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УДК 004.896

AN OVERVIEW OF THE APPLICATION OF ARTIFICIAL INTELLIGENCE IN MARINE ORGANISM

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Summary. *As marine resources dwindle and environmental problems increase, monitoring and protection of marine organisms is becoming increasingly important. Marine organism detection can help us quickly and accurately identify and track biological targets in the marine environment. The application of artificial intelligence in marine organism detection is the most prominent research result in recent years. This paper reviews the application of artificial intelligence in marine organism detection and discusses the future development direction.*

Practical applications of marine organism detection based on AI computer vision are specifically realized in object detection, community counting and behavioral analysis. The following is an overview of these three directions.

In real underwater environments, a large number of dense, fuzzy, and small-sized objects appear. It is difficult for current general-purpose target detectors to detect these samples. Figure 1 demonstrates some of the problems in underwater object detection.

a) *b)* *c)*

Figure 1 – Blurring objects (*a*), Marine benthic buildup (*b*), Gaps between sea urchins (*c*)

To solve these problems, Xu et al. proposed a quantitative marine benthic organism detection algorithm EFP-YOLO based on YOLOX. The results show that the model achieves a recognition rate of 64.6 % on the DUO dataset and exhibits superior performance compared to other target detection algorithms [1].

Aquatic counting in aquaculture has always been a pressing problem for farmers.Liu et al. proposed an improved CSRNet convolutional neural network based on Shrimpseed_Net, which is capable of realizing high-precision shrimp seeds counting and has been deployed on cell phone. The interface of the detection software deployed on the cell phone is shown in figure 2. Accurate counting of shrimp seeds in real scenes can be performed in a short time [2].

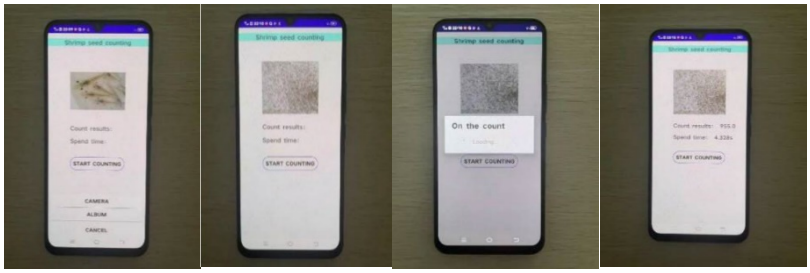

Figure 2 – Shrimp Seed Counting Mobile Software Interface

Currently ornamental fishes have a strong commercial value worldwide, and studying the behavior of some ornamental fishes can provide ideas for their aquaculture research and commercial research. Anagha Muralidharan et al. proposed a method to automatically analyze the NTD detection of anxiety in zebrafish using a deep learning model using DeepLabCut to classify zebrafish according to their anxiety level based on the classification and then compared the deep learning models based on the training dataset of image frames and found that specific architectures (e.g., InceptionV3) were able to effectively perform the task of classifying zebrafish as anxious or non-anxious [3].

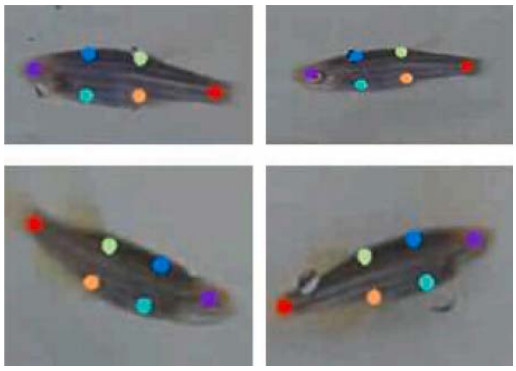

Figure 3 – Labeled six points on the zebrafish (Keyframes). Zebrafish were labeled as head, mid-dorsal 1, mid-ventral 1, mid-dorsal 2, mid-ventral 2, and tail

Conclusion. The research field of artificial intelligence-based computer vision for recognizing marine organisms has excelled, and the technology has great potential to support the development of various marine activities. This paper provides an overview of marine fisheries based on deep learning technology,

pointing out that with the help of deep learning technology, the marine industry has made great strides and the technology is developing rapidly. It is hoped that this paper will inspire readers to pay attention to marine affairs and encourage more people to participate in scientific research.

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УДК 004.65:004.451

DATABASE DESIGN FOR MULTI-TENANT E-COMMERCE PLATFORM

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Summary. *The purpose of this article is to propose a complete database design scheme that meets the specific needs of multi-tenant e-commerce platforms. This includes essential strategies such as multi-tenant isolation policies, permission management, index optimization, performance improvements, and scalability considerations, all aimed at building a high-performance, scalable database system.*

The article identifies core functional needs in modules like user, merchant, product, order, and payment management. These requirements guide design strategies that ensure effective data isolation, optimized performance, scalability, and robust security.

The purpose of this article is to propose a comprehensive database design scheme tailored to the specific needs of multi-tenant e-commerce platforms. This design incorporates widely used technologies, including schema-based multi-tenancy for data isolation [1], role-based access control (RBAC) for permission management [2], adaptive indexing for query optimization [3], caching and load balancing for performance enhancement [4], and data partitioning for scalability [5]. Through these well-established techniques, this design aims to achieve a high-performance, scalable database system that meets the rigorous demands of e-commerce platforms.

The design addresses core modules like user management, merchant management, product management, order management, and payment management, while proposing strategies for effective data isolation, performance optimization, and security. Eight core entities are identified: Tenant, User, Role, Permission, Product, Order, OrderItem, and Payment. Tenant serves as the central entity, with