Research on the Application of Computer Vision Technology in Aquaculture

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Abstract. At present, domestic aquaculture is still dominated by artificial aquaculture, the automation level of aquaculture process is low, and the basic research on aquaculture is relatively lacking, which makes the intelligent management and monitoring ability of aquaculture weak. Based on this, this paper first analyses the current situation and development trend of computer vision tech, then studies the computer vision recognition scheme design of aquaculture, and finally gives the specific utilization of computer vision tech in aquaculture.

Keywords: Computer Vision Tech, Computer, Aquaculture

1. Introduction

With the continuous improvement of people's living standards, people's demand for aquatic products is also constantly improving, which makes aquaculture has a broader development prospect. In order to further improve the yield and efficiency of aquaculture, we need to further improve the aquaculture tech. At present, domestic aquaculture is still dominated by artificial aquaculture, the automation level of aquaculture process is low, and the basic research on aquaculture is relatively lacking, which makes the intelligent management and monitoring ability of aquaculture weak. With the maturity and progress of modern tech represented by computer vision, it has been widely applied and studied in many fields, especially in the field of aquaculture, which greatly promotes the efficiency and level of aquaculture.

At present, the utilization of computer vision tech in aquaculture mainly focuses on the recognition of several aspects as shown in Figure 1 below. The utilization in these aspects can effectively improve the efficiency of aquaculture operation and improve the production quality of aquaculture. And thanks to the improvement of automation ability, the demand for personnel is reduced, which greatly reduces the interference caused by human factors.

Domestic aquaculture industry output has become an important part of the agricultural industry, and greatly promote the development of agricultural economy. In order to improve the efficiency and quality of aquaculture, it is necessary to detect the status of aquatic organisms effectively. These state indicators include the shape, size and texture of aquatic animals. As important information of aquaculture, these state parameters can directly reflect the growth status of aquatic organisms, thus
providing reference for the development of targeted aquaculture strategies and decision-making, and can indirectly reflect the status of aquaculture environment.

Figure 1. Utilization of computer vision tech in aquaculture.

In addition, the utilization of computer vision tech in the quality detection and growth state monitoring of aquatic products is still improving. With the development of aquaculture, the density of aquaculture is increasing, and the water quality of aquaculture water changes rapidly. It is necessary to effectively detect the status of aquatic organisms, so as to avoid the loss of yield caused by the lag of information. In view of the information monitoring requirements of fish behavior, stress status and biomass in aquatic facilities, computer vision tech has a broad utilization prospect.

In short, as an economic, high-precision and high-efficiency detection tech, computer vision tech can extract the typical characteristics of aquatic organisms, and can effectively judge the health status of aquaculture organisms. Research on the utilization of computer vision tech in aquaculture will help to upgrade aquaculture industry, improve production efficiency and quality, and guide aquaculture production. Therefore, it is of great practical value to study the utilization of computer vision tech in aquaculture.

2. Current situation and development trend of computer vision tech

2.1. Current situation of computer vision tech
Data and information are analyzed, identified, detected and tracked, so as to recognize and understand images. At present, this tech has been widely used in many fields, and has become a typical utilization of AI tech. In addition, computer vision tech can remember the ideal output for each input image, or classify the components of the image by scanning the contour and color features.

Computer vision based on deep learning algorithm has been able to identify the elements of the picture. It can not only distinguish human from animals and inanimate objects, but also recognize individuals according to biological characteristics. Biometrics based on computer vision tech can verify the identity of organisms according to their unique physiological characteristics. Deep learning algorithm can identify the unique patterns of aquatic organisms, and can accurately and recognize the subtle differences between different organisms.

2.2. Energy saving principle of air conditioning system
The development of computer vision tech has gone through several different stages, such as Markov computing vision, active vision and objective vision, multi view geometry, layered 3D reconstruction, computer vision and deep learning vision. At present, with the iterative progress of AI algorithm and other technologies, the market scale and utilization fields of visual artificial intelligence are constantly expanding. The growth of market scale of computer vision tech in recent years is shown in Figure 2.

Deep learning and the use of CNN make computer vision more capable of replicating human vision. Computer vision based cognitive system is better at recognizing patterns from images.
2.3. The development trend of computer vision tech
With the development of computer vision tech, it is easier to distinguish things from computer vision. Learning based object vision and geometry-based space vision continue to exist in parallel [1, 2]. For the recognition of aquatic organisms in aquaculture industry, object recognition based on deep learning has gradually developed from general recognition to object recognition in specific fields, which can provide more clear and specific prior information and effectively improve the accuracy, efficiency and practicability of recognition.

3. Design of computer vision recognition scheme for aquaculture

3.1. Utilization requirements of computer vision recognition in aquaculture
Compared with the traditional free range culture mode, the intensive culture mode of aquaculture industry not only has high survival rate, but also can effectively improve the quality, and has less impact on the water environment [3-4]. However, there are also many deficiencies in the intensive aquaculture mode, which is manifested in the large demand and consumption of human resources. With the increase of aquaculture density, water quality conditions will change rapidly, and the health status of aquatic organisms will be threatened. Therefore, the aquaculture industry needs to inspect the aquaculture site regularly, which not only increases the workload of relevant personnel, but also increases the labor cost of the industry.

The utilization of computer vision tech in aquaculture industry can more quickly and comprehensively carry out biomass estimation, stress behavior monitoring and behavior analysis of aquatic organisms. In the aspect of biomass estimation of aquatic organisms, stress injury to sensitive aquatic organisms can be avoided. In the aspect of emergency behavior detection, it can avoid the lag brought by traditional methods. In addition, at the level of detection and text analysis of aquatic organisms, it can continuously and efficiently detect and track the behavior of aquatic animals.

3.2. Overall design of computer vision recognition for aquaculture
The overall design of aquaculture computer vision recognition mainly focuses on tech and utilization. Among them, on the technical level, it is necessary to build an effective detection and tracking algorithm for aquatic organisms, and establish a prerequisite for the practical utilization of computer vision tech in aquaculture, so as to further promote the intensive progress of aquaculture industry [4]. In addition, on the utilization level, in view of the common problems in the current aquaculture process, the quality estimation and stress behavior monitoring of aquaculture organisms were carried out, and the changes of stress behavior activity were tracked and detected. The overall design scheme of computer vision recognition for aquaculture is shown in Figure 3 below.

![Figure 2. Market scale growth of computer vision tech.](image)

- **Figure 2.** Market scale growth of computer vision tech.
3.3. Hardware design of computer vision recognition for aquaculture

In the hardware design level of computer vision recognition in aquaculture, it mainly includes image acquisition devices such as lens, camera, light source, connection equipment and analysis storage equipment. Because the environment of aquaculture farm is often complex, there is a certain distance between aquaculture and aquaculture analysis, so the image acquisition device is required to have the ability of remote information control and image transmission [5]. In addition, in the aspect of image transmission mode, it is necessary to select the mode with long transmission distance, stable signal and high image quality. For example, the transmission mode represented by 5G, Wi-Fi and other technologies can well meet the transmission requirements of image information.

4. Utilization of computer vision tech in aquaculture

4.1. Biomass and growth assessment of cultured organisms

The biomass of aquaculture is the premise and basis of decision-making for grading, feeding, catching and controlling aquaculture density. Traditional aquatic biomass measurement methods will bring stress and physical damage to aquatic organisms. Using computer vision tech can not only measure accurately and quickly, but also save a lot of human and material resources. It is difficult to monitor the growth of aquaculture animals using computer vision tech [6]. This is because the environment of aquatic organisms is more complex, and the organisms are in the process of dynamic changes, which poses a great challenge to the utilization of this tech. Therefore, monocular vision tech is often used to evaluate the biomass and growth of cultured organisms, and binocular vision tech is used to evaluate the biomass and growth of cultured organisms.

4.2. Behaviour monitoring and stress assessment of aquatic products

The behavior of aquatic organisms is closely related to environmental stimulation and physiological status. Through the monitoring of aquatic biological behavior changes, we can realize the effective assessment of pollutants in the water environment. According to the change of different parameters, automatic biological monitoring can quickly predict the pollution of water environment. Secondly, the behavior analysis of aquatic organisms can also be used as the basis for analyzing the state of water environment, which can effectively detect water pollutants. In addition, with the development of aquaculture, computer vision tech can be used to study the interaction between aquatic organisms under aquaculture conditions, which can establish a scientific basis for the growth and behavior information of aquatic organisms to control the aquaculture environment.

4.3. Other utilizations in aquaculture

First of all, in the aspect of automatic monitoring of water quality in aquaculture, traditional monitoring methods are easy to be affected by human factors or instruments, resulting in measurement data error. Computer vision tech can realize automatic and unattended monitoring. Secondly, in the aspect of feeding monitoring, avoiding the waste in the feeding process can effectively reduce the cost of aquaculture, and reduce the water pollution in the process of aquaculture, so as to effectively improve the living environment of aquatic animals. Using computer vision tech to control the feeding
not only helps to control the amount of feed accurately, but also can monitor the health status of aquatic organisms.

5. Conclusion

In summary, computer vision tech can extract the typical characteristics of aquatic organisms, and can effectively judge the health status of aquaculture organisms. It is helpful to upgrade aquaculture industry, improve production efficiency and quality, and guide aquaculture production. This paper analyzes the current situation, development process and development trend of computer vision tech through the research on the current situation and development trend of computer vision tech. Through the analysis of the design of computer vision recognition scheme for aquaculture, the overall design of computer vision recognition for aquaculture is studied. Through the research on the specific utilization of computer vision tech in aquaculture, the specific utilization of computer vision tech in biomass and growth assessment of aquaculture organisms, behavior monitoring and stress state assessment of aquaculture were analyzed.

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