流碰撞出了许多新奇的 idea，也做出了一些大胆的科学尝试。

4.1 实习课题介绍

实习课题 1：

Control theoretical approach for privacy preservation in distributed optimization and learning
Yongqiang Wang, Clemson University
（Intramural advisor：张亚）

该课题研究网络多个节点分布式信息交互过程中的隐私保护问题。本课题基于控制理论和方法研究多智能体系统平均一致性中的隐私保护问题，系统能达到平均一致的同时保证节点的隐私性。课程组成员分别使用基于状态分解的方法和基于同态加密的方法来保护隐私，并且搭建了 5 个节点的网络进行了仿真验证。

实习课题 2：

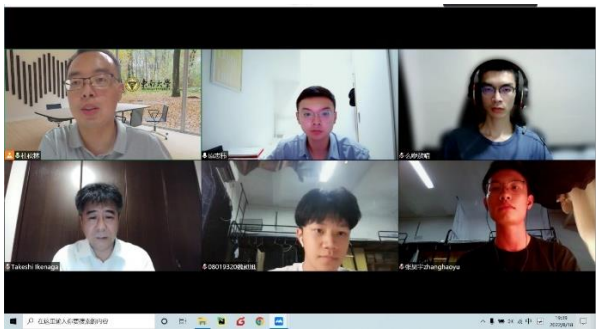
Shared spare parts warehouse scheduling based on health prediction
Zhen Song, Jingdong Industry
（Intramural advisor：李俊）

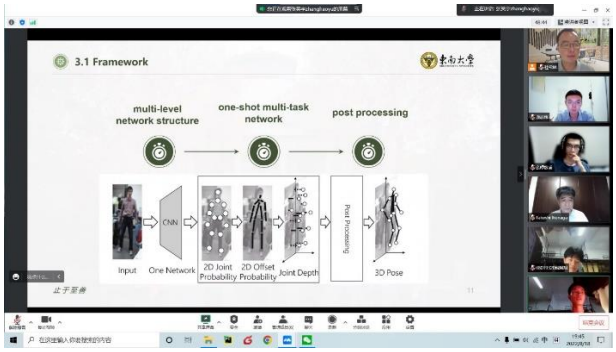
针对工业用备品备件常常出现“用时没备、备了没用”的痛点问题，本课题旨在初步分析评估通过共享备件仓节约备件资金，减少资金浪费的方法。在调研相关文献的基础上列举了部分优化和补货算法，讨论了 EOQ 补货算法，分析了相关文献中备件分类情况下的最优订货量等参数，最后对部分改进算法提出了改进策略，并分析总结了各改进算法的优缺点。

实习课题 3：

3D Human Pose Estimation from Monocular Video
Takeshi Ikenaga, Waseda University
（Intramural advisor：杜松林）

该课题聚焦基于单目视频的三维人体姿态估计问题，同学们和日本早稻田大学 Takeshi Ikenaga 教授进行了充分的讨论，杜松林老师还邀请了 genDESIGN 公司从事三维游戏软件研发的工程师就人体姿态估计在游戏开发中的应用和同学们进行了探讨。除了针对本课题的讨论，Takeshi Ikenaga 教授还对同学们感兴趣的未来研究方向选择、批判性研究逻辑培养、长期职业发展规划等问题做出了回答和讨论，讨论气氛热烈、友好，同学们表示受益匪浅。

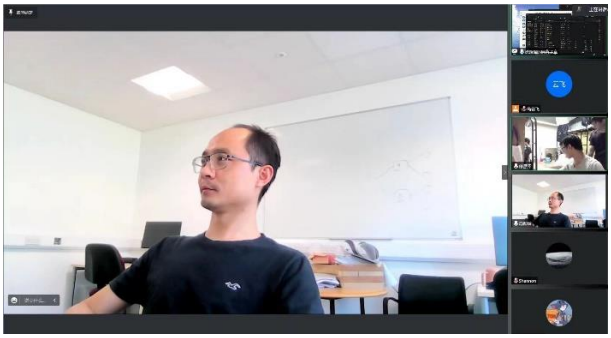


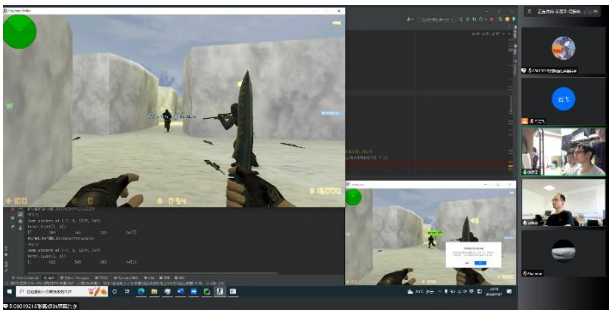


实习课题 4：

Pedestrian fall detection based on 2D pose estimation
Zhenhua Feng, University of Surrey
（Intramural advisor：杨万扣）

该课题以稀疏场景行人为检测对象，对 YOLO 检测算法的参数进行了合理设计，通过引入 GIoU 损失函数、结合多尺度融合目标检测层等结构优化，在 YOLOv3 检测器基础上提高了检测实时性与准确率，使其在行人检测方向接近今日主流跟踪算法水平。在小组成员的通力协作下，本课题基于自有数据集，还设计编写了针对射击游戏的自动瞄准系统，实现了游戏内敌我检测、辅助射击等功能，是 YOLO 检测器在游戏检测领域的一次尝试。



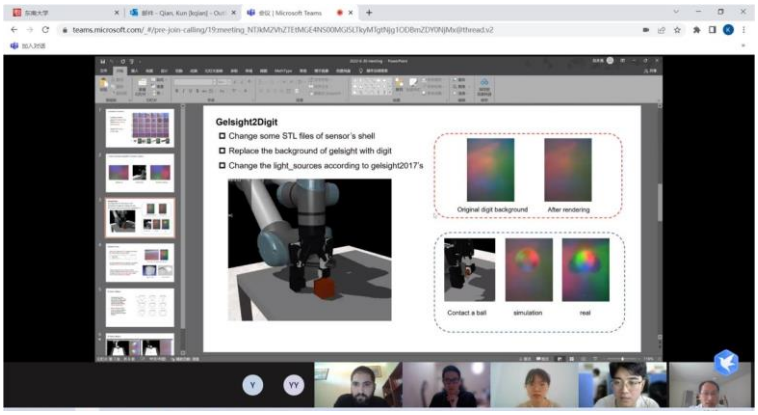


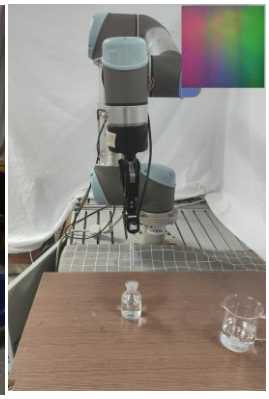
实习课题 5：

Application of visual and tactile sensing in robot manipulation learning
Shan Luo, King's College London
（Intramural advisor：钱堃）

该课题利用新型手内触觉图像传感器引导机器人手爪姿态控制，通过建立机器人强化学习算法赋予机器人自主学习操作技能的能力，实现了机器人对试管、胶头滴管等典型管状物体的插拔、挤压等自主操作。在同学们的努力下还搭建了一个“化学实验员机器人”原型系统，

实现了试管摆放、移液等新颖有趣的应用功能。





实习课题 6：

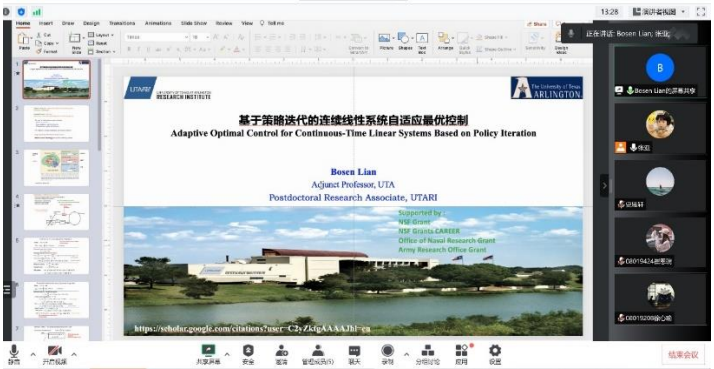
Unmanned intelligent weighbridge based on visual perception
Hong Pan, Swinburne University of Technology
（Intramural advisor：夏思宇）

中国港口已进入数字智能时代，港口信息化、无纸化和智慧化在港口转型升级方面发挥了不可替代的作用。该课题目标是利用 AI 视频分析算法实现地磅的无人值守化系统中的部分功能。具体解决各种复杂场景下的港口货车车牌的识别，以及车辆装载货物状态的识别问题。在课题成员的共同努力下，顺利实现了算法的设计、开发与测试，并成功应用在南京某港口的智慧地磅系统中。

实习课题 7：

Data-driven optimal control of linear system
Bosen Lian, University of Texas, Arlington
（Intramural advisor：张亚）

该课题研究实际应用中被控系统的模型参数无法获得时，如何应用当前快速发展神经网络和机器学习技术来解决控制问题。课题组学生分别对线性离散系统和线性时滞系统实现 Q-learning 方法在离散线性单智能体系统中的应用，验证 Q-learning 方法的可行性；结合自适应动态规划和 Q-learning，设计无模型控制器，基于强化学习与最小二乘法实现最优控制；最后通过仿真验证得到了较好的结果。



实习课题 8：

Research of lightweight human pose estimation network
Kemao Qian, Nanyang Technological University
（Intramural advisor：王辰星）

该课题研究了一种 3D 人体姿态估计的轻量化深度神经网络 MobileHumanPose，该网络模型的尺寸仅有 ResNet-50 的 1/7，而性能与最先进的模型相当，能够有效解决 3D 人体姿态估计方法在提高预测准确率的同时耗费了大量计算量的问题。同学们在 PC 机上先实现了该模型后，又尝试将模型部署到手机等移动端上，得到了不错的效果。并且，根据已经实现的内容，发现了新的问题，将对问题继续深入研究。

4.2 学生感受

经过本次“云实习”中课题项目的锻炼，同学们既获得了宝贵的科研训练，又经历了一段难忘的体验，让我们听听同学们的心声。

◆ 事先得知了会议在 Teams 上全程英文交流，我内心对此有些许恐慌，不过可以打开 Chrome 的实时字幕功能，确实非常有用，在外方语速非常快的情况下也能帮助我们大致地理解了会议的主要内容。

——余意

◆ 在与外方交流开会时，我作为旁听者，了解到了许多触觉方面的知识。刚开始的时候担心自己英语水平会听不懂等，但是钱老师有时候会非常贴心的重复一遍，后面大家交流渐入佳境，让我感受到了大家对于科研的热爱。

——孙畅

◆ 在实习过程中，我发现“自瞄”也许并不是最优的应用场景。相比其他应用到实际生活的场景，“自瞄”的选题优势在于能够激发我们探索的兴趣。虽然本次的程序并不能对社会提供贡献，但是我真真实实感到了自动化对生活的影响。另外，与冯老师交流之后，我有了不少收获，而且把思维拉到了应用上。这些天一直在考虑算法和程序的实现，并没有考虑交互的问题。而且我最近也有关注求职的信息，我发现现在很多企业在招聘的岗位三分之二是与编程无关的，更多的在与用户体验有关的职业。这让我思考，现在社会的需求是算法还是应用。从我们使用的 YOLO 来看，我认识到，现在类似成熟的算法可能满足大部分应用的需求了。但是它仍有不足，仍有一些高精领域无法使用现有算法进行突破，这也许正是无数默默无闻科研工作者的意义所在。他们不是闭门造车，所做的研究都是对社会的另一种贡献。这是一种潜移默化、润物无声的影响。

——侯亚斌

◆ 触觉传感器在机器人系统中扮演着越来越重要的角色。我主要负责触觉图像特征提取与物体姿态估计部分的内容。我对触觉图像特征提取的传统方法和深度学习方法有了更加深刻的理解。

——戚云鹏

◆ 现在整个项目结束了，我感觉我学到的内容还是非常非常多的。我第一次深入地了解了一个算法（YOLO）的提出思想、实现原理、它每个版本的迭代过程，特别是能体会到 v1-v3 过程中融入的当时热门的各种网络结构。以前没有标过数据集的我也标了数据集、用自己的数据集并仿照 v2 论文里的训练方法，在每次炼丹的过程中调试诸如 epoch、学习率等各种参数等。虽然最后依然存在一些问题，但效果还是令人满意的。

——徐源泽

◆ 本次实习是我们首次完整地体验深度学习目标检测的项目流程，从数据采集到完成

应用，都由我们亲自完成。并且，我们选择的应用场景是自主选择的轻松活泼的电脑游戏中的应用。这给人以丰富的成就感。

——张熙睿

◆ 通过这次云实习，我深刻地体会到一个项目从提出到最终实现所需付出的巨大努力。此过程不仅让我熟悉了科研或工程项目的完整实现流程，更为难得的是，我们通过中外云合作的方式，有机会与海外名校导师深入探讨项目研究方向和实现思路，进一步拓展了专业知识，使我受益匪浅。除此之外，写作、表达与创新等科研或就业时必需的技能也得到了提升，为今后的职业发展奠定了坚实的基础。

——南馨语