第14届中国智能系统会议

The 14th Chinese Intelligent Systems Conference

程 序 册

Program Guide

主办单位：中国人工智能学会

协办单位：中国人工智能学会智能空天系统专业委员会

承办单位：温州大学

北京航空航天大学

温州铂尔曼酒店

2018年10月13-14日

中国智能系统会议往届信息

CISC

牡丹江 2017
牡丹江师范学院
张　岩

扬州 2015
扬州大学
张天平

焦作 2013
河南理工大学
王福忠

烟台 2011
鲁东大学
杨洪勇

重庆 2009
重庆大学
柴　毅

2016 厦门
国防科技大学
刘衡竹

2014 北京
北京航空航天大学
贾英民

2012 上海
上海理工大学
王朝立

2010 北京
北京工商大学
刘载文

目录

会议简介

中国智能系统会议是每年举办一次的全国性学术会议，其宗旨是为智能系统领域的专家学者、研究生和工程技术人员提供一个学术交流的平台，以推动我国智能系统相关的控制理论及应用技术的发展。第 14 届中国智能系统会议（CISC'2018）将于 2018 年 10 月 13-14 日在浙江省温州市召开。

本届会议由中国人工智能学会主办，中国人工智能学会智能空天系统专业委员会协办，温州大学与北京航空航天大学共同承办。会议得到了北京大学、北京理工大学、北京科技大学、北京邮电大学、北京工商大学、南开大学、重庆大学、河南理工大学、上海大学、东华大学、上海理工大学、上海应用技术大学、中山大学、鲁东大学、南京航空航天大学、苏州大学、扬州大学、哈尔滨工程大学等多家兄弟单位的大力支持以及乐清市总商会和泰力实业有限公司的倾力赞助。

会议共收到投搞论文 230 余篇，经程序委员会的认真评审，最终有 167 篇论文被录用并收入会议论文集。会议论文集由 Springer 出版社在“Lecture Notes in Electrical Engineering”系列分两卷出版。

会议邀请了我国智能系统及其空天控制领域的院士、杰青、长江学者、万人计划入选者、IEEE Fellow 等国内外著名专家、学者作大会报告，就近年来智能系统相关的理论以及应用方面的成果与进展进行广泛的交流；会议分组报告论文作者将围绕相关专题进行研讨。

我们真诚感谢所有作者和参会人员对本届中国智能系统会议的鼎力支持和厚爱！秋临瓯江之畔，共话学海，我们期待大家收获多多，快乐满满！

第 14 届中国智能系统会议欢迎您的到来！

组织机构

主办单位

中国人工智能学会

协办单位

中国人工智能学会智能空天系统专业委员会

承办单位

温州大学　　北京航空航天大学

支持单位

北京大学　　北京理工大学

北京科技大学　　北京邮电大学

北京工商大学　　南开大学

重庆大学　　河南理工大学

上海大学　　东华大学

上海理工大学　　上海应用技术大学

中山大学　　鲁东大学

南京航空航天大学　　苏州大学

扬州大学　　哈尔滨工程大学

赞助单位

乐清市总商会　　泰力实业有限公司

大会主席

贾英民 (北京航空航天大学)　　薛　伟 (温州大学)

程序委员会主席

杜军平 (北京邮电大学)　　楚天广 (北京大学)

邓志东 (清华大学)　　张　霖 (北京航空航天大学)

组织委员会主席

洪振杰 (温州大学)　　付永领 (北京航空航天大学)

刘衡竹 (国防科技大学)　　王国利 (中山大学)

邀请委员会主席

段广仁 (哈尔滨工业大学)　　孙青林 (南开大学)

张天平 (扬州大学)　　王朝立 (上海理工大学)

评奖委员会主席

陈增强 (南开大学)　　柴　毅 (重庆大学)

杨洪勇 (鲁东大学)　　张笑钦 (温州大学)

财务委员会主席

蔡　强 (北京工商大学)　　张　青 (中国民航大学)

周武能 (东华大学)　　王福忠 (河南理工大学)

出版委员会主席

李海生 (北京工商大学)　　陈　谋 (南京航空航天大学)

李洪波 (清华大学)　　李晓斌 (上海应用技术大学)

区域委员会主席

任雪梅 (北京理工大学)　　刘忠信 (南开大学)

周　进 (上海大学)　　尹宏鹏 (重庆大学)

会议秘书长

张维存 (北京科技大学)　　胡众义 (温州大学)

裴文靖 (北京航空航天大学)

重要信息

- 会议时间：2018 年 10 月 13 - 14 日
- 会议地点：温州铂尔曼酒店
- 会议日程：学术报告，2018 年 10 月 13 日
  会议考察，2018 年 10 月 14 日
- 会议语言：中文和英文

会议报到

- 报到时间：2018 年 10 月 12 日，8:30-22:30
- 报到地点：温州铂尔曼酒店大堂

会务组联系方式

- 联 系 人：胡众义（18957720163）
  裴文靖（17701026616）

- 电子信箱：cisc2018@126.com
- 会议网站：http://sias.buaa.edu.cn/

酒店预订

1. 温州铂尔曼酒店：

会议会场酒店

地　　址：温州市永嘉新区阳光大道新桥路口，近新强路

酒店电话：0577-66999999　　传真：0577-66999990

入住时间：10 月 12 日

房间价格：标间合住：200 元/间/人（含早餐、健身）

标 准 间：400 元/间（含早餐、健身）

大 床 房：400 元/间（含早餐、健身）

注 1：标间合住每人每天 200 元，发票开取需两人协商，提前去酒店前台说明办理。

注 2：标间及大床房房价 400 元/间，为温州大学与温州铂尔曼酒店的协议价格（原房价 721 元/间），请参会者务必按时返回酒店预订回执。

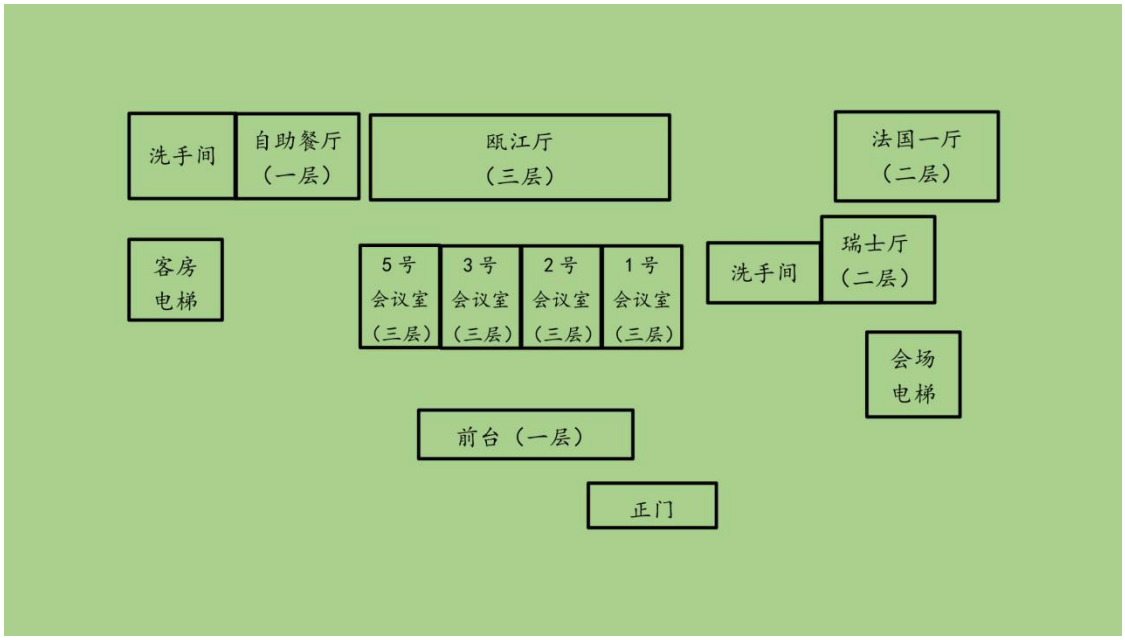
2. 房间预订方式：

采用回执预订方式，完成住宿预订者方能得到入住保障。

注 3：不同标准的房间先订者先得，如某一标准的房间已被预订完，请预订其他标准的房间，预订确认后不接受更改。

3. 附近其他宾馆：

请参会人员自行预订。



酒店平面示意图

酒店周边地图

温州市地图


温州南站
温州火车南汽车客运站
温州客运中心
温州站
会场
永嘉站
温州龙湾国际机场
温州南站
温州科技职业学院
双屿客运中心
温州商贸城
江心屿
会场
永嘉站
温州火车南汽车客运站
红星美凯龙
温州肯恩大学
温州乐园
华润万象城
新一医
温州大学(高教园校区)
温州客运中心
温州站
温州市政府
银泰百货
温州国际会议展览中心
温州汽车东站
沈海高速
温州市委党校
万达广场
龙湾区
鹿城区
瓯江
乌牛车站
北白象客运站
104国道
G15
G104
G1513
S26
S10
S77

交通信息

1、温州龙湾国际机场 - 温州铂尔曼酒店

乘出租车约 51 分钟（约 33.3 公里），打车费用约 139 元

2、温州南站 - 温州铂尔曼酒店

乘出租车约 32 分钟（约 15.3 公里），打车费用约 58 元

乘公共交通约 1 小时 26 分钟，票价 4 元

步行 130 米，乘坐 30 路，火车南站上车，上桥站下车；同站换乘 70 路，上桥站上车，瓯北新桥站下车，步行 640 米到达温州铂尔曼酒店。

3、温州站 - 温州铂尔曼酒店

乘出租车约 29 分钟（约 13.7 公里），打车费用约 51 元

乘公共交通约 1 小时 7 分钟，票价 2 元

步行 430 米，乘坐 50 路，新南站上车，瓯北新桥站下车，步行 660 米到达温州铂尔曼酒店。

4、永嘉站 - 温州铂尔曼酒店

乘出租车约 19 分钟（约 8.2 公里），打车费用约 26 元

乘公共交通约 1 小时

步行 620 米，乘坐 永嘉 202 路，永嘉火车站上车，瓯北新桥站下车，步行 660 米到达温州铂尔曼酒店。

5、温州客运中心 - 温州铂尔曼酒店

乘出租车约 31 分钟（约 11.1 公里），打车费用约 39 元

乘公共交通约 1 小时 10 分钟，票价 2 元

步行 680 米，乘坐 50 路，牛山北路站上车，瓯北新桥站下车，步行 660 米到达温州铂尔曼酒店。

6、温州火车南汽车客运站 - 温州铂尔曼酒店

乘出租车约 35 分钟（约 14 公里），打车费用约 52 元

乘公共交通约 1 小时 30 分钟，票价 4 元

步行 300 米，乘坐 30 路（末班发车 18:00），火车南站上车，上桥站下车；步行 190 米，同站换乘 70 路，上桥站上车，瓯北新桥站下车，步行 640 米到达。

会议日程

10 月 12 日（星期五）		
8:30-22:30	**会议报到** **联系人：**胡众义（18957720163） 裴文靖（17701026616）	温州铂尔曼酒店大堂
18:00-19:30	**晚餐**	西餐厅
20:00-22:00	**2018 年中国人工智能学会智能空天系统专业委员会会议** **主持人：**贾英民（北京航空航天大学） 付永领（北京航空航天大学） 杜军平（北京邮电大学） 张维存（北京科技大学） 任雪梅（北京理工大学） 蔡　强（北京工商大学）	法国一厅
10 月 13 日（星期六）		
8:30-9:00	**开幕式** **主持人：**汪鹏君（温州大学）	瓯江厅
9:00-9:15	**大会合影** **主持人：**肖磊、黄辉（温州大学）	
9:15-10:05	**大会报告 1：**大型高炉智能系统 **报告人：**孙优贤（浙江大学） **主持人：**贾英民（北京航空航天大学）	
10:05-10:20	**茶歇**	
10:20-11:10	**大会报告 2：**数据驱动的设备寿命预测技术 **报告人：**胡昌华（火箭军工程大学） **主持人：**柴毅（重庆大学）	
11:10-12:00	**大会报告 3：**基于忆阻的神经形态系统分析与设计 **报告人：**曾志刚（华中科技大学） **主持人：**陈增强（南开大学）	
12:00-13:30	**午餐**	西餐厅
13:30-14:20	**大会报告 4：**智能空间机器人关键技术研究及应用 **报告人：**黄攀峰（西北工业大学） **主持人：**李海生（北京工商大学）	瓯江厅

14:20-15:10	**大会报告 5：**具有多种不确定性的非线性系统鲁棒自适应控制 **报告人：**张天平（扬州大学） **主持人：**杨洪勇（鲁东大学）	瓯江厅
15:10-16:00	**大会报告 6：**大机动无人机智能控制理论与应用 **报告人：**陈谋（南京航空航天大学） **主持人：**那靖（昆明理工大学）	
16:00-16:50	**大会报告 7：**The Development of Future Intelligent Robot Systems **报告人：**JuJang Lee（韩国科学技术院） **主持人：**楚天广（北京大学）	
16:50-17:00	**茶歇**	
17:00-18:45	**分组报告 1：**多智能体系统 **论文编号：D-1, D-2, D-3, D-4, D-10, D-12, D-13,** **主持人：**刘忠信（南开大学），莫立坡（北京工商大学）	瑞士 1 厅
	分组报告 2：分布式控制 **论文编号：C-5, C-6, D-6, D-11, J-2, I-1, L-9** **主持人：**魏新江（鲁东大学），杨正全（中国民航大学）	1 号会议室
	分组报告 3：非线性控制理论及应用 **论文编号：E-1, H-1, H-2, K-2, K-7, K-12, N-5** **主持人：**尹宏鹏（重庆大学），赵林（青岛大学）	2 号会议室
	分组报告 4：系统辨识与信息融合 **论文编号：A-12, E-2, J-1, J-4, L-1, M-1, O-1** **主持人：**魏伟（北京工商大学），李瑞（电子科技大学）	3 号会议室
	分组报告 5：先进智能算法及其应用 **论文编号：B-2, B-9, G-6, G-8, G-9, O-2, O-9** **主持人：**宋运忠（河南理工大学），余雷（苏州大学）	5 号会议室
19:00-20:30	**闭幕式及晚宴** **主持人：**李洪波（清华大学） 王朝立（上海理工大学） **颁发优秀论文奖** **颁奖人：**孙青林（南开大学） 胡忠志（南京航空航天大学） 王国利（中山大学） 王福忠（河南理工大学） 周 进（上海大学） 任雪梅（北京理工大学） 周武能（东华大学） 李晓斌（上海应用技术大学） 徐正光（北京科技大学）	瓯江厅
10 月 14 日（星期日）		
9:00-15:00	**会议考察** 浙南云谷（温州科技大市场） “瓯江蓬莱”江心屿	

大会报告

报告 1

大型高炉智能系统

孙优贤 院士

浙江大学

摘要：钢铁工业是我国的基础原材料工业和国民经济的重要支柱产业。钢铁工业发展迅速，但其发展面临着环境负荷重、能源效率低、资源瓶颈制约等问题。钢铁制造流程中，大型高炉是铁素物质流转换的核心工序，占钢铁生产总能耗的60%~70%，是钢铁流程实现绿色化与智能化的关键。传统的基于人工经验和炼铁机理的高炉操作方式，存在操作主观性强、模型精度不足和关键参数失准等缺点，导致铁水质量不稳、生产效率下降、原燃料浪费严重，亟需研发新的智能化系统，实现大型高炉多目标优化。本项目采用人工智能的理论方法，融合高炉炼铁领域知识和运行数据，提出了大型高炉多目标智能优化运行理论与技术，开发了大型高炉多目标智能系统，实现了大型高炉多操作模式下的智能优化：1）在深度学习框架下融合高炉专家知识与操作制度，通过混合增强智能，实现既定原燃料条件和操作参数下所能达到的大型高炉最佳运行指标的优化；2）通过深度学习与遗传算法相结合，实现建模与优化一体化运行，解决了大型高炉操作参数的重大难题。所开发的大型高炉多目标智能系统在柳州钢铁集团 2#高炉投用后，取得了巨大的社会经济效益。

报告人简介：孙优贤，1964 年毕业于浙江大学化学工程系，毕业后留校任教；1982 年晋升副教授；1984 至 1987 年获德国洪堡研究奖学金，赴德国斯图加特大学进修；1988 年晋升为教授；1991 年晋升为博士生导师；1995 年当选为中国工程院院士。现任浙江大学工业控制研究所所长，工业自动化国家工程研究中心主任，工业控制系统安全技术国家工程实验室主任。曾任中国自动化学会理事长、

中国仪器仪表行业协会副会长，中国化工学会自动化委员会主任，浙江省自动化学会理事长。曾任国际自动控制联合会（IFAC）制浆造纸委员会副主席，民盟中央常委，全国政协常委，浙江省人大副主任，浙江省民盟主委。

长期从事复杂工业过程建模、控制及优化，工厂综合自动化系统，重大工程自动化控制系统，鲁棒控制理论及应用、工业控制系统安全等领域的研究，先后承担或主持了一大批国家重大科技项目，开创了我国第一个国家工程研究中心，提出了"中国工业过程自动化高技术产业化"等 2 项国家高技术产业化重大专项，先后主持或完成了国家自然科学基金重大项目、国家自然科学重点基金、863 高技术计划、国家科技攻关计划、国家高技术产业化重大专项、省部级重大科技项目及企业重大自动化工程等 50 余项科研项目。率先建立了现代控制工程应用理论体系，创造性地解决了工业过程控制中的一系列关键问题，取得诸如容错控制技术，故障诊断技术，多系统同时镇定技术，全集成新一代主控系统，高端控制装备及系统的设计开发平台，高安全成套专用控制装置及系统等一系列技术发明和技术创新。研究成果与实际应用紧密结合，并实现了产业化，达到了相当生产规模，取得了重大的经济效益和社会效益。

1995 年当选院士以来，获得国家科技进步一等奖 1 项，二等奖 3 项，三等奖 1 项，国家优秀教学成果奖 2 项，出版专著、编著 18 部，被 SCI、EI 收录论文 500 余篇，授权专利 20 余项。并先后获得浙江省科学技术重大贡献奖、浙江省杰出创新人才、何利何梁科技进步奖、全国教育系统劳动模范、人民教师奖章、全国首届优秀科技工作者、全国有突出贡献中青年专家等荣誉称号。

报告 2

数据驱动的设备寿命预测技术

胡昌华

火箭军工程大学

摘要：系统地探讨了基于机理分析的寿命预测技术，基于回归分析的寿命预测技术，基于经验的寿命预测技术，基于失效数据统计分析的寿命预测技术，基于退化数据统计分析的寿命预测技术。

报告人简介：胡昌华，火箭军工程大学导航制导与控制国家重点学科带头人、导弹测试与控制技术国家虚拟仿真中心主任，长江学者特聘教授,国家杰出青年科学基金获得者，国家教学名师，军队领军人才，教育部自动化类教学指导委员会委员，中国自动化学会常务理事、技术过程故障诊断与安全性委员会副主任，军委科技委精确制导专家组专家，军委装备发展部装备质量特性与可靠性专家组专家，火箭军导弹专家，陕西省自动化学会副理事长，主要研究导弹自动测试、故障诊断与寿命预测等，出版专著 7 部、教材一部，一部教材入选国家规划教材，发表论文 300 余篇，SCI 收录 62 篇，SCI 他引 1268 次，获国家科技进步二等奖 1 项，军队（省）部级科技进步一、二等奖 9 项，当选全国优秀科技工作者，新世纪百千万人才国家级人选、国家有突出贡献的中青年专家，中国科协“求是”杰出青年实用工程奖，中国科协八大代表，享受政府特殊津贴专家，军队杰出专业技术人才奖，军队院校育才奖金奖，全军爱军精武标兵，火箭军十大砺剑尖兵。

报告 3

基于忆阻的神经形态系统分析与设计

曾志刚

华中科技大学

摘要：神经形态计算这一名称来源于使用集成电路模拟生物神经元细胞组织。研究者发现大脑神经元并不是每一次都全部激活，数据实际上是以信号的潜在脉冲方式传播，从而需要进一步研究信息是否编码在一系列脉冲的振幅、频率或延迟中。通过模仿动物大脑的认知架构以实现模拟神经生物智能处理信息的新型计算模式，能极大地提升计算系统的感知与自主学习能力。

忆阻是一种非线性的无源两端口动态器件，其阻值随两端电信号变化而改变的性质，非常类似于生物神经元突触的功能。将忆阻引入到神经形态计算的设计中，以模仿生物突触传导神经递质的过程，实现对生物突触的物理模拟，创造出基于忆阻的生物突触模拟器，是值得深入研究的方向之一。同时，通过运用模拟的突触电路实现神经元与神经元之间传递的信息的存储与计算，研究神经形态计算模型、硬件电路等来模拟大脑，有望发展出不同于传统人工智能中采用的冯 •诺依曼架构来实现大尺寸的神经形态计算系统，满足大数据时代对智能计算的需求。本报告将简介基于忆阻的逻辑运算电路设计，汇报基于忆阻的神经形态网络在算法和功能方向的研究进展。

报告人简介：华中科技大学教授、博士生导师，国家杰出青年科学基金获得者，教育部长江学者特聘教授，万人计划科技创新领军人才，图像信息处理与智能控制教育部重点实验室主任，华中科技大学自动化学院院长。发表 SCI 收录学术论文 180 多篇。先后担任 IEEE Transactions on Neural Networks；IEEE Transactions on Cybernetics；IEEE Transactions on Fuzzy Systems；Cognitive Computation；Neural Networks；Applied Soft Computing；自动化学报；控制工程；系统工程与电子技术的编委。担任 IEEE Transactions on

Neural Networks and Learning Systems； Neural Computing & Applications； Neurocomputing；International Journal of Fuzzy Systems；Neural Processing Letters 等 5 个 SCI 源国际学术期刊的客座编委。担任过三十多个国际学术会议的大会主席，程序委员会主席，出版主席等。曾获湖北省自然科学一等奖、湖北省科技进步一等奖、教育部高等学校科学研究优秀成果奖自然科学奖一等奖、国家科学技术进步奖二等奖各一次。

报告 4

智能空间机器人关键技术研究及应用

黄攀峰

西北工业大学

摘要：进入 21 世纪以来，航天器在轨服务与维护技术已成为航天高技术领域发展的新热点和国家安全的战略制高点，空间机器人作为开展此项任务的有效手段已成为研究热点，本报告将介绍西北工业大学智能机器人研究中心在国家重大任务和重大项目的支持下，开展空间机器人关键技术研究及在轨试验情况；首选阐述了我国“空间维护技术科学试验”重大任务中的空间机器人遥操作系统研制和飞行试验情况；其次，介绍了新型空间绳系机器人关键技术攻关和研制进展，对空间机器人的难点问题和发展趋势进行了梳理；展望了空间机器人技术在轨服务、载人航天工程和深空探测等方面的应用前景。

报告人简介：黄攀峰，香港中文大学博士，西北工业大学航天学院教授，博士生导师，IEEE 高级会员，国家杰出青年基金获得者，国家“万人计划”领军人才，科技部中青年科技创新领军人才，教育部“新世纪优秀人才”。现任中央军委科技委专家组专家，2030 国家某重大专项专家组专家，载人航天应用与服务专家组特邀专家。曾任国家 863 计划重大项目专家组专家，国家重大任务副总师。主要研究方向：空间机器人技术、遥操作技术、机器人视觉、航天器智能控制技术等。

报告 5

具有多种不确定性的非线性系统鲁棒自适应控制

张天平

扬州大学

摘要：首先，介绍非线性系统的分类、系统不确定性的主要形式以及常见的几类非线性系统，进一步，简要介绍后推设计与动态面控制设计的主要思想以及在控制器设计中的优缺点。其次，介绍处理随机系统的常用的工具：伊藤微分公式、随机小增益定理、随机输入状态稳定、变能量函数，处理未建模动态、输出约束和状态约束常用的几种方法，存在的优缺点；处理增益符号未知、状态约束的两个引理；随机方程数值解的方法以及 K－滤波器的设计方法。最后，对一类具有输入及状态未建模动态的随机纯反馈非线性系统，讨论自适应动态面控制设计、稳定性分析。将动态面控制技术与切贝晓夫不等式有机结合，所设计的自适应控制能保证闭环系统概率意义下有界，且误差信号均方或 4 阶矩意义下稳定。进一步，对具有动态不确定性和全状态约束的纯反馈非线性系统，通过引入非线性映射，并利用改进的动态面控制设计方法，讨论全状态约束条件下自适应动态面控制设计、稳定性分析，进一步给出了控制增益符号未知条件下具有未建模动态和全状态约束的自适应跟踪控制设计及稳定性分析。

报告人简介：张天平，1964年生，扬州大学信息工程学院自动化系主任，教授，博士生导师，控制科学与工程学科带头人。现为中国自动化学会智能自动化专业委员会委员，中国人工智能学会智能空天系统专业委员会委员，江苏省自动化学会常务理事，江苏省自动化学会控制理论及应用专业委员会副主任。1992年获华东师大数学系运筹学与控制论专业硕士学位，1996年4月获东南大学自动化所自动控制理论及应用专业博士学位。2005年10月至2006年10月在新加坡国立大学电气与计算机工程系访问。1998年被评为江苏省优秀青年骨干教师，2016年入选扬州大学高端人才支持计划领军人才项目。是国

家自然科学基金面上项目、优青、杰青项目的通讯评审专家；是信息部重点项目会评专家；是科技部智能机器人重点专项会评专家；是2013年中国智能自动化会议组织委员会主席；是2015年中国智能系统会议程序委员会主席。

目前主要从事复杂系统的鲁棒自适应控制、智能控制及随机非线性系统控制的研究；先后主持5项国家自然科学基金面上项目，参于国家自然科学基金项目4项。近年来，在《Automatica》、《IEEE Trans on Automatic Control》、《IEEE Trans on Neural Networks and Learning Systems》、《IEEE Trans on Fuzzy Systems》、《IEEE Trans on Systems，Man，and Cybernetics：Systems》、《Int. J. Robust Nonlinear Control》、《Information Sciences》、《IET Control Theory and Applications》、《Int. J. Adaptive Control and Signal Process 》、《Int. J. Systems Science》、《Neurocomputing》、《自动化学报》等重要学术刊物及国内外重要学术会议上发表论文260余篇，SCI收录50余篇，EI收录160余篇，SCI单篇最高他引280余篇次。指导的研究生中4篇硕士论文获江苏省优秀硕士论文。

报告 6

大机动无人机智能控制理论与应用

陈谋

南京航空航天大学

摘要：大机动无人机具有非定常气动、强非线性、强动态不确定、强耦合、强干扰等对象特征，导致传统的线性化飞行控制可能失效，进而严重威胁无人作战飞机的飞行安全。报告主要针对大机动无人机大包络和多任务等飞行控制要求，主要介绍了大机动无人机大包线自适应控制、多逼近器协同控制、鲁棒受限控制三个方面的研究成果。对同时存在系统不确定、不可观测状态、时变未知干扰和系统故障的大机动无人机，将神经网络应用于逼近系统的不确定，利用非线性干扰观测器估计外部时变未知干扰，设计非线性状态观测器逼近系统不可观测状态以及运用故障估计器估计系统故障，并给出几种异类逼近器之间的耦合设计技术。此外讨论了所发展的智能飞行控制在无人机中的应用以及未来研究工作的展望。

报告人简介：陈谋，博士，南京航空航天大学自动化学院教授，博士生导师，副院长。2011 年入选教育部“新世纪优秀人才支持计划”，2012 年入选江苏省“六大高峰人才”(A 类)，2013 年获江苏省杰出青年基金资助，2018 年入选江苏省“333”人才工程青年科技领军人才。先后在南京航空航天大学获学士与博士学位，2007 年 11 月-2008 年 2 月在英国拉夫堡大学访问研究。2008 年 6 月-2009 年 9 月新加坡国立大学博士后研究员(Research fellow A)。2014 年 5 月-2014 年 11 月澳大利亚阿德莱德大学高级研究学者。目前担任 SCI 收录英文期刊《IEEE Transactions on Systems, Man, and Cybernetics: Systems》、《IEEE Access》、《Neurocomputing》、《International Journal of Advanced Robotic Systems》编委、SCI 收录英文期刊《Chinese Journal of Aeronautics》和《SCIENCE CHINA Information Sciences》青年编委，中文 EI 收录期刊《航空学报》青年编

委等。同时也担任教育部高等学校教学指导委员会兵器类委员、中国航空学会导航制导与控制分会委员、中国自动化学会系统仿真专业委员会委员、中国航空学会武器系统专业委员会委员、江苏省自动化学会理事等。近 5 年主持国家自然科学基金面上项目、国家安全重大基础研究计划项目子项目、江苏省杰出青年基金项目等 20 余项。先后获教育部自然科学奖一等奖 1 项(排名第二)、获国防科技进步二等奖 2 项(排名第一)，申请授权发明专利 10 余项。出版中英文专著各 1 部，参编著作 3 部，发表学术论文 100 余篇，其中发表和录用国际期刊论文 80 余篇，SCI 他引超过 1300 次。

报告 7

The Development of Future Intelligent Robot Systems

JuJang Lee, IEEE Fellow

EE, KAIST, Korea

Abstract: The applications of the development of “Intelligent Robot Systems” are existed various fields, such as “Silver Robot”, “Space and Military Robot”, “Ubiquitous Robot”, and “Genetic Robot”. The silver robot can improve the quality of our life and productive. The technology could promote the welfare of the aged (silver) people through the health monitoring and the assistive equipment.

Future plans from NASA and the military call for we of space robotics. Space robotics is still a relatively small market with the potential to grow, however the government is currently the only customer. Ubiquitous Robot Systems will be the function of Intelligent Robots and internet networks.

Ubiquitous Robots(UbiBot) can be used by anyone for any service through any device and any network at anytime and anywhere in u-space. In case of Genetic Robot (Genebot), some artificial creatures which have its own genes and behaves autonomously according to internal state such as motivation and emotion.

Finally, Professor Hans Moravec predicts that machines will attain human levels of intelligence by the year 2040, and that by 2050, they will surpass we. “Machines, which will grow from us, learn our skills, and share our goals and values, can be viewed as “Child of Minds” ”, he also said.

Brief introduction: JuJang Lee is an emeritus professor and was the professor of the department of electrical engineering of KAIST, Korea. His research fields are in Robotics and Intelligent Robust Control. He is a Fellow of the IEEE, SICE, Japan, and ICROS, Korea. Dr. Lee was the vice president of IEEE Industrial Electronics. He was the president of ICROS, Korea. He was the Assocate Editor of IEEE Transactions on IE and TI. He was lots of the General Chairs at IEEE International Conferences. He has published around 800 papers. Dr. Lee received his BS and MS degrees in the department of electrical engineering from the Seoul National University in 1973 and 1975, respectively. He also received his Ph.D. degree in electrical engineering from the Unversity of Wisconsin in 1984. He was the visiting professor in Robotics Institutes at the CMU, USA, and in department of mechanical enigineering at the Imperial College, London, UK. He is now a special program professor in department of electrical engineering, CQUT, China.

大会特邀嘉宾

吴宏鑫，江苏丹徒人，中国科学院院士，1965 年毕业于清华大学自动控制系控制理论及其应用专业。现任北京控制工程研究所研究员，博士生导师。北京控制工程研究所、中国空间技术研究院和中国航天科技集团公司科技委顾问。主要从事航天和工业领域的自适应控制和智能控制理论与应用研究。

孙增圻，江苏靖江人，清华大学计算机系教授，博士生导师。1966 年毕业于清华大学自动控制系留校工作，1981 年在瑞典获博士学位。曾任中国人工智能学会副理事长，中国自动化学会机器人竞赛工作委员会主任，中国自动化学会智能自动化专业委员会主任。计算机系副主任（95－01），863 计划航天领域遥科学及空间机器人专家组成员、组长（93－01）。长期从事智能控制及机器人方面的教学和研究工作。

论文摘要

A. 系统辨识与建模仿真

A-1

Research on Cosine-type Non-uniform Air Gap Structure Based on Finite Element Analysis

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Abstract That the air gap magnetic field of PMSM contains a large number of harmonics, aiming at the problem, this paper presents a cosine-type non-uniform air gap motor structure. Taking a 22kW3000rpm permanent magnet synchronous motor as the researching object, a motor model was established by finite element analysis software to calculate the air gap flux density, no-load back EMF and output torque distribution curve respectively. The comparing results prove that the cosine type non-uniform air gap structure can effectively reduce the no-load back EMF harmonic components, reduce the torque ripple and improve the motor efficiency.

A-2

The development of a Charge Movement Model for Blast Furnace Based on Extended Kalman Filter

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Abstract In this paper, by analyzing the movement of blast furnace charge in the void area after the chute, the system's state equations and measurement equations are established, and the extended Kalman filter is used to predict and track the da-ta. Extended Kalman filter is a method that can expand nonlinear equations into linear equations through Taylor expansion to make better

observations. Then three-dimensional equations of state are established. The position, velocity, and acceleration of the charge are used to fit. Finally, the blast furnace is verified through experiments state of charge equation and measurement equation of charge and validity of three-dimensional extended Kalman filter.

A-3

Finite Element Analysis of the Bearing Assembly of Motion Simulator in Wide Temperature Range

Qingsheng Xiao[1 *], Yongling Fu[2], Linjie Li[2], Xiao Han[1]

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Abstract In this paper, a bearing assembly which is the part of a motion simulator operating at ambient temperature -173 ℃ and vacuum of 1×10^{-5}Pa is studied. ANSYS Workbench finite element software is used to simulate the stress and strain of the bearing assembly which contains shaft, sliding bearing and bearing seat in different temperature fields. To study the change of clearance between sliding bearing and bearing seat and the equivalent stress on shaft subjected to maximum load, It can guide the design and machining of the motion simulator, also can prevent the occurrence of stuck or loose sliding fault.

A-4

Simulation Research Based on Asynchronous Motor Vector Control Technology

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Abstract In order to improve the dynamic performance of the three-phase asynchronous motor open-loop control system, a current closed-loop vector control strategy is adopted. In the rotor flux-oriented control system, the closed-loop PI control of the decoupled exciting current and torque current is used to obtain the stator voltage in the dynamic coordinate system; finally, the asynchronous motor is controlled by the SVPWM and the asynchronous motor is realized the

control of the flux and speed of the asynchronous motor. The simulation results of the vector control of the asynchronous motor show that the current closed-loop control strategy can control the stable operation of the motor.

A-5

Multi-model Modeling of heating Furnace system based on FCM and GA Optimization ElasticNet-SVR

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Abstract Aiming at the characteristics of non-linear, time-varying and wide-ranging working conditions of heating furnace, with the improvement of control requirements for actual system prediction, single model modeling has the problems of large amount of calculation and poor accuracy. A multi-model modeling method is proposed in this paper. This method first divides the actual data of the heating furnace system into training set, validation set and test set, and uses FCM clustering to divide the training set into different working conditions; The Elastic Net-work (ElasticNet) and support Vector Machine regression (SVR) models are established in each local condition, and the optimal model of each local condition is selected from the two models by the validation set; use genetic algorithm (GA) to obtain the optimal weight of each local model, finally construct a model suitable for the global. This modeling method has a good global adaptability to the identification process. The veracity of the model is verified on the test set, and good results are obtained.

A-6

Hopfield Neural Network Identification for Prandtl-Ishlinskii Hysteresis Nonlinear System

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Abstract A new Hopfield Neural Network (HNN) identification approach is proposed for a Prandtl-Ishlinskii (P-I) hysteresis nonlinear system. Firstly, The P-I hysteresis nonlinear system is transformed into canonical form by linear state transformation with $B^{\perp}$ to suit the identification design. Then, we define a energy function E which is constituted by the transformed canonical state space system coefficients. Another suitable energy function E_n is proposed with HNN to identify the hysteresis system. Finally, simulation results have verified the performance of the proposed identification.

A-7

Hierarchical Modelling and Simulation of a Novel Integrated Electro-Mechanical Hydrostatic Actuator Based on Bond Graph

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Abstract Thrust vector control (TVC) actuation system is an important part for swing angle control of the nozzle of the launch vehicle. This communication studied a new type of powered electrically actuator: electro-mechanical hydrostatic actuator (EMHA) for driving the nozzle. The key components of the system were firstly introduced and then the mathematical models were presented. The hierarchical method was used for modelling, the models were built from the functional and behavioral - based on the bond graph. Finally, the simulation analysis of the two models is carried out in AMESim virtual prototype simulation environment. This paper shows different levels of models can be used when consider the different engineering needs such as controller design and the energy loss analysis of the system.

A-8

Prediction Model of Steel Mechanical Properties based on integrated KPLS

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Abstract In this paper, an integrated KPLS (Kernel Partial Least Square) prediction model for steel mechanical property is proposed. To eliminate the heterogeneity among variables in the hot rolling process, the KFA (Kernel Factor Analysis) is used to obtain the latent factor load vectors. Then the variables with large factor load were clustered into subsets, and the KPLS components are extracted respectively for each subset variable and target variable. Finally, the KPLS results of all subsets were integrated as input, and an integral KPLS prediction model is constructed with the target variables. An application study was carried out on the real production data of a steel-making plant. The experimental result shows that the precision of the presented method is greatly improved.

A-9

Static and Dynamic Performance Modeling and Simulation of a Microturbine

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Abstract The paper deals with the development of a thermodynamic simulation model of T100P microturbine from generalized maps. The microturbine unit consists of a compressor, a combustion chamber, a turbine, a recuperator and a diffuser, noted that the compressor and the turbine shared a single shaft with a high–speed generator. Finally, the steady-state and dynamic model have been matched with the experimental data and a good result is obtained. The model is to be used in the research on the development of control systems, verification on dynamic performance and control system hardware verification.

A-10

Non-rigid 3D Shape Classification Based on Low-level Features

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Abstract Non-rigid 3D shape classification is an important issue in digital geometry processing. In this paper, we propose a novel non-rigid 3D shape classification method using Convolutional Neural Networks (CNNs) based on the scale-invariant heat kernel signature (SIHKS). Firstly, SIHKS feature is extracted and we can get a matrix for every 3D shape. Then CNNs is employed to shape classification. The matrix of 3D shapes can be the input of CNNs. Finally, we can obtain the category probability of 3D shapes. Experimental results demonstrate the proposed method can get better results compared with SVM.

A-11

The Modeling and Implementation of Non- Rigid Motion of Carcasses

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Abstract The unmanned aerial vehicle (UAV) air show is most popular today, but it has drawbacks when displaying the image. Aiming to investigate the image scatter sample, based on bionic movement, this article uses the dragon as an experimental object to find the multi-link device rotation system such as 3d rotation transformations. Ultimately, considering the skeleton's characteristics, the methods used are to construct both complex and non-rigid images and both three-dimensional motion and plane trajectory models. The result of the MATLAB simulation is vivid, and thus, the method discussed in this article provides a general solution for unmanned aerial vehicle (UAV) air shows.

A-12

Reconstructed multi-innovation gradient algorithm for the identification of Sandwich systems

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Abstract Inspired by multi-innovation stochastic gradient identification algorithm, a reconstructed multi-innovation stochastic gradient identification algorithm (RMISG) is presented to estimate the parameters of sandwich systems in this paper. Compared with the traditional multi-innovation stochastic gradient identification algorithm, the RMISG is constructed by using the multistep update principle which solves the multi-innovation length problem and improves the performance of the identification algorithm. To decrease the calculation burden of the RMISG, the key-term separation principle is introduced to deal with the identification model of sandwich systems. Finally, simulation example is given to validate the availability of the proposed estimator.

A-13

Research of CDG to identify individuals via Deterministic Learning Theory

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Abstract An approach of human identification based on cardiodynamicsgram(CDG) is proposed in this paper. Algorithm design for the electrocardiogram (ECG) is carried out to achieve human identification, which includes collecting ECG data from the PTB database, filtering the ECG, synthesizing the VCG by using the filtered 12-lead ECG, and intercepting the ST-T segment from the VCGs. Then the CDGs are obtained by using radial basis function (RBF) neural networks (NNs) to model the ST-T segment through deterministic learning (DL). The obtained knowledge is stored in constant RBF networks. Finally stable features-Spatial heterogeneity index and temporal heterogeneity index are extracted to characterize the uniqueness of an individual, and SVM is used to train the classification model in MATLAB. The test data is fed to the obtained model to evaluate our proposed method. The results show that the proposed method can achieve more than 85% correct classification rate.

B. 故障诊断与监测技术

B-1

A Fault Detection Method for Non-Gaussian Industrial Processes via Joint KICA and FVS

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Abstract The data in industrial processes have the features of non-linear and non-Gaussian. In order to enhance the accuracy of fault detection for industrial processes, and to reduce the calculation time consumption, a method is proposed to combine the joint kernel independent component analysis and the feature vector selection (FVS) to achieve fault detection in this paper. Firstly, the joint kernel function of Gaussian radial basis kernel function and polynomial kernel function is used to improve the learning and generalization ability of kernel independent component analysis (KICA) algorithm, and this can be employed to improve the accuracy of fault detection. Secondly, FVS is given to reduce the computational complexity of Joint KICA, especially in the case of large sample size. Finally, the simulation results of Tennessee Eastman (TE) process can be used to verify the effectiveness of this proposed method.

B-2

Bearing fault diagnosis based on generalized S transform denoising and convolutional neural network

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Abstract This paper utilizes convolutional neural network (CNN) combining generalized S transform denoising (GSTD) method to complete noisy bearing fault diagnosis. After GSTD, images with more obvious failure information can be obtained. Then these feature images are

trained by convolutional neural network. The recognition accuracy of the proposed method on testing dataset achieves as high as 99.25%. Finally, the proposed method is compared with other diagnosis methods to prove its effectiveness in processing noise signal.

B-3

Title Fault Diagnosis of Transmission Network Based on Fusion of Time Sequence and Hierarchical Transitional WFPN

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Abstract In order to reduce the complexity of the model and improve the accuracy of the model, and make full use of the timing information of the alarm signal. A trans-mission network fault diagnosis method based on time sequence and hierarchical transitional WFPN was proposed. Firstly, the existing model was improved to re-duce the complexity of the model, then the time correlation characteristics of component, protection and circuit breaker were constructed, and the protection and circuit breaker that did not conform to the correlation characteristics were found by time sequence reasoning. Finally, the fault diagnosis of power network was carried out by fuzzy inference. Through the analysis of typical examples, it is found that this method improves the accuracy and fault tolerance of fault diagnosis.

B-4

Intelligent sensor detection technology in lighting design and application

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Abstract Sensors are an important part of intelligent lighting. They can sense the sound and brightness of the environment, the movement and presence of the human body, and sense the temperature, humidity and air quality of the environment. After sensor detection, it can further control the movement of lighting products, switch light and shade, color temperature, switch and scene changes, achieve the lighting effects of functional lighting, scene lighting, and

environ-mental protection requirements for energy saving and emission reduction. The application of sensors and light sensors in intelligent lighting control has increased the level of intelligence in lighting control and saved a lot of energy.

B-5

Remote-Monitoring Alarm System from Vehicle Burglar Design —Based on Single Chip Microcomputer

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Abstract This paper designs a remote-monitoring alarm system from vehicle burglar, based on MCU 52 series as main control chip. Through vibration sensor and pyroelectric infrared sensor, once Single Chip Microcomputer obtains monitoring signals, it can transmit signals to users' mobile terminal by GSM communication chip of SIM900A, so as to real-time monitoring. This design module is stable, cost effective, and is ideal for experiment teaching.

B-6

Intelligent monitoring system of Cremation equipment based on Internet of things

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Abstract The cremation of the remains and the burning of relics and sacrifices are the core and key to the funeral and funeral services. With the development of computer and numerical computation, the research of cremation process is becoming more and more important. Changing the traditional combustion method is of great significance for efficient operation of equipment and energy saving and emission reduction. In this paper, we transmit the combustion data collected by the smart sensor to the remote server terminal in real time through GPRS data transmission technology. Then we set up a database for data storage. Logistic regression, random forest,

XGBoost algorithm three data analysis models were used to establish a multi-input and multi-output simulation model of cremation equipment. And the actual working conditions in the process of cremation equipment were simulated to provide guidance. An intelligent monitoring system for cremation equipment is established, which integrates computer technology, sensing technology, automatic control technology, network technology and communication technology. This is of great significance for promoting the scientific development of modern funeral business.

B-7

Fault detection for discrete-time systems over signal to noise ratio constrained channels

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Abstract This paper studies fault detection for the discrete-time systems with signal to noise ratio constrained channels. By using the descriptor system method, a fault detection strategy is proposed. First, in order to guarantee the residual generation system is admissible, an augmented robust fault detection filter is constructed, and the fault is estimated; then, a constant threshold is designed to detect the fault. Finally, a simulation example is given to show the applicability of the proposed approach.

B-8

3D Printing Fault Detection Based on Process Data

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Abstract 3D printing technology is a kind of rapid prototyping technology. In the 3D printing process, several common faults often happen, resulting in interruption of the printing process or poor quality of the printed product. In order to maintain nor-mal function of the 3D printer, users need to manually check the scene all the time. In order to perform real-time detection of faults in the printing process of the 3D printer, multiple sets of experiments were conducted. We use sensors to obtain multiple parameters of the 3D printer. The machine learning method is used to

classify and detect whether the printing process is in a fault state. This method can effectively detect the fault condition that occurs during real-time 3D printing process and can be promoted in more 3D printers.

B-9

Fault Detection Method based on the Monitoring State Synchronization for Industrial Process System

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Abstract Currently, with the requirements of quality, safety and service in many modern industrial process systems, fault detection and diagnosis become a significant issue to ensure the high control performances. Under these circumstances, this paper presents a fault detection method based on the monitoring state synchronization to perceive and evaluate the system operation situation. This model firstly considers the system states measured by some sensors as the nodes and defines the distributed monitoring state network with changing dynamically over time, all of which have been given their definition, calculation method and actual physical meaning, and finally its synchronization state of distributed network can be employed to achieve fault detection. Furthermore, this method can be used to provide a novel and feasible research method for the global assessment of the operation states and for monitoring the local operation fault of modern industrial process systems. The application of this method on a simple multivariate process system example shown that it can not only track the operation state of the whole system well to detect the fault, and not only monitor the situation of each distributed network node in real time to achieve fault diagnosis, but also make use of the correlation between the network node states to effectively locate the system operation fault.

B-10

Inspection of Rail Surface Defects Image based on Histogram Processing by the Judgment Threshold

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Abstract It is a challenge to accurately detect the defects under the influence of light, reflection, shadow and rust. This paper optimizes the background difference method as preprocessing by reducing the template so that the influence of shadow can be reduced, and presents a histogram processing algorithm based on the judgment threshold to detect defects of the rail images. The judgment threshold is obtained by Otsu method. As we all know, the applicable condition of the Otsu method is the proportion of the target and background close to each other, and in order to achieve this kind of condition, the histogram processing is to remove partial histogram which is obtained by the judgment threshold. The histogram processing is performed cyclically and a new threshold for judging is obtained by Otsu method on the remaining histogram after the every loop. The constraint formula is introduced to make the threshold converge to the fixed value. Finally, the image is segmented by this threshold. The experimental results show the benefits of the proposed algorithm comparing to the existing algorithms.

B-11

A Fault Diagnosis Approach Based on Deep Belief Network and Its Application in Bearing Fault

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Abstract With the development of Industry 4.0, not only the equipment but also the operational conditions in industrial manufacturing are becoming more and more complex. It is necessary to diagnose failures, whose probability is now increasing violently. As a typical deep learning model, the Deep Belief Network (DBN) can be employed to extract features from the original data directly. Compared with traditional fault diagnosis methods, the DBN can get rid of the dependence on signal processing technology and diagnosis experience. In this paper, the fault diagnosis approach based on DBN is studied to identify the bearing failure. First of all, the basic principles of DBN and the steps of fault diagnosis are described. Then some key parameters of DBN which affect the fault identification performance are analyzed and determined according to the simulation experiments. The practicability of this method is verified by comparing with Support Vector Machine (SVM) and Back Propagation Neural Network (BPNN) at last.

B-12

Design and Implementation of Remote Monitoring System for Working Conditions of Cremation Equipment

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Abstract With the embedded technology and the 4G TD-LTE wireless data transfer tech-nology, a remote acquisition system for the working data of cremation equipment has been researched in this paper. The acquisition system realizes acquiring data and uploading data to internet, centralizing storage and monitoring the data time-ly. The data will support engineers in realizing remote cremation equipment maintenance, fault diagnosis, operation monitoring and upgrade of cremation equipment.

C. 复杂系统与网络控制

C-1

Quasi-Interval Bipartite Consensus Problems on Discrete-Time Signed Networks

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Abstract In this paper, discrete-time signed networks with cooperative and antagonistic interactions are considered in the presence of time-varying topologies. A separation approach is

proposed such that the cooperations and antagonisms can be clearly distinguished. It is shown that given the repeated joint strong connectivity, signed networks can achieve bipartite consensus (respectively, stability) if and only if the repeated joint structural balance (respectively, unbalance) are ensured. Furthermore, when only joint spanning tree condition is satisfied, quasi-interval bipartite consensus (respectively, stability) holds if and only if there peated joint structural balance (respectively, unbalance) can be guaranteed for the signed digraphs formed by only these joint root nodes. The simulation tests are included to verify the effectiveness of our obtained results.

C-2

An optimized scheme for monitoring data transmission of complex engineering systems

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Abstract In operation process of complex engineering systems, some problems of low transmission performance have severely burst out because of high concurrency and large monitoring data size. Three aspects such as operating mode, pre-compression pretreatment and data compression are considered to optimize the transmission process of system monitor data in this paper. Improvement of coding output process in LZSS algorithm is proposed as the compression processing method before data transmission. Finally, an optimization scheme is applied to an air launch site in mass monitoring data transmission process. The experimental results demonstrate that the proposed method significantly improves the transmission process. With the addition of the optimization scheme, transmission time is shortened nearly 75%.

C-3

Optimal Placement of Wireless Sensor Networks for 2-Dimensional Source Localization

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Abstract Optimal sensor network configuration for 2-Dimensional (2D) source localization is investigated systematically in this paper. The maximization of the determinant of Fisher

information matrix (FIM) is chosen as the optimality criterion. Homogeneous range, received signal strength (RSS), time-of-arrival (TOA) and angle-of-arrival (AOA) sensor networks with different measurement noises are considered. The optimal configuration conditions for these four types of sensors are given out. Discussions based on these conditions are done to derive the optimal sensor configurations.

C-4

Optimal Sensor Configuration for Three-Dimensional Range-Only Target Localization

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Abstract Optimal sensor configuration for range-only target localization in three-dimensional (3D) space is investigated in this paper. Based on the fact that to achieve more accurate localization, larger amount of information should be gathered, the maximization of the determinant of Fisher information matrix (FIM) is chosen as the optimality criterion. And by regarding the determinants as continuous polynomial functions of multiple formal variables, the optimal geometric configuration is systematically discussed.

C-5

Structural Controllability of Optimized Networks with Onion-like Topologies

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Abstract Recently, an optimization method has been proposed to increase the ability of complex networks to resist intentional attacks on hub nodes. The finally optimized networks exhibit a novel type of "onion-like" structure. At the same time, structural controllability of complex networks also has been a hot research topic in recent years. Thus, structural controllability of "onion-like" networks deserves sufficient discussion. In this study, we explored the relationship between the attack robustness and structural controllability of scale-free networks before and after optimization.

After implementing large quantity of numerical simulations, it has been found that the optimized scale-free networks have both increased robustness and enhanced structural controllability. Current research results can shed some light on the deep understanding of structural complexity and dynamical properties of real-world networked systems.

C-6

Research on an advanced cooperative censored positioning algorithm in wireless sensor networks

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Abstract In cooperative positioning, the additional information from agent-to-agent links helps more agents complete their position estimates, but at the same time, leads to increased network traffic and even degraded positioning accuracy. Transmit and receive censoring can significantly reduce complexity and network traffic without hampering the positioning performance. In this paper, an advanced combined censored positioning algorithm is proposed to further reduce the use of invalid information links. Specifically, a method in the algorithm with variable step size has a positive impact on accuracy. The simulation results manifest that the proposed algorithm is efficient to reduce computational complexity and improve positioning performance.

C-7

Consensus of a class of heterogeneous networked system with sampled-data

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Abstract This paper studies the consensus problem for a class of heterogeneous networked system. We first discretize the continuous-time networked system by sampled-data method. Then we convert the networked system into the reduced-order error system by a system transformation.

Based on algebraic graph theory and matrix theory, a sufficient condition for the networked system to achieve consensus is obtained by analyzing the stable problem of the reduced-order system. Simulation example will be given to show the usefulness of the results.

C-8

Distribution Network Fault Location Based on Improved Binary Particle Swarm Optimization

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Abstract Due to the local optimum and the inaccurate fault location of distribution network when DG (distributed generation) access using the traditional BPSO (binary particle swarm optimization), an IBPSO (improved binary particle swarm optimization) to locate the fault places is proposed. Firstly, the locating model of distribution network fault is established, which mainly includes the improved coding mode, the improved switching function and the improved fitness function. Then, the BPSO is improved, in which the inertial weight in the algorithm has the adaptive ability, so that the particle can maintain better. At last, this algorithm is used to simulate and locate the fault of distribution network with DG. The results prove that the algorithm and the improved function can accurately locate fault places when the single point fault and multi point fault in the distribution network with DG.

C-9

Research on Obstacle Avoidance Control Strate-gy of Networked Systems Based on Leader-Follower Formation Tracking

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Abstract This paper studies the obstacle avoidance control of networked system in completing leader-follower formation tracking task. By using methods of the behavior along the wall, the artificial potential field and the hybrid autonomous obstacle avoidance control, the obstacle

avoidance control strategy of possible obstacles in different environments is studied. In addition, the cooperative obstacle avoidance control method is used to discuss the obstacle avoidance in specific environment. Finally, the simulation results show that the obstacle avoidance control strategy studied in this paper is flexible and effective.

C-10

An Information Theory Based Approach for Link Prediction in Complex Networks

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Abstract We consider the link prediction problem in complex networks from the perspective of information theory. An approach is developed to take advantage of different structural features of networks. Specifically, in case only one feature is available, the conditional self-information of the event that there is a link connecting two nodes is used to evaluate the link existence likelihood. In case of multiple available features, we give a linear model to evaluate the existence likelihood of all potential links. Simulation results show that our approach gives satisfying results in synthetic complex networks compared with other methods using typical proximity indices.

C-11

Evolution of Function Modules in Complex Networks

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Abstract It is generally accepted that the function module plays an important role for the understanding of structure and function of complex networks. This brief studies the issue of the evolution of function modules in complex networks from the view of automaton state evolution. The definitions of two kinds function modules, including the fixed module and the period module, are presented to characterize the nature of complex networks, and the corresponding evolutions of

complex networks are further addressed. Furthermore, the developed concepts of function module are applied to the typical boolean network and the representative cyclical group respectively, and then the obtained results can reveal the practical features of these networks.

D. 多智能体系统与分布控制

D-1

Flocking motion of second-order multi-agent systems with mismatched disturbances

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Abstract Based on the problem of flocking for second-order multi-agent systems with mismatched disturbances, a distributed control algorithm with individual local information is investigated. For each agent, a disturbance observer is designed. And then based on disturbance observer, a distributed control protocol with feed-forward compensation term is proposed. By using Lyapunov stability and input to state stability theory, it proves that the distributed control law enables to make all agents eventually converge to the leader's velocity when at least one agent can receive the leader's information. Finally, a numerical simulation example illustrates the effectiveness of the conclusion.

D-2

Event-triggering Consensus of Second-order Multi-Agent Systems

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Abstract The consensus problem of second-order multi-agent system with event-trigger control is studied in this paper. In order to reduce the waste of hardware resources, improve the communication efficiency and increase the convergence speed of multi-agent systems, distributed event-trigger control algorithm is presented by means of the information of the neighborhood nodes. A closed-loop system model of second-order multi-agent under event-trigger strategy is established. By applying the of analytical tools such as matrix theory and modern control theory, the convergence condition of multi-agent systems with event-trigger control is obtained. Finally, the simulation results show the effectiveness of the algorithm.

D-3

Flocking of heterogeneous multi-agent with time delay and nonlinear inner-coupling functions

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Abstract In this paper, flocking of heterogeneous multi-agent is researched. The multi-agent consists of two types of agents with different dynamics. Based on some the certain assumptions, a controller with time delay and nonlinear inner-coupling function is given. It can be proved that each agent's velocity tracks the leader's by using the Lyapunov stability theory. Particularly, Collisions can be avoided between agents. Finally, a simulation is proposed to test and verify the availability of the controller.

D-4

Finite-time consensus problem of second-order multi-agent systems with external disturbances

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Abstract Finite-time consensus for second-order multi-agent systems with external disturbances is

investigated in this article. By turning the original system into an equivalent system, which can be represented by disagreement vector, sufficient conditions that guarantee all agents reach finite-time average consensus are derived. Finally, simulations are supplied to show the validity of the gotten theoretic results.

D-5

Composite-rotating consensus of leaderless multi-agent systems with time-delay

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Abstract This paper addresses the composite-rotating consensus problem of a class of second order multi-agent systems with time-delay. In order to solve the composite-rotating consensus problems, a distributed control protocol is introduced. Then the stability analysis is completed by using the method of frequency domain analysis and the maximum upper bound of time-delay is also obtained. Finally, the effectiveness of the theoretical results are verified by simulations.

D-6

Sampled-data Based Mean Square Bipartite Consensus of Double-integrator Multi-agent Systems with Measurement Noises

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Abstract A distributed sampled-data based bipartite consensus protocol is proposed for double-integrator multi-agent systems with measurement noises under signed digraph. A time-varying consensus gain and the agents' states feedback are adopted to counteract the noise effect and achieve bipartite consensus. By determining the state transition matrix of the multi-agent system, we describe the dynamic behavior of the system. Under the proposed protocol, the states of some agents converge in mean square to one random vector while the rest of agents' states are convergent to another random vector. It is noted that these two vector are at the same amplitude, however their signs are different. It is proved that sufficient conditions for achieving the mean square bipartite consensus are: 1) the topology graph is weighted balanced, structurally

balanced and has a spanning tree; and 2) the time-varying consensus gain satisfies the stochastic approximation conditions. We verify the validity of the proposed protocol by numerical simulations.

D-7

Fault-tolerant time-varying formation tracking for second-order multi-agent systems subjected to directed topologies and actuator failures with application to cruise missiles

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Abstract Fault-tolerant time-varying formation tracking problems for second-order multi-agent systems with actuator failures and directed topologies are investigated. Firstly, a distributed formation tracking control protocol is constructed using the adaptive law. In the case where the information of actuator failures remain unknown and only the local information of neighboring agents is available. Then the formation tracking condition is provided, and it is proven that by designing the formation tracking protocol using the proposed approaches, time-varying formation tracking can be achieved by the multi-agent system in the presence of actuator failures. The obtained results are applied to solve the formation tracking problem of a multi cruise missile system through acceleration tracking. Finally, numerical simulations are presented to demonstrate the effectiveness of the theoretical results.

D-8

Event-Triggered Synchronization of Linear Multi-Agent Systems with Time-Varing Communication Delays

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Abstract In this paper, the event-triggered control protocol of the general linear multi-agent systems with time-varing delays is considered. The state of each agent is sampled when a certain event was triggered, and its state can be transmitted to its neighbors after a time-varing

communication delay. The distributed event-triggered protocols, which is consisted of the event-triggered control laws and the triggering functions, are designed according to Riccati matrix equation, under which the consensus problem of multi-agent systems can be solved. Finally, some simulation examples are presented to demonstrate the effectiveness of the theoretical results.

D-9

Practical Distributed Cooperative Control of Multiple Nonholonomic Unicycle Robots

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Abstract In this work, we study the distributed cooperative control problem of multiple nonholonomic unicycle robots with a time-varying reference trajectory. Under the mild assumptions that the communication topology is bidirectional connected, the reference trajectory is bounded and known for at least one robot and the velocity of the reference trajectory is bounded but unknown for all robots, a novel distributed cooperative control protocol is proposed guaranteeing that all the robots follow the reference trajectory with an arbitrarily small ultimate tracking errors. Simulation examples are given to verify the proposed distributed cooperative scheme.

D-10

Consensus of linear multi-agent systems with a smart leader

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Abstract This paper addresses the consensus problem with linear systems via a smart leader under directed topology. The smart leader tracks a given reference model and a control function is constructed to control the smart leader. The smart leader can utilize its neighboring followers'

feedback information when the control function meet certain condition, which can effectively reduce the leader's controller cost and the tracking error among the leader and followers. By utilizing the relative output message of neighboring agents, a reduced-order observer is adopted under the assumption that the directed topology have a directed spanning tree. A sufficient condition is given to guarantee that the leader-following system can achieve consensus. Finally, simulation examples are given to demonstrate the effectiveness of the obtained results.

D-11

Containment control of second-order multi-agent systems with mismatched disturbances

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Abstract For the cluster movement problem of multi-agent systems, this paper studies containment control of second-order multi-agent systems with mismatched disturbances. State observers and disturbance observers are designed to estimate the un-known states and disturbances of the systems, and a control protocol based on the active anti-disturbance observers is constructed. By applying matrix theory and modern control theory, the dynamic characteristics of second-order multi-agent systems based on disturbance observers are studied. In numerical simulations, the observers based containment control algorithm is applied to make the motion states of the systems eventually converge to the target area formed by multiple leaders, which verifies the validity of the conclusions in this paper.

D-12

Target-enclosing for multi-agent systems at same height

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Abstract In this paper, we consider the target-enclosing problem of multi-agent systems, where two algorithms are provided to achieve enclosure for static or moving targets at same height. We first establish the center estimator for targets. Then two control protocols are designed. The first protocol is designed with distance-only measurement for static targets. The second protocol is designed with local position information of neighbor targets. Some simulation results are provided to show the effectiveness of the obtained theoretical results.

D-13

Fast Convergence for Flocking motion of Discrete-Time Multi-Agent System with Disturbance

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Abstract For discrete-time flocking problems of networked systems with multiple leaders, containment control algorithms converged in finite time is presented. Based on modern control theory, algebraic graph theory and linear matrix inequality meth-od, the proposed control algorithm is analyzed theoretically. The convergence condition is obtained to ensure the flocking motion in the finite time for discrete-time multi-agent systems with disturbance. Finally, the system simulation results are given to illustrate the correctness of the conclusion.

D-14

Distributed fixed-time consensus algorithm for multiple nonholonomic chained-form systems

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Abstract In this paper, the fixed-time control algorithm is used to address the consensus problem

for multiple nonholonomic chained-form systems. For the sake of analysis, a switching control strategy is introduced to solve the fixed-time consensus problem. Compared with the finite-time control algorithm, the convergence time of the fixed-time consensus protocol, can be guaranteed regardless of the initial conditions. Rigorous proof using Lyapunov theory shows that the sates of multiple nonholonomic chained-form systems can reach a consensus in a fixed time. To further illustrate the effectiveness of the control algorithm, a numerical simulation is given.

E. 图像处理与 SLAM

E-1

Weighted Tensor Schatten *p*-norm Minimization for Image Denoising

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Abstract In the traditional non-local similar patches based denoising algorithms, the image patches are firstly flatted into a vector, which ignores the spatial layout information within the image patches that can be used for improving the denoising performance. To deal with this issue, we propose a weighted tensor Schatten *p*-norm minimization (WTSN) algorithm for image denoising and use alternating direction method (ADM) to solve it. In WTSN, the image patches are treated as matrix instead of vectorizing them, and thus make full use of information within the structure of the image patches. Furthermore, the employed Schatten p-norm requires much weaker incoherence conditions and can find sparser solutions than the nuclear norm, and thus is more robust against noise and outliers. Experimental results show that the proposed WTSN algorithm outperforms many state-of-the-art denoising algorithms in terms of both quantitative measure and visual perception quality.

E-2

A novel Multi-Exposure Image Fusion Approach based on Parameter Dynamic Selection

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Abstract This paper propose a parameter dynamic selection approach for multi-exposure image fusion(MEF)that based on image cartoon-texture and structural patch decomposition. The image texture component is obtained by using texture-cartoon decomposition from the input image. The dynamic parameter is achieved by calculating the image texture entropy. The image patch is divided into three conceptually independent components by using structural patch decomposition. Respectively processing and fusing these three components, a fusion patch and aggregate fused patches are reconstruct into a fused image. This novel MEF method achieves dynamic parameter selection by utilizing texture-cartoon decomposition to obtain fusion images with more details.

E-3

Research on Loop Closing for SLAM Based on RGB-D Images

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Abstract This paper mainly studies a loop closing detection method based on visual SLAM. We used RGB-D image as data source. The main idea is to construct a word bag based on DBoW3. Using rBRIEF makes it possible to perform feature extraction after the image is rotated. And added the elimination of mismatch links to improve the accuracy of detection. In order to ensure the reliability of the loop closing test results, the matching image is also verified. RGB-D image is rich in information and can synchronously extract the depth and color information of the main objects in the scene. The depth information directly reflects the distance information of each object in the scene.

E-4

An Overview of SLAM

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Abstract Simultaneous Localization and Mapping (SLAM) based on LIDAR and Visual SLAM (VSLAM) are key technologies for mobile robot navigation. In this paper, the SLAM algorithm based on these two types of sensors is described, and their advantages and disadvantages are comprehensively analyzed and compared. In order to better achieve active navigation and positioning, path planning and ob-stacle avoidance, the advantages of both should be brought into full play. In the end, the future development direction of mobile robot is discussed.

E-5

Autonomous Localization and Mapping for Mobile Robot based on ORB-SLAM

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Abstract We aim to realize autonomous localization and mapping for mobile robot while no prior knowledge of its environment provided, based on one of the state-of-the-art SLAM algorithm called ORB-SLAM. A local 3D point cloud map is constructed, through the depth information acquired from RGB-D sensor and corresponding camera poses estimated from ORB-SLAM, which is then transformed to a 2D occupancy grid map using octree. Based on the 2D map, an information-theoretic exploration algorithm is used to travel through all the environment. Finally, experiments are carried out in a mobile robot.

E-6

A Method of Semantic Image Inpainting with Generative Adversarial Networks

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Abstract Semantic image inpainting focuses on the completing task of high-level missing regions at the basis of the uncorrupted image. The classical methods of image inpainting can only deal with low-level or mid-level missing regions due to the lack of representation of the image. In the essay, we conclude a new method of semantic image inpainting. It's based on the generative model with learning the representation of image database. We propose an architecture of

completion model using perceptual loss and contextual loss based on generative adversarial networks after having trained generative model using DCGAN. We qualitatively and quantitatively explore the effect of missing regions of different types and sizes on image inpainting. Our method successfully completes inpainting tasks in large missing regions and results looks realistic with extensive experiments. We conclude that the performance of our model mostly is good when completing image corrupted with the mask with an area of less than 50% as well as with center or random masks.

E-7

Urban Street Image Matching Method based on Improved SURF Algorithm

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Abstract The Speeded Up Robust Features (SURF) algorithm was too cumbersome to extract the feature points, so it could not meet the needs of more rapid image matching. This paper takes the urban street image as the research object and proposes a more efficient and rapid image matching strategy which is based on SURF. Firstly, use Haar wavelet for image preprocessing to remove high frequency information and extract the low-frequency part of the image. Secondly, use Brisk algorithm to extract feature points from the processed image instead of the step of extracting the feature points by SURF. Finally, use surf's feature point description method and matching strategy to match. The simulation results showed that the improved algorithm increased the matching rate and reduces matching time, the effect is more prominent when the image affect by the influence of light.

E-8

Online RPCA on Background Modeling

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Abstract Fast RPCA method for background modeling has to load video sequence into memory to conduct matrix decomposition. It is efficient with small-size video or limited image sequences, but

not for online update or big data processing. So to satisfy the need for dynamic subspace, this work provides an option for processing one sample per time instance with an online optimization scheme to recover static camera background scene from video sequence. Experiments are conducted via LRSLibrary benchmarks. Results show that our proposed online fast RPCA can be a supplement to other online approaches.

E-9

An Image Dehazing Algorithm Based on Bin-ocular Disparity

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Abstract This paper discusses the principle of the common dehazing algorithms, points out their shortcomings, and puts forward a novel image defogging algorithm based on binocular disparity. This method is consisted of two identical cameras. 1) We can get two images on a flat, one is disparity image based on SAD feature matching, the other is depth image corresponding to foggy image by using the inverse principle between disparity and depth. 2) Luminance component and depth images are respectively regarded as guided image with guided filter and the input images, to estimate atmospheric optical transmission diagram. Therefore, 3) we introduce atmospheric optical transmission corresponding to sky corrected by brightness difference mechanism. The experimental results show that the proposed algorithm can achieve better recovery results and eliminate the halo phenomenon caused by defogging single image.

E-10

Sliding Window Based Monocular SLAM Using Nonlinear Optimization

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Abstract In this paper, a sliding window based real-time monocular SLAM is proposed. In our method, latest multiple states are estimated in a sliding window by using nonlinear optimization, and the other states are marginalized out from the sliding window. Meanwhile, we convert

measurements corresponding to marginalized states into prior, so as to bound the computational complexity and improve the accuracy of state estimation without loop detection. Two experiments are designed to evaluate the accuracy and effectiveness of our method. The results show that the performance of our method is much better than the monocular ORBSLAM, and our method can effectively estimate the sparse point cloud of map structure and camera motion with unknown scale.

E-11

Link Selection in Radio Tomographic Imaging with Backprojection Transformation

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Abstract Multi-path interference in Radio Tomographic Imaging (RTI), often brings unpredictable degeneration to the reconstructed image and degrades the accuracy of Device-Free Localization(DFL). By analyzing the reconstruction process of RTI, this paper certifies that the shadow fading can be transformed as a linear combination of the contribution of RF links. This transformation named backprojection indicates that the selection of informative RF links is helpful to resist the multi-path noise. Then a method based on Bayesian Compressive Sensing (BCS) and backprojection is proposed to figure out the contributive RF links and reconstruct the image. Besides, by transforming the reconstruction issue of high-dimensional image into the analysis problem of low-dimensional measured data, the proposed method also decreases the time complexity of BCS without reducing the accuracy. The experimental results show the effectiveness and practicability of the method in RTI and DFL.

E-12

A Method Based on Pseudo Inverse of Image Jacobian Matrix on Uncalibrated Visual Control for Robot

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Abstract It is necessary for controlling the robot manipulator to acquire an image Jacobian matrix in the field of uncalibrated visual servo for image-based. In fact, it is difficult to do. In this article, a new controller of uncalibrated visual sevro is proposed, which uses pseudo inverse of image Jacobian matrix of robot manipulators. On the basis of the mathematical model of robot, asymptotic convergence is proved by the Lyapunov theory, which means the image errors to zero. Simulations is carried out, which verify performances of the presented scheme.

E-13

Indoor Navigation for Quadrotor using RGB-D Camera

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Abstract In this paper, we present hardware design and software architecture of a navigation system for quadrotor. By getting data from RGB-D camera and processing it on the onboard computer with visual simultanenous localization and mapping (SLAM) algorithm that we proposed, we can obtain real-time pose of the quadrotor and a 3D dense map of the surroundings. At the same time, we use an improved rapidly exploring random tree algorithm (RRT*) to get a safe global path with obstacle avoidance in Octomap (the map is stored in Octotree format), and using the path to perform navigation. The experimental results demonstrate the navigation and 3D SLAM capabilities of the quadrotor in our system.

E-14

Image Recognition of Engine Ignition Experiment Based on Convolutional Neural Network

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Abstract In the engine ignition experiment, the specific instant of the ignition is usually obtained from a large quantity of high-resolution pictures taken with high-speed cameras, which puts forward an urgent request for the rapid image recognition. To address this issue, a picture recognition method based on convolutional neural network (CNN) is described. First, a training data set for the CNN model is made based on the original experimental images. Second, the constructed CNN model is trained to obtain the classification result. Finally, the CNN model is evaluated and optimized for the image recognition of engine ignition. The experimental results show that the method can quickly and accurately recognize the engine ignition.

E-15

Feature Points Designing and Images Merging In the Final Approaching Phase of Rendezvous and Docking

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Abstract In this paper, three feature points are designed on the fore-end cabin of the target spacecraft model. Some feature points are regarded as control points. A global affine transformation based on control points is used to image merging. The feature extracted on the front-end cabin and on two solar panels is merged with the same image. That is to say, three feature points and one characteristic circle on the fore-end cabin and 48 feature points on two solar panels are merged into the same image. In the experiment, a global affine transformation is applied for images merging based on three control points and five control points respectively. The experimental results achieved images translation, rotation, scaling and shearing. They are merged into the one image in the end. It lays the foundation for the measurement of the position and attitude of the target spacecraft.

F. 电子电力系统及控制

F-1

Circulating Current Minimization in MC-WPT System with Multiple Inverter Modules Operate in parallel

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Abstract The magnetic coupled wireless power transfer (MC-WPT) system with multiple inverter modules operated in parallel is investigated in this paper. The circulating current among the inverter modules is analyzed first. A novel topology with a control scheme is proposed aiming to minimize the circulating current among the inverter modules based on the active and reactive current decomposition. In the proposed circulating minimization method, there is only one loop which is proved to be a phase control loop. It is shown that the circulating current minimization can be achieved if the phase of all the modules output voltages are the same. Performance is verified with both simulations and experiments on a prototype MC-WPT system where two resonant inverter modules are operated in parallel. Finally, a conclusion is given.

F-2

Auxiliary Rotor Slot Optimization Design for Improving Back-EMF Waveform of PMSM Based on MagneForce

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Abstract As lots of harmonics are in the back- electromotive force (EMF) of Permanent Magnet Synchronous Motor (PMSM), an auxiliary rotor slot is presented to re-duce the Total Harmonic Distortion (THD), to improve the waveform of back-EMF, and to make the waveform of it close to sinusoid. A 22kW3000rpm PMSM is simulated by MagneForce software. The simulation

results show that the THD is decreased by 48.4%, while the fundamental voltage amplitude is increased by 4.4%, and the waveform is closer to sinusoid after the auxiliary rotor slot is opened.

F-3

Research on Three-phase Grid-connected Inverter Model Predictive Control

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Abstract This paper presents a method of three-phase grid-connected inverter model predictive control (MPC) for the shortcomings of slow dynamic response and poor robustness of three-phase grid-connected inverters. Through MPC prediction, the optimal control quantity is obtained based on the optimization function. The establishment and implementation process of the MPC algorithm are introduced. The corresponding simulation model is established in Matlab/Simulink environment. The simulation results show that the MPC has the characteristics of fast dynamic response and strong robustness. It has good steady-state performance and is suitable for high-performance control of three-phase grid-connected inverters.

F-4

An improved algorithm for maximum power point tracking of photovoltaic cells based on Newton interpolation method

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Abstract Photovoltaic (PV) arrays are power generation equipment in PV systems. Maximum power point Tracking (MPPT) scheme in the PV array affects the power generation efficiency of the PV system. In this paper, based on the deficiencies of existing MPPT methods, an algorithm by combining the increment conductance method with variable step size and Newton interpolation method is proposed, which can automatically adjust the step size according to changes in the external environment to avoid power loss and improve the photovoltaic power generation efficiency. The results show the improved MPPT algorithm can efficiently control the vibration amplitude of the power waveform output compared with the traditional conductance increment

method. The problem studied in this paper is somewhat interesting. I have the following comments. Meanwhile, it presents a faster tracking speed and a good adaptability for the environment.

F-5

Designed of Wind Power Generation Control System Based on Matrix Converter

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Abstract In this paper, the matrix converter (MC) as the full power converter of the direct-drive permanent magnet synchronous wind power generation system (DD-PMSG) is analyzed. The space vector modulation for the MC is deduced and calculated, respectively. And the field oriented control is used as the control strategy for the DD-PMSG. On the one hand, the simulation model of the MC fed DD-PMSG is built by MATLAB/Simulink, and the simulation on the RL load is carried out, which verifies the correctness of the theoretical analysis and the modulation method. On the other hand, the simulation results show that the MC has the ad-vantages of good input and output waveforms, controllable amplitude and frequency, high input power factor and so on. It also shows that the MC is suitable for DD-PMSG, which provides a theoretical basis for further research.

F-6

Unit Commitment and Load Distribution within a Power Plant

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Abstract With the rapid development of electricity market, a power plant or power supply producer involved in the market need to face the economic dispatch problem, which includes unit commitment and load distribution. These problems were formerly resolved by the dispatching

department of the state power grid manager. Taking into account the new situation in the electricity market, this paper presents a new solution to this problem, i.e, dynamic programming method combined with equal incremental cost criteria.

F-7

Plant/Controller Integrated Design for Dualmotor Servo Systems with Backlash

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Abstract This paper proposes an integrated design of the plant, finite-time controller and bias torque for the dual-motor servo systems with backlash. To achieve the finite-time error convergence of the tracking error, a recursive fast terminal sliding mode controller (FTSMC) is proposed, which contains two sliding mode control laws for the situations that both of motors driving the load and only one motor driving the load. Since the backlash will result in the load uncontrollable problem, the time-varying bias torque is designed to eliminate the backlash nonlinearity. Finally, an integrated design uses the particle swarm optimization algorithm to optimize the parameters of all the controller, bias torque and backlash. Simulation results are conducted to validate the desired load tracking performance of the proposed integrated design.

F-8

Optimal Robust Guaranteed Cost Backstepping Control for Multi-motor Driving System

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Abstract This paper proposes an optimal robust guaranteed cost backstepping control for the multi-motor driving system with parameter uncertainties. First, the state representation of the multi-motor driving system with parameter uncertainties is established, and a feedforward controller is designed based on the backstepping control technique. Then, based on the feedforward control, an optimal robust guaranteed cost feedback controller is designed to achieve the asymptotically stability of the error system. The proposed controller not only can increase the

system robustness to the parameter uncertainties, but also can make the cost function limited by a certain upper bound. Lyapunov theory proves the stability of the control system. Finally, simulation results based on a four-motor driving system demonstrate the effectiveness of the proposed control scheme.

F-9

Nested Optimization Based Co-design Method for Motor Driving System

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Abstract Due to the complex structure of the motor driving system, the control performance can be influenced significantly by the plant design. To improve the control performance, a plant/controller co-design method is developed in this paper. A combined optimization index considering both the plant design and the controller design is developed for the motor driving system. By solving the proposed co-design problem, the largest load's moment of inertia can be achieved with the same control performance. A nested optimization strategy is adopted to simplified the co-design problem to achieve the system optimality reliably and effectively. Simulation results illustrate the effectiveness of the proposed plant/controller co-design method.

G. 先进智能算法及其应用

G-1

Improved Deep Deterministic Policy Gradient Algorithm based on Prioritized Sampling

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Abstract Deep reinforcement learning tends to have low sampling efficiency, and prioritized sampling algorithm can improve the sampling efficiency to a certain extent. The prioritized sampling algorithm can be used in deep deterministic policy gradient algorithm, and a small sample sorting method is proposed to solve the problem of high complexity of the common prioritized sampling algorithm. Simulation experiments prove that the improved deep deterministic policy gradient algorithm improves the sampling efficiency and the training performance is better.

G-2

Research on the Values Tendency Analysis of the Micro-blogging User based on Social Networks

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Abstract With the development of Internet, the public opinion on the Internet is paid more and more attentions. Micro-blogging, as a popular social platform, is prone to cause some group unexpected events. In view of this, Value Tendency Analysis based on Social Network (VTASN) is proposed in this paper. VTASN is based on Schwartz values and it includes three parts: value vector space generation, value vector computation and individual value priority evaluation. The simulated experiments verify the effectiveness of VTASN.

G-3

Subspace Clustering based Association Analysis between Multiple Process-variable-parameters and Faults

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Abstract Aiming at the problem of large amount of data and low utilization rate in complex industrial systems and processes, an association analysis method of process variables and faults is

proposed. Because of the characteristic that large number of process variables and large data volume consist in complex industrial system, a subspace clustering based quantitative association rule mining method is proposed to the association analysis between multiple process-variables and faults. The validity and efficiency of the method is verified by using the fault datasets of TE process.

G-4

Semi-Supervised Learning based on Coupled Graph Laplacian Regularization

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Abstract This paper aims at constructing coupled graph to discover the intrinsic sample structures under the Semi-Supervised Learning (SSL). Specifically, we first select some anchors by a clustering method such as K-means, and build the weight matrix by local reconstruction coefficients that represent each sample as a linear combination of its neighboring anchors. Then the graph Laplacian matrices over anchors and samples are respectively constructed by the weight matrix. On one hand, the anchor graph gives the coarse data structure and reduces the influences of the noise of training samples and outliers. On the other hand, the sample graph gives the detailed description for the fine structures of samples. We integrate the two graphs into a unified optimization framework, and propose the coupled graph Laplacian regularized semi-supervised learning approach. Experiments on several publicly datasets show that the proposed approach achieves the superior classification performances, while the computational costs are comparable to state-of-the-art methods.

G-5

Grey Markov model prediction method for regu-lar pedestrian movement trend

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Abstract This paper focuses on the problem that mobile vehicles easily collide with regular pedestrians in dangerous area, and the gray prediction algorithm is applied to establish the markov model of regular pedestrian data. Predict their walking trajectory according to the regular pedestrian movement trend, and provide active and safe predictive control for vehicle braking in the region. Taking the coke oven coal transportation area as an example, a set of regular pedestrian trajectory data is selected to verify the model and prediction method. The experimental results show that this method can predict this type of pedestrian trajectory. When it is compared with the results of the traditional gray model prediction, the error is smaller and the accuracy is higher.

G-6

Design of a Kind of Trajectory Optimization Algorithm for a Manipulator Based on Genetic Algorithm

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Abstract According to a existing 3-DOF manipulator, its kinematic constraints are analyzed. A manipulator trajectory optimization algorithm is proposed based on genetic algorithm. Considered with several obstacles, both the running time and the energy consumption are taken as the optimization targets with the speed and acceleration constraints. The fourth-fifth-order polynomial is used as the interpolation curve to fit the joint trajectory, which is to ensure the continuity of joint operation. Based on genetic algorithm, the optimal trajectory under the relevant constraints is obtained. The algorithm can solve the problem of trajectory optimization in the environment with several obstacles very well. The experiment results show the efficience of the algorithm.

G-7

Microblog search based on deep reinforcement learning

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Abstract The big data and real-time publish make microblog search a challenge. We imitate

mechanism of the behavior of playing Atari to realize microblog search based on reinforcement learning (RL). In this paper, we propose the Reinforcement Search Deep Q-Network (RSDQN) for microblog search, which is combined by Deep Q Network (DQN) and Long Short Term Memory Networks (LSTM). RSDQN sequentially takes action according to the current state of the environment. With state translating, the model parameters are trained by instant reward and total reward. We evaluate the instant reward as Q-Value and the total search results with normalize discounted cumulative gain (NDCG). Experimental results on Sina Weibo dataset showed better performance on the whole.

G-8

User Behavior Prediction with SVM for Garment Ordering System

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Abstract In this paper, a iPAD based garment ordering system is first developed via support vector machine (SVM) learning algorithm. The garment ordering system is introduced with its development history and current situation. SVM algorithm has the advantages of pattern recognition which is used to deal with the binary issues for the user selection. From the perspective of requirement of the ordering meeting, the ordering system is designed and accomplished with module decomposition. The data are collected from the central unit of actual ordering meetings and loaded in the system based on the potential selection so as to reduce the loading pressure and waiting time of the end users. Experiments are performed to testify the efficacy of the proposed algorithm for users behaviour prediction for higher system performance.

G-9

A planning evaluation method for esophageal VMAT based on machine learning

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Abstract To reduce the complexity associated with VMAT planning, we developed a model which can predict the dose volume histograms (DVHs) of organ-at-risk using the prior knowledge of the high quality esophageal VMAT plans and the distance to target histograms (DTHs). We extracted the anatomical information and dose in-formation of patients from DICOM-RT files. With these information, the DTH and DVH curves were calculated. Principal component analysis was used to identify the main features of DTH and DVH curves. Then, least absolute shrinkage and selection operator regression was used to establish the functional relationship between the main features of DTH and DVH curves. In this study, the training dataset consists of 35 esophageal VMAT plans and the trained model was validated by 12 cases outside the training dataset. The experimental results demonstrated that the DTH/DVH curves can be effectively expressed by one or two principal components, the accuracy of the model in prediction is about 75%. These promising results suggest that this method can predict does distribution in the esophageal VMAT plans and assist the physicist to make plans by giving objective function and orientation, which can improve the efficiency and quality of plan making.

G-10

Research on a fast matching method of K nearest neighbor for WIFI fingerprint location

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Abstract Aiming at the problem of low speed and positioning fluctuations of indoor WiFi fingerprints. Firstly, we use the method of Gauss fitting and averaging to acquire the average value of the received signal. Secondly, we use a distance to be similarity measure to define a threshold to classify the fingerprint database. Finally, by improving the K nearest neighbor algorithm and on the basis of classification, Implement fast matching of K nearest neighbor. The experimental results show that the time efficiency of the classified location system has been greatly improved, with an average decrease of 62.8%; In the positioning accuracy, WiFi fingerprint positioning of the average error from 4.17m down to 2.12m.

G-11

New personnel positioning algorithm in mine based on PSO-GSA

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Abstract Aiming at the problem that the localization algorithm based on received signal strength indication is difficult to dynamically track the parameter change in the complex environment of coal mines. In order to improve the accuracy of the mine personnel positioning, this paper proposes a method to use the improved gravitational search algorithm to position the underground personnel in the weighted centroid positioning. Utilizing the long distance path loss model got the distance between the beacon nodes and unknown nodes, and then through the weighted centroid localization algorithm performed the unknown node position-ing. Finally, the improved GSA-PSO optimized the preliminary location results and parameters. Experimental results show the proposed method can improve both the positioning accuracy effectively and the adaptive ability of changeful environment.

G-12

A Cross-modal Short Text Semantic Expansion Method for Microblog Search

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Abstract Image is an important part of microblog, and its visual information can offer ad-ditional semantics besides the textual information. To overcome short text's se-mantic sparsity problem and fully utilize the semantics of text and image, we propose a cross-modal short text expansion method for microblog search in this paper. First, we expand short texts using the distributed representations of words, and then based on deep neural network, we extract related information of images and append them to the original short text. The expanded pseudo-documents contain

richer semantics, and by turning pseudo-documents into vectors, we can achieve accurate microblog search. Experiments on real-world datasets show that the proposed cross-modal short text expansion method can effectively extract the semantics of microblogs and improve search performance.

G-13

A Ship Tracking Algorithm of Harbor Channel Based on Orthogonal Particles Filter

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Abstract This paper, employing Bayes state estimation, proposes a ship tracking algorithm of harbor channel based on orthogonal particle filter. 1) The dynamic model fully takes speed of state change into consideration during the movement of target ship, to improve the problem that the existing correlation algorithms have poor adaptability to the target ship tracking of the complex mode. 2) The proposed algorithm reorganizes and estimates particles by using orthogonal particles arrays, which can avoid particles degradation problems caused by resampling. Experimental results demonstrate that our algorithm outperforms other algorithms.

H. 智能交通与车辆控制

H-1

Trajectory Tracking of Intelligent Vehicles Based on Decoupling Performance

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Abstract This paper presents a novel method to achieve trajectory tracking of intelligent vehicles.

Both kinetic control and kinematical control are considered in the design procedure, which are called execution layer and decision layer respectively. In the execution layer, input-output decoupling is applied to velocity-varying 4WS vehicles kinetic model. As a result, 3-DOF movements of vehicles can be tracked independently. In the decision layer, the trajectory tracking error model is used to design the desired movements of intelligent vehicles based on sliding mode control. Finally, the two layers can be combined into a system. The simulation results show the system can make the intelligent vehicles track a certain trajectory accurately.

H-2

Path Planning for Unmanned Campus Sightseeing Vehicle with Linear Temporal Logic

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Abstract In order to solve the global path planning problem of unmanned campus sightseeing vehicles, this paper proposes a path optimization method based on linear temporal logic (LTL). First, the plan avoids the cumbersome and huge modeling for the actual road environment, and all the stops are modeled as a weighted finite-state transition system. Second, use LTL language to describe the tasks that the unmanned sightseeing vehicle needs to perform in actual operations. Next, construct a Product automaton that contains the environment model and task requirements. Finally, use a path search method based on Dijkstra algorithm to search for the optimal route on the Product automaton, and the optimal route is mapped back to the stops transition system in the actual environment, so that the route which the vehicle needs to perform during actual operation is obtained. Simulation results show that this method can completely solve the problem of patrolling between multiple stops, and can guarantee the optimality of the operating route.

H-3

The Research on Force-Magnetic Effect of Wheelset of High-speed Train Based on Metal Magnetic Memory Method

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Abstract High-speed railway in the world is developing towards the direction of high-speed and heavy load. The safety of train is an important part of the research of high-speed train. The online detection based metal magnetic memory method is pro-posed to meet the safety requirement. In order to detect the characteristics of the magnetic memory signal of the wheelset or axle in real-time, the research on the force-magnetic effect of the wheelset or axle material is necessary. This paper takes 25CrMo4 as an example to analyze the relationship between the force and the magnetic. The experimental results show that the magnetic memory signal has a tendency to become smaller with the increase of the load on the experimental specimens.

H-4

Automated Guided Vehicle Indoor Positioning Method Based Cellular Automata

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Abstract Automated guided vehicle (AGV) can greatly improve warehousing operation efficiency and reduce labor costs. As a key technology, the positioning method is crucial for the path planning and cruising of AGVs. In view of existing technology, the method with high positioning precision is too expensive, and the low cost method performance is too poor. In this paper, a low cost and high precision positioning method based on cellular automata is proposed. This method utilizes the wireless communication system that AGV has equipped to complete the positioning through the continuous iteration of simple cell evolution rules in the cell space mapped by the positioning space. For the problem of positioning errors caused by environmental factors changing and equipment aging, this method integrates spatiotemporal correlation and differential calculations as constraints in the evolution rules to achieve high-precision positioning. Through simulation experiments, the feasibility and effectiveness of the method are verified and analyzed. It has a good application prospect.

H-5

Train Velocity Tracking Control with Considering Wheel-Rail Adhesion

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Abstract Velocity tracking plays a key role in train safe operation. Furthermore, the complex relation between wheels and rail affects velocity tracking. How to obtain a precise tracking algorithm with considering wheel-rail adhesion is a hard problem. This paper designs controllers in two cases respectively. The first algorithm is obtained based on the known wheel-rail adhesion model, while the second one is given with considering the unknown parameters of adhesion model. The simulation results comfirm the availability of the proposed controllers.

H-6

Research of Driving Cycle Construction for Electric Drive Mining Truck Based on Travelling Analysis Method

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Abstract This paper is concerned with the driving cycle construction for the electric drive mining truck based on travelling analysis method. Firstly, the complete operation data of the dump truck is collected, which is based on the continuous transportation test on an open pit road. Secondly, according to the travelling analysis meth-od, a single duty cycle data separated from the multi-group dump truck duty cycle data, is divided into short travelling kinematic sequences. Next, based on the driving characteristics, ten characteristic parameters are selected. Through the principal component analysis and density peak clustering analysis, the data dimension is reduced to three principal component, and then the classification of the kinematics sequences is obtained. Further, a typical driving cycle for mining truck can be built by extracting kinematic sequences from each category. Finally, compared with the actual data, the typical driving cycle can strongly reflect the operating characteristic of electric drive mining truck on the open pit road.

I. 飞行器导航、制导与控制

I-1

Stabilizing Quadrotor Helicopter with Uncertainties Based on Controlled Lagrangians and Disturbance Observer

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Abstract How to apply the Controlled Lagrangian method to stabilization controller design for the quadrotor helicopter with uncertainties is investigated in this paper. The dynamical model of the uncertain quadrotor is transformed to a linear model without uncertainties and an uncertain term to facilitate controller design. First, a stabilization controller for linearized model is design based on the Controlled Lagrangian method. For the under-actuated quatrotor, its uncertainties and control inputs are mismatched, the mismatched uncertainties are replaced with equivalent matched uncertainties by utilizing the equivalent disturbance method, then a disturbance observer is constructed to estimate the matched uncertainties, and added to the controller for linearized model to compensate the effect of uncertainties. It is proved that states of the controlled quadrotor are uniformly ultimately bounded and converge to a small neighborhood of the desired equilibrium point. Simulation results verify effectiveness of the proposed controller with the observer.

I-2

Attitude Control of Oblique Cross Quad-rotors UAV

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Abstract Compared with cross quad-rotors, oblique cross quad-rotors are more flexible, stable, and suitable for expansion, so that a growing number of attentions are paid on them. However, some drawbacks such as high model dependency, poor anti-interference ability and robustness are appeared when traditional controllers are used for the attitude control of oblique cross quad-rotors, which is because of strong coupling among the various channels. These problems can be solved by

designing a controller based on Linear Active Disturbance Rejection Control (LADRC) algorithm. Firstly, the unmanned aerial vehicle (UAV) modeled is established by the Newton-Euler formula. Secondly, a series of simulation including tracking, anti-interference and robustness experiments are carried out. Finally, the comparison with classic proportional-integral-derivative (PID) controller are analyzed. The results show that LADRC controller has higher performance, such as better tracking capacity, stronger anti-interference ability and robustness.

I-3

Data Acquisition Technology of Time Tagging for Pulsar Navigation

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Abstract The spacecraft position in space can be calculated by time-of-arrival of X-ray photon signals. In paper a simulation test system is designed to verify the X-ray pulsar navigation principle on the ground. In the system integrated data acquisition device is used for the weak light pulse signal detection with high precisely timing. The device is composed of three circuit boards including time reference, data acquisition and signal processing which can carry out data acquisition of great magnitude and speed. Compared with the other simulation systems there are several aspects to be improved such as data acquisition speed, time tagging precision, data processing ability continuously, noise filtering customized, and data wireless communication. The technology is very significant for on-orbit flight application of X-ray pulsar navigation satellites in future. It can be also applied to other data acquisition systems with high speed, such as radar signal processing system, atomic nuclear physics signal processing system and weak light signal processing system.

I-4

Distributed Cooperative Guidance Strategy for Multi-missile Attack the Maneuvering Target

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Abstract This paper proposed a distributed cooperative guidance strategy in order to achieve multi-missile cooperative attack the maneuvering target. Firstly, H_∞ robust guidance law is adopted to intercept the maneuvering target, which can keep strong robustness and eliminate the prediction of the acceleration of the target. Then the theory of network synchronization is used to design the cooperative guidance components, which is no need to estimate the impact time manually and can make state of all the missiles gradually converge automatically. Finally, De Bruijn network is used to build the local interactions, which has good fault tolerant property, flexibility and high reliability to support large-scale missiles cooperative attacks. The simulation results verifies that the law can drive all the missiles salvo attack the maneuvering target simultaneously.

I-5

Application of single neuron LADRC in trajectory tracking control of parafoil system

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Abstract In order to further reduce the nonlinearity of the parafoil system and the effect of environmental disturbance on its trajectory tracking control. On the basis of linear active disturbance rejection control (LADRC), using the self-learning ability of neural network, a single neuron is used to construct adaptive parameters, so that parameters can be adjusted accordingly based on the change of system errors, so as to achieve on-line self-tuning of parameters. The simulation results of track tracking by parafoil show that the effect of external interference can be effective-ly overcome and high precision tracking control can be realized. Compared with the traditional LADRC, the anti-interference ability and robustness are obviously improved.

J. 机器人控制

J-1

Prescribed Performance Control for Robotic Systems with unknown dynamics

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Abstract In this paper, a prescribed performance controller for robotic systems with guaranteed transient and steady-state performance is proposed. A performance function that characterizes the convergence rate, maximum overshoot and steady-state error is employed to construct a new coordinate system. Then, the tracking error of the original system can be retained within a prescribed bound by stabilizing the transformed system. The unknown dynamics are accurately estimated by an estimator. The merit of the estimator is that the structure is simple and only one parameter needs to be tuned. The stability of the control system including the prescribed performance control and the unknown dynamics estimator is proved via Lyapunov theory. Simulation results are carried out to validate the effectiveness of the proposed control scheme.

J-2

Backstepping Based Neuroadaptive Control for Uncertain Robot Systems

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Abstract This paper gives a command filter backstepping method to design an adaptive controller to achieve position tracking for robot systems with uncertain parameters. Command filter is used to deal with computing complex problem of classical backstepping strategy. The neutral network is used to approximate uncertain dynamics. The error compensation signal is used to eliminate the error caused by the filtering. An example is applied to demonstrate effectiveness of control method.

J-3

Position/Force Control of the Mobile Manipulator with Rheonomic Constraints

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Abstract In the view of the rheonomic constraints problem of the mobile manipulator, the corrected orthogonalization method is adopted to solve the problem that velocity and force are not orthogonal under rheonomic constraints. By transforming the system with the designed transformation matrix, the velocity and the force are mapped to the orthogonal spaces. Then, a position/force strategy is designed, which drives the position and force converge to zero. Furthermore, we consider the situation where there is interference in the motor and propose the desired torque control strategy and the desired motor control strategy. The robustness of the system is enhanced. By selecting the proper Lyapunov function, the effectiveness of the proposed strategy is proved. Through simulation, the validity of the above conclusions are verified.

J-4

Dynamic Modeling of a Variable Structure Two-wheeled Robot during the Mode Switching Process of Segway Mode and Bicycle Mode

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Abstract The variable structure two-wheeled robot (VSTWR) is a typical nonlinear system. The dynamic model of the VSTWR during the mode switching process of Segway mode and Bicycle mode is analyzed in this paper. According to kinematic and energy analysis, dynamical models based on Appell equations and Chaplygin equations are built. The computer numerical simulation based on Matlab is achieved. And the validity of the two dynamic models are testified by the simulation results.

J-5

Research on Location Strategy of Multi-Mobile Robots Based on Gaussian Plume Model

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Abstract This paper simulates the concentration distribution of leakage gas in the leakage area based on the Gaussian plume model which is more suitable for continuous point source diffusion. The research about multi-mobile robots track and locate leak source is completed by using formation control algorithm, concentration gradient method and headwind search method. The simulation results show that the Gaussian plume model can directly simulate the plume distribution of the leaking gas, the multi-mobile robots can be controlled by formation, and the leakage point can be tracked and located by using the concentration gradient method and the headwind search method.

J-6

Synchronization Control for Multiple Nonholonomic Mobile Robots

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Abstract This brief investigates the problems of synchronization control for a group of multiple nonholonomic mobile robots. An integrated algorithm of a kinematic controller and a torque controller is proposed to solve synchronization tracking problem of multi-nonholonomic mobile robots based on backstepping technique, and its asymptotic stability is then guaranteed by the use of Lyapunov-like analysis. A distinctive feature of the proposed algorithm is to introduce the network topology with directed topology graph characterizing communication interaction among agents based on algebraic graph theory. An illustrate example and its simulation is finally provided to demonstrate the theoretical results.

J-7

Adaptive Terminal Sliding Mode Trajectory Tracking Control of Mobile Robot Based on Disturbance Observer

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Abstract This paper proposes an adaptive terminal sliding mode trajectory tracking control scheme for the wheel mobile robot in the presence of wheel skidding and slipping and unknown center of mass. An auxiliary kinematics controller is designed to make the auxiliary velocity of the robot asymptotically converge to the desired velocity, and a torque controller is designed to make the velocity of the robot converge to the desired velocity within a limited time. The disturbance observer is used to estimate the lumped disturbance. It is proved that all the signals in the closed-loop system are bounded and that the tracking error converges to zero. Simulation results demonstrate the effectiveness of the proposed scheme.

J-8

Adaptive Switching Control for Robotic Manipulators with Unknown Disturbances

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Abstract In this paper, an adaptive switching controller is designed for the problem of trajectory tracking in the field of robotic manipulator. The proposed controller which consists of a PD scheme and an adaptive switching law is under the condition that the robotic manipulator's supremum of bounded disturbance is not known. According to the Lyapunov stability theorem, it shows that the presented controller can not only ensure the robot to track the desired trajectory and stabilize the robotic system, but also enhance the ability to varying loads. Finally, Simulations is studied. It shows that the presented controller has an advantage in avoiding the overlarge input torque.

J-9

Robust Fixed-time Tracking Control of Wheeled Mobile Robots

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Abstract This paper considers the problem of trajectory tracking control of a two-wheeled mobile robot in fixed time. By using the differential flatness property, the system model is linearized with several input transformations and an input prolongation. Then a feedback control law is designed to ensure the convergence of tracking errors in fixed time. The dynamic model with disturbances and unmodeled dynamics is also derived, and it is controlled in fixed time by designing a novel integral sliding mode surface. Theoretical results are finally verified by numerical simulations.

J-10

Adaptive Neural Network Control for Uncertain Robotic Manipulators with Output Constraint using Integral-Barrier Lyapunov Functions

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Abstract In this paper, an adaptive neural network (NN) output tracking control approach is presented for uncertain robotic manipulators with the output constraint. Integral-barrier Lyapunov functions (iBLF) are adopted to prevent the output from violating the given constraint. And adaptive neural networks, which are capable of approximating the arbitrary continuous function at any precision, are employed in handling uncertainties and disturbances. By appropriately choosing design parameters, the proposed method can guarantee the semi-global uniformly ultimate boundedness of the output error, and all signals of the closed-loop system remain bounded. The effectiveness and performance of the proposed control method are illustrated through a numerical simulation example.

K. 控制理论前沿与应用

K-1

Multi-objective Robust Output Feedback Control for Receiver Station-keeping in Boom and Receptacle Refueling

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Abstract This paper considers the multi-objective reliable robust output feedback control problem for receiver station-keeping in boom and receptacle refueling (BRR), which considers the main features of BRR, i.e., mass and inertia variation of receiver aircraft, sensors failure, input constraints and disturbance attenuation. A new receiver aircraft model is firstly established in terms of those main features of BRR. Then, a new multiple objectives robust output feedback controller is designed for this control problem. The controller's existence is derived by using the Lyapunov method and linear matrix inequalities (LMIs) technique; and then the desired controller can be achieved by the LMI tools. A practice example is presented to demonstrate that the proposed controller design method can successfully solve the multi-objective control problem.

K-2

Adaptive Neural Control of Stochastic Nonlinear System with Dynamic Uncertainties

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Abstract In this paper, an adaptive neural dynamic surface control (DSC) scheme is developed for a class of stochastic nonlinear systems in the presence of input and state unmodeled dynamics. A dynamic signal is employed to handle the state unmodeled dynamics. A normalization signal and a novel adjustable parameter are used to deal with the input unmodeled dynamics. By theoretical analysis, it is shown that all the signals in the closed-loop system are bounded in probability.

K-3

Optimization control for wastewater treatment process based on data and knowledge decision

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Abstract In this paper, a whole process optimization control (WPOC) method is proposed for the wastewater treatment process (WWTP). The WPOC method is studied under the scheme of hierarchical control. First, the intelligent decision part is designed based on the data and knowledge information of the system. The optimal direction is adjusted according to the preference of decision makers and the current system performance. Then, the weight coefficients of the performance indexes are provided to the optimization layer. The NSGA-II algorithm is adopted for solving the multi-objective optimization problem. The tracking control task is finished using the neural network control method. Simulation results, based on the international benchmark simulation model no.1(BSM1), show that WPOC method can achieve the energy saving with meeting effluent discharge, and the comprehensive evaluation of energy consumption and effluent quality is also improved.

K-4

Full-state stabilization of hovercraft based on discrete constant control

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Abstract The full-state stabilization problem of hovercraft is studied in this work. Under the mild assumption that no damping terms contained in the system dynamics, we propose a new discrete constant control scheme guaranteeing the hovercraft moving towards reference states with a prescribed distance in each control cycle and moving to an arbitrarily small neighborhood of references in finite control updates. Several simulation examples including stabilization and way-point assignments cases are carried out to verify the proposed controller.

K-5

Control Strategy of PV-hybrid Energy Storage Device Based on Household Load

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Abstract In order to improve the stability and economy of roof photovoltaic system. The frequency distribution of photovoltaic power can be obtained by using Hilbert-Huang transform (HHT), and a boundary frequency algorithm is proposed to determine the frequency of photovoltaic power generation. Then, the roof photovoltaic-hybrid energy storage control model based on household load is constructed, and the model is solved by LINGO software. Data analysis and comparison show that under the condition of full life cycle and real time price of photovoltaic power generation, user economy is superior to that of fixed price condition. The effectiveness of the proposed model coordination control strategy is verified by the user's economy.

K-6

Adaptive Neural Control for Nonlinear Systems in Non-strict-feedback Form

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Abstract This article studies the ANC problem for nonlinear systems. Unlike the classical backstepping strategy, the control issue of nonlinear system in non-strict feedback (NSF) form is more challenging. In the design process, neural networks and high-gain observers are applied to tackle with the issues of unknown nonlinearity and unmeasured states, respectively. Adaptive backstepping technique and a high-order sliding mode (HOSM) differentiator are combined to present a novel ANC algorithm. In the stability analysis, signals in the considered systems turn to be SGGB with appropriately designed parameters. Finally, a numerical example is practiced. The results of the numerical simulation further illustrate the usefulness of the new algorithm.

K-7

Optimal Controls for Dual-Driven Load System with Synchronously Approximate Dynamic Programming Method

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Abstract This paper applies a synchronously approximate dynamic programming (ADP) scheme to solve the Nash controls of the dual-driven load system (DDLS) with different motor properties based on game theory. First, a neural network (NN) is applied to approximate the dual-driven servo unknown system model. Because the properties of two motors are different, they have different performance indexes. Another NN is used to approximate performance index function of each motor. In order to minimize the performance index, the Hamilton function is constructed to solve the approximate optimal controls of the load system. Based on parameter error information, an adaptive law is designed to estimate NN weights. Finally, the practical DDLS is simulated to demonstrate that the optimal control inputs can be studied by ADP algorithm.

K-8

Adaptive compensation for MIMO nonlinear systems against actuator failures

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Abstract In this note, an adaptive backstepping scheme is proposed for a class of multi-input multi-output (MIMO) nonlinear minimum phase systems aiming at accommodating three types of common actuator failures: stuck failure, bias failure and loss of effectiveness failure. These failures are uncertain in failure type, value and time. The scheme ensures all signals boundedness and output asymptotic tracking. An aircraft application illustrates the effectiveness of the given scheme.

K-9

Adaptive Synchronization Control for Dual-Manipulator System Using Finite Time Parameter Estimation

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Abstract In this paper, an adaptive synchronization control method is proposed for dual-manipulator systems to guarantee the satisfactory synchronization and tracking performance on the basis of effective finite time parameter estimation. The mean-coupling synchronization scheme is employed to obtain the mean-coupling error, and a fast finite time sliding mode surface and a auxiliary control variable are presented based on the position tracking error and mean-coupling error to facilitate the control design. Then, the fast terminal sliding mode synchronization controller is proposed to ensure that both the tracking error and the synchronization error can converge to zero in finite time. Moreover, an adaptive parameter estimation law is developed by the extracted parameter error information to accurately identify the unknown system parameters. Comparative simulations are provided to validate the effectiveness of the proposed method.

K-10

State-feedback Stabilization of Stochastic Non-holonomic Systems(SNSs) under Arbitrary Switchings with Time-varying Delays

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Abstract This result deals with the state-feedback stabilization of SNSs with time-varying delays and arbitrary switchings with. The backstepping state feedback stabilizing controllers are given.

K-11

Finite-time Stochastic Stabilization for Markovian Jump One-sided Lipschitz Systems

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Abstract This paper considers the finite-time stochastic stabilization problem for Markovian jump one-sided Lipschitz systems. The transition rates matrix of the system is partly unknown. The feature of the studied systems lies that the nonlinearities satisfy the property of onesided Lipschitz. Firstly, the definitions of one-sided Lipschitz function and finite-time stochastic stability are introduced. Then, the feedback laws are designed to make the closed-loop systems finite-time stochastically stable. Finally, a numerical example is used to demonstrate the effectiveness of the designed controllers.

K-12

Performance Analysis of Flux-Switching Stator Permanent Magnet Motor Based on Linear Active Disturbance Rejection Control

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Abstract Flux-switching permanent magnet motor (FSPMM) is a new stator permanent magnet brushless motor. It overcomes many shortcomings of the conventional permanent magnet motor having magnets in the rotor and has a well application prospect. The three-phase 12-slots/10-poles FSPMM is used as the control object. On the basis of the working principles, the mathematical models have deduced and the mechanical properties are calculated. The characteristics of the electromagnetic are analysed by setting up the steady and dynamic-state models of the FSPMM. Linear Active Disturbance Rejection Control (LADRC) is designed in the speed loop of the FSPMM to realize the linear control of the nonlinear system. By using the Linear Extended State Observer (LESO), the total disturbances can be estimated and compensated in real time. The performance robustness is verified by the Monte Carlo experiments of the two control strategies,

including the LADRC algorithm, and the traditional PI control strategy. The results show that LADRC strategy has a greater capability of disturbance rejecting and stronger performance robustness.

K-13

On Finite-Time Stability of Switched Homogeneous Systems

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Abstract The finite-time stability is investigated for switched homogeneous systems. It is assumed that each subsystem possesses a homogeneous Lyapunov-like function. The derivative of the function is with hybrid homogenous degrees. Two substantially different situations are considered and different sufficient conditions are provided, respectively.

K-14

A design scheme of adaptive switching neural control with uncertain nonlinearity and external disturbance

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Abstract In this paper, we concern with the robust adaptive tracking control problem using neural networks for switched nonlinear systems with uncertain nonlinearity and external disturbance. The hypothesis condition that the sign of control gain is known has been relaxed by the proposed control strategy. RBF neural networks (NNs) are utilized to model the unknown nonlinear functions and a robust adaptive neural tracking control method is recommended to enhance the switching the system robustness. Based on switched multiple Lyapunov function strategy, we have derived the adaptive updated control law and the appropriate switching law. It is shown that the

technique proposed is able to guarantee that the resulting closed-loop system is asymptotically stable in the Lyapunov sense such that the system output tracking error performance can be well obtained. The effectiveness of the presented control method is demonstrated by the simulation results.

L. 信息获取、估计与预报

L-1

State Prediction Based on ARIMA Model for Aerial Target

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Abstract In order to predict the air combat data accurately and quickly, a prediction method is developed for the aerial target based on autoregressive integrated moving average (ARIMA) model in this paper. The air combat situation data mainly consists of the velocity, altitude of aerial target and the angle between the target line of sight and target velocity. Finally, with an example simulation, the results indicate that the developed method can accurately and efficiently predict the air combat state data.

L-2

Prediction of Gas Utilization Ratio Based on the Kernel Extreme Learning Machine

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Abstract Gas utilization ratio (GUR) is a significant indicator to measure the operation status and energy consumption of blast furnaces (BFs). Accurately predicting the GUR can reflect the actual

operating status of the BFs and the consumption of the charge in real time. Kernel extreme learning machine (KELM) algorithm not only has the characteristics of fast computation speed of extreme learning machine (ELM), but also has better stability and generalization ability. This study applies KELM to investigate the relationship between GUR and some significant factors which affect GUR. An improved fruit fly optimization algorithm (IFOA) is used to optimize the parameters in the KELM model. The experimental results demonstrate that the prediction model based on the KELM has better prediction effect in forecasting accuracy and modeling time needed.

L-3

Vibration signal EMD filter detection method for blast furnace opening machine

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Abstract The vibration signals generated during the operation of the blast furnace opener contain various noises, which are disturbing and superimposed, and it is difficult to identify the operating status of the open machine, put forward a kind of based on Empirical Mode Decomposition (EMD) filter method. From the physical structure of the opening machine, the complexity of the vibration signal is qualitatively analyzed. The EMD technology is used to adaptively decompose the vibration signal into a single intrinsic mode function (IMF) with different frequency components. the high frequency noise components is filtered in the IMF component, the remaining IMF components are reconstructed to form a new vibration signal and compared with the results of the wavelet threshold denoising way. The con-sequences show that the EMD filtering method can overcome the disadvantages of glitches and signal superposition after wavelet denoising, and can fully preserve the nonlinear characteristics of the vibration signal. It is an effective method for filtering and denoising detection of mechanical vibration signals of blast furnace opening machines.

L-4

A Target Information Conversion Method Of Antiaircraft Weapon System

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Abstract A detailed conversion method was provided to create good conditions for the search and tracking of phased array radar, and improve the target acquisition probability of the system. By using attitude compensating and coordinate transformation we eliminated the system's transmission error, eventually provided the target information that launcher truck required. Finally, the flight experiment results are presented to validate it.

L-5

Interval observer design for nonlinear switched systems

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Abstract This paper deals with the interval observer design problem for nonlinear switched systems. The nonlinearity is assumed to satisfy the property of Lispschitz. The interval observers are constructed and multiple linear copositive Lyapunov function is used to analyze exponential stability of the error systems. Different from the most of current works, the sufficient conditions for the existence of interval observers are derived by the forms of linear programming. Finally, a numerical example is simulated to show the efficiency of the proposed method.

L-6

A NLOS Error Mitigation Algorithm based on ELM and EKF in Indoor Tracking

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Abstract Extended Kalman Filter (EKF) has a good performance in positioning and tracking systems due to its simple algorithm, low computational complexity, suitable for weak nonlinear systems, and good tracking performance in Gaussian environments. The error caused by non-line-of-sight (NLOS) propagation in the indoor environment on measured value has a great influence on EKF tracking performance and may even be divergent. The method of using neural network to correct NLOS has good adaptability and robustness, which can effectively mitigate errors and improve accuracy. This paper proposes an NLOS error mitigation based on Extreme

Learning Machine (ELM) and EKF. ELM uses the state information of EKF to classify the measured values, determines the propagation path affected by NLOS error, and then corrects the measured values using the ELM trained for the path. Experiments show that compared with the traditional method, this algorithm can effectively mitigate the influence of NLOS and further improve tracking accuracy.

L-7

Prediction of permeability index of blast furnace based on online sequential extreme learning machine

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Abstract Permeability index of the blast furnace is one of the vital monitoring parameters to reflect the operation status of the blast furnace. At present, there are few pre-diction models for the permeability index at home and abroad. Therefore, this paper proposes to establish a prediction model of the permeability index by using online sequential extreme learning machine (OS-ELM) combined with wavelet analysis, and this paper compares it with the prediction models established by extreme learning machine (ELM), support vector machine (SVM) and BP neural network algorithm. The simulation results show that the prediction model based on OS-ELM has better accuracy than others.

L-8

A Fuzzy Multi-objective Strategy of Polymer Flooding Based on Possibilistic Programming

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Abstract Against some practical problems for people to solve optimization of polymer flooding in oil exploitation, which include the uncertainty of crude oil price and differences of decision maker's satisfaction degree about the performance index, a fuzzy multi-objective optimal control model will be established and solved by an improved possibilistic programming algorithm based on Gaussian Probability Distribution in this paper. Gaussian Probability Distribution has comparative complex membership function, so the algorithm can process actual decision information better and reflect decision maker's subjectivity much better. And a full implicit finite-difference method will be used to solve complicated governing equations in the process of optimization. Additionally, we obtain a regular conclusion in which the decision maker can acquire different appropriate schemes by changing aspiration levels. The acquired optimal schemes in oil field exploitation verify the feasibility and effectiveness of the improved algorithm.

L-9

Estimating the Perturbation Origin in Networked Dynamical Systems with Sparse Observation

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Abstract We consider the problem of estimating the location of the source and the start time of the perturbation diffusion in networked dynamical systems, under the condition that only a subset of nodes can be observed. A maximum likelihood (ML) estimator is formulated, which taking advantage of the linear correlation between the time at which a node receives the perturbation and its delay time from the source. Experiments verify the effectiveness of the proposed algorithm in scalefree (BA) and small-world (WS) networks.

L-10

Prediction of Remaining Life of Rolling Bearing Based on Optimized EEMD

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Abstract Aiming at the problem that the early vibration signal has a weak decay characteristic in the prediction of the remaining life of the rolling bearing, a method for optimizing the bearing residual life prediction based on the optimized ensemble empirical mode decomposition (EEMD) is proposed. First, the eigenmode decomposition of the vibration signal is performed. The effect depends on two important parameters: the average number of times and the size of the added noise. Therefore, white noise criteria are added to the set of empirical mode decomposition. Then, the decomposed intrinsic mode function (IMF) is filtered with the gray correlation degree of the envelope spectrum to filter out IMF components with decay characteristics and reconstruct signals. Finally, Multi-feature parameter vector of the re-constructed signal, its redundancy is removed by principal component analysis (PCA), and then input neural network to predict bearing residual life. Experiments show that the proposed method has higher prediction accuracy and stability.

L-11

A Multi-Sensor Characteristic Parameter Fusion Analysis Based Electrical Fire Detection Model

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Abstract Electrical fires are mostly caused by the release of thermal energy from electrical equipment. It is more difficult to detect the cause of fire than normal fires. A fire detection model that combines characteristics of many types of electrical fire sensors is proposed. These fire detection systems are difficult to accurately monitor the cause of electrical fires. The proposed model uses smoke, CO concentration, temperature, and electrical line residual current as characteristic parameters of electrical fire. It analyzes a three-tier structure including information layer, feature layer, and decision layer. Fire-risk-factor and warning duration are defined as decision factor. When the model is working, it firstly collects the residual current signal that characterizes the fault of the electrical equipment through multiple types of sensors. It conducts multi-parameter real-time monitoring of the main characteristic signals of the early stage of the electrical fire. Then it completes the fusion of the detected characteristics of electrical fire to achieve accurate identification of electrical fires. The proposed model is simulated according to national standard fire test dataset. The simulation result shows that it can quickly and accurately forecast the electrical fire and effectively reduce false alarm rate in of electrical fire detection process.

L-12

Forecasting Short-Term Residential Electricity Consumption Using A Deep Fusion Model

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Abstract Electricity consumption forecasting is practically significant for either detecting abnormal power usage pattern or resource-conserving purpose. Indeed, it is a non-trivial task since electricity consumption is related to multiple complex factors, including historical amount of consumption, calendar dates and holidays, as well as residential power consumption habits. To this end, we propose an end-to-end structure to collectively forecast short-term power consumption of private house-holds, called RCFNet (Residual Conventional Fusion Network). Specifically, our RCFNet uses 1) three branches of residual convolutional units to model the temporal proximity, periodicity and tendency properties of electricity consumption, 2) one fully connected neural network to model the weekday or weekend property, and 3) a residual convolution network to fuse the above output to produce short-term prediction. All the convolutions used here are one-dimensional. Through experimental studies on residential electricity consumption dataset in Australia, it is validated that the proposed RCFNet outperforms several well-known methods. Besides, we demonstrate that residential power consumption is closely related to the living characteristics of residents.

M. 大数据与生物医疗工程

M-1

Automatic Cell Segmentation and Signal Detection in Fluorescent in Situ Hybridization

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Abstract With the progress of science and technology, computer technology has also been developed, and there are a huge promotion and wider application in the field of medicine. This study is to determine the positive rate of breast cancer cells, mainly in cell segmentation and signal point recognition methods. Containing threshold iterative segmentation, edge detection, K-means clustering and watershed, four methods are used to segment the cells. But these methods do not allow good separation of adherent cells, therefore, we should improve the segmentation methods of adherent cells. The distance transformation is done first, then the watershed method is used. Finally, the watershed based on distance transformation is combined with the contour extraction to separate the adherent cells. And for the identification of signal points, using the Otsu achieved a more satisfactory result, and the accuracy rate has reached over 90%. According to the result of cell segmentation, the accuracy rate is basically more than 80%, in the subsequent study can also be improved to get more accurate results. Therefore, it is feasible to use computer technology for automatic segmentation to determine whether breast cancer cells are positive, and it can be popularized and applied.

M-2

Study on the Changes of Macular Retinal Thickness in Myopia

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Abstract With the increasing use of eyes at close range, myopia has become a public health problem in many areas. Fundus changes caused by high myopia have become one of the main causes of vision loss. In order to have a deeper understanding of myopia, we need to clarify the characteristics of myopia. In this paper, the retinal tomographic images obtained by optical coherence tomography (OCT) were used to analyze the changes of retinal thickness and retinal

boundary morphology of myopia with the myopic diopter. The results showed that the retinal thickness and diopter have the highest correlation in the 2mm-2.5mm region of the macula from the nasal side. The retinal thickness in this region was reduced by approximately 3.189μm for every 100 myopic degrees. The subretinal boundary can be modeled by a quadratic function, and the quadratic coefficient decreases with increasing diopter.

M-3

Combining STFT and Random Forest Algorithm for Epileptic Detection

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Abstract In the automatic detection of epileptic seizures, time varying electroencephalography (EEG) signals monitoring of critically ill patients is an essential procedure in intensive care units. There is increasing interest in using seizure detection algorithms, such as random forest, for seizures EEG analysis, but a better understanding of how to design and train random forest for EEG decoding and how to visualize the informative EEG time and frequency features the dimensionality reduction of PCA is still needed. Here, we studied seizure detection algorithms designed for recognizing diseased signals from raw seizures EEG. Our results show the recognizing performance of random forest algorithm reaching at mean recognizing accuracies 96%. It can exploit and might help doctors better diagnose the extent of epilepsy.

M-4

A mixed approach for fetal QRS complex detection

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Abstract Non-invasive fetal electrocardiogram (NI-FECG) plays an important role in detecting

and diagnosing fetal diseases. Fetal electrocardiogram (FECG) is used to know the information of the fetal health. In this paper, we propose a mixed approach for extracting FECG from maternal abdominal ECG (AECG) recording. The proposed method is based on a combination of the wavelet transform and Support Vector Machines (SVM). As a first tier, the wavelet transform is used to detect maternal QRS complex from abdominal ECG recording. Then, a coherent averaging method was using to construct MECG and remove MECG from AECG recording. After removing MECG, SVM is used to locate fetal QRA complex from residual signal. The accuracy (84.53%) and Positive predictive value (PPV) (89.6%) in this study are much higher than other method.

M-5

Tumor Recognition in Liver CT Images Based on Improved CURE Clustering Algorithm

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Abstract Spectral Computed Tomography (CT) images can help doctors diagnose the lesions of the organs and the types of organ lesions. According to the gray level information and spatial information of the spectral CT image of the liver, the characteristics of the image are selected. Using the improved Clustering Using Repre-sentatives (CURE) unsupervised clustering algorithm to cluster the image features to automatically identify liver tumors ,not only does it not need to manually mark a large number of training samples, but also does not require long training on the classification model. This paper has two improvements to the CURE algorithm: (1) Liver is divided into multiple categories, and then combining the multiple categories into two categories according to certain rules instead of being divided into two categories directly by CURE. (2) When the liver in the spectral CT image is healthy, in order to meet the practical application, analyze the image before classification to avoid separating the normal liver into two categories. The experimental results show that the location of liver tumors is well marked based on the improved CURE clustering algorithm. It has a good clinical guidance value after being evaluated by clinicians and imaging doctors.

M-6

Matlab-based Myocardial Ischemia Detection System Design Via Deterministic Learning

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Abstract In this paper, based on a recently presented myocardial ischemia detection method via deterministic learning theory, a flexible computer-aided-diagnosis system for ischemic heart disease is proposed. Surface 12-lead ECG signals are collected and cardiac dynamics are extracted via deterministic learning. This kind of cardiac dynamics is shown to be sensitive to the variance during myocardial ischemia, and is used for myocardial ischemia detection. Benefit from the powerful matrix computing capabilities and data visualization capabilities of Matlab platform, we develop an effective myocardial ischemia detection system, facilitate the application of deterministic learning and Matlab programming language in myocardial ischemia detection. The effectiveness of the proposed system is verified at Chinese National Center of Cardiovascular Diseases, which is helpful for building up a real-time software tool towards assisting the physician in cardiology departments.

M-7

Automatic Liver and Tumor Segmentation of CT Based on Cascaded U-Net

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Abstract Automatic segmentation of liver and tumor plays a crucial role in medical-aided diagnosis. At present, neural networks have been widely used in medical image processing. There are many FCN-based methods used for the automatic segmentation of the liver and the tumor, but

results are not precise enough to the details in the images. In this paper, we use cascaded U-Net to segment livers and tumors automatically. The first U-Net is used to segment livers, and the livers are the input of the second U-Net. We perform experiments on the published 3DIRCAD dataset and the dataset provided by medical institutions. Medical institutions provide CT of patients with advanced liver cancer. Compared with FCN, U-Net is more accurate. When the false positive rate is the same, U-Net's true positive is higher. The accuracy of segmentation of the liver is 91.3% and 89.8%, respectively, and the accuracy of segmentation of the tumor reaches 82.4% and 86.6%.

M-8

Using Big Data to Enhance the Capability of the Situational Awareness of Battlefield

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Abstract This paper studies the basic methods of using big data to enhance the capability of the battlefield situational awareness. In the paper, the big data structure of the battlefield situational awareness is built based on the idea of confirming representation dimension of the big data of the battlefield situational awareness, defining their memory granularity, distinguishing their update frequency and establishing their association graphs. The big data sources of the battlefield situational awareness are expanded through pre-war basic data preparation, dynamic data acquisition, implicit data mining. The paths of effective use of the big data of the battle-field situational awareness are put forward such as the general-purpose Operations View via broadcast, Sub-domain publishing local situation, direct pushing priori data, and customizing personalized data.

M-9

An Extreme Gradient Boosting Algorithm for Short-term Load Forecasting Using Power Grid Big Data

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Abstract Directed at the problem of more and increasing data types & volume in power grid, a short-term power load forecasting algorithm based on big data and Extreme Gradient Boosting (XGBoost) is proposed, based on the analysis of power grid load big data low. The algorithm includes the following steps. First, the outlier data and missing data are preprocessed. Then, the K-means algorithm is used to cluster the load big data of the power grid. Finally, The XGBoost algorithm was used to train the load forecasting model, based on the impact of historical load, calendar effect and meteorological factors on the load. Simulation results show that compared with support vector machine, random forest and decision tree, the proposed algorithm has a higher prediction accuracy and smoother prediction error, with smaller mean absolute percentage error, mean absolute error and relative error.

M-10

CT Recognition for Liver and Lesions

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Abstract This article uses a two-step method for liver and lesions recognition, and our main purpose is to identify liver lesions. Therefore, the first step does not need much resources. After the segmentation of the liver is performed, and the recognition of the lesions in the second step requires fine identification. Therefore, it is necessary to identify with U-net, which has a high recognition accuracy. This paper proposes a method that can effectively reduce the complexity of the algorithm and ensure the accuracy. The first step is to use the traditional segmentation algorithm level set to segment the liver, and the second step to increase the segmentation effect by increasing the depth of the U-net and reducing the size of the convolution kernels. 89.3% of the lesions segmentation accuracy can be obtained on commercial medical institutions' CT, and the lesions segmentation accuracy on the open data set can reach more than 90%, which may meet the needs of the assistant doctors.

N. 模糊系统与神经网络

N-1

A Novel Fuzzy Logic System with Consequents as Fuzzy Weighted Averages of Antecedents

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Abstract Fuzzy logic system is an intelligent system based on IFTHEN rules, which can handle uncertainties effectively, and has been applied to various fields. The design of rules is a key step when a fuzzy logic system is modelled in a practical situation. In this paper, a novel fuzzy logic system named FWA with novel rules is proposed, in which the consequents are fuzzy weighted averages of antecedents. The proposed rules establish some relationship between consequents and antecedents in advance, so that the proposed FWA fuzzy logic system will reduce training time, improve training efficiency, and optimize parameters faster.

N-2

Computing Derivatives in Fuzzy Logic Systems with Consequents as Fuzzy Weighted Averages of Antecedents

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Abstract Zhang, Liu and Tian have proposed a fuzzy logic system (called FWA) with consequents as fuzzy weighted averages of antecedents [5]. However, it is generally complicated to compute the derivatives that are needed to implement steepest-descent parameter tuning algorithms for such systems. Therefore, in this paper, we provide mathematical formulas for computing the derivatives of trapezoidal membership functions used in [5].

N-3

The Fuzzy Attitude Control of Visual Servo System

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Abstract The attitude control problem of multi-degree-of-freedom systems has received considerable attention. In this paper, a fuzzy attitude control method is proposed for the multi-degree-of-freedom visual servo system, which is comprised of a target device and a tracking device. The target device has a single freedom, while the track device has four. Firstly, based on characteristics of this system, the kinematic model is established. Next, the excepted attitude is computed from the feature point on the pictures got by the CMOS camera. Then, a fuzzy controller is designed to make the device's attitude meet our requirement. Finally, a simulation platform of the system is developed in MATLAB environment. The result demonstrates that the proposed fuzzy controller can improve the nonlinear coupling system performance.

N-4

Robust Stability Analysis for Uncertain Polynomial Fuzzy Systems with Time-varying Delay via Delay-partitioning Approach

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Abstract In this paper, a new robust stability criteria by delay-partitioning approach is presented for uncertain polynomial fuzzy system with timevarying delay. The parameter-dependent Lyapunov-Krasovskii functional is employed for the stability analysis, which is constructed in the formwork of state vector augmentation. All the conditions in the proposed approach can be represented as sum-of-squares (SOS) problems.

N-5

The Fuzzy Control of Electro-hydraulic Servo System Based on DE Algorithm

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Abstract In order to improve the control performance of the electro-hydraulic servo system, this paper firstly presents an intelligent fuzzy controller relying on experience. Then, the differential evolution (DE) algorithm is used to optimize the membership function and control rules to overcome the shortcoming that the fuzzy controller based on the human experience does not reach the optimal performance. The simulation results show that, for the optimized fuzzy controller, the control intensity applied to the object in the early period is more increased, the system has almost no overshoot, the response time is shorter, and the tracking performance is improved.

N-6

Tri-self-taught learning of Artificial Neural Networks

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Abstract We present a conceptually simple and general framework for self-taught learning, and this method can modify weights of neural networks when making prediction on samples according to the previous knowledge. The method called Tri-STNN. Based on Tri-training, it adds a Judge Network to make a higher accuracy of prediction. Tri-STNN is simple to be trained and the training datasets for Judge Network is easy to obtain. Moreover, Tri-STNN is capable of lots of tasks. We test Tri-STNN on the datasets of CIFAR-10, and the result shows that Tri-STNN can constantly keep self-taught learning and improve the generalization ability for new samples.

N-7

Exponential Synchronization Control of Neural Networks with Time-Delays and Markovian Jumping Parameters

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Abstract In this paper, the exponential synchronization control is considered for neural networks with time-delays and Markovian jumping parameters. The jumping parameters are modeled as continuous-time finite-state Markov chain. By resorting to the Lyapunov functional method, a linear matrix inequality (LMI) approach is developed to derive the synchronization required. Simulations with Matlab verify the effectiveness of the proposes criteria.

N-8

Towards End-to-End Gesture Recognition with Recurrent Neural Networks

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Abstract With the development of smart devices, gesture recognition is used in more and more fields. The current gesture recognition devices on the market are inconvenient and expensive. Human motion analysis and recognition based on attitude sensor is a new field. The algorithm based on the recurrent neural network takes into account the timing information of the actions and can better resolve the uncertainty of the human motion in time, but as the training sample increases, the efficiency becomes lower. This paper proposes an action recognition method based on Connectionist temporal classification for sequence learning. This method realizes end-to-end recognition of gestures.

N-9

Anti-disturbance tracking controller design for PMSM via T-S disturbance modeling

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Abstract This brief proposes a rotor angular velocity anti-disturbance control way for typical permanent magnet synchronous motor (PMSM) models by using fuzzy disturbance modeling. Following T-S fuzzy description for unknown exogenous disturbances, a nonlinear observer (DO) is used to estimate unknown load disturbances existed in PMSM models. Furthermore, based on the estimation of disturbances, a composite control input is discussed to ensure the PMSM stability. Meanwhile, the dynamical trajectory of angular velocity can track to the desired value. It is noted that corresponding theorem proof can be achieved by applying Lyapunov analysis method with optimization theory.

N-10

Exponential Stability of Neural Network with General Noise

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Abstract The problem of exponential stability of neural network (NN) with general noise is considered in this article. The noise in our neural network model which can be a mixture of white and non-white noise is more suitable for real nervous systems than white noise. By utilizing the random analysis method and Lyapunov functional method techniques, we obtain the conditions of the exponential stability for neural network with general noise. Unlike the NN with white noise in

the existing papers, which are modeled as stochastic differential equations, our model with general noise is based on the random differential equations. Finally, an illustrative example is presented to demonstrate the effectiveness and usefulness of the proposed results.

N-11

Application of the fuzzy C-means clustering algorithm for the burden distribution matrix of blast furnace

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Abstract Burden distribution matrix is the key to guarantee the long-term stable production of the blast furnace. The optimization of the burden distribution matrix aims to form a reasonable burden surface. It can help to achieve the goal of smooth, high-quality and low-consumption blast furnace production. This paper uses the blast furnace condition parameter to measure the burden distribution matrix. And these data is characterized by panel data in statistics. The fuzzy c-means algorithm is used to cluster. Finally, evaluation indicators are using to analyze the clustering effect. It has important reference value for the blast furnace actual production.

N-12

Real-time Classification of Steel Strip Surface Defects Based on Deep CNNs

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Email: leejy@ustb.edu.cn

Abstract Steel strip surface defects recognition is very important to steel strip production and quality control, in which correct classification of these surface defects is crucial. The surface

defects of steel strips are classified according to various features, but it is hard for traditional methods to extract all these features and use them effectively. In this paper, we propose a method to deal with the problem of defect classification based on deep convolutional neural networks (CNNs). We adopt GoogLeNet, as our base model and add an identity mapping to it, which obtains improvement to some extent. At the same time, we establish a dataset of cold-rolled steel strip surface defects of six types and augment it in order to reduce over-fitting. Then we detect defects of six types with our network and reach an accuracy of 98.57%. Besides, our network achieves a speed of 125 FPS, which fully meets the real-time requirement of the actual steel strip production lines.

N-13

Edge Detection for Conveyor Belt Based on the Deep Convolutional Network

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Abstract Conveyor belt deviation is the most common failure of the conveyor system. Timely and accurate detection of deviations from conveyor belt and rapid processing are the guarantee for the safe and stable operation of entire system. Based on the industrial scene of coal transport belt, this paper develop a new method of belt edge detection based on deep convolution network, addressing the problems that traditional mechanical anti-deviation treatment is not timely and the edge detection of the conveyor belt with machine vision is imprecise. We establish a new dataset of the conveyor belt edge, by contrast experiments on training FCN, Deeplab, HED, we selecte the HED model which is most suitable for this task, then compress the model and simplify its output. Finally, the processing speed of the single picture is 0.26s and the error of conveyor belt edge detection is less than 16mm. The method proposed in this paper is quick and simple, with high precision and strong anti-jamming capability. It can be used for all kinds of production scenarios.

O. 其他

O-1

Evolutionary characteristics and the adaptability improvement of an innovation ecosystem based on an extension NK model

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Abstract Based on the influence of members' roles and their relationship strengths on the adaptability of an innovation ecosystem, this paper extends the basic NK model by introducing weight parameter and relationship strength parameter. According to the extended model, three evolutionary characteristics are obtained. Firstly, for an innovation ecosystem, compared with the traditional view of "strengthening the weakness", "strengthening the strengths" will achieve a higher efficiency for its adaptability enhancement. Secondly, a suitable relationship strength but not a highest one will help to enhance its adaptability. Finally, a global vision will help to achieve the optimal evolution path. Moreover, on the basis of the evolutionary characteristics, we put forward to three strategies to improve the system adaptability.

O-2

Research on Multi-View Based Embedded Software Safety Mechanism

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Abstract As embedded software is widely used in a variety of safety-critical control systems, the scale of the software and the complexity are constantly increasing, and the system safety problems caused by software have become more serious. Related fields of software for the current accident mechanism described angle is not comprehensive, so this research focuses on the safety mechanism of the embedded software. Through analysis and empirical data collection, the accident model of embedded system software is given. According to the accident model, the control strategies based on development view, structure view, logic view and environment view are proposed. Using this control strategy, the safety design, analysis, and software safety related development and management of embedded system software can be performed more comprehensively to provide effective protection for system safety.

O-3

Research on Load Balancing Method of Object Storage System based on Data Heat Prediction and Migration

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Abstract Since most existing object storage systems balance the load by scheduling task requests, there is no concern about the uneven load generated by random access to the data, resulting in a large number of requests to be concentrated on a small number of servers. Based on Weighted Least-Connection(WLC) and Consistent Hashing, a load balancing algorithm for Heat Prediction and Migration(HPM) is proposed. By refining the number of connections to the object layer and comprehensively considers the number of connections, the difference of heterogeneous nodes and objects as the object heat, and predicts the heat to guide the scheduling of objects. Finally, the effectiveness of the algorithm is verified by simulation.

O-4

User Interaction Based Bursty Topic Model for Emergency Detection

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Abstract When an emergency suddenly occurs, people usually share information and feelings in the social network. Therefore, it is of great significance to detect emergencies by analyzing and mining messages posted by users. Considering social network contains a mass of user interaction behavior, in this paper, we proposed a novel bursty topic model for emergency detection, named User Interaction based Bursty Topic Model (UIBTM). To overcome the problem of short text sparsity and ambiguity, UIBTM first uses comment texts and the amount of users liking the microblog to enrich the semantic of microblog, then generates the bursty topic model for bursty topic discovery and emergency detection. Comprehensive experiments on the dataset of Sina Microblog show that UIBTM can effectively over-come the sparsity of short text and detect emergencies efficiently.

O-5

A Method for Reutilization of Scrap Metal

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Abstract With the development and progress of industrial technology, there will be a large amount of scrap metal produced. Discarding the scrap metal everywhere will cause environmental pollution and a great waste of resources. This paper presents a method for reutilization of scrap metal in order to recover and utilize the metal scrap. Firstly, identifying the reusable areas by using image processing algorithms. Then, processing available areas of the irregularly shaped scrap metal. Finally, producing parts of mechanical equipment or new types of handicrafts that meet human needs. This method not only makes use of metal scrap reasonably, but also protects environmental resources.

O-6

Smart Home System Based on Open Source Hardware Development Platform

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Abstract Smart home products have quickly integrated into our lives. The smart home comprehensively utilizes advanced various hybrid smart technologies to organically combine home electrical devices related to the home life field and regards each electrical device as a subsystem. This article selected an open source hard-ware platform to design a smart home system. It combines long-distance communication and short-distance communication, and wired communication and wireless communication combine to enable mobile phones to control home appliances anytime and anywhere. This set of smart home control management system has the characteristics of low price, superior performance, and has a very large market size and potential.

O-7

Dynamic Scheduling Algorithm Considering Uncertain Service Time in Cloud Manufacturing Environment

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Abstract Cloud manufacturing is an advanced production method in modern manufacturing. Cloud manufacturing can improve the production efficiency of a company by satisfying the diversified needs of customers by managing distributed resources in a centralized manner and rationally distributing and sharing resources according to production requirements. The production scheduling problem is the core is-sue of production in the cloud manufacturing environment. This paper first analyzes the characteristics of the cloud manufacturing mode of production and the new problems brought by these characteristics to the scheduling, and then analyzes the limitations of the traditional scheduling algorithm. Thirdly, based on the uncertainty of service time in cloud manufacturing environment, the paper pro-poses a new dynamic scheduling algorithm. Finally, the algorithm is verified by simulation experiments.

O-8

An Assessment Method of Vacuum Circuit Breaker Based on Variable Weight and Cloud Model

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Abstract This paper uses assessment method of vacuum circuit breaker (VCB) conditions based on variable weight and cloud model. The state indicators are determined by the test data and relevant literature. The improved analytic hierarchy process method is used to optimize the subjectivity of the weights, and the variable weight is introduced to correct the constant weight, which according to the actual data. The cloud model is used to dividing the condition level of vacuum circuit breaker and calculating the membership degree of each grade cloud. The condition of the vacuum circuit breaker is determined by the fuzzy synthesis of the weights and the condition matrix. Taking the ZN63A-12 vacuum circuit breaker as an exam-ple, the results based on the method are closer to the actual condition, which can provide a reference to the condition maintenance.

O-9

A TT&C Resources Schedule Method Based on Markov Decision Process

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2. The Key Laboratory of Complex System Safety and Autonomous Control (Chongqing University), Ministry of Education. 400044, Chongqing, China

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Abstract For the problem of how to improve the efficiency in the scheduling of Tracking, Telemetry and Command (TT&C) resources, the paper proposes a model of TT&C resources scheduling based on the Markov decision process. In this model, the total work time of TT&C equipment for the spacecraft is considered as the decision criterion and the adjustment range of TT&C equipment are introduced. When a finite-stage backward recursive iterative algorithm is applied to solve the model, the optimal TT&C equipment scheduling strategy, which leads to effectively completion of the TT&C tasks, is obtained. And the TT&C equipment is adjusted according to the optimal strategy. Finally, simulation cases illustrate the proposed method.

O-10

The Hardware System Based on Wi-Fi Failure Prevention System for Photovoltaic Arrays

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Abstract Real-time online monitoring the working status of the photovoltaic array and warning potential faults will play a crucial role in the safe operation of the photovoltaic power generation system. This paper presents a hardware system which is based on Wi-Fi failure prevention system of photovoltaic arrays. The collected data from each collecting node are transmitted to the STM32 chip to process and analysis. The system achieves the data transmission between the upper computer and the lower computer through the Wi-Fi technology and accomplish the real-time monitoring the working status of the photovoltaic array by the upper computer. The test results show that the system is not only stable but also reliable and it can monitor the working environment and status of the photovoltaic array in real time accurately.

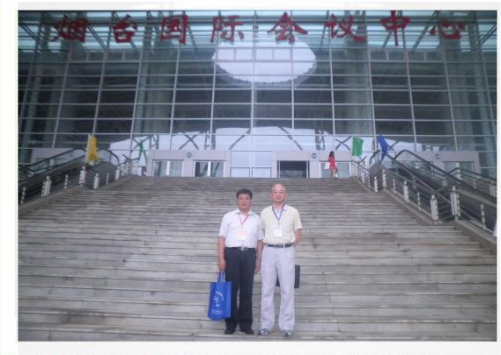
往届回忆

2009 • 重庆

2012 • 上海

2009
—2013

2010 • 北京



2011 • 烟台

2013 • 河南

往届回忆

北京 2014

往届回忆

扬州 2015


2015年中国智能系统会议(CISC'2015)
11th Chinese Intelligent Systems Conference
开幕式
Opening Ceremony
China

往届回忆

厦门 2016

牡丹江回忆 2017


第13届中国智能系统会议
The 13th Chinese Intelligent Systems Conference
主办单位：中国人工智能学会
协办单位：中国人工智能学会智能空天系统专业委员会
承办单位：牡丹江师范学院
北京航空航天大学
2017年10月14-15日 中国


王丽卫
任雪梅


林岩
马保菁

会议邮箱：cisc2018@126.com

会议网站：http://sias.buaa.edu.cn/

SOCIETY OF INTELLIGENT AEROSPACE SYSTEMS

温州铂尔曼酒店

2018年10月13-14日