40. A systemic review of crop diseases detection and recommender models: techniques applications and future directions.

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Abstract

In modern agriculture, the timely detection and management of crop diseases are crucial for ensuring food security and minimizing economic losses. This systemic review delves into the current landscape of crop disease detection and recommender models, highlighting the techniques, applications, and potential future directions in this field. The review synthesizes findings from numerous studies, focusing on the technological advancements in disease detection methods, including imaging, spectroscopy, and machine learning algorithms. Furthermore, it examines the development and implementation of recommender systems that provide actionable insights for farmers and agronomists. The methodology involved a thorough search of relevant databases, including IEEE Xplore, ScienceDirect, and Google Scholar, to identify and synthesize studies published between 2018 and 2023. The review reveals that convolutional neural networks (CNNs) are the most widely adopted architecture for image-based crop disease detection, with modifications and advancements in CNN architectures leading to improved performance. Furthermore, the review identifies gaps in existing crop disease recommendation models, highlighting the need for large language models (LLMs) that can leverage textual data sources, such as agricultural reports and expert knowledge, to provide more comprehensive and context-aware recommendations. The study also examines real-world applications and deployment strategies of these models in precision agriculture and decision support systems, underscoring the importance of user-friendly interfaces and integration with existing agricultural practices. Finally, the review outlines future research directions, including the fusion of spatial transformer networks for enhancing the efficiency of disease detection models by accounting for spatial variations in plant images. Incorporation of LLM in crop disease recommender models and integration of explanation mechanisms is in AI crop models to enhance trust and interpretability in crop disease management. This systematic review serves as a valuable resource for researchers, agronomists, and technology developers working towards sustainable and intelligent crop disease monitoring and control strategies.

Key words: *Convolutional Neural Networks(CNNs), Large Language Models(LLMS), Recommender Models, Spatial Transformer Networks(STN), User Interfaces(UI).*