

2021 东南大学电气工程学院第二届国际暑期学校项目总结报告

Final Report of SEU EE International Summer School Program

项目主题

Theme

高比例新能源接入的低碳化电力系统

Low Carbon Power System with High Penetration of Renewable Energy Resources

一、 项目介绍

本项目是由东南大学电气工程学院组织，面向全球大学生提供丰富的暑期线上线下混合式课程，结合电气工程知名专家系列课程切实推动电气专业本科/研究生教育改革与发展，营造大学生创新氛围，使学生能更好地了解本学科国际前沿的学术方向和研究动态，开阔学术视野，拓宽科研思路，提高学术素养，强化学生创新意识与创业精神，全面提高电气工程专业大学生的创新能力和培养质量。

课程内容由东大电气学院教师联合国内外教授专家为学员提供指导。本项目理论授课共计 40 学时，可替代专业培养计划中的实习实践类课程。本校学生参加讲座将获得相应的 SRTP 学分。

二、 项目执行情况

这次的高比例新能源接入的低碳化电力系统国际暑期学校于 2021 年 7 月 1 日到 7 月 31 日之间举办。该项目是东南大学 2021 年（国际）暑期学校项目之一，由东南大学教务处和东南大学电气工程共同举办。因为疫情关系，项目不仅有海外教授专家为学员提供线上授课指导，还邀请了 MATLAB 企业专家对学生进行了视频实践培训。

1) MATLAB 应用与实践 (研讨)

该课程安排旨在拓展学生的国际视野，达到理论知识与实训技能相结合的效果。本次国际暑期学校 MATLAB 项目由东南大学电气工程学院胡秦然教授筹办，吸引了校内外学生的积极参与。本次暑期学校结束前，同学们也认真准备了课程大作业与全班分享，内容包括 MATLAB 基本函数编程、方程建模和求解、数模信号转换方法、傅里叶变换分析、人工神经网络建模等信息化新型电力系统常用

基础技术，以及由知名企业专家传授的关于 MATLAB 底层化建模的技术与实践等。具体本校课程以及外教远程授课安排如下表格所示。

This course consists of interactive **MathWorks** Webinars (MathWorks 公司特邀在线课程) and course projects under the supervision from **Southeast University** faculty and Experts from **MathWorks**.

Courses	Agenda
Matlab Basics	Jul. 5, 8:00 – 10:30 am
Seminar Discussion on figure drawing, equations solving, curve fitting, differential equation solving, symbolic operation	Jul. 7, 8:00 – 10:30 am
Statistics, probability and noise	Jul. 12, 8:00 – 10:30 am
Analog-digital transformation, digital-analog transformation, Convolution and its realization	Jul. 14, 8:00 – 10:30 am
Discrete Fourier transform, FFT and spectrum analysis	Jul. 19, 8:00 – 10:30 am
Digital filter, Artificial neural network	Jul. 21, 8:00 – 10:30 am
Final Project	Jul. 26, 8:00 – 10:30 am
Final Project	Jul. 28, 8:00 – 10:30 am





2) 电力系统综合课程设计(研讨)

Curriculum Design of Power System (Seminar)

Courses	Presenters	Agenda
New paradigms in HVDC transmission systems with Renewable Energy	Prof. Enrique Acha (Tampere University)	July 18 15:00 - 17:00
Utilizing demand-side generalized energy storage to decarbonize future smart cities	Dr. Hongcai Zhang (University of Macau)	July 16 15:00-17:00
Efficient Integration of Uncertainties in the Low Carbon Power System: Motivations, Tools, and Applications	Dr. Yi Guo (ETH Zurich)	July 15 14:00 - 16:00

“电力系统综合课程设计”系列课程第一讲—“New paradigms in HVDC transmission systems with Renewable Energy”，应我院陈涛老师的邀请，2021年7月18日下午，芬兰坦佩雷大学教授、IEEE Fellow 及墨西哥国会奖章获得者 Enrique Acha 教授采用线上教学的形式进行了3小时的全英文授课，并提供了全套PPT课件供大家课后复习，深入浅出地介绍了电力电子技术和 HVDC 技术在低碳新

能源电力系统中的广泛应用、最新技术模式和技术发展趋势。Enrique Acha 教授与同学们在线上问答环节进行了多次互动，回答了同学们对低碳化新能源电力系统的疑问，加强了同学们对电气工程学科的学习热情。

Course Description

This is a short course dealing with a selection of topics in the general area of power electronics applications in modern electrical power systems. It is aimed at MSc students and undergraduate students in their final year.

Contents

1. Power Electronics in Modern Power Systems
2. Power Electronics in Modern Power Generation
3. Modelling and Simulation of Modern Power Grids

The screenshot also shows a Zoom interface with a participant list on the right and a chat window at the bottom right. The chat contains the following messages:

Enrique Acha Daza对所有人说:
I cannot hear

我对所有人说:
I can hear you quite well
Could you hear me

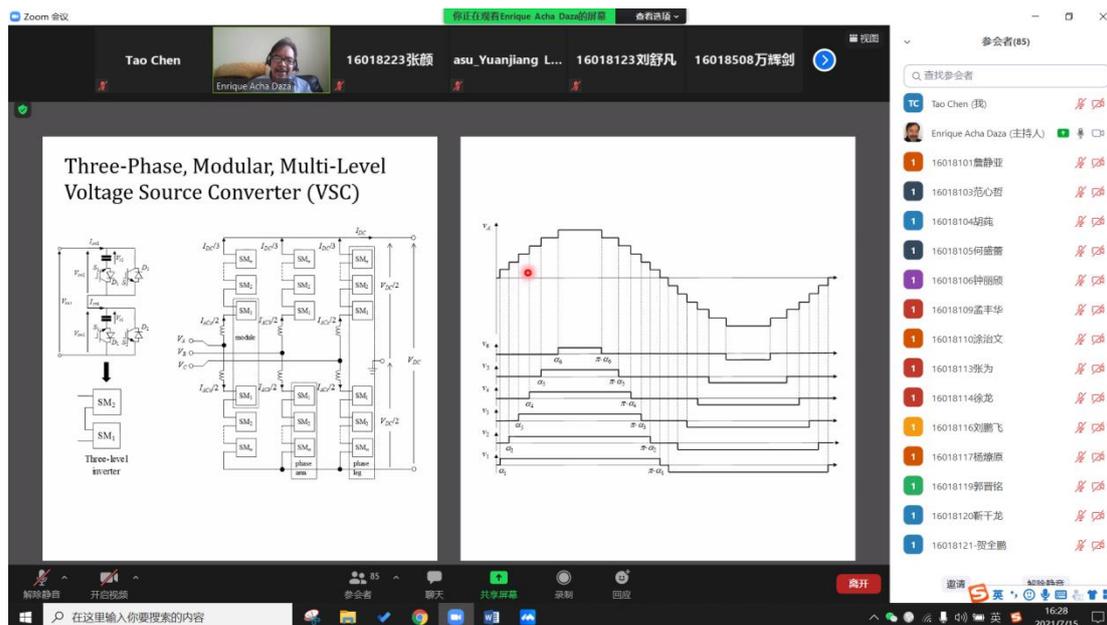
Zoom 会议底部显示: 16:01 2021/7/15

Power Semiconductor Valves, Basic Switching Principles and Bridges

The slide displays the following diagrams and graphs:

- Thyristor:** A schematic diagram showing the Anode, Gate, and Cathode terminals.
- IGBT:** A schematic diagram showing the Gate, Collector, and Emitter terminals.
- (a) Switched inductor (ON/OFF control):** A graph showing the current i_a and voltage v_a waveforms for a thyristor in ON and OFF states.
- (b) Controlled rectifier (delay angle control):** A graph showing the current i_a and voltage v_a waveforms for a thyristor with a delay angle α .
- Bridge:** A schematic diagram of a thyristor bridge with terminals V_{a1} , V_{a2} , V_{a3} , V_{a4} , V_{a5} , and V_{a6} .

Zoom 会议底部显示: 16:13 2021/7/15



Enrique Acha 教授（IEEE Fellow）线上授课实况

在“电力系统综合课程设计”系列课程第二讲—“Utilizing demand-side generalized energy storage to decarbonize future smart cities”中，澳门大学 Hongcai Zhang 教授以移动式储能为主题，介绍了电动汽车需求响应技术的发展历程、现状及展望，并着重从需求侧柔性资源、需求响应基本概念、移动式储能等方面进行了深入浅出的讲解，并采用线上电子板书的形式给同学进行了深入的原理性讲解，吸引了同学们学习该类课程的浓厚兴趣。

您正在观看 HongcaiZhang 张洪... 的屏幕

Content

- Background & motivation
- Coordinated electric vehicle charging
- Thematically controlled load scheduling
- Summary

正在讲话: HongcaiZhang 张洪...
HongcaiZhang 张洪...
陈涛 (TaoChen)
16018504 万玲玲
Saif
16018109 孟丰华
16018117 杨旭

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腾讯会议

Storage-like aggregate model for large-scale EVs

- Individual model: use extreme energy consumption trajectories to describe feasible region of battery charge/discharge

(a) Energy boundaries

(b) Power boundaries

正在讲话: HongcaiZhang 张洪...
HongcaiZhang 张洪...
陈涛 (TaoChen)
16018504 万玲玲
Saif
16018109 孟丰华
16018117 杨旭

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HongcaiZhang 张洪... 的屏幕共享

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16:08 2021/7/16

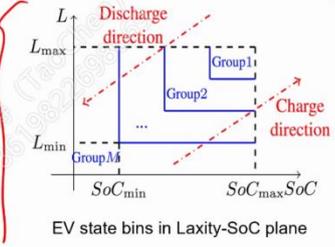
腾讯会议

Control: heuristic algorithm that guarantees accuracy

- Laxity-SoC-based charging/discharging control
 - Charging laxity*

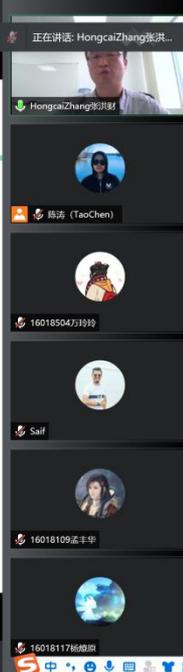
$$U_i = t_i^d - t - \frac{(SoC_i^d - SoC_i(t)) \times B_i}{\eta_c \times P_i^c}$$
 - State-of-Charge
 

$P_t \rightarrow P_t + \Delta P_t$



EV state bins in Laxity-SoC plane

正在讲话: HongcaiZhang张洪...



* A. Subramanian, M. J. Garcia, D. S. Callaway, K. Poolia, and P. Varaiya, "Real-time scheduling of distributed resources," IEEE Transactions on Smart Grid, vol. 4, no. 4, pp. 2122-2130, 2013. 38

Hongcai Zhang 教授在线授课实况

“电力系统综合课程设计”系列课程第三讲—“Efficient Integration of Uncertainties in the Low Carbon Power System: Motivations, Tools, and Applications”，应我院陈涛老师的邀请，2021 年 7 月 15 日下午，苏黎世联邦理工大学（ETH Zurich）Yi Guo 教授采用线上教学的形式进行了全英文在线课程精彩讲授。为同学们介绍了各类不确定性处理技术的基本原理、建模方法、求解方法和理论框架体系。同学们认真学习了 Yi Guo 教授的课程，并与 Yi Guo 教授进行了积极的互动，对计及大量不确定性变量的低碳新能源电力系统有了初步的了解，并对不确定性处理的建模框架和数学基础有了一定把握，产生了浓厚的学术研究兴趣。

腾讯会议

正在讲话: 郭毅 (TaoChe...)

Stochastic Optimization and Optimal Control with Applications to Power Systems

Yi Guo

2021 Summer School in Southeast University
ETH Zürich

July 22, 2021

Yi Guo (ETH Zürich) SEU Summer School July 22, 2021 1 / 31

在这里输入你要搜索的内容

14:03 2021/7/22

腾讯会议

正在讲话: 郭毅

background introductions on optimization with uncertainties

robust + stochastic optimization

- optimization problem

$$\begin{aligned} & \text{minimize} && f(x, \xi), \\ & \text{subject to} && g_i(x, \xi) \leq 0, i = 1, \dots, m. \end{aligned}$$

make no sense ! $f(x, \xi)$ and $g_i(x, \xi)$ are random variables/functions, not just numbers

- need to reformulate the problem
- many ways to do so, depending on assumption on ξ and optimization goals

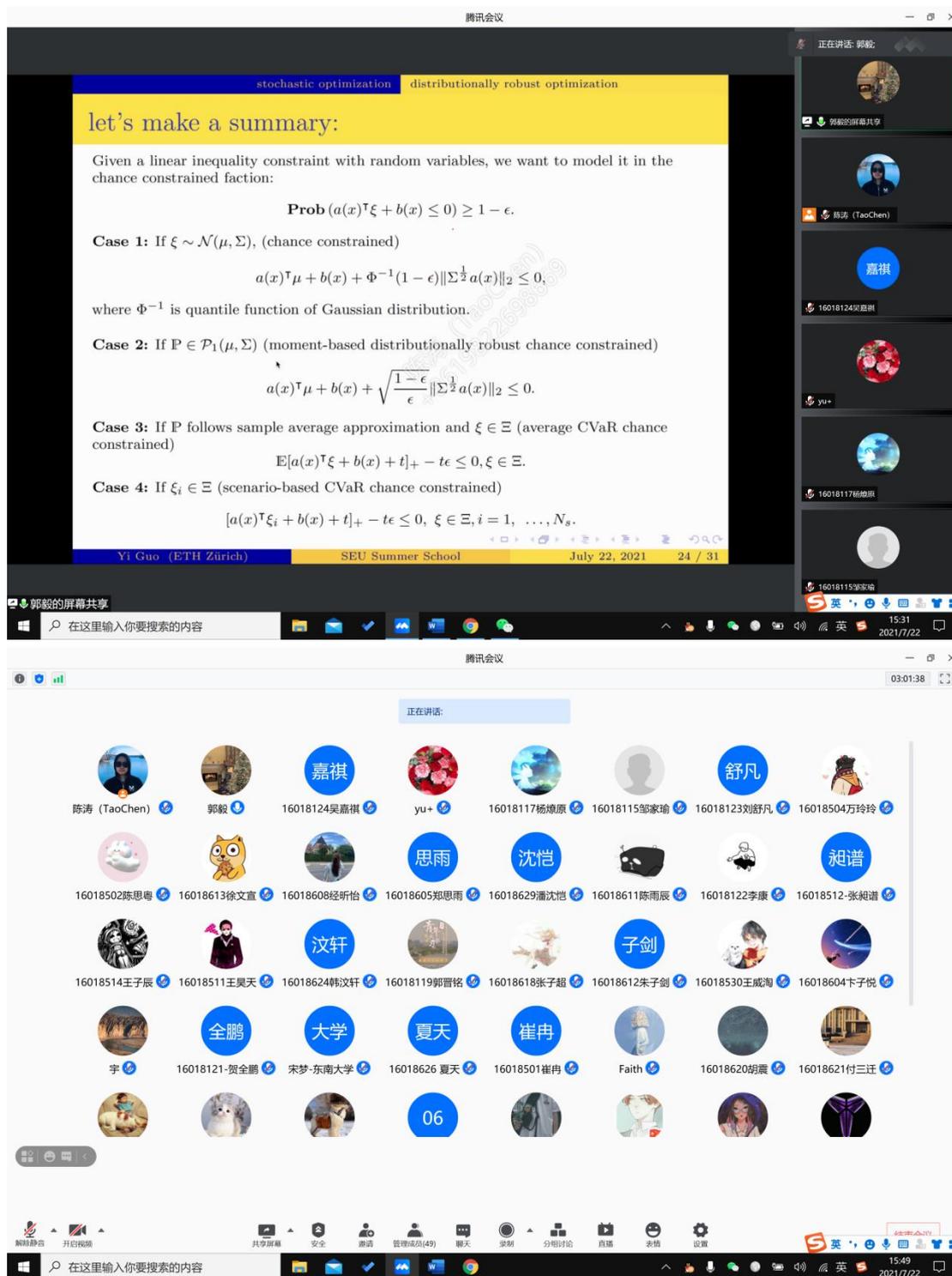
- goals

 - constraint satisfied on average, with high probability
 - objective, on average, with high probability, or in the worst case

Yi Guo (ETH Zürich) SEU Summer School July 22, 2021 5 / 31

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14:12 2021/7/22



苏黎世联邦理工大学 Yi Guo 教授线上授课实况

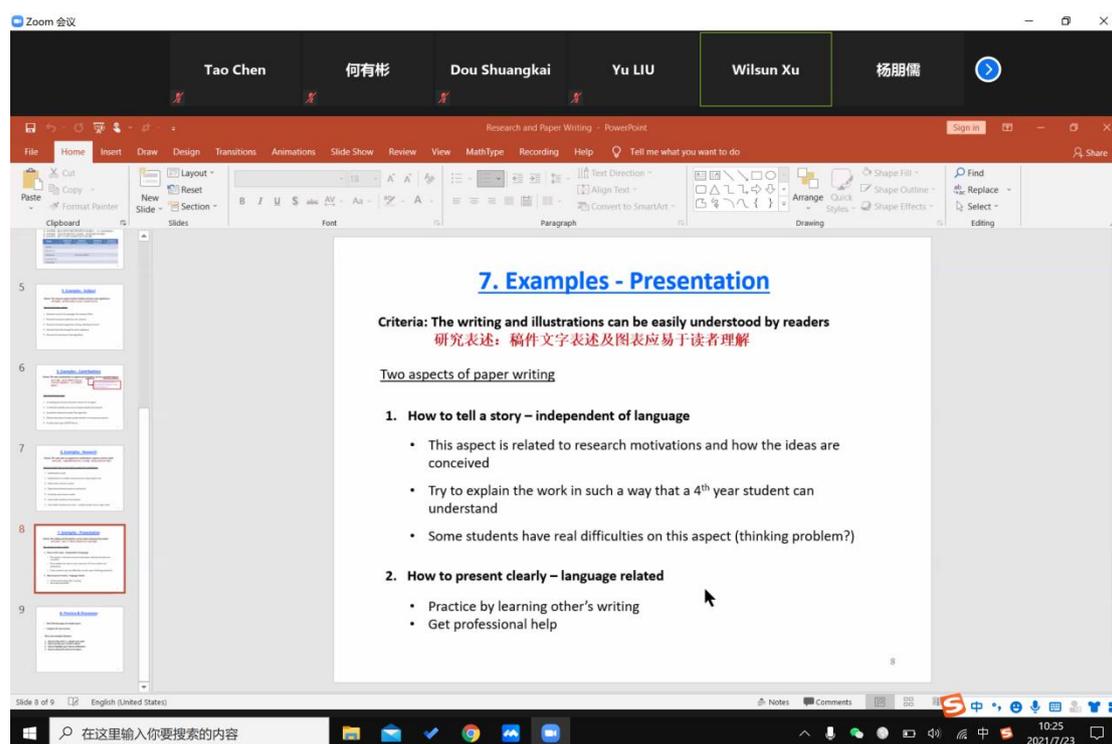
3) 文献检索与学术写作(研讨) 部分

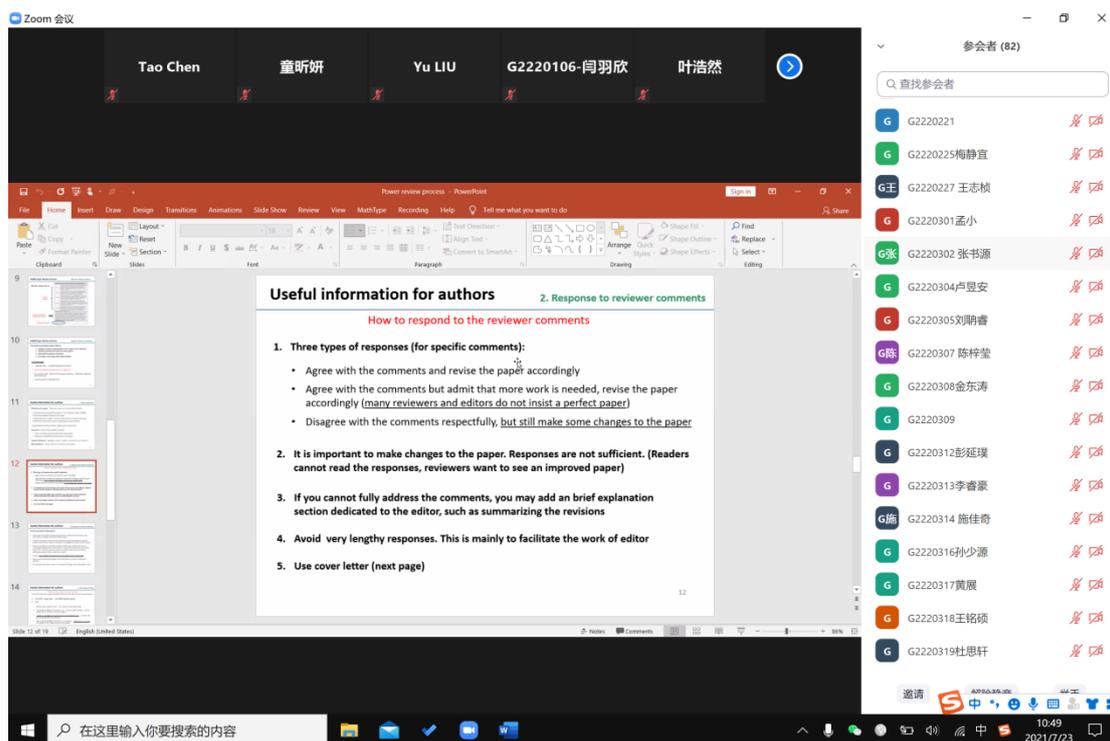
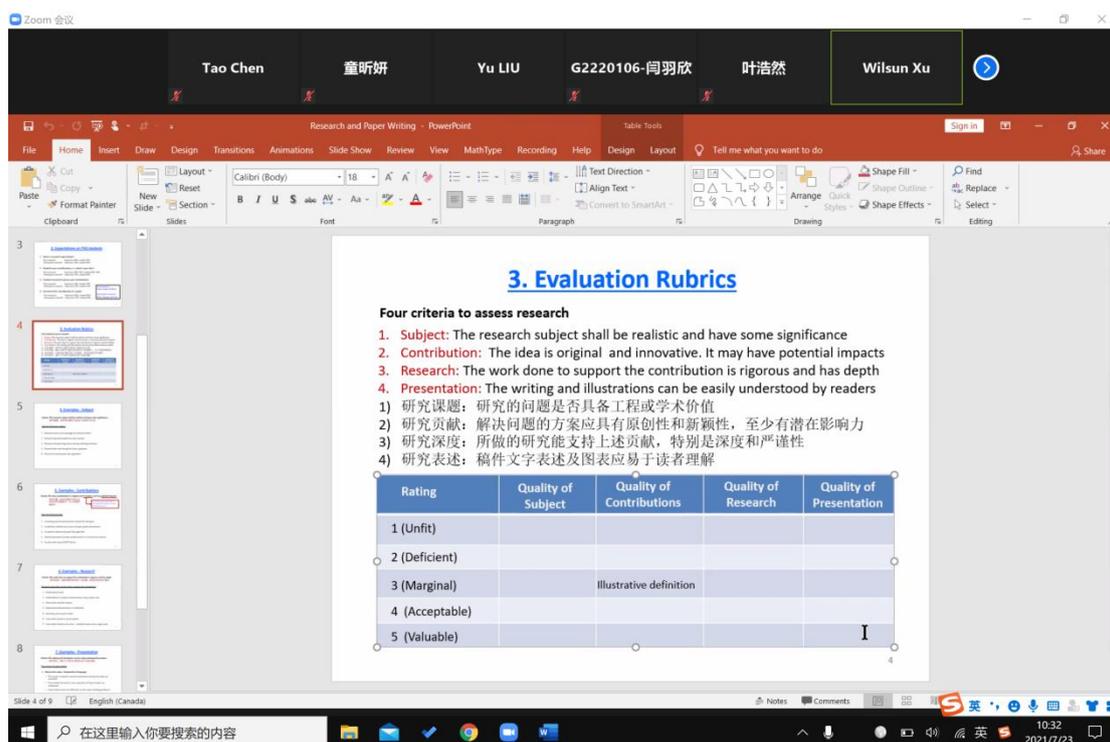
Information Retrieval and Academic Writing Prepared for the Research in the Low Carbon Power System (Seminar)

This course consists of interactive Webinars as well as Writing Contest

Courses	Presenters	Agenda
How to Write Academic Paper in English	Dr. Wilsun Xu (University of Alberta)	July 23 09:30-11:30
How to Explore Academic Information	Dr. Kun Qian (University of Tokyo)	July 17 09:00-11:00
How to Write Academic Paper in Chinese	Dr. Hongxun Hui (University of Macau)	July 21 14:00-16:00

“文献检索与学术写作(研讨)”系列课程第一讲—“How to Write Academic Paper in English”，应我院刘宇老师的邀请，2021 年 7 月 23 日上午，加拿大阿尔伯塔大学（University of Alberta）、IEEE Fellow Wilsun Xu 教授与东南大学电气工程学院国际暑期课程筹备小组协商，采用线上的形式进行了名为英文写作的全英文在线课程精彩讲授。





IEEE Fellow Wilsun Xu 教授线上授课

Wilsun Xu 教授以电力系统领域写作为引线，将电力系统分析类研究、英文写作、国际学术研究方法三大主题衔接起来，层层深入，环环相扣，前来学习的老师与学生受益匪浅。最后，Wilsun Xu 教授为我们介绍了典型的低碳电力系统

写作论文样例，引发了同学们的热议讨论。

第二讲课 How to Explore Academic Information 主题，日本东京大学 Kun Qian 博士通过腾讯线上会议为学生讲解了国际学术规范与科学研究的基本信息检索处理方法，并结合其自身经历和学术背景讲解了相关领域的升学、就业前景，引发了同学们的高度关注。



How to Explore Academic Information?

Kun QIAN (Dr.-Ing., SMIEEE)

Associate Editor, IEEE T-AFFC
JSPS Postdoctoral Research Fellow
The University of Tokyo, JAPAN
July 14th, 2021



東南大學
SOUTHEAST UNIVERSITY



Biography



*IEEE Senior Member
AE, IEEE T-AFFC
AI, Audio, Healthcare*

Kun QIAN received his doctoral degree for his study on automatic general audio signal classification in 2018 in electrical engineering and information technology from Technische Universität München (TUM), Germany. He is currently working as a JSPS Postdoctoral Research Fellow in the Educational Physiology Laboratory, Graduate School of Education, The University of Tokyo (UTokyo), Japan. He is a Senior Member of the IEEE. He was sponsored by fellowships to conduct cooperative research at the Nanyang Technological University (NTU), Singapore, the Tokyo Institute of Technology (Tokyo Tech), Japan, and the Carnegie Mellon University (CMU), USA. Dr.Qian serves as an Associate Editor for the IEEE Transactions on Affective Computing, Frontiers in Digital Health, and BIO Integration, and is the leading organiser of the special session on computer audition for healthcare (CA4H) at ICASSP2021, Toronto, Canada. He (co-)authored more than 60 publications in peer reviewed journals, and conference proceedings having received more than 940 citations (h-index 18). From the year 2021, Dr. Qian has been awarded with the title of BIT Teli Young Fellow.



IEEE Publications

SIGNAL PROCESSING FOR NEUROREHABILITATION AND ASSISTIVE TECHNOLOGIES

Kun Qian, Zeteng Zhang, Yoshihara Yamanoto, and Bijen W. Schuller

Artificial Intelligence Internet of Things for the Elderly

From assisted living to health-care monitoring



An aging population is increasingly prevalent in both developed and developing countries, raising a series of social challenges and economic burdens. In particular, more elderly people are staying alone at home than are living with people who can take care of them. Therefore, assisted living (AL) and health-care monitoring (HCM) can be critical issues in the era of human-centered artificial intelligence (AI). In this context, we aim to provide an encompassing review summarizing the state-of-the-art works overlying AI and the Internet of Things (IoT) to help the elderly live more and better. We systematically and comprehensively compare paradigms in terms of methodologies and application scenarios. The pros and cons among these technologies are discussed in detail. Thus, we summarize current achievements and indicate their limitations. Finally, perspectives on highly promising future work are presented.

Overview
According to a report [1] by the World Health Organization, an aging population has become more and more prevalent in both developed and developing countries. Taking Japan as an example, approximately 27.6% of the citizens are already 65 or older [2], which makes the whole society face a series of economic, health, and social challenges. In this era of human-centered AI (HCAI), we have witnessed tremendous efforts in the fields of AI and health monitoring that have been made by leveraging the power of AI and the IoT, which

IEEE INTERNET OF THINGS JOURNAL, VOL. 8, NO. 10, 3043–35, 2021

3043

Can Appliances Understand the Behavior of Elderly Via Machine Learning? A Feasibility Study

Kun Qian¹, Senior Member, IEEE, Tomoya Koike, Student Member, IEEE, Kazuhiro Yoshihara², Bijen W. Schuller³, Fellow, IEEE, and Yoshihara Yamanoto⁴, Member, IEEE

Abstract—Over the last half decade, fast development of the Internet of Things and machine learning (ML) made it feasible to leverage the power of artificial intelligence to facilitate a variety of intelligent systems in smart home. Nevertheless, the studies on designing specific computing technologies for helping elderly to enjoy a comfortable, convenient, and independent daily life are extremely limited. On the one hand, there are increasingly growing demands from the aging society to implement the cutting-edge technology enabling a better life quality for the elderly. On the other hand, there is still a lack on fundamental investigations, applicable infrastructures, and advanced data-driven frameworks. In this end, we propose a novel machine learning framework for analyzing the daily life behavior of elderly—old in this study are living alone—in the data collected from their home appliances, i.e., televisions and refrigerators. First, the interevent intervals for the use of the appliances collected in one month from 76 elderly are the raw data to describe the behaviors. Then, three ML paradigms are investigated and compared, which include “classical” ML methods and the state-of-the-art deep learning approaches. Finally, we indicate the correct findings and limitations in this feasibility study. Experimental results demonstrate that our proposed method can reach performance peak at an unweighted average recall of 58.7% (chance level: 58.6%) in a subject-independent test for classifying symptoms/behavior types.

Index Terms—aging society, context awareness, Internet of Things (IoT), machine learning (ML), smart appliances.

Manuscript received September 4, 2020; revised November 26, 2020; accepted December 10, 2020. This paper was published December 15, 2021. Date of current version May 1, 2021. This work was supported in part by the Zhejiang Lab’s International Talent Fund for Young Professionals. Clinic in part by

1. INTRODUCTION

IN THE beginning of this century, Schmidt and Lachoven characterized smart appliances as the devices that are attentive to their environment [1]. In traditional fields, e.g., power consumption, smart appliances can contribute to the analysis of the consumer’s demand responses via the help of a series of mathematical models [2]–[6]. On the one hand, within the fast development of the Internet of Things (IoT) and artificial intelligence (AI) over the last few years [7], tremendous work has been successfully applied in the fields, including industrial environmental surveillance [8], home management [9], smart buildings [10], [11], smart cars [12], smart campus [13], and smart agriculture [14]. These encouraging achievements make us confident that an era of AIoT (AI plus IoT) is coming.

On the other hand, the efforts leveraging the power of AI and IoT toward a ubiquitous and pervasive computing based on smart appliances for the personalized healthcare are still under way. In particular, the demand from the group of elderly has been increasingly raised since the aging of the population is evident in all developed and many developing countries [15], [16]. Taking Japan the world’s oldest country [16] as an example, approximately 27.6% of the citizens are already 65 years old or even older [17]. As a recent review literature indicated, AI has been found showing promising potential for aging and longevity research in terms of biomarker discovery, personalized medicine, target identification, drug discovery, regenerative medicine, gene therapy, immuno-oncology and immuno-sensomics, and many others [18].

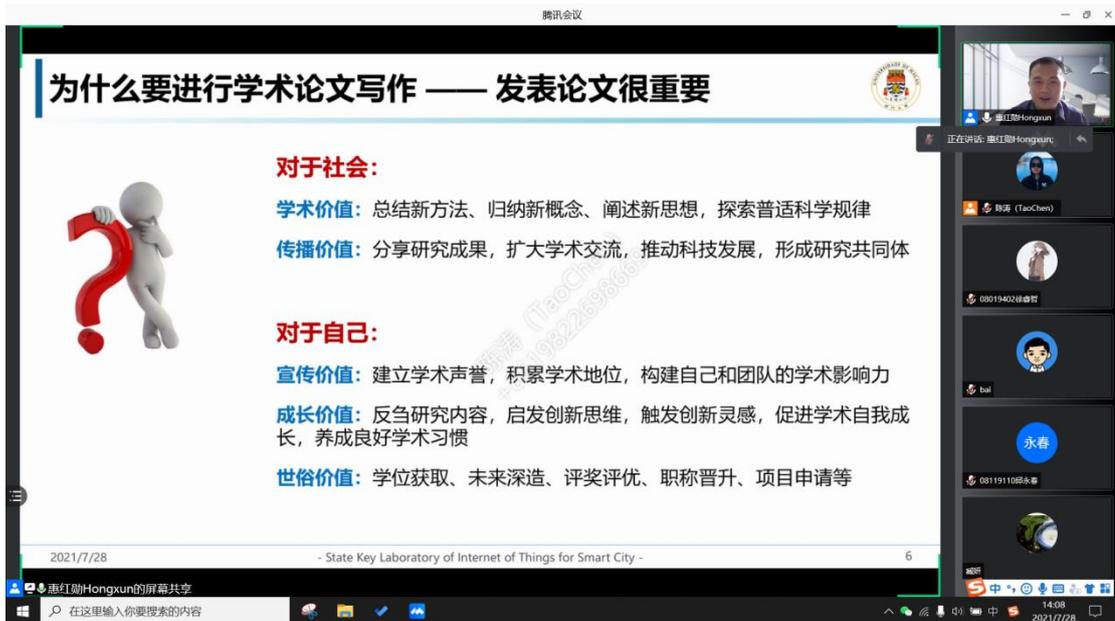
Nevertheless, the choice of applicable smart appliances designed for bettering the life of the elderly is quite limited.

Kun QIAN (Dr.-Ing.)

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钱昆教授线上课程内容

本课程最后一讲由澳门大学惠红勋博士通过腾讯线上会议的方式，为学生讲解了中文学术写作的基本形式、结构和注意事项，在互动环节，惠红勋博士深入浅出的讲解深受学生们的好评。



为什么要进行学术论文写作 —— 发表论文很重要

对于社会：

- 学术价值：** 总结新方法、归纳新概念、阐述新思想，探索普适科学规律
- 传播价值：** 分享研究成果，扩大学术交流，推动科技发展，形成研究共同体

对于自己：

- 宣传价值：** 建立学术声誉，积累学术地位，构建自己和团队的学术影响力
- 成长价值：** 反刍研究内容，启发创新思维，触发创新灵感，促进学术自我成长，养成良好学术习惯
- 世俗价值：** 学位获取、未来深造、评奖评优、职称晋升、项目申请等

2021/7/28 - State Key Laboratory of Internet of Things for Smart City - 6

惠红勋Hongxun的屏幕共享

正在讲话: 惠红勋 hongxun

陈涛 (TaoChen)

02019402徐睿哲

bai

永春

081191106永春

14:08 2021/7/28

腾讯会议

如何发现有价值的科学问题

《Science》衡量稿件学术水平有以下三条：
第一条，在已沉寂的研究领域提出创新思想；
第二条，在十分活跃的研究领域取得重大进展；
第三条，将原先彼此分离的研究领域融合在一起。

作为学生科学问题的一般来源：
(1) 导师；(2) 工程；(3) 学术报告；
(4) 阅读论文...



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正在讲话: 惠红勋Hongxun

惠红勋Hongxun

陈涛 (TaoChen)

08019402徐森野

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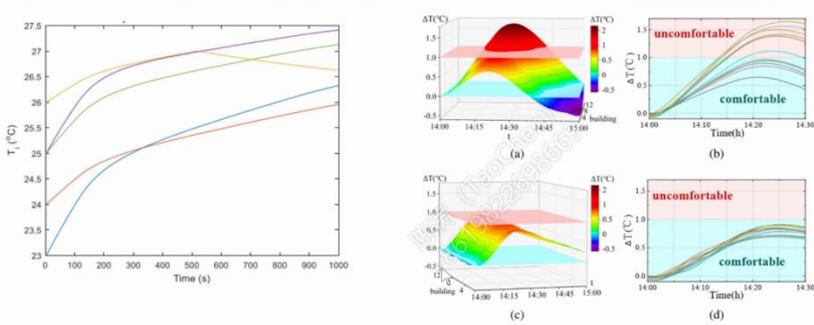
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2021/7/28 14:13

腾讯会议

如何更好地呈现自己的论文 —— 图表



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正在讲话: 惠红勋Hongxun

惠红勋Hongxun

陈涛 (TaoChen)

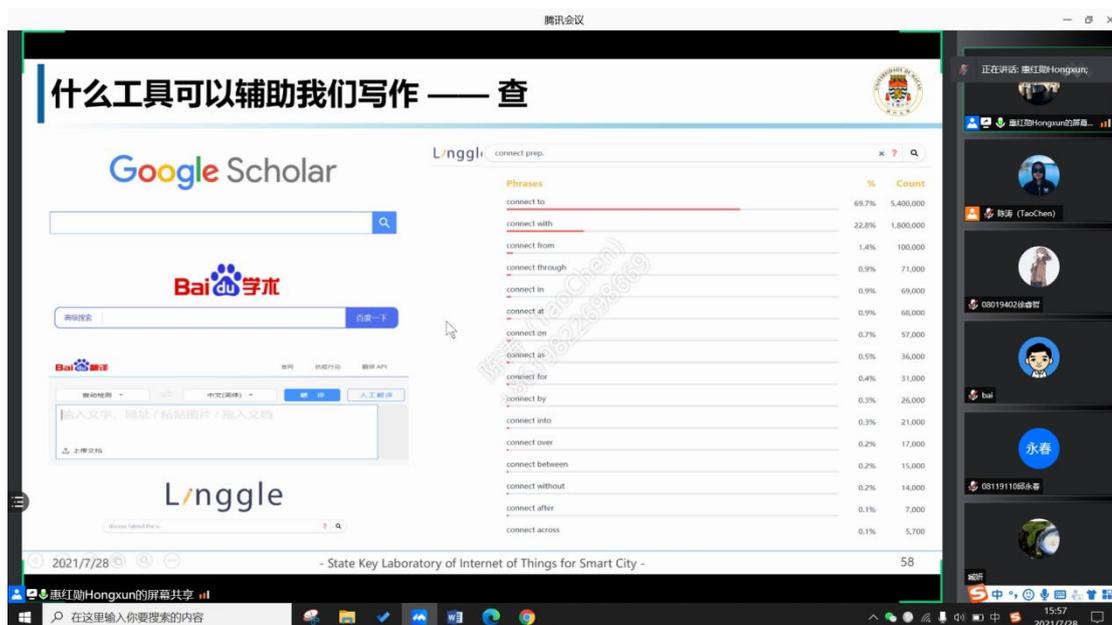
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2021/7/28 15:45



澳门大学惠红勋博士线上授课实况

三、 学生心得体会

蔡辉煌：通过 Mathworks 的工程师和任课老师的共同讲解，使我对 matlab 软件的发展背景，特点与应用场景以及基础功能有了认识和了解。本课程的学习和理解，是对包括数字信号处理、电机学、电力电子等专业课程的分析工具和理论研究补充与提升。

崔筱曼：任课老师和 mathworks 的工程师联合对我们课程大作业的思路进行答辩，帮助梳理了开展研究的思路和时间节点，为后续课程大作业的研究打下了良好的基础。

胡多儿：通过老师的讲解，使我对新型电力系统的背景与前景、特点与应用以及各类能源技术有了基础的认识和了解，本次课程部分讲座为全英文授课，听力理解起来有一定难度，但是这一过程也是英文能力的锻炼过程，是对专业课程的补充与提升。老师的授课内容条理分明，知识详细易懂，通过 PPT、老师的演示计算和视频，在两个小时的课程中使我们对可再生能源为主的新型电力系统有了一定认知，使我受益颇丰。

杜思轩：作为低年级同学，对于本次课程的专业内容理解起来有一定难度，但是相关原理性的介绍使我受益匪浅，激发了日后进一步学习能源领域相关知识

的动力和热情，尤其是领略了学术大家的风采，更加坚定了日后从事科学研究的志向。

司楚天：这次暑期学校项目我学到了很多知识，锻炼了英语听力，拓宽了我的视野，让我对低碳新型电力系统有了更深入的了解。还有很多未知的领域等待我们去探索，我们要时刻保持一颗积极求知的心态，在未来研究生阶段中踏实认真做科研，多多参加像这样的讲座，掌握最前沿的科研动态。

金东涛：虽然讲座以全英文形式呈现，对于长期在中文授课环境中学习电力知识的我来说，同步理解存在一定的困难，但是大部分词汇和内容还是比较浅显易懂的。本次课程给予了我们新的学习动力，相信在未来的一年，我能在不断地提升和探索当中找到自己未来想要深造的方向。

廖子振：本次外教课程的内容十分充实和精彩，有助于我们认识电力系统及电力能源在我国国情下的发展状况，也让我们对如何发展新能源有了更多的好奇心。唯一不足的是本次课程是全英文授课，对部分内容在听课时还是不太清楚。

宋运忠：通过本次观看电力系统的外教课程，从根本上分析了新型低碳电力能源的问题，使我们能通过具体的数据以及实例形象地认识到了电力系统电力能源对于我国的重要性以及如何发展新能源。本次课程使我们大体上了解了授课内容，如果能配备一个中文翻译，具体对某些专业性名词做出解释，我觉得会是一个更好的教学体验。

魏灵峰：经过这次暑期课程，我对于低碳可再生能源新型电力系统有了初步了解，同时也让我看得到了本科期间所学基础知识在更深入研究中的应用以及英语在专业研究中的应用，让我受益匪浅，尤其让我激发了学习好英文的热情。

汤一天：这是我第一次从头到尾听英文讲课，并没有把所有内容都听懂，但是我能感觉到 Acha 教授讲的十分生动和权威。我对电气工程领域问题的理解更深了，并且知道了可再生能源和我们专业有密不可分的关系，我们电气专业在可再生能源的研究和应用方面都有很大的可作为空间，比如现在很火的电动汽车、风力发电等。

项目总结

本次高比例新能源接入的低碳化电力系统国际暑期学校是我学院第二次举办的国际暑期学校，理论与实际相结合，国际知名企业专家与电气工程学院邀请的海外专家学者综合授课，结合课程需求优化了课程设置，得到了学生的一致好评，同时在电气工程行业内形成较好的反响。但本次课程由于疫情的原因，基本都是线上授课，师生互动效果受到一定影响，虽然我们已经提前通过建立微信群的形式充分准备了授课信息的传达，但是课程准备还是过于匆忙，在实际操作训练方面安排偏少，而课程之间的连贯性还需要进一步加强，后面我们将进一步改进提高，力争把东南大学国际暑期学校项目举办成我校的名片项目。

电气工程学院

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