2023年第52期总427期

农牧业信息化专题

本期导读

前沿资讯

1.梯度作物产量解决方案如何利用数据分析加强加州番茄种植者的水分管理

2. CropLife 100家农业零售商对2024年农业科技的期望更高

学术文献

1. 使用人工智能进行水果分级：方法和挑战综述

2. 农业机器人综述，重点关注其感知系统

3. 社论：智慧农业中的机器学习和人工智能

4. 农业领域的人工智能技术:系统文献综述

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
2023年12月25日

前沿资讯

1．How Gradient Crop Yield Solutions Is Using Data Analytics to Enhance Water Management for California Tomato Growers（梯度作物产量解决方案如何利用数据分析加强加州番茄种植者的水分管理）

简介：In the heart of California's Central Valley, a groundbreaking agricultural revolution is underway. Gradient Crop Yield Solutions, a subsidiary of the esteemed The Morning Star company, is leading the charge in transforming the way tomatoes are grown, using cutting-edge ground sensor technology and remote sensing analytics to optimize irrigation practices.

The satellite imagery provided by EOS Data Analytics has not only propelled their customer base to over 26,000 acres but also saved farmers a remarkable 10-15% in irrigation costs. As we delve into their story, we will uncover the impressive journey of Gradient and its mission to reshape the future of farming.

Crop monitoring in California

Growing tomatoes in California, despite the region's favorable climate, presents several agricultural challenges. It is continually impacted by water scarcity, with inconsistent irrigation management leading to crop yield losses and impacted plant health.

To address these issues, Gradient Crop Yield Solutions emerged from the dynamic research and development department of The Morning Star company, focusing on improving water management practices. This transformative journey began on a modest scale, encompassing a mere 1,300 acres in 2018. However, it was the overwhelming interest from growers that necessitated the creation of the Gradient Crop Yield Solutions platform.

By 2019, the company officially took flight, servicing an initial customer base of 6,200 acres. Fast forward to 2021, and Gradient's reach extended to an impressive 21,000 acres. Today, they proudly serve growers across California's expanse, spanning from the south to the north, accounting for a total of 26,000 acres.

Ground and space solutions for crop yield optimization

One of the critical issues addressed by Gradient is over-irrigation, often prompted by hot weather conditions. Instead of merely relying on evapotranspiration and weather data, Gradient's system uses ground sensors to measure and maintain optimal volumetric water content in the soil, reducing the need for unnecessary watering. This approach benefits both the environment and the grower's bottom line. However, their innovation doesn't stop at the ground level. After a series of trial-and-error experiments, they realized that the need for monitoring large acreages with an increased level of precision is quite evident.

Eventually, Gradient decided to harness the power of satellite imagery offered by EOSDA Crop Monitoring to obtain a holistic view of the field uniformity. This data allows their farmers to optimize irrigation practices. Jesus Salcedo, Software Engineer at Gradient, explains: "Satellite imagery allows us to monitor different areas without being present in the field. It saves us from the need to consistently visit fields for checks that may not be necessary."

The result is a 10-15% reduction in irrigation costs, compared to conventional grower-standard methods. It's a transformation that redefines the farming landscape, demonstrating the positive impact of precision agritech.

Yuliia Maryanova, Account Manager at EOS Data Analytics and a key collaborator with Gradient, highlights the convenience that growers now have at their fingertips: "EOSDA Crop Monitoring provides growers with a daily stream of in-depth satellite data analytics, complemented by Gradient's ground data. This unique synergy ensures that growers can make informed decisions about their crops."

Furthermore, Gradient is actively working on an enhanced nutrition program to combat deficiencies, particularly in tomatoes. They will offer it as a personalized service.

Right now, they practice individual consultations with growers beyond giving access to an online platform. Field technicians are being dispatched to monitor and assess the conditions within growers' fields. This hands-on approach ensures that any signs of plant stress are swiftly identified and communicated. Meanwhile, the technological advantage of using the combination of ground and satellite data analytics streamlines their operations and provides growers with quick responses to any potential issues.

Paving the way to a sustainable future for California's tomato growers

In an era where sustainable and efficient farming practices are paramount, the collaboration of Gradient and EOS Data Analytics highlights an important trend of advanced technology becoming available to every grower. The journey from a modest water management project to a sprawling operation across California is an inspiring tale of success. By combining the power of ground sensor technology, satellite imagery, and hands-on support, Gradient is revolutionizing how tomatoes are grown while preserving precious resources and saving growers valuable time and money.

As Yuliia Maryanova aptly summarizes, "Analyzing field conditions remotely through satellite imagery provides growers with important insights. But Gradient goes even further by offering a more individual approach. This personalized touch is what sets them apart in the world of precision agriculture, ensuring healthier crops, a sustainable future, and delighted growers."

Gradient is on a relentless mission to redefine tomato farming in California with a focus on sustainability and efficiency. Their commitment to innovation and collaboration is facilitated by utilizing remote sensing analytics by EOSDA Crop Monitoring.

By visualizing in-ground sensor locations and data in the near future, Gradient aims to further empower growers to make informed decisions, benefiting both crops and the environment. Their collaboration with EOS Data Analytics has garnered positive feedback. Meanwhile, thorough training ensures growers can utilize the platform effectively.

As operations expand, Gradient envisions covering hundreds of thousands of acres. This reflects the team's dedication to growers and the vision for a sustainable and prosperous future for California's tomato farming industry.

来源：EOS Data Analytics；Global Ag Tech Initiative；
发布日期:2023-12-19
全文链接:
http://agri.nais.net.cn/file1/M00/10/35/CsgkOGWFRL2ADOyUAAflNKhFxqM527.pdf

2．CropLife 100 Ag Retailers Are Expecting More from Ag Tech in 2024(CropLife 100家农业零售商对2024年农业科技的期望更高)

简介：Let's face it – ag tech is hot right now. If you visited any summer or fall trade show this year, chances are there were plenty of examples of new and improved ag technology to check out, writes Eric Sfiligoj at CropLife.

According to the data from the 2023 CropLife 100 survey, ag technology was also a growing sector of the ag retail business during the year. In fact, respondents on the 2023 survey reported that their revenues in this area grew a respectable 2%, from $796.2 million in 2022 to $815.1 million this year.

Furthermore, the outlook for the ag tech sector among CropLife 100 ag retailers is extremely bright. In particular, ag retailers have high hopes that artificial intelligence (AI) and autonomous vehicles will revolutionize the ag equipment sector between now and the end of the decade.

However, most expect the implementation of autonomous vehicles and AI systems into ag equipment to take some time yet. In fact, when asked what role AI might play in the upcoming growing season, half of the respondents (50%) said it was still too early to tell. Another 35% thought AI's place in the industry would be "small" in 2024. Only 15% foresee such systems playing a "big role" in the nation's crop fields next year.

In terms of what AI and improved ag technological systems will offer to the industry, the majority of respondents (67%) thought improving the decision-making process would be the biggest benefit, for both ag retailers and growers. Another 30% indicated using technology would help alleviate the ag industry's persistent labor crisis. The remaining 3% said offering input cost savings would be what attracted the ag business to adopting such systems.

来源：CropLife；Global Ag Tech Initiative；
发布日期:2023-12-19
全文链接:
http://agri.nais.net.cn/file1/M00/03/63/CsgkOWWFRB-AXGfnAAioT40bpdQ682.pdf

学术文献

1．Fruit sizing using AI: A review of methods and challenges(使用人工智能进行水果分级：方法和挑战综述)

简介：Fruit size at harvest is an economically important variable for high-quality table fruit production in orchards and vineyards. In addition, knowing the number and size of the fruit on the tree is essential in the framework of precise production, harvest, and postharvest management. A prerequisite for analysis of fruit in a real-world environment is the detection and segmentation from background signal. In the last five years, deep learning convolutional neural network have become the standard method for automatic fruit detection, achieving F1-scores higher than 90 %, as well as real-time processing speeds. At the same time, different methods have been developed for, mainly, fruit size and, more rarely, fruit maturity estimation from 2D images and 3D point clouds. These sizing methods are focused on a few

species like grape, apple, citrus, and mango, resulting in mean absolute error values of less than 4 mm in apple fruit. This review provides an overview of the most recent methodologies developed for in-field fruit detection/counting and sizing as well as few upcoming examples of maturity estimation. Challenges, such as sensor fusion, highly varying lighting conditions, occlusions in the canopy, shortage of public fruit datasets, and opportunities for research transfer, are discussed.

来源：POSTHARVEST BIOLOGY AND TECHNOLOGY

发布日期:2023-09-23

全文链接:

http://agri.nais.net.cn/file1/M00/10/35/CsgkOGWFQBKAdMBPAJULb2awB5M240.pdf

2．An extensive review on agricultural robots with a focus on their perception systems(农业机器人综述，重点关注其感知系统)

简介：Agriculture represents an essential aspect of human existence, providing the sustenance necessary for survival in the form of food and various other products. Additionally, it serves as a foundational pillar of economic development, offering employment and income opportunities to countless individuals. The incorporation of machine vision in agriculture has emerged as a crucial technology, enabling farmers to automate various tasks, such as crop monitoring and yield prediction using cameras and image processing techniques and even providing real-time information on crop maturity for harvest planning. This not only helps increase efficiency and productivity but also provides valuable insights for precision agriculture, enabling more quick and informed decision-making and ultimately leading to improved crop yields and financial returns. This scholarly work conducts a thorough examination of the various components that comprise a machine vision system, specifically delving into the techniques of image acquisition, processing, and classification. It also explores the methods employed within each of these techniques, and how the combination of such processes is used to perform various agricultural activities such as weeding, seeding, harvesting, fruit counting, overlapping, sorting, etc. Furthermore, it aims to guide on how the knowledge gained can be applied to build practical machine vision systems for agriculture. Additionally, this work highlights the research gaps, address current problems that can be solved and its potential for future advancement in the field of agriculture, and guides readers towards promising areas for future endeavours.

来源：COMPUTERS AND ELECTRONICS IN AGRICULTURE

发布日期:2023-08-14

全文链接:

http://agri.nais.net.cn/file1/M00/03/63/CsgkOWWFQYqAc5iFAXQlo2BXWfk730.pdf

3．Editorial: Machine learning and artificial intelligence for smart agriculture(社论：智慧农业中的机器学习和人工智能)

简介：Information, knowledge and equipment are the three main components of smart agriculture. This special edition focuses on a few issues that still require research and discussion. For example, using and enhancing machine learning techniques for crop disease

and pest detection and recognition, plant species recognition, smart agricultural IoT, food material supply chain security tracing, and other crucial issues in smart agriculture.

The four professors contributed to edit and review the manuscripts for this edition. CZ was mainly responsible for the computer vision and food security part, DP was responsible for the Iot and robot, SY was responsible for the pest control, and SZ was responsible for the Iot and computer vision part. All authors contributed to the article and approved the submitted version.

来源：FRONTIERS IN PLANT SCIENCE

发布日期:2023-01-09

全文链接:

http://agri.nais.net.cn/file1/M00/10/35/CsgkOGWFQ6uAZLdpAAT9cfJ-lS4209.pdf

4．Artificial Intelligence Technology in the Agricultural Sector: A Systematic Literature Review(农业领域的人工智能技术:系统文献综述)

简介：Due to the increasing global population and the growing demand for food worldwide as well as changes in weather conditions and the availability of water, artificial intelligence (AI) such as expert systems, natural language processing, speech recognition, and machine vision have changed not only the quantity but also the quality of work in the agricultural sector. Researchers and scientists are now moving toward the utilization of new IoT technologies in smart farming to help farmers use AI technology in the development of improved seeds, crop protection, and fertilizers. This will improve farmers' profitability and the overall economy of the country. AI is emerging in three major categories in agriculture, namely soil and crop monitoring, predictive analytics, and agricultural robotics. In this regard, farmers are increasingly adopting the use of sensors and soil sampling to gather data to be used by farm management systems for further investigations and analyses. This article contributes to the field by surveying AI applications in the agricultural sector. It starts with background information on AI, including a discussion of all AI methods utilized in the agricultural industry, such as machine learning, the IoT, expert systems, image processing, and computer vision. A comprehensive literature review is then provided, addressing how researchers have utilized AI applications effectively in data collection using sensors, smart robots, and monitoring systems for crops and irrigation leakage. It is also shown that while utilizing AI applications, quality, productivity, and sustainability are maintained. Finally, we explore the benefits and challenges of AI applications together with a comparison and discussion of several AI methodologies applied in smart farming, such as machine learning, expert systems, and image processing.

来源：IEEE ACCESS

发布日期:2022-12-26

全文链接:

http://agri.nais.net.cn/file1/M00/03/63/CsgkOWWFP3mAZRXQAFLVe3_EsKo068.pdf