Chapter 8
Smart Agriculture Resource Allocation and Cost Optimization Using ML in Cloud Computing Environment

Pancham Singh
Ajay Kumar Garg Engineering College, Ghaziabad, India

Mrignainy Kansal
Ajay Kumar Garg Engineering College, Ghaziabad, India

Mili Srivastava
Ajay Kumar Garg Engineering College, Ghaziabad, India

Muskan Gupta
Ajay Kumar Garg Engineering College, Ghaziabad, India

ABSTRACT

In this research, resource allocation in machine learning is used to analyze how cloud computing is being applied in smart agriculture. This chapter goes over the advantages of cloud computing for farming and how machine learning can enhance resource allocation for higher agricultural yields and less negative environmental impact. The chapter also examines implementation difficulties for cloud-based agricultural solutions and speculates on potential fixes. Insights for researchers and practitioners in the area are provided by the research, which demonstrates the potential for merging cloud computing and machine learning in smart agriculture to increase productivity and sustainability. The research also assessed the efficacy of the ML-based techniques using a variety of performance indicators, including reaction time and throughput. The management of cloud workloads has shown considerable promise when using machine learning-based methods. This chapter offers a thorough overview of current developments in ML-based cloud workload management and identifies areas for further research.

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1. INTRODUCTION

The agriculture sector is struggling to meet the rising food demand while minimizing its environmental impact. Technology integration, including cloud computing and machine learning, has the potential to revolutionize the agriculture sector and assist in overcoming these difficulties. In particular, scalability, cost-effectiveness, and real-time crop status monitoring can all be made possible by using cloud computing in the agriculture (Khalifeh et al., 2021). By improving resource allocation, machine learning can help farmers manage their crops more effectively, cut down on waste, and boost yields.

An emerging field called "smart agriculture" employs technology to maximize agricultural productivity and has the potential to increase farming practices' effectiveness and sustainability. With its capacity to store and handle massive volumes of data, cloud computing is well-suited to support applications for smart agriculture (Masip-Bruin et al., 2020). A branch of artificial intelligence called machine learning can assist in the analysis of this data and offer insights that can be used to resource allocation decisions.

Resource allocation in smart agriculture is optimised via machine learning techniques. These algorithms can analyse huge databases, spot patterns, correlations, and anomalies, then generate forecasts and suggestions. Farmers can acquire useful insights into the different elements that affect crop growth, such as soil moisture levels, weather conditions, pest infestations, and fertiliser requirements, by integrating machine learning models with cloud-based data analytics platforms (Yeganeh et al., 2023). The use of this data can optimise resource allocation by guiding decisions about when to apply fertiliser, schedule irrigation, take insect control measures, and rotate crops.

Precision agriculture, commonly referred to as smart agriculture, is a creative strategy that makes use of cutting-edge technologies to improve farming methods, boost crop yields, and cut down on resource waste. There is an increasing need for efficient and affordable agricultural solutions due to the expanding global population and the requirement to produce more food responsibly. The application of cloud computing and machine learning techniques in smart agriculture has considerable promise for improving resource allocation and lowering costs. These technologies have become potent tools in a variety of industries (Alam et al., 2020). Collaboration and knowledge exchange among farmers, researchers, and agronomists are facilitated by the integration of cloud computing and machine learning in smart agriculture. Cloud-based platforms serves as centralised data and model repositories, enabling stakeholders to exchange their discoveries, best practises, and cutting-edge methods. This collective intelligence has the potential to improve decision-making procedures, advance crop management strategies, and spur agricultural innovation. Additionally, cloud computing makes it possible to remotely monitor and control agricultural systems, giving farmers the freedom to use mobile or web-based applications to effectively manage their businesses from any location.

The use of cloud computing and machine learning in smart agriculture has enormous potential for cost- and resource-saving resource allocation optimisation. Farmers may boost agricultural yields, decrease resource wastage, and make data-driven decisions by utilising cloud-based platforms and machine learning algorithms (Mullachery & Alismail, 2023). Incorporating these technology improves agricultural operations' productivity and efficiency while also fostering innovation and sustainability in the industry.

However, there are difficulties in implementing cloud computing and machine learning in smart agriculture. Since sensitive information is frequently present in agricultural data, protecting data security and privacy is of the utmost significance (Chen, 2020). To safeguard data from unauthorised access and breaches, effective cybersecurity measures must be put in place. Furthermore, stable internet access is necessary for rural agricultural areas to use cloud services. Investment in dependable network

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