2019年第27期总194期

农牧业信息化专题

本期导读

前沿资讯

1. 以色列大数据和精准农业技术使农场更加智能化
2. 对农业机器人的需求将大幅增加
3. 潘云鹤院士澳门大学开讲：人工智能已走向2.0新阶段
4. 中国—罗马尼亚农业科技园在布加勒斯特落成

学术文献

1. 基于无人机的高分辨率热成像技术，使用ICI 8640 P，FLIR Vue Pro R 640和thermoMap相机用于植被监测和植物表型分析

2. CropSight：一个可扩展的开源信息管理系统，用于分布式植物表型和基于IoT的作物管理

3. 农业中的人机交互：调查与当前的挑战

中国农业科学院农业信息研究所
联系人：王晶静
联系电话： 010-82106769
邮箱：agri@ckcest.cn
2019年7月8日

前沿资讯

1．以色列大数据和精准农业技术使农场更加智能化

简介：以色列专家表示，精准农业是有助于提高农场效率，增加产量和减少浪费的完整自动化解决方案。以色列的精准农业已从“滴水”开始变成了“洪流”。“滴水”是滴灌，是以色列在发展现代农业中发明的节水灌溉技术，在减少用水量的同时提高了作物产量。目前已有近百家以色列公司生产测量、分析、监测和自动化过程的工具，以确保作物和土壤的精确需水量（即需水的准确时间和地点），以确保最少的资源浪费和最大的效率和产量。以色列在水管理、数据科学、无人机和传感器等精准农业技术研究方面拥有先进技术。其精准农业利用传感器和卫星图像等技术收集数据，并运用智能算法来分析应用这些数据，为农民提供一个完整的解决方案，就像用户从计算机上购买一个软件包一样，包括灌溉以及施肥和害虫控制等多种功能。

目前，以色列许多农场开始建立互联网农业。随着微型卫星、无人机和带有长寿命电池的传感器的发展，农业正在经历数字革命。

——CropX公司开发的高级自适应灌溉的CropX软件系统。在农田中安装的传感器利用装有GPS功能的智能手机应用程序，同步传输土壤数据，不仅能告诉农民每小块地在某一时间内所需的水，肥料和农药数量，还可以相应地自动控制灌溉。

——Taranis公司设计了一个应用程序从农田传感器和卫星图像收集数据信息，并利用智能仪表集中处理传入数据，让现场侦察员帮助制定和实施有效的疾病和有害生物预防效管理决策。

——Tevatronic 开发了一种完全自动化灌溉和施肥系统，无线传感器从农场每个区域土壤中收集精确数据，智能控制器将这种云存储数据实时转换为精确的灌溉施肥操作，无需人工干预。该系统可测量每个植株的压力水平，以确定何时开始和停止灌溉。相比之下，传统控制器可以定时释放预定量的水和肥料。根据不同作物测试结果，该系统可将生产力提高15-31％，并节省高达27-75％的水和肥料。

——ATP实验室，作为农业物联网“数字工具平台”，使用数据分析和人工智能从大量的种植者那里收集数据，生成基于云的可操作的最佳实践建议，并生成实时数字化图片帮助农民提高生产率、盈利能力和可持续性。

——Saturas公司开发了廉价的微型传感器和无线转发器，嵌入商业果树的树干中，进行准确和连续的干水电位测量。以此为核心建立的精确灌溉系统在西班牙和以色列的柑橘和杏仁农场进行测试，可为农民节约15-20％的用水量，并提高产量和质量。

来源：科技部

发布日期:2019-06-28

全文链接:

http://agri.ckcest.cn/file1/M00/06/87/Csgk0F0dYjaAAlEdAAKGkhokbUk112.pdf

2．Demand for agricultural robots to increase sharply（对农业机器人的需求将大幅增加）

简介：美国透明市场研究机构（Transparency Market Research）最近的一项商业研究显示，到2024年，农业机器人的需求将增长24.1%。《透明市场研究农业机器人市场报告》（Transparency Market Research Agriculture Robots Market report）指出，尽管全球人口不断增长，但由于许多新兴经济体都专注于城市化，导致可用于耕地的面

积有限。报告称，“这些因素提出了一个问题：如何才能从现有农田中获取最大产量，并催生了用于杂草控制、云播种、播种、土壤分析和环境监测的农业机器人市场。”

研究人员表示，随着人们对农业机器人所带来的好处的认识以及世界上具有成本效益的地区的技术变得越来越便宜，在2016年至2024年预测期内，全球农业机器人的需求将以惊人的24.1%的复合年增长率成倍增长。该报告的分析师评估称，全球农业机器人市场的机遇，在2016年转化为10.1亿美元的收入，并估计到2024年底，这一数字将增至57亿美元。

报告指出，使全球农业机器人市场需求增长的关键因素，除了人口增长对全球粮食供应造成的压力越来越大外，还包括：食品生产商长期大幅节约成本的愿景，以及政府对采用现代农业技术的支持。此外，无人驾驶飞行器（UAV）或无人机（专门为农业农场设计），发达国家食品生产商对新技术的欢迎，也有望在不久的将来推动全球农业机器人市场需求增长。另一方面，农产品公司在生产阶段之前需要大量的资本投资，一些新兴经济体缺乏意识，以及缺乏使用这些设备的标准化安全法规，阻碍了市场发展；除此之外，农业机器人的商业化是一个耗时的过程，研究人员称，在这个市场上运作的玩家将不得不克服这个过程才能获得最大利润。

区域参与者占据主导地位。全球农业机器人市场呈现出这样一种局面，即区域参与者在其所在国家占据主导地位。例如，2015年，Clearpath Robotics, Harvest Automation, Inc.和PrecisionHawk, Inc.这三家公司在北美地区名列前茅；而SenseFly SA和Naio Technologies在欧洲则占据了上风；在亚太地区，Shibuya Seiki在同年被确定为领导者。由于这一市场的绝对盈利能力和迅猛的增长速度，预计在不久的将来会有许多新参与者进入市场，蚕食占主导地位的参与者的市场份额。TMR报告的分析师们建议，为了让主要参与者保持自己的优势地位，应该开发尖端技术，以满足不同的需求。

2015年，北美作为全球农业机器人市场的一个区域占据了最大的需求，尽管预计在预测期结束时，人口众多的亚太地区将成为一个高利润的地区，中国和日本是该地区对农业机器人需求不断增长的两个国家。

来源：Future Farming

发布日期:2019-06-25

全文链接:

http://agri.ckcest.cn/file1/M00/06/87/Csgk0F0dY0WAZ0bYAAiTrc4akcc135.pdf

3. 潘云鹤院士澳门大学开讲：人工智能已走向2.0新阶段

简介：澳门大学20日举行“大学讲坛”讲座，邀请著名计算机应用专家、中国工程院院士潘云鹤以《人工智能走向2.0》为题发表演说，分析人工智能迈向2.0的发展趋势，并结合中国国情提出发展人工智能的建议。

讲座上，潘云鹤结合“中国人工智能2.0战略”，深入浅出地阐述了人工智能的前瞻性问题，向学生们详细介绍了人工智能的发展历程和基本概念，重点分析了人工智能进入2.0的时代背景、主要特征、技术发展趋势和面临的挑战等问题。

潘云鹤指出，人工智能2.0的新技术特征可见于大数据上的深度学习、群体智能的萌芽、跨媒体推理的兴起、自主智能装备的涌现等。广泛应用在智能城市、智慧医疗、智能制造等方面。

谈到人工智能与中国发展的关系，潘云鹤分析说，2017年国务院发布了《新一代人工智能发展规划》，确立了这前沿技术对国家发展的重要性，构筑了人工智能发展的蓝图，并对人工智能换代作出了前瞻性的战略性分析与规划，充分利用人工智能技术与产

业促进中国的经济与社会发展。

潘云鹤的演说逻辑清晰、思想前沿、内涵丰富，引起了学生们的浓厚兴趣。在问答交流环节，与会师生纷纷提问，与潘云鹤交流互动，现场气氛热烈。

来源：中国新闻网

发布日期:2019-06-20

全文链接:

http://agri.ckcest.cn/file1/M00/06/87/Csgk0F0dYcmABhnyAAWjbmgtXp4752.pdf

4. 中国—罗马尼亚农业科技园在布加勒斯特落成

简介：2019年5月16日，中国农业科学院农业环境与可持续发展研究所和布加勒斯特农业科学与兽医学大学合作共建的中国—罗马尼亚农业科技园举行落成仪式。

中罗农业科技园由中方提供的一座地下智能LED植物工厂和一栋具有中国特色的节能日光温室组成。植物工厂具有高产、节水的特点，其占地面积和栽培面积分别仅有50平方米和150平方米，通过中方研创的植物LED节能光源、浅液流营养液立体栽培、光—温耦合节能降温、智能控制等技术，可年产植物35000株；日光温室占地面积和栽培面积分别为500平方米和350平方米，主要展示中方提供的轻简装配式节能日光温室结构、主动蓄放热调温、喷雾降温、内嵌式无土栽培、水肥一体化以及数据采集与控制等先进技术。

中罗农业科技园是落实 “一带一路”科技创新行动计划、中国—中东欧国家科技创新伙伴计划的重要举措。科技园有望通过技术合作与技术示范，推动中国成熟农业技术在罗及其他中东欧国家的转移转化，同时提升相关国家的设施农业创新能力与产业化水平，实现合作共赢。

来源：科技部

发布日期:2019-06-18

全文链接:

http://agri.ckcest.cn/file1/M00/06/87/Csgk0F0dYU6AZiKbAAWY1dEiYDU728.pdf

学术文献

1. UAV-Based High Resolution Thermal Imaging for Vegetation Monitoring, and Plant Phenotyping Using ICI 8640 P, FLIR Vue Pro R 640, and thermoMap Cameras(基于无人机的高分辨率热成像技术，使用ICI 8640 P，FLIR Vue Pro R 640和thermoMap相机用于植被监测和植物表型分析)

简介：The growing popularity of Unmanned Aerial Vehicles (UAVs) in recent years, along with decreased cost and greater accessibility of both UAVs and thermal imaging sensors, has led to the widespread use of this technology, especially for precision agriculture and plant phenotyping. There are several thermal camera systems in the market that are available at a low cost. However, their efficacy and accuracy in various applications has not been tested. In this study, three commercially available UAV thermal cameras, including ICI 8640 P-series (Infrared Cameras Inc., USA), FLIR Vue Pro R 640 (FLIR Systems, USA), and thermoMap (senseFly, Switzerland) have been tested and evaluated for their potential for forest monitoring, vegetation stress detection, and plant phenotyping. Mounted on multi-rotor or fixed wing systems, these cameras were simultaneously flown over different experimental sites located in St. Louis, Missouri (forest environment), Columbia, Missouri (plant stress detection and phenotyping), and Maricopa, Arizona (high throughput phenotyping). Thermal imagery was calibrated using procedures that utilize a blackbody, handheld thermal spot imager, ground thermal targets, emissivity and atmospheric correction. A suite of statistical analyses, including analysis of variance (ANOVA), correlation analysis between camera temperature and plant biophysical and biochemical traits, and heritability were utilized in order to examine the sensitivity and utility of the cameras against selected plant phenotypic traits and in the detection of plant water stress. In addition, in reference to quantitative assessment of image quality from different thermal cameras, a non-reference image quality evaluator, which primarily measures image focus that is based on the spatial relationship of pixels in different scales, was developed. Our results show that (1) UAV-based thermal imaging is a viable tool in precision agriculture and (2) the three examined cameras are comparable in terms of their efficacy for plant phenotyping. Overall, accuracy, when compared against field measured ground temperature and estimating power of plant biophysical and biochemical traits, the ICI 8640 P-series performed better than the other two cameras, followed by FLIR Vue Pro R 640 and thermoMap cameras. Our results demonstrated that all three UAV thermal cameras provide useful temperature data for precision agriculture and plant phenotying, with ICI 8640 P-series presenting the best results among the three systems. Cost wise, FLIR Vue Pro R 640 is more affordable than the other two cameras, providing a less expensive option for a wide range of applications.

来源：REMOTE SENSING

发布日期:2019-02-07

全文链接:

http://agri.ckcest.cn/file1/M00/06/87/Csgk0F0dXFWAI1P1AQqg2gYUCc4604.pdf

2. CropSight: a scalable and open-source information management system for distributed plant phenotyping and IoT-based crop management(CropSight:一个可扩展的开源信息管理系统，用于分布式植物表型和基于IoT的作物管理)

简介：Background: High-quality plant phenotyping and climate data lay the foundation for phenotypic analysis and genotype-environment interaction, providing important evidence not only for plant scientists to understand the dynamics between crop performance, genotypes, and environmental factors but also for agronomists and farmers to closely monitor crops in fluctuating agricultural conditions. With the rise of Internet of Things technologies (IoT) in recent years, many IoT-based remote sensing devices have been applied to plant phenotyping and crop monitoring, which are generating terabytes of biological datasets every day. However, it is still technically challenging to calibrate, annotate, and aggregate the big data effectively, especially when they were produced in multiple locations and at different scales. Findings: CropSight is a PHP Hypertext Pre-processor and structured query language-based server platform that provides automated data collation, storage, and information management through distributed IoT sensors and phenotyping workstations. It provides a two-component solution to monitor biological experiments through networked sensing devices, with interfaces specifically designed for distributed plant phenotyping and centralized data management. Data transfer and annotation are accomplished automatically through an hypertext transfer protocol-accessible RESTful API installed on both device side and server side of the CropSight system, which synchronize daily representative crop growth images for visual-based crop assessment and hourly microclimate readings for GxE studies. CropSight also supports the comparison of historical and ongoing crop performance while different experiments are being conducted. Conclusions: As a scalable and open-source information management system, CropSight can be used to maintain and collate important crop performance and microclimate datasets captured by IoT sensors and distributed phenotyping installations. It provides near real-time environmental and crop growth monitoring in addition to historical and current experiment comparison through an integrated cloud-ready server system. Accessible both locally in the field through smart devices and remotely in an office using a personal computer, CropSight has been applied to field experiments of bread wheat prebreeding since 2016 and speed breeding since 2017. We believe that the CropSight system could have a significant impact on scalable plant phenotyping and IoT-style crop management to enable smart agricultural practices in the near future.

来源：GIGASCIENCE
发布日期:2019-01-15
全文链接:
http://agri.ckcest.cn/file1/M00/06/87/Csgk0F0dV-GACaHfAIOvP89s3hs642.pdf

3. Human-robot interaction in agriculture: A survey and current challenges(农业中的人机交互:调查与当前的挑战)

简介：Human-robot interaction (HRI) is an extensive and diverse research topic that has been gaining importance in last years. Different fields of study have used HRI approaches for solving complicated problems, where humans and robots interact in some way to obtain advantages from their collaboration. Many industrial areas benefit by applying HRI strategies in their applications, and agriculture is one of the most challenging of them. Currently, field crops can reach highly autonomous levels whereas speciality crops do not. In particular, crops such as fruits and vegetables are still harvested manually, and also some tasks such as pruning and thinning have long been considered to be too complex to automate completely. In addition, several countries face the problem of farm labour shortages. As a consequence, the production process is affected. In this context, we survey HRI approaches and ap-plications focused on improving the working conditions, agility, efficiency, safety, productivity and profitability of agricultural processes, in cases where manual labour cannot be replaced by but can be complemented with robots.

来源：BIOSYSTEMS ENGINEERING
发布日期:2019-01-10
全文链接:
http://agri.ckcest.cn/file1/M00/06/87/Csgk0F0dW16AdG9xABp5MY9PzGI912.pdf