

The development and application of UAV intelligent machine learning system based on artificial intelligence

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Abstract. In the rapid development of artificial intelligence technology, some scholars proposed to integrate artificial intelligence and UAV technology together, comprehensively improve the application technology level of UAV, and truly meet the needs of information collection and processing in different fields. According to the application of UAV technology means in recent years, whether in the military field or the civil field, UAV has a very broad prospect for development. Intelligent UAV will replace the traditional UAV in a comprehensive way. Therefore, Chinese scientific research field should strengthen the integration of artificial intelligence and UAV technology research and development efforts, so as to guide the sustainable and healthy development of our UAV cause. After understanding the advantages of artificial intelligence and UAV technology, this paper mainly explores the development and application of UAV intelligent machine learning system according to the existing UAV technical means and artificial intelligence algorithm, and takes the UAV intelligent machine learning system in the agricultural field as an example to effectively verify the reliability of the application algorithm.

Keywords: artificial intelligence; Drones; Machine learning system; Agriculture; Neural network.

1. Introduction

Machine learning, as another important research field of artificial intelligence application after expert system, is the core content of artificial intelligence and neural algorithm computing in the new era. The research on UAV mainly includes three basic contents: first, it means no pilot, second, it can complete a series of tasks and missions, and finally, it can be reused. Although the UAV has made excellent achievements in the rapid development of science and technology, it still cannot change the basic mode of manual control. Due to the limitations of human physiological ability and mental level, it is impossible to effectively control the flight state and various parameters of the UAV anytime and anywhere. Therefore, it is necessary to focus on improving the autonomous working ability of the UAV in practice and exploration.[1-3]

At present, scholars at home and abroad have proposed a number of UAV research topics based on artificial intelligence technology. From the perspective of practical development, artificial intelligence technology has experienced decades of development, belongs to a strong comprehensive ability of theoretical knowledge and technical means, which contains biology, information theory, control theory, computer technology and other disciplines of knowledge, provides human wisdom for instruments, machines and equipment. According to the analysis of the basic meaning of artificial intelligence shown in Figure 1 below, current researches on artificial intelligence are mainly reflected in three aspects: first, it refers to perception, such as visual recognition, text mining, etc.; The second is the decision, such as information recommendation, data prediction, etc.; And then feedback, such as robots, automatic generation, etc.[4-6]

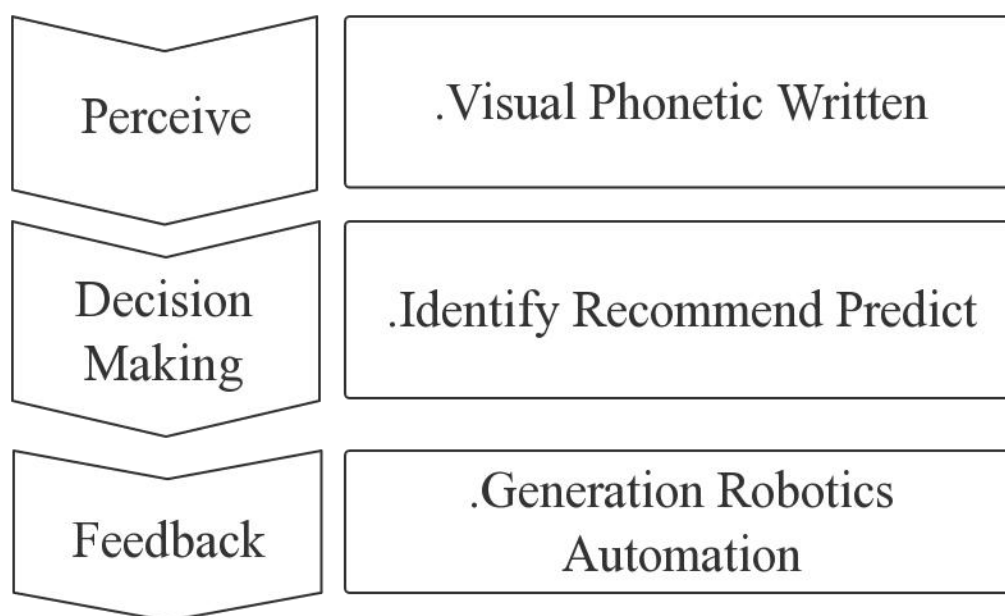


Figure 1 Basic meaning of artificial intelligence

Combined with the analysis of practical cases, it can be seen that UAV technology itself has two advantages: on the one hand, strong concealment. Compared with artificially piloted aircraft in the traditional sense, UAV has unique advantages in all aspects. It can get rid of the restrictions of traditional human factors and effectively control the operating range, flight height and working speed according to its own characteristics. At the same time, it can also enhance its own tightness by means of sharp turns, ultra-accelerated lifting and lowering, so as to improve its survival ability in different environments. On the other hand, the operation is flexible and simple. Drones in different countries will choose different take-off methods, such as short-range take-off, which includes rocket-propelled take-off, slide-rail sliding take-off, and short-range sliding take-off. Because the UAV itself has the characteristics of light weight and small size, the actual operation requirements are not strict, and it can be scientifically designed and applied according to the practical work requirements. Nowadays, most UAV control systems in the agricultural field use programming control mode, but it is difficult to achieve the expected anthropomorphic work objectives based on simple programming. For example, in the process of autonomous picking, the picking robot needs to comprehensively analyze the shape, size and maturity of the fruits waiting to be picked, and then accurately judge whether they can be picked according to the information it has mastered. This process requires intelligent machine learning technology to enable robots to improve the quality and efficiency of fruit picking through self-recognition. Therefore, after understanding the design structure and application direction of the UAV intelligent machine learning system, this paper takes the UAV collective learning system in the field of agriculture as an example for verification and analysis, so as to clarify the inevitable direction of the development of artificial intelligence in the new era.

2. Method

2.1 Deep machine learning algorithm

By using machine learning algorithm, the behavior of robots can make effective decisions according to logical judgment, gradually changing the traditional mode of controlling actions by simple programming. Nowadays, intelligent algorithms are used in the design of UAV intelligent collective learning control system, and neural network is one of the most common algorithms of machine learning. Based on the model principle of biological neural network, it can carry out

effective training after mastering big data samples, and has a strong ability of decision judgment and target prediction.

Based on the analysis of the figure above, we can see that all neurons are connected to each other, and these related neurons can effectively transmit information. Therefore, in the process of intelligent training, on the one hand, the weight value of the sample can be scientifically adjusted, and on the other hand, the neural network can be guaranteed to have adaptive input function, so as to improve its self-learning ability. After applying artificial neural network algorithm in UAV intelligent machine learning system, the system can use active learning to deal with various difficult problems, such as speech recognition, machine vision and so on. Among all kinds of neural network algorithms, BP neural network algorithm is one of the most common ones. From the perspective of practical application, BP neural network algorithm has the function of transmission, through the comparative analysis of the expected output value and the actual output value back propagation error signal, the use of weight value constantly corrected, to ensure that the actual output and the expected output more and more close, and finally improve the accuracy of system operation. The deep machine learning algorithm with neural network as the core will use the minimization cost function to improve the accuracy of the system, and obtain the high-level feature information based on fewer single-layer parameters and deeper network structure. Especially in the graph processing and speech recognition work, after the construction of the deep network structure, the complex mapping from the bottom to the top semantic is easier to be established, so it has strong recognition ability and learning ability. By comparing and analyzing traditional shallow learning models, we can see that deep learning models have unique advantages, and the specific results are shown in Table 1 below:[7-11]

Table 1 Comparison results

Contrast project	Traditional algorithm model	Deep learning algorithm model
Number of hidden layers	1-2	More than 5 floors
Feature extraction method	Artificial design or autonomous learning	Autonomous learning
Cost function	There is a convex cost function and the global optimal solution is converged.	Nonconvex cost function with a large number of local optimal solutions.
Prior knowledge and experience	Be very dependent on	Rely less

Based on the analysis of the above table, it can be seen that deep learning algorithm can achieve the basic goal of effective control in independent learning, has low dependence on bright knowledge and work experience, has strong convergence performance, and has a large number of local optimal solutions. As a form of deep neural network learning algorithm, the nodes contained in the visible layer and the hidden layer are not connected. The former can be used as vector input, while the latter can obtain the characteristic values of data samples. The number of nodes in both of them will not be limited and can be used to construct the neural network machine learning model to ensure higher accuracy in the whole learning process. In the training process of neural network learning algorithm, in order to further improve the accuracy of the applied algorithm, the back-propagation method as shown in Figure 2 below should be selected:

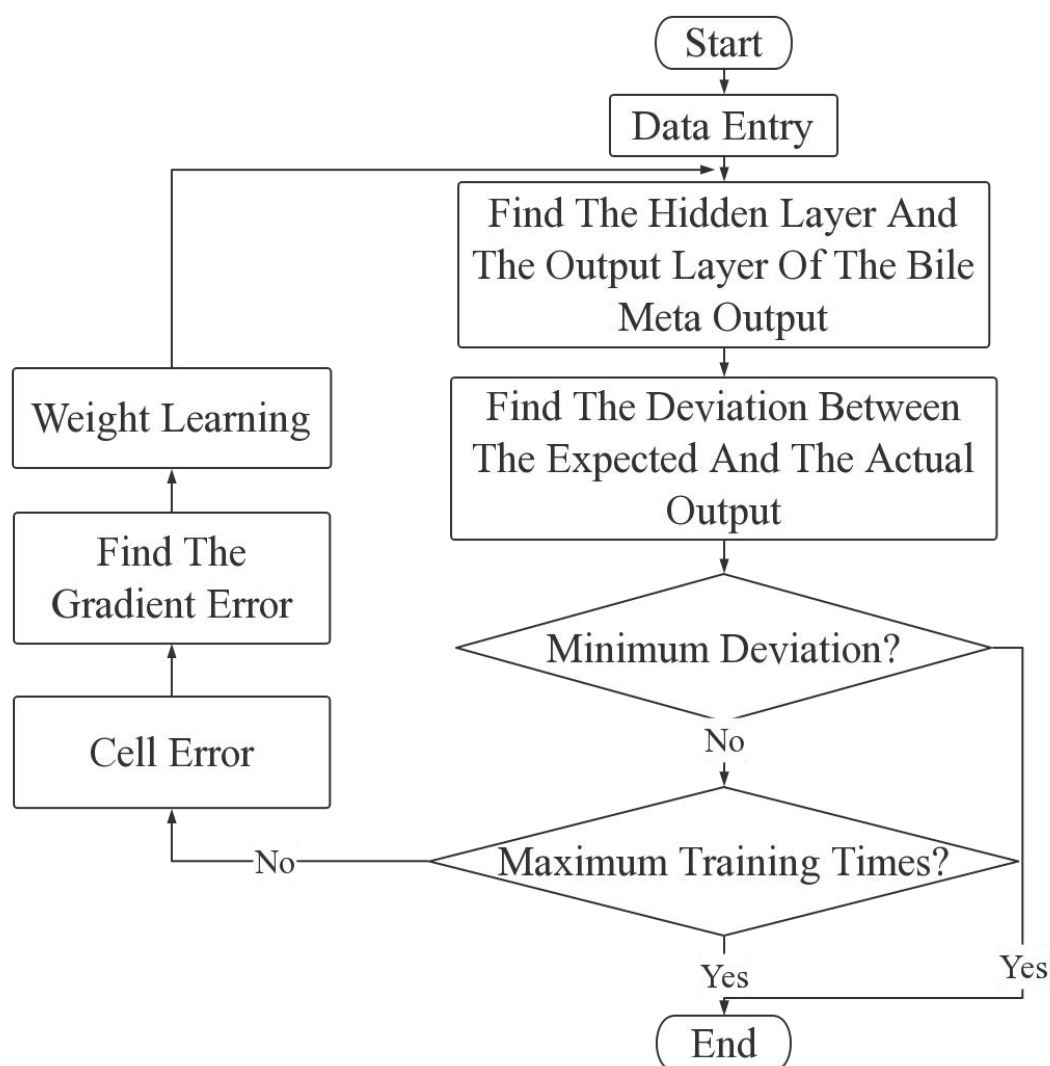


Figure2 Flowchart of back propagation

According to the analysis of the figure above, practical operation steps can be divided into the following points: On the one hand, the deviation between the expected value and the actual output value should be calculated and analyzed; On the other hand, the error information is fed back and the error value is controlled on the basis of scientific adjustment of the weight value, so as to ensure that the final output content and the expected content are infinitely close to achieve the expected learning effect. From the perspective of practical application, the operation accuracy of the whole system will be higher and higher after the deep confidence network model is applied, which can lay a foundation to meet the various functions of the UAV intelligent machine learning system.[12-15]

3. Result analysis

This paper takes agricultural UAV intelligent deep learning algorithm as an example to explore the application effect of UAV intelligent machine learning system based on artificial intelligence. Nowadays, when designing picking robots, researchers mainly focus on two factors: on the one hand, the high precision of fruit recognition should be improved; on the other hand, the robot should be guaranteed to have good mobility and self-picking ability. The overall operation process is shown in Figure 3 below:

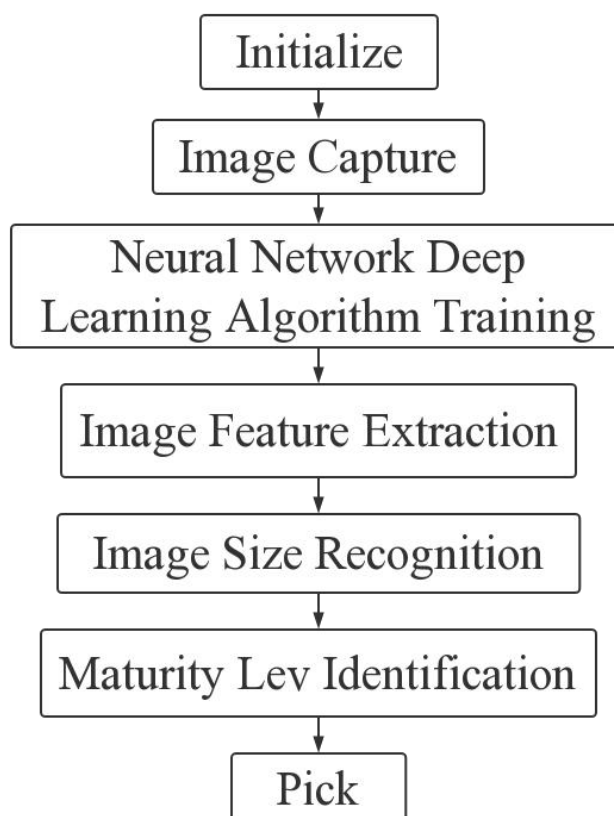


Figure 3 Intelligent recognition flow chart of agricultural UAV

In the research experiment of this paper, the machine learning function of the robot vision system is mainly used to acquire the contour of the fruit, judge the size according to the morphological characteristics of the fruit, and after mastering the location of the fruit, image pixels are extracted and graded according to the maturity corresponding to the color. Through comparative analysis of the traditional learning algorithm and the neural network deep learning algorithm, it can be seen that both of them can accurately identify the shape and size of fruits. However, in the judgment of fruit maturity, the neural network deep learning algorithm has unique advantages, and the application efficiency of the algorithm will become higher and higher with the increasing number of identification samples. The final experimental results are shown in Table 2 below:

Table 2 Experimental results

Number of apple samples	Recognition accuracy of traditional learning algorithm		Recognition accuracy of neural network deep learning algorithm	
	size	grade	size	grade
1000	99.8	98.7	99.9	99.6
2000	99.6	98.1	99.8	99.2
3000	99.5	97.2	99.7	99.1
4000	99.4	96.1	99.5	98.9
5000	99.3	95.2	99.3	98.8

Based on the analysis in the above table, it can be seen that after the number of 1000 fruit samples is mastered, the accuracy of the neural network deep learning algorithm to recognize the fruit size can reach 99.3%, and the recognition level can reach 99.1%. After mastering the quantity of 3000 fruit samples, the accuracy of the neural network deep learning algorithm to recognize the fruit size can reach 99.7%, and the recognition level can reach 99.6%. This proves that Chinese scholars should continue to explore the research topics of artificial intelligence and UAV

technology, and pay attention to mastering the technical methods and service functions of intelligent machine learning system, so as to meet the application requirements of UAV technology in various fields.

In the era of artificial intelligence, the technical research of UAV system will develop in the following directions: First, information fusion. Intelligent unmanned aerial vehicle will be equipped with a variety of sensors, mainly used to provide electromagnetic radiation information, visible light information, infrared information and other contents of the target. Nowadays, most of these information will be transmitted back to the ground control station for processing through the communication link. As the data information contained is relatively large, the overall processing speed is slow. Based on the optimization and innovation of artificial intelligence technology, the UAV platform can complete information fusion, quickly provide more advanced target feature information, effectively reduce the difficulty of the operator's decision, and provide strong support for the subsequent automatic operation; Second, independent warfare. At present, UAV mainly uses human in the loop mode, so it is still a remote-controlled aircraft in essence. It can complete various tasks according to the instructions of the operator after providing target information, without realizing the objective of autonomous intelligent control at all. The UAV intelligent system based on artificial intelligence technology can autonomously identify the target according to its own information under certain circumstances, accurately judge the nature of the target and launch attacks. Finally, improve the system. In the development of artificial intelligence technology, all UAVs are equipped with independent and limited intelligence agents, which can achieve expected work goals by making them cooperate with each other. At the same time, artificial intelligence technology is used to highly abstract process the states of all agents and form dynamic and efficient information data flow in the agent network, which can not only realize real-time sharing of target information, but also effectively optimize the dynamic information of air route, so as to solve the problem that a single traditional UAV cannot complete the task independently. Guide the UAV industry to develop steadily in the direction of intelligence and digitalization.

4. Conclusion

To sum up, artificial intelligence, as the basis for the research of UAV intelligent machine learning system, can not only solve various problems faced by the current technological development of the industry, but also fully meet the needs of UAV technology application in various fields. Therefore, Chinese scholars should strengthen the application research of UAV intelligent machine learning system with the field of artificial intelligence as the core to improve our comprehensive competition level.

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