Chapter 11
A Multicloud-Based Deep Learning Model for Smart Agricultural Applications

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ABSTRACT

Modern agriculture primarily relies on smart agriculture to predict crop yields and make decisions. Crop productivity could suffer due to a lack of farmers, labor shortages in the agricultural sector, adverse weather, etc. Smart farming uses advanced technology to improve the productivity and efficiency of agriculture. Crop yield is increased with smart agriculture, which also keeps an eye on agricultural pests. Artificial intelligence is an innovative technology that uses sensor data to predict the future and make judgments for farmers. AI methods like machine learning and deep learning are the most clever way to boost agricultural productivity. Adopting AI can help with farming issues and promote increased food production. Deep learning is a modern method for processing images and analyzing big data, showing promise for producing superior results. The primary goals of this study are to examine the benefits of employing DL in smart agricultural applications and to suggest a multi-cloud DL architecture for such applications.

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INTRODUCTION

Modern agriculture relies heavily on smart agriculture to estimate crop yields and identify decision-making (Sehgal Foundation, 2023). Currently, crop productivity may fail due to insufficient farmers, agriculture workforce, weather conditions, etc. Introducing smart agriculture (*Eos 2022*) can improve crop productivity and monitor crop and agricultural pests. It can make agriculture more efficient and effective. UNCTAD (2017) reported that smart agriculture could reduce production costs while increasing agricultural yield and encouraging the effective use of agriculture resources, including human labor, energy, fertilizer, and water utilization.

According to Kathleen Walch (2020), farmers are better equipped to track all processes and apply specific actions identified by machines through superhuman accuracy with the most recent breakthroughs in connectivity, automation, and technologies. Artificial Intelligence (AI) can make judgments for farmers and predictions using sensor data. Farmers and data scientists are still evolving approaches to maximize the workforce needed in farming (Wang et al., 2021). Hence, smart farming has evolved into a learning system and has become even more inventive as vital information resources improve daily.

Artificial Intelligence in Smart Agriculture

Farmers can employ AI algorithms to estimate how much light their crops' foliage gets. AI approaches (*Intellias 2022*) can improve crop productivity in smart agriculture. AI systems using visual abilities can monitor and assess daily plant variations to calculate the growth rate. (Subeesh & Mehta, 2021). Most smartly, agricultural productivity can be increased using AI techniques such as machine learning (ML) and deep learning (DL).

ML and DL Applications can find and fix problems with agricultural growth (Hugo Storm et al., 2020). ML can improve the iterative process by learning from patterns and associations between them when making decisions. With higher prediction outcomes, the ML algorithm tries to produce accurate output. By classifying diverse crop yields, ML can enhance eyesight and improve the quality of images (Cravero et al., 2022).

Why Deep Learning in Smart Agriculture?

Crop management can be accelerated by smart agriculture. Since there are several factors, including climate and genetics, it is difficult to predict the yield of crops. Farmers may use intelligent technologies such as deep learning to accurately anticipate crop yields once they know how these elements affect crop yields. DL is an ML technique using artificial neural networks (ANNs) principles (Sarker, 2022). According to Kuradusenge et al. (2023), using DL methods to foretell agricultural diseases is practical and affordable. The DL approaches enhance agricultural research's capacity to discern the picture classification of agriculture. DL can be applied to various smart agriculture (Zhang et al., 2022) areas such as automating weed detection, classification of crops, collecting and extracting information about cultivated land, estimating crop yield (for example, the number of tomatoes in the plant), identifying and classifying leaves of different plant species, identifying plant diseases out of healthy leaves, identify a variety of spatial patterns, predict the growth of animals, predict the soil moisture content over an irrigated field, and predict weather conditions based on historical data.

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