

International Conference on **Artificial Intelligence and Cloud Computing (ICAICC-2025)**

Conference Proceedings

May 10, 2025 (Virtual)

The Convergence of AI, Machine Learning, and Neural Networks in Precision Agriculture: Generative AI as a Catalyst for Future Food Systems

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The integration of Artificial Intelligence (AI), Machine Learning (ML), and Neural Networks is transforming precision agriculture by enhancing crop management, resource efficiency, and yield optimization. This study explores how Generative AI acts as a catalyst for the future of food systems by enabling predictive analytics, automated decision-making, and adaptive farming techniques. Traditional agricultural practices often face challenges related to climate variability, soil health, and resource allocation. By leveraging AI-driven models, farmers can optimize irrigation, pest control, and crop selection through real-time data analysis. Neural networks enhance pattern recognition in satellite imagery and sensor data, improving disease detection and precision fertilization. Generative AI further refines these processes by simulating various agricultural scenarios, forecasting production trends, and recommending sustainable strategies. The study also examines challenges such as data privacy, model interpretability, and AI adoption barriers. Ultimately, the convergence of AI, ML, and neural networks in precision agriculture holds immense potential to revolutionize food security, sustainability, and global supply chains.