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Abstract

To achieve long-term sustainability, agriculture must urgently increase productivity while simultaneously lowering its environmental impact due to the rising global food demand and the mounting issues brought on by climate change. This study aims to generate green nanomaterials that will revolutionize sustainable agriculture by creatively integrating bioinformatics, artificial intelligence (AI), and nanotechnology. Using bioinformatics, we can pinpoint important genetic markers linked to improved disease resistance, drought tolerance, and nutrient efficiency in crops, allowing them to flourish even in less-than-ideal environments. In addition, artificial intelligence (AI)-powered models create and enhance nanomaterials with the least possible environmental impact, guaranteeing optimal performance and compatibility. With the help of these nanomaterials, an agricultural system can become more robust and productive by lowering its need for fertilizer chemicals, increasing water retention, strengthening soil health, and promoting nutrient uptake. Studies conducted in the field attest to the effectiveness of these artificial intelligence-designed nanomaterials, showing that they may both reduce environmental degradation and greatly increase crop yields. In addition to meeting the urgent need to boost agricultural output, this synergistic use of bioinformatics and AI opens the door for a scalable, long-term solution that aligns with international objectives for protecting the environment and resilience to climate change. Ultimately, this study establishes the groundwork for a paradigm change in farming methods, ushering in a new era of ecologically conscious farming.

Keywords: sustainability, nanotechnology, agriculture, bioinformatics, artificial intelligence

EARLY DISEASE DETECTION OF PLANT LEAVES USING DEEP LEARNING

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Abstract

In recent years artificial intelligence has taken more attention in the field of agriculture to handle the climate changes, rising population and food security issues. The utmost objective is to produce healthy crops and vegetables in large quantities and offer good value. Conventional techniques frequently depend on experts' visual inspection, which can be laborious, arbitrary, and error prone. To meet this target, early detection of plant leaves diseases is very important because this may cause loss of yield, time, water, and money for farmers. This study determines which deep learning model is most effective at identifying vegetable diseases from standard RGB images. The ImageNet dataset was used to build the various deep learning models that were examined in this study, including ResNet50, InceptionV3, MobileNetV1, AlexNet, VGG16, MobileNetV2, and MobileNet3. This study is based on a dataset of images of vegetables, such as tomatoes, potatoes, pepper bell peppers, and cucumber plants that were collected from the Plant Village or Kaggle dataset. Farmers will gain advantages from increased yield, a stable income, and the prevention of fertilizer and water loss resulting from disease detection. The model is compared with existing models by using F1 Score, Precision, Confusion matrix and Recall as a quality assessment matrix. This study improves precision agriculture by offering a reliable and effective tool for early disease detection.

Keywords: Artificial Intelligence, plant disease detection, convolutional neural networks (CNN), smart agriculture, precision farming.