New Vegetable Production Mode Based on Big Data and Artificial Intelligence

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Abstract

Vegetables play an important role in people's health. According to relevant data, per capita vegetable intake is about 924 grams per day in China, and the country consumes at least 506 million tons of vegetables every year. Under the background of Implementing Rural Revitalization Strategy, attaching great importance to improving agricultural quality and efficiency, green production and driven by scientific and technological innovation, China's vegetable industry is in a critical period of transformation to scale, intelligence and modernization. However, there are some practical problems in the field of vegetable production, such as one-sided, inefficient, spatiotemporal, dynamic, data island and data ocean, which greatly hindered the development of vegetable industry. A new vegetable production model based on big data and artificial intelligence is proposed in this paper according to the characteristics of physiological environment such as vegetable growth period difference and soil climate adaptability. By analyzing the real-time data and intelligent decision-making of knowledge base in vegetable production, this mode studies the data fusion algorithm of heterogeneous data, the intelligent decision analysis method of knowledge base and the personalized intelligent recommendation model, and realizes the nanny AI production and big data intelligence by using the prediction function of the model, the reasoning decision-making function of the expert system, and the data mining and knowledge expression function of the intelligent algorithm cloud service system.

1. Introduction

Vegetables play an important role in people's health. According to relevant data, China's average daily intake of vegetables is about 924 grams, and the country consumes at least 506 million tons of vegetables every year. Under the background of Implementing Rural Revitalization Strategy, attaching great importance to improving agricultural quality and efficiency, green production and driven by scientific and technological innovation, China's vegetable industry is in a critical period of transformation to scale, intelligence and modernization. However, there are some practical problems in the field of vegetable production, such as one-sided, inefficient, spatiotemporal, dynamic, data island [1] and data ocean, which greatly hindered the development of vegetable industry.

Aiming at the problems of low standardization of vegetable production and low management efficiency, this paper intends to develop a new vegetable production mode based on agricultural big data [2-3] and AIdecision [4-7]. The new mode will grasp the crop production environment, growth and development global dynamic big data timely and accurately through cloud service platform [8], intelligent hardware management equipment, vegetable production teaching app,

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etc. The cloud service platform takes different management measures for different growth, meteorological conditions and occurrence of diseases and insect pests, providing supporting and nanny type real-time guidance for agricultural producers. This method is of great significance for improving the level of standardized production technology and improving the quality of agricultural products, which is conducive to promoting the development of high-quality and high-quality facilities vegetable industry, so as to promote the development of modern agriculture and promote the low-income population to increase their income and become rich.

2. Application of Big Data and AI in Vegetable Production

Under the guidance of big data technology and AI intelligent decision-making, the new mode of vegetable production realizes the efficient utilization of data through the fusion technology of heterogeneous data [9-11], and realizes the real-time and accurate guidance of vegetable production through the optimization of relevant algorithms.

2.1. Research Status of Big Data Technology

With the development of Internet and Internet of things, the application of big data has been paid more and more attention, which greatly promotes the development of big data technology. In order to obtain more useful big data information to guide production, American farmers generally use mobile devices to collect data; Miyazaki Prefecture of Japan also collects crop production information through sensors and cameras; the Chinese Academy of Agricultural Sciences has developed a remote monitoring system for crop seedling conditions of the Internet of things to accurately monitor and manage crop growth. Although the above methods can realize the collection of crop data, the accuracy of the collected data is very low, which prompted a large number of experts and scholars to further study on how to improve the data accuracy. In 2016, foreign scholars arys Carrasquilla Batista and others further improved the accuracy of data acquisition by applying online Kalman filter; since 2017, Chinese scholars such as Meng Li [12], Jianguo Xu [13] and Lijie Li [14-15] have developed agricultural information intelligent decision-making system based on big data technology, realizing real-time data acquisition, monitoring and control.

Because big data platform plays an important role in big data analysis, processing and extraction of useful information, the construction of big data platform arises with the development of big data technology. Farmeron, a farm cloud management service, provides farmers around the world with a Google like approachIn 2013, Shandong Agricultural University of China set up a research and application extension organization of agricultural big data, "agricultural big data industry innovation strategic alliance", followed by the Ministry of agriculture, Beijing, Shanxi, Heilongjiang, Yunnan, Chongqing, etcAgricultural big data platform has been built in succession. On July 3, 2019, at the main forum of the third Baidu AI developer conference, baidu CTO Dr. Haifeng Wang announced that Baidu's brain was officially upgraded to 5.0. On the basis of algorithm breakthrough and computing architecture upgrading, it realized the integration and innovation of AI algorithm, computing architecture and application scenarios, and became an AI big data production platform integrating software and hardware, marking a new milestone in the construction technology of big data platform.

2.2. Rresearch Status of AI Technology

In recent years, as AI products continue to beat the world champion in many aspects, the development of AI has been widely concerned all over the world. Many foreign developed countries are accelerating the application of AI in agricultural production. John Deere, a multinational agricultural enterprise, combines AI, machine learning and computer vision to identify and remove weeds that affect crop growth. This undoubtedly brings good news to the research and development of vegetable production. China has also realized the intelligent cultivation of hydroponic vegetables based on Baidu brains AI product technologies, such as visual technology, Easydl, Paddle pad, Edgeboard, etc. In order to promote the large-scale development of AI technology and comprehensively improve the intelligent level of industrial development, the State Council of China issued the development plan of new generation artificial intelligence on July 20, 2017, to carry out AI pilot application in key industries and fields such as manufacturing, finance, agriculture, logistics, commerce and home furnishing. This policy also greatly promoted the application and development of AI in vegetable production.

2.3. Heterogeneous Data Fusion

Although the current vegetable production has Pb level data, there is heterogeneity between data from different sources, which leads to the problem of data ocean and data island, and it is difficult to realize the efficient use of data. In order to solve this problem, foreign scholars rumelhar and Hinton put forward the back propagation algorithm in 1985, which solved the complex calculation problem of two-layer neural network and realized the data fusion between multi-sensor; in 2008, Raquel Salazar and others built a powerful nonlinear estimator to monitor the patterns and relationships between data; then Marco Guerriero and MBased on Bayesian data fusion method and neural network, outanoute and others further improve the

prediction accuracy of greenhouse environment, and provide guarantee for the fusion of heterogeneous data. Based on D-S evidence theory and Grubbs criterion, Chinese scholars Xiaohong Huang [16] and Lin Cui [17] realized the fusion of heterogeneous data and improved the decision accuracy of greenhouse environment measurement and control. In 2018, Wenting Wang [18] and others took Zhengzhou as the research area and adopted single window algorithm, The Landsat ETM and spot images were used to retrieve the land surface temperature, and the soil moisture inversion model was established based on the measured soil moisture and meteorological data. In the same year, Jiao Guo and Lin Zhu used maximum likelihood (ML) and support vector machine (SVM) to fuse sentinel-1 radar image and sentinel-2 optical image respectively. With the deepening of research and continuous improvement of methods, the accuracy of heterogeneous data fusion is constantly improved, and the robustness of the system is also improved.

2.4. Problems in Existing Research

Although the existing big data research has made some achievements, there are still some disadvantages in basic theory, industrial scale, information perception, intelligent application decision-making and so on.

Although "3S" technology and Internet information technology have been realized to analyze agricultural big data to guide the fine production and management of vegetables, many agricultural areas in China have not yet established information collection, transmission, integration, analysis and utilization system, which leads to low standardization of intelligent agricultural information data, insufficient data collection coverage, and lack of accuracy and authority of agricultural data, It is difficult to realize the intelligent system of Weixing and vegetable production.

Although the existing data monitoring methods are simple and fast, the amount of processed data is still huge, and it is not easy to analyze and understand, and the fault tolerance of low-level processing is relatively low.

Although a variety of big data platforms for the whole country and provinces have been established, the heterogeneity and management autonomy of different systems lead to the failure to realize the effective sharing of resources and services, which greatly hinders the application of big data and AI in vegetable production.
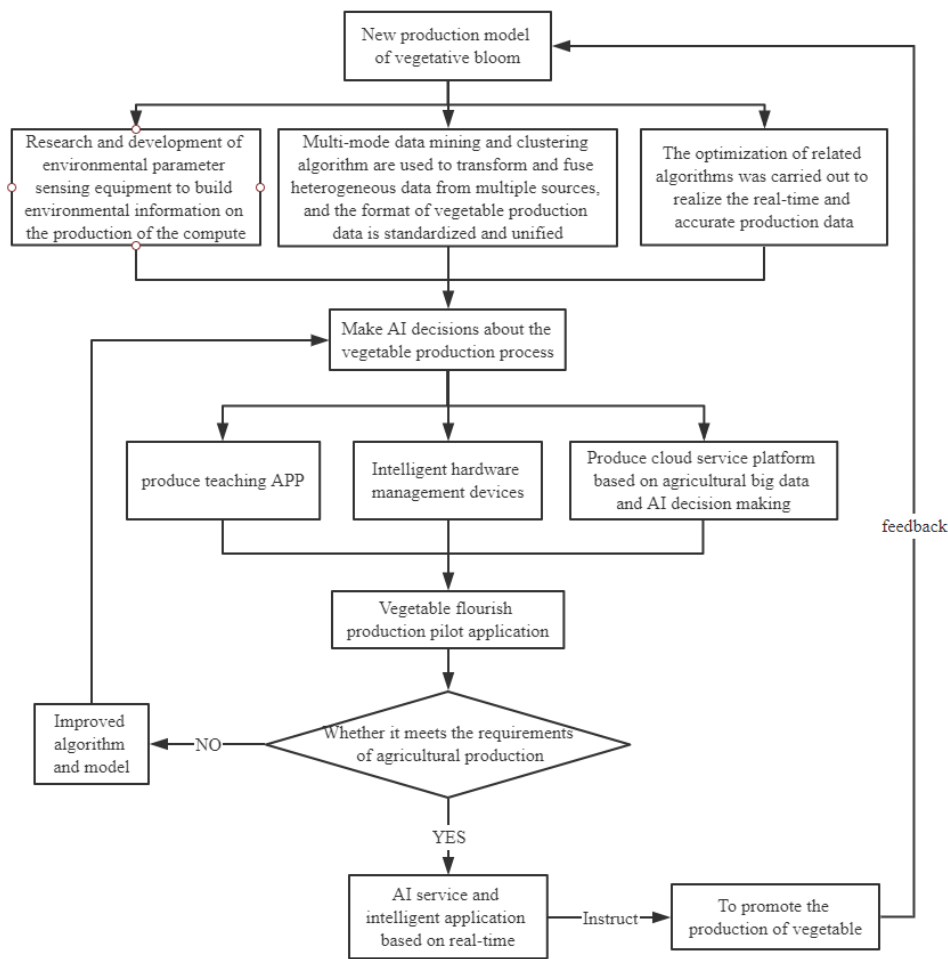

Figure 1. Technical route.

3. New Method of Vegetable Production Under Big Data and AI

It can be seen from Figure 1 that AI decision-making for vegetable production process is the core of the new mode. The new mode constructs a computer model of environmental information for vegetable production by developing environment aware equipment, uses multimodal data mining and clustering algorithm to transform and fuse multi-source heterogeneous data, and optimizes relevant algorithms to realize real-time and accurate production data. Secondly, through AI decision-making, further research and development of vegetable production cloud service platform, intelligent hardware management equipment, production teaching app, to guide the vegetable production in an all-round way. Finally, the vegetable production pilot application was carried out, and the digital relationship between crop growth and development, environment, water and fertilizer elements based on deep learning was analyzed to improve the algorithm model. Through the pilot application feedback results, the new model is improved and optimized. The new mode will also change the traditional working paradigm of vegetable production and management, realize intelligent and efficient vegetable production, make the production mode more simple and efficient, data acquisition technology more accurate and convenient, information processing and analysis technology more intelligent, information expression and service technology more accurate.

4. Analysis and Discussion

4.1. Application Analysis of New Vegetable Production Mode

The new model will guide vegetable production through modern technologies such as big data, AI and cloud services. Big data technology is committed to the analysis, integration and processing of vegetable production data. AI provides solutions for the fusion of heterogeneous data and solves the problem of data island in traditional vegetable production. Traditional vegetable production methods often come from the planting experience of generations of farmers, but lack of scientific basis and accurate, real-time production guidance. The hardware management equipment of the new mode collects the environmental information of vegetable production by using video detection and various sensors such as temperature and humidity, CO_2 concentration, light intensity, etc., and then processes the production data through the cloud service platform and feeds back to the production teaching app. Finally, the app provides real-time guidance for vegetable production. The new model will further improve the accuracy of environmental information detection on the basis

of existing research, and guide vegetable production more finely, so as to improve the efficiency of vegetable production and reduce the labor force required for production.

4.2. Discussion of New Method of Vegetable Production

The new mode of vegetable production improves the accuracy and authority of data in the process of vegetable production by designing efficient algorithm of distributed data processing, establishes intelligent vegetable production system, breaks the current situation of data island and data ocean in the process of vegetable production, and promotes the standardization and unification of multi-source heterogeneous vegetable production data.

It Gives full play to the advantages of deep learning and fusion model, simplify the process of traditional model construction, develop vegetable production cloud service platform, hardware management equipment and production teaching app based on big data and AI decision, and solve the problems of poor perception of equipment and fragmentation of information in the existing production process. Solve the problems in the process of planting, watering, fertilizing and picking vegetables, and promote the intelligent and industrial development of vegetable production.

5. Conclusion and Prospect

In the process of agricultural modernization, big data and AI will play an important role. The new mode of vegetable production will realize intelligent and modern vegetable production relying on deep learning, data mining, AI decision-making, cloud computing and other technologies, realize the deep integration of modern information technology and agricultural industry, change the agricultural production mode, and improve the quality and efficiency of vegetable production The price of vegetables is capped, the production cost of agricultural products is too high, the impact of imported agricultural products, the excessive use of agricultural resources and other issues, to help the construction of agricultural modernization.

This paper introduces the new application mode of big data and AI in vegetable production. Based on the existing research, the model, algorithm and production mode are improved to realize the high-efficiency fusion of heterogeneous data and the all-round guidance of vegetable production process. However, with the change of different climate and soil conditions, There are some unknown influences factors may exist, which will be solve in the next research direction.

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