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State-of-The-Art Computer Vision Technologies Based On Deep Learning That Can Assist Farmers in Operations

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Description

The agricultural sector is undergoing a rapid digital transformation and gaining strength on the foundation of cutting-edge strategies like artificial intelligence and related technologies. Deep learning-based computer vision, which is at the heart of artificial intelligence, makes it possible for various agricultural tasks to be carried out automatically and precisely, making smart agriculture a reality. Non-contact and effective technology-driven solutions in agriculture are made possible by computer vision methods and high-quality image acquisition with remote cameras. This review contributes to the development of cutting-edge deep learning-based computer vision technologies that can aid farmers in everything from land preparation to harvesting. In addition, this study identifies the obstacles that prevent the solutions from being implemented in real time in the farmer's field. The overall result suggests that convolutional neural networks are the foundation of modern computer vision approaches, and that the various architectures of these networks offer high-quality solutions with high precision and accuracy for a variety of agricultural activities. However, real-time solutions and the use of a high-quality dataset are what make the computer vision approach successful.

Traditional Information and Knowledge Management System for Collecting and Monitoring Agricultural Data

The current state of precision agriculture aims to define the decision support system for farm management by simultaneously preserving the resources used and optimizing output. Constructively pointing out that data-driven farming, which can boost productivity, efficiency, and profits, must be used to address the emerging trend toward food security. Technology intervention is necessary because of the major issues like food demand, labor shortage, water shortage, climate change, and rising energy demands. At this point, primary validation is required for the opportunity presented by smart agriculture, which includes digital agriculture, precision agriculture, and modern agricultural practices. The traditional information and knowledge management system for collecting and monitoring agricultural data is time-consuming, error-prone, and laborious. Smart agriculture is primarily based on three platforms: science, innovation, and ICT (Information and Communication Technology). Smart agriculture can take advantage of cutting-edge technologies like the Internet of Things, machine learning, cloud computing, blockchain, and other similar ones to make the farming sector smarter. As a result, the technological advancements in remote sensing, digital applications, sensors, advanced imaging systems, cloud data storage, and intelligent data analysis employing decision support systems must be effectively utilized and take advantage of these opportunities to enhance food production and address the upcoming challenges in this sector. Computer vision has two distinct but intertwined objectives. Computer vision aims to create autonomous systems that can perform tasks that frequently human visual systems are unable to perform, while computer vision aims to represent the human visual system using computational models in biological science.

Various Applications of Deep Learning-Based Computer Vision in Agriculture

Algorithms for detecting basic shapes like edges, curves, and corners were the primary focus of early computer vision research. Gray level segmentation was used in image processing prior to the advent of deep learning, but it was not robust enough to represent complex classes. Artificial neural networks, which outperform conventional approaches to image processing in terms of performance and accuracy, play a significant role in today's computer vision algorithms. Multiple processing layers can learn and infer complex patterns using computation models based on deep learning, mimicking the human brain. In fact, these activities serve as the foundation for modeling and automating agricultural tasks like weed detection, disease identification, yield estimation, and so on. The rise of deep learning and computer vision over the past few years has made it possible to automate traditional agricultural practices. The various applications of deep learning-based computer vision in agriculture have been extensively discussed in this paper. In particular, the paper focuses on seven distinct application areas, including yield estimation, weed management, livestock management, soil analysis, irrigation management, plant health analysis, and seed quality analysis. Survey of the use of profound advancing especially, the evaluation and arranging of water assets uncovered that the water area would keep on embracing profound learning at a sped up rate, and it will assume a critical part in store for water-related research and the extensive variety of utilization regions. Numerous applications and research opportunities have emerged as a result of deep learning-powered technologies, all of which have the potential to alter hydrological science workflows. Recent advancements in algorithms for image classification, object detection, segmentation, and other aspects of deep learning-assisted image analysis, have expanded their use in a variety of agricultural pre- and post-harvest activities.