EDITORIAL

Inaugural Editorial for the *Digital Intelligence in Agriculture*

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Abstract

This editorial highlights the importance of establishing the journal *Digital Intelligence in Agriculture* and the typical applications of digital intelligence technology in agriculture such as planting industry, forestry, animal husbandry, and fishery. Digital intelligence technology is driving global agriculture towards a new stage of smart agriculture characterized by "data-driven and intelligent decision-making". Its core is to achieve comprehensive empowerment of agricultural production, operation, management, and services through technologies such as the Internet of Things, big data, artificial intelligence, cloud computing, and blockchain. Smart technology aims to achieve multiple goals in agriculture, including cost reduction and efficiency improvement, quality improvement and income increase, resource conservation, and environmental sustainability. It is a key path to address future food security challenges and achieve agricultural modernization.

Keywords: big data, AI, IoT, blockchain, robotic automation, agriculture.

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1 Introduction

Agriculture, as the oldest cornerstone of human civilization, is standing at a historic crossroad. A series of severe challenges, such as continuing global population growth, intensifying climate change, growing constraints on water and arable land resources, and structural labor shortages, poses a huge threat to global food security and sustainable agricultural development [1–3]. Therefore, relying on experience and traditional production methods is inadequate for addressing these complex issues, creating an urgent need for the industrial transformation of agriculture [4–6].

The solution to these challenges lies in a profound paradigm shift. We are currently in the midst of a fourth industrial revolution driven by cutting-edge technologies such as big data, artificial intelligence (AI), the Internet of Things (IoT), and cloud computing. Digital intelligence technology, formed by the fusion of these technologies, injects new vitality into the most traditional industry of agriculture with its powerful capabilities in data acquisition, processing, analysis, and intelligent decision-making, pushing agriculture from an "experience-driven" era to a

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"data-driven" era. This is not only a technological evolution, but also a revolution that is reshaping agricultural production methods, business models, and even the entire industrial ecosystem.

Digital intelligence technology is reshaping agriculture at its core. By integrating AI, IoT, big data, and robotics, it enables a shift from traditional methods to “smart farming”, and agriculture is becoming precise—using resources like water and fertilizers optimally, predictive—forecasting yields and detecting pests early, and sustainable—reducing waste and environmental impact. The significance is vast: It boosts productivity and profitability for farmers, safeguards food security for a growing global population, and promotes climate-resilient practices. Ultimately, it turns farming into a data-driven, efficient, and future-proof industry.

Primarily, it drives unprecedented gains in productivity and efficiency. AI algorithms analyze data from satellite imagery, drones, and in-field sensors to monitor crop health, soil conditions, and microclimates in real-time. This enables precision farming, where resources like water, fertilizers, and pesticides are applied optimally to specific areas rather than uniformly across entire fields. This not only boosts yields but also significantly reduces waste and input costs.

Secondly, it enhances sustainability and resource conservation. By leveraging data, farmers can implement targeted irrigation to combat water scarcity, and minimize chemical usage, thereby protecting local ecosystems and reducing agriculture’s environmental footprint. Predictive models can also forecast disease outbreaks or pest infestations before they spread, allowing for early and controlled intervention.

Moreover, digital intelligence mitigates risk and improves resilience. AI models can predict yield outcomes based on weather patterns and historical data, aiding in better planning and market decisions. Robotics automate arduous and repetitive tasks like harvesting and weeding, addressing labor shortages and increasing operational consistency. In essence, digital intelligence empowers farmers to move from reactive guesswork to data-driven decision-making. It is critical for meeting the escalating global food demand amidst challenges like climate change and limited arable land. Ultimately, it ensures that agriculture becomes not only more productive but also smarter and more sustainable for future generations.

2 Typical applications of digital intelligence in agriculture

The penetration of digital intelligence technology is far from an abstract or theoretical concept; it has materialized into a diverse array of concrete technologies and integrated solutions that are actively driving rapid and substantial improvements in agricultural productivity [7, 8]. This transformation is evident in the widespread deployment of precision agriculture systems, which utilize IoT sensors, drones, and satellite imagery to enable real-time monitoring of soil conditions, crop health, and micro-climates. These data are processed by AI-powered analytics platforms to generate actionable insights, facilitating optimized decisions in irrigation, fertilization, and pest control. Furthermore, intelligent machinery and autonomous robots are automating tasks from planting to harvesting, increasing efficiency and addressing labor shortages. By integrating these technologies—big data, artificial intelligence, IoT, and robotics—digital intelligence creates a smart agricultural ecosystem. This ecosystem not only boosts yields and reduces resource waste but also enhances the sustainability and resilience of farming operations against environmental challenges.

2.1 Planting industry in agriculture

Precision navigation and autonomous driving technologies empower agricultural machinery to perform precise field operations with minimal human intervention, significantly enhancing operational accuracy and efficiency. Simultaneously, unmanned aerial vehicle (UAV) remote sensing, integrated with multispectral imaging technology, enables macroscopic crop monitoring and facilitates early detection of growth anomalies, pest infestations, and disease outbreaks. Complementing these aerial systems, a densely deployed sensor network—often part of IoT—continuously collects real-time data on key environmental variables such as soil moisture, nutrient levels, and micro-meteorological conditions. This continuous data stream drives intelligent decision-making systems, including automated irrigation and variable-rate fertilization systems, ensuring precise resource allocation tailored to the specific needs of each plot [9]. Together, these technologies form an integrated cyber-physical system that supports comprehensive "smart countryside" management, optimizing agricultural productivity while promoting environmental sustainability.

2.2 Forestry and grassland

Through the integrated application of satellite remote sensing and UAV patrols, coupled with advanced AI-powered image recognition technology, comprehensive and efficient surveys as well as dynamic monitoring of both the total volume and health status of forest resources can be effectively conducted. This multi-layered monitoring approach allows for the precise and timely detection of various abnormal situations, including wildfires, pest infestations, illegal logging, and other ecological disturbances. It thereby serves as a highly efficient "sky eye", offering continuous, large-scale observational capabilities that significantly enhance the protection, management, and sustainable operation of forest ecosystems [10].

2.3 Side industries and processing

In the agricultural product processing stage, computer vision technology enables intelligent sorting and automated quality grading by rapidly and accurately analyzing characteristics such as color, size, shape, and surface defects [11]. This significantly enhances operational efficiency and ensures consistent product quality. Meanwhile, blockchain technology establishes a secure, transparent, and immutable traceability system that covers the entire product journey—from initial production and processing to storage, logistics, and final sale. By providing an unforgeable record of origin, handling, and transactions, this end-to-end visibility effectively safeguards food safety, strengthens regulatory compliance, increases brand value, and builds greater consumer trust.

2.4 Animal husbandry

Intelligent wearable devices, such as ear tags and neck rings, continuously monitor key real-time physiological parameters in livestock, including body temperature, physical activity, and rumination behavior [12]. By applying AI algorithms to analyze this data, early warnings for potential diseases and accurate identification of estrus cycles are achieved. This supports precision feeding strategies and intelligent breeding management, thereby significantly enhancing production efficiency and promoting higher standards of animal welfare.

2.5 Fisheries

This integrated system utilizes a combination of underwater sonar, multi-parameter sensors, and AI-powered analytical models to continuously and accurately monitor key water quality indicators—including temperature, pH, dissolved oxygen, and salinity—within aquaculture zones. It enables data-driven feeding decisions, minimizing waste and optimizing growth conditions. Furthermore, the technology supports biomass estimation and early disease detection through behavioral and environmental anomaly recognition [13]. These capabilities facilitate the development of "smart fishing grounds", promoting ecologically sound and intensive aquaculture practices that enhance both productivity and sustainability.

3 Building an academic bridge for interdisciplinary integration

It is within this context of profound transformation that digital intelligence in agriculture has arisen. The establishment of this journal aims to respond to the call of the times and provide a focused, authoritative, and international academic exchange platform for emerging and crucial interdisciplinary fields.

- **Promote cutting-edge exploration**
  This journal focuses on fundamental theoretical innovation and core technological breakthroughs in the intersection of digital intelligence technology and agricultural science, and publishes the most original research results.

- **Promote disciplinary integration**
  This journal breaks down disciplinary barriers, builds bridges connecting multiple disciplines such as agriculture, information science, engineering, environmental science, and social science, and encourages deep interdisciplinary and collaborative innovation.

- **Service industry practice in agriculture**
  This journal emphasizes the application value of research, strives to promote the transformation of advanced scientific and technological achievements into real productivity, and publishes technical reports, case studies, and review comments with guiding significance.

4 The future of digital intelligence in agriculture

The launch of the journal *Digital Intelligence in Agriculture* holds significance far beyond the birth of another academic journal. It is a confirmation of a new disciplinary direction, a response to the call of global researchers to overcome difficulties, and a practical entry into the grand goal of building a more efficient, sustainable, and resilient global agricultural and food system. The road ahead will inevitably come with challenges: issues such as data standards, algorithm reliability, technology cost and inclusiveness, and the cultivation of cross disciplinary talents still need to be explored together. Therefore, we sincerely call on scholars, engineers, agronomists, industry pioneers, and policy makers around the world who are committed to this field to invest their insights and outstanding achievements in it. Let's exchange ideas, share wisdom, and work together on this platform. Let us work together to cultivate fertile soil with data, empower the future with algorithms, and sow the seeds of the future and harvest prosperity in this hopeful digital field.

Data Availability Statement

Not applicable.

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Conflicts of Interest

The authors declare no conflicts of interest.

Ethical Approval and Consent to Participate

Not applicable.

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