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农牧业信息化专题

本期导读

前沿资讯

学术文献

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前沿资讯

1. Rapid adoption of artificial intelligence in agriculture（人工智能在农业中的快速应用）

简介：2018年，农业人工智能市场价值6亿美元，预计到2025年将达到26亿美元。在农产品和田间耕作技术方面，农业正迅速采用人工智能（AI）和机器学习（ML）。根据市场研究公司MarketsandMarkets的数据，2018年农业人工智能市场价值6亿美元，预计到2025年将达到26亿美元，预测期间的复合年均增长率（CAGR）为22.5%。

认知计算 最具颠覆性的技术

报告指出，认知计算将成为农业服务领域最具颠覆性的技术，因为它可以理解、学习和响应不同的情况（基于学习），从而提高效率。

推动农业市场AI增长的主要因素包括：

- 由于人口增长，对农业生产的需求不断增长
- 越来越多地采用信息管理系统和新的先进技术来提高作物产量
- 通过实施深度学习技术提高作物产量
- 世界各国政府支持采用现代农业技术的举措日益增多

根据MarketsandMarkets公司电子与半导体副总监Apurva Agarwal的说法，“物联网（IoT）和人工智能技术（如机器学习、计算机视觉和预测分析）的结合，使农民能够实时分析天气条件、温度、土壤湿度、植物健康和农作物价格的实时数据。”

利用人工智能改善天气预报

天气追踪和预报是人工智能在农业上的重要应用，因为它有助于收集最新的天气状况信息，如温度、降雨、风速和方向，以及太阳辐射。根据一项研究，90%的作物损失是由天气事件造成的，其中25%的损失可以通过预测天气模型加以预防。

利用手持仪器、传感器、GPS和现场气象站等多种设备进行天气跟踪，获取实时信息。实时信息的可用性有助于农民做出各种决策，如及时播种作物、杂草检测和作物收获前分析。天气跟踪和预报应用市场预计将在预测期内以25%的最高复合年均增长率（CAGR）增长。

北美将主导农业市场的人工智能

MarketsandMarkets公司电子与半导体高级研究分析师Rahul Kumar表示，“预计到2025年，北美将占据农业人工智能市场的主要份额，而亚太地区预计将在预测期间以最高复合年均增长率（CAGR）增长。”

IBM, Microsoft, John Deere, Granular, Blue River Technology和The Climate Corporation等几家农业技术供应商在北美地区的存在，正推动该地区农业人工智能市场的增长。在预测期内，亚太地区农业市场的人工智能预计将以较高的CAGR增长。农业应用领域对深度学习和计算机视觉技术的不断采用，是推动亚太地区农业人工智能市场增长的主要因素。

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http://agri.ckcest.cn/file1/M00/0E/7F/CsgkOF1eAwiALsPdAAb3Mbr3Gh8375.pdf

2. Technology to move Australian agriculture forward（推动澳大利

亚农业向前发展的技术）

简介：A 3-year project aimed at unearthing new ways to move Australian agriculture forward has wrapped up with a list of 39 emerging technologies and 24 new industries.

The 6 part series of 'Horizon Scans', developed by Brisbane-based university QUT and funded by AgriFutures Australia highlights futuristic technologies, trends, innovations and new industry opportunities, all with strong potential to expand and grow Australian agriculture.

Emerging technologies

The latest watchlist of 24 potential emerging agricultural industries that provide opportunities for development include medicinal marijuana, hemp milk, and hydroponic berries, Asian vegetables, hydroponic hops, Australian edible natives, insect farming, wild camel and goat harvesting. While emerging technologies were identified in robotics and artificial intelligence, data, biotechnology, genomics, business models, renewable energy, and advanced materials.

Leap of faith

"Many of the technologies and new industries identified through the scans have obvious application, others may require a leap of faith to understand the potential impact they can have on individual farm businesses or agricultural industries, " said QUT researcher, Dr Grant Hamilton.

They also present an opportunity for growth, and the capacity to do so in an environmentally sustainable way by using new technologies.

"It takes a highly innovative business or individual to realise those opportunities but the payoff can definitely be worth it," said Dr Hamilton.

Be open to new possibilities

AgriFutures Australia Senior Manager, Business Development Jennifer Medway encouraged Australian producers to be open to new possibilities.

"Technologies can emerge from inside Australia in sectors unrelated to agriculture and open up new opportunities we haven't seen before, or overseas technologies have the potential to completely transform the way we do things here in Australia."

Driving on-farm transformation

"We are already starting to see the benefits of autonomous robotics and human physical augmentation technologies in improving productivity and the safety of workers in repetitive and physically demanding tasks. As the future of work takes shape over the coming decades, these technologies will be essential in driving on-farm transformation," said Ms Medway.

Examples include Wearable User Interfaces, Natural Language Interfaces, Human-in-the-loop Machine Learning, Computer Vision, Collaborative Robots, Context-aware Computing, Human Augmentation and Brain-computer Interface.

Energy infrastructure

Other transformational technologies identified through the scans are driving smarter and more reliable energy infrastructure.

The increasing availability of low cost and efficient electricity generation and storage technologies will facilitate entirely new models of energy consumption.

"Renewable energy technologies, previously unheard of just a few years ago, are now a

real possibility and include Solar Retransmission, Perovskite Solar Cells, Sodium-Ion Batteries, Moisture Harvesting and Artificial Photosynthesis," said Ms Medway.

来源： Future Farming

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http://agri.ckcest.cn/file1/M00/0E/7F/CsgkOF1eA2-AEaOhAAV7EmI2cOM828.pdf

3. Artificial intelligence helps banana growers protect the world's most favorite fruit（人工智能帮助香蕉种植者保护世界上最受欢迎的水果）

简介： Artificial intelligence-powered tools are rapidly becoming more accessible, including for people in the more remote corners of the globe. This is good news for smallholder farmers, who can use handheld technologies to run their farms more efficiently, linking them to markets, extension workers, satellite images, and climate information. The technology is also becoming a first line of defense against crop diseases and pests that can potentially destroy their harvests.

A new smartphone tool developed for banana farmers scans plants for signs of five major diseases and one common pest. In testing in Colombia, the Democratic Republic of the Congo, India, Benin, China, and Uganda, the tool provided a 90 percent successful detection rate. This work is a step towards creating a satellite-powered, globally connected network to control disease and pest outbreaks, say the researchers who developed the technology. The findings were published this week in the journal Plant Methods.

"Farmers around the world struggle to defend their crops from pests and diseases," said Michael Selvaraj, the lead author, who developed the tool with colleagues from Bioversity International in Africa. "There is very little data on banana pests and diseases for low-income countries, but an AI tool such as this one offers an opportunity to improve crop surveillance, fast-track control and mitigation efforts, and help farmers to prevent production losses."

Co-authors included researchers from India's Imayam Institute of Agriculture and Technology (IIAT), and Texas A&M University.

Bananas are the world's most popular fruit and with the global population set to reach 10 billion in 2050, pressure is mounting to produce sufficient food. Many countries will continue depending on international trade to ensure their food security. It is estimated that by 2050 developing countries' net imports of cereals will more than double from 135 million metric tonnes in 2008/09 to 300 million in 2050. An essential staple food for many families, bananas are a crucial source of nutrition and income. However, pests and diseases -- Xanthomanas wilt of banana, Fusarium wilt, black leaf streak (or Black sigatoka), to name a few -- threaten to damage the fruit. And when a disease outbreak hits, the effects to smallholder livelihoods can be detrimental.

In the few instances in which losses to the Fusarium Tropical race 4 fungus have been estimated, they amounted to US$121 million in Indonesia, US$253.3 million in Taiwan, and US$14.1 million in Malaysia (Aquino, Bandoles and Lim, 2013). In Africa, where the fungus was first reported in 2013 in a plantation in northern Mozambique, the number of

symptomatic plants rose to more than 570,000 in September 2015.

The tool is built into an app called Tumaini -- which means "hope" in Swahili -- and is designed to help smallholder banana growers quickly detect a disease or pest and prevent a wide outbreak from happening. The app aims to link them to extension workers to quickly stem the outbreak. It can also upload data to a global system for large-scale monitoring and control. The app's goal is to facilitate a robust and easily deployable response to support banana farmers in need of crop disease control.

"The overall high accuracy rates obtained while testing the beta version of the app show that Tumaini has what it takes to become a very useful early disease and pest detection tool," said Guy Blomme, from Bioversity International. "It has great potential for eventual integration into a fully automated mobile app that integrates drone and satellite imagery to help millions of banana farmers in low-income countries have just-in-time access to information on crop diseases."

Deep learning

Rapid improvements in image-recognition technology made the Tumaini app possible. To build it, researchers uploaded 20,000 images that depicted various visible banana disease and pest symptoms. With this information, the app scans photos of parts of the fruit, bunch, or plant to determine the nature of the disease or pest. It then provides the steps necessary to address the specific disease. In addition, the app also records the data, including geographic location, and feeds it into a larger database.

Existing crop disease detection models focus primarily on leaf symptoms and can only accurately function when pictures contain detached leaves on a plain background. The novelty in this app is that it can detect symptoms on any part of the crop, and is trained to be capable of reading images of lower quality, inclusive of background noise, like other plants or leaves, to maximize accuracy.

"This is not just an app," said Selvaraj. "But a tool that contributes to an early warning system that supports farmers directly, enabling better crop protection and development and decision making to address food security."

This study, implemented by the Alliance between Bioversity International and the International Center for Tropical Agriculture (CIAT), has shown the potential of cutting-edge technologies such as AI, IoT (Internet of Things), robotics, satellites, cloud computing, and machine learning for the transformation of agriculture and for helping farmers.

来源：ScienceDaily

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http://agri.ckcest.cn/file1/M00/0E/7F/CsgkOF1eAd6ANrXLAAQ-bspmQIA620.pdf

4. Taranis and BASF provide crop monitoring in Brazil（Taranis和巴斯夫在巴西提供作物监测服务）

简介：Taranis and BASF announced a partnership which will provide farmers in Brazil with go-to-market crop monitoring solutions.

Precision agriculture company Taranis and BASF announced their partnership to provide farmers in Brazil with go-to-market crop monitoring solutions. The partnership

signals the expansion of Taranis' operations in the Brazilian market and will later focus on other global regions.

Predict and prevent threats

Taranis' precision agricultural intelligence platform utilises deep-learning technology combined with high-speed UAVs and manned aircrafts to provide farmers with insights around seed emergence, weeds, insect damage, nutrition deficiency and more. Those insights enable farmers to predict and prevent threats to over 20 million acres of crops on a granular level, using forecasting models and technical recommendations to improve crop yields.

"We are thrilled to be working together with BASF, one of the largest seed and chemical industry leaders in the world, bringing together high-quality, unprecedented in-season insights and valuable historical data so that farmers can monitor the evolution of their crops from year to year, to learn the best methods to increase productivity," says Ofir Schlam, CEO and Co-founder of Taranis.

"With our technology, farmers will be able to take pre-emptive actions against diseases, pests and weeds in the field—thereby increasing their yield and minimise costs."

After the trial period, Taranis and BASF began offering their joint services to farmers in Brazil earlier this year, focusing on large scale crops such as soy, corn, sugar cane and cotton. Using BASF loyalty points, farmers can get access to Taranis' services – a bonus for clients who have worked with BASF over the years.

Promote sustainable agriculture

"To promote sustainable agriculture, we invest in new digital tools that connect innovative thinking with concrete solutions, contributing to the farmer's legacy. As part of AgroStart (our startup ecosystem program), we have approached more than 400 startups since 2016 looking for co-created solutions to support farmers in decision making. We are excited to integrate Taranis' services into our digital farming solutions," said Almir Araújo, head of BASF's Latin American Digital Agriculture department.

来源： Future Farming

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学术文献

1. AgROS: A Robot Operating System Based Emulation Tool for Agricultural Robotics(AgROS:一个基于机器人操作系统的农业机器人仿真工具)

简介： This research aims to develop a farm management emulation tool that enables agrifood producers to effectively introduce advanced digital technologies, like intelligent and autonomous unmanned ground vehicles (UGVs), in real-world field operations. To that end, we first provide a critical taxonomy of studies investigating agricultural robotic systems with regard to: (i) the analysis approach, i.e., simulation, emulation, real-world implementation; (ii) farming operations; and (iii) the farming type. Our analysis demonstrates that simulation and

emulation modelling have been extensively applied to study advanced agricultural machinery while the majority of the extant research efforts focuses on harvesting/picking/mowing and fertilizing/spraying activities; most studies consider a generic agricultural layout. Thereafter, we developed AgROS, an emulation tool based on the Robot Operating System, which could be used for assessing the efficiency of real-world robot systems in customized fields. The AgROS allows farmers to select their actual field from a map layout, import the landscape of the field, add characteristics of the actual agricultural layout (e.g., trees, static objects), select an agricultural robot from a predefined list of commercial systems, import the selected UGV into the emulation environment, and test the robot's performance in a quasi-real-world environment. AgROS supports farmers in the ex-ante analysis and performance evaluation of robotized precision farming operations while lays the foundations for realizing "digital twins" in agriculture.

来源：AGRONOMY-BASEL

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2. A Simplified Optimal Path Following Controller for an Agricultural Skid-Steering Robot(农用滑移机器人简化最优路径跟踪控制器)

简介：The dynamics of a skid-steering robot present intrinsic non-linearities that make the design and implementation of a controller a very complex task, time-consuming, and difficult to implement into an embedded system with limited resources. This paper presents a simplified first order digital model approximation and an optimal observer-based control approach for the tracking of the lateral position of such robots. In order to verify the validity of this proposal, 3D real-time interactive simulations and real validations with an agricultural skid-steering robot were performed with satisfactory results.

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