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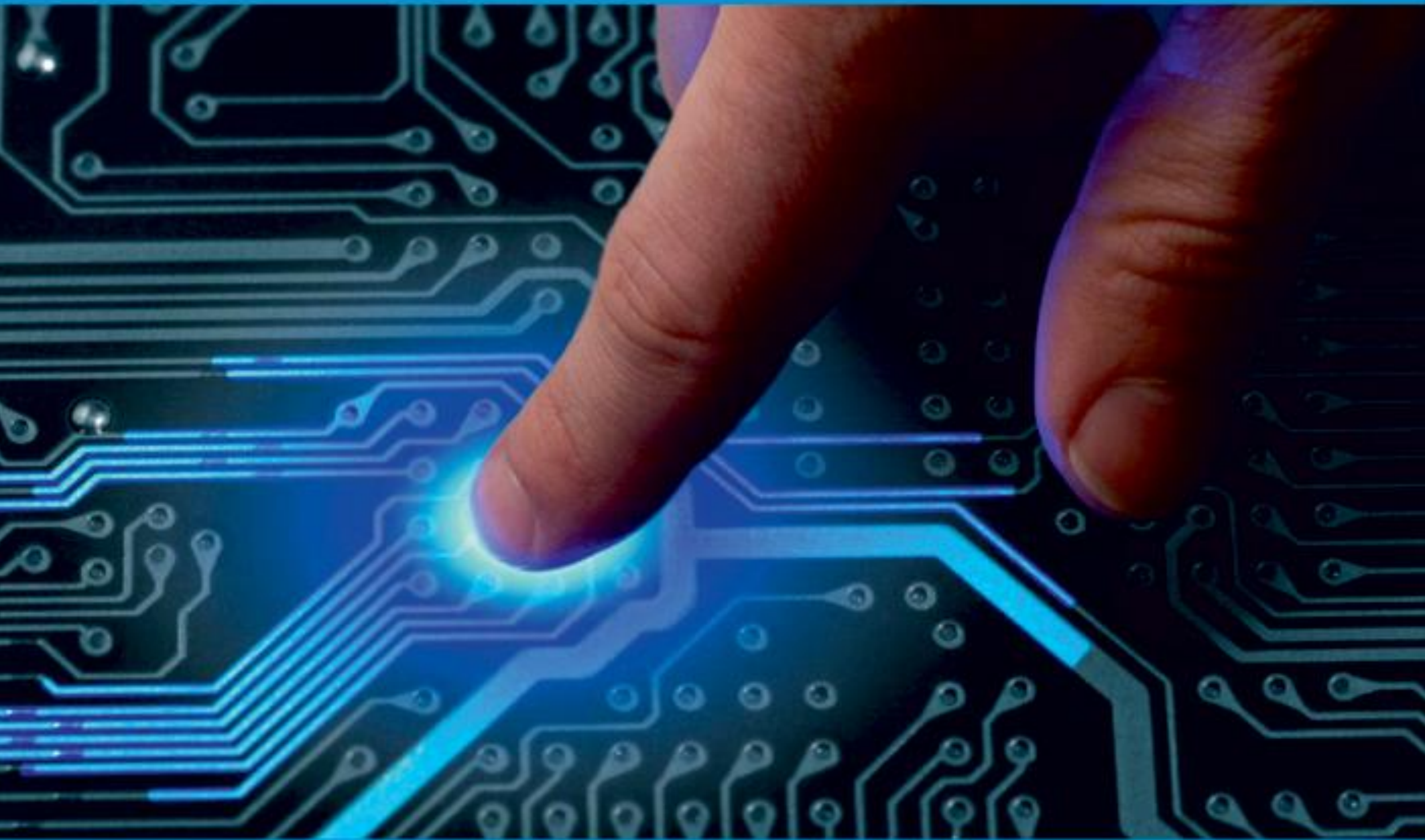

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Optimizing Numerical Underwater Target Prediction Model Performanc Using Machine Learing Technique

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ABSTRACT: The accuracy of underwater target recognition by autonomous underwater vehicle (AUV) is a powerful guarantee for underwater detection, rescue, and security. Recently, deep learning has made significant improvements in digital image processing for target recognition and classification, which makes the underwater target recognition study becoming a hot research field. This article systematically describes the application of deep learning in underwater image analysis in the past few years and briefly expounds the basic principles of various underwater target recognition methods. Meanwhile, the applicable conditions, pros and cons of various methods are pointed out. The technical problems of AUV underwater dangerous target recognition methods are analyzed, and corresponding solutions are given. At the same time, we prospect the future development trend of AUV underwater target recognition

This paper provides a study of the latest target (object) detection algorithms for underwater wireless sensor networks (UWSNs). To ensure selection of the latest and state-of-the-art algorithms, only algorithms developed in the last seven years are taken into account that are not entirely addressed by the existing surveys. These algorithms are classified based on their architecture and methodologies of operation and their applications are described that are helpful in their selection in a diverse set of applications. The merits and demerits of the algorithms are also addressed that are helpful to improve their performance in future investigation. Moreover, a comparative analysis of the described algorithms is also given that further provides an insight to their selection in various applications and future enhancement. A depiction of the addressed algorithms in various applications based on publication count over the latest decade (2023-2013) is also given using the IEEE database that is helpful in knowing their future application trend. Finally, the challenges associated with the underwater target detection are highlighted and the future research paradigms are identified. The conducted study is helpful in providing a thorough analysis of the underwater target detection algorithms, their feasibility in various applications with future challenges and defined strategies for further investigation.

I. INTRODUCTION

The marine environment is complex and changeable, and there are many factors that affect the accuracy and stability of target recognition, so the passive recognition of underwater acoustic signals is facing great challenges. The performance is mainly affected by ambient noise interference, transmission loss and multipath interference. In addition, there are various types of underwater acoustic signals, natural and man-made, that are derived from marine animals, sea waves, ships, submarines, drilling platforms and so on. Each of them has its own ‘acoustic signature’, and in some cases humans are able to recognise the targets through listening and using a spectrogram. However, humans need to undergo long-term training in order to be able to differentiate these sounds and they are affected by physical and psychological factors, which can often lead to certain deviations in the practical application. Therefore, using artificial intelligence technology to automatically recognise the underwater acoustic signals is the current development trend.

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II. LITERATURE SURVEY

AUTHOR NAME : Sheezan Fayaz, Shabir A. Parah & G. J. Qureshi

DESCRIPTION: Underwater object detection is an essential step in image processing and it plays a vital role in several applications such as the repair and maintenance of sub-aquatic structures and marine sciences. Many computer vision-based solutions have been proposed but an optimal solution for underwater object detection and species classification does not exist. This is mainly because of the challenges presented by the underwater environment which mainly include light scattering and light absorption. The advent of deep learning has enabled researchers to solve various problems like protection of the subaquatic ecological environment, emergency rescue, reducing chances of underwater disaster and its prevention, underwater target detection, spooring, and recognition. However, the advantages and shortcomings of these deep learning algorithms are still unclear. Thus, to give a clearer view of the underwater object detection algorithms and their pros and cons, we proffer a state-of-the-art review of different computer vision-based approaches that have been developed as yet.

AUTHOR NAME: Md. Moniruzzaman, Syed Mohammed Shamsul Islam, Mohammed Bennamoun & Paul Lavery

DESCRIPTION: Deep learning, also known as deep machine learning or deep structured learning based techniques, have recently achieved tremendous success in digital image processing for object detection and classification. As a result, they are rapidly gaining popularity and attention from the computer vision research community. There has been a massive increase in the collection of digital imagery for the monitoring of underwater ecosystems, including seagrass meadows.

AUTHOR NAME: Fenglei Han,[1]Jingzheng Yao,[1]Haitao Zhu,[1]and Chunhui Wang[1]

DESCRIPTION: Due to the importance of underwater exploration in the development and utilization of deep-sea resources, underwater autonomous operation is more and more important to avoid the dangerous high-pressure deep-sea environment. In this paper, a combination of max-RGB method and shades of gray method is applied to achieve the enhancement of underwater vision, and then a CNN (Convolutional Neutral Network) method for solving the weakly illuminated problem for underwater images is proposed to train the mapping relationship to obtain the illumination map. . After the image processing, a deep CNN method is proposed to perform the underwater detection and classification, according to the characteristics of underwater vision, two improved schemes are applied to modify the deep CNN structure. In the first scheme, a convolution kernel is used on the feature map, and then a down sampling layer is added to resize the output to equal. In the second scheme, a down sampling layer is added firstly, and then the convolution layer is inserted in the network, the result is combined with the last output to achieve the detection. Through comparison with the Fast RCNN, Faster RCNN, and the original YOLO V3, scheme 2 is verified to be better in detecting underwater objects. The detection speed is about 50 FPS (Frames per Second), and mAP (mean Average Precision) is about 90%.

III. PROBLEM STATEMENT

During the past few decades, water pollution due to man-made waste has become severe, leading to contamination of water resources and affecting aquatic life. Despite environmental regulations, trash, litter and trash objects like plastic are disposed of into the water bodies, affecting the underwater living creatures. This also creates a huge risk to the very evolution of marine life. We are wrong when we say the impact is only on marine life it is also to human health as it increases the nitrogen and phosphorus in our waterways and this overabundance can cause major concerns to human health. With the increased usage of Plastic, It has reached the ocean by the source of rivers and many other forms of water that is flowing through the landfills, and also by dumping from ships, a subsequent contribution from the effluents from wastewater plants is also evident. In, five major areas of concentration of plastics in the sea have been identified: one in the Indian Ocean, two in the Atlantic and Pacific. The high concentration of all forms of micro plastics is in these surface areas.

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IV. EXISTING SYSTEM

Underwater target detection using deep learning involves the application of neural networks and related algorithms to identify and classify objects or anomalies underwater. Here's a general outline of an existing system for underwater target detection using deep learning:

1. **Data Collection**: High-quality underwater imagery or sensor data is collected using various underwater imaging systems such as sonar, acoustic cameras, or underwater drones equipped with cameras. These data sources capture images, videos, or acoustic signals of the underwater environment.
2. **Data Pre-processing**: Raw data collected from underwater sensors often require preprocessing to enhance image quality, remove noise, correct for distortions, and standardize data formats for input into deep learning models. Techniques like image enhancement, noise reduction, and normalization are commonly applied.

V. PROPOSED SYSTEM

Designing a proposed system for underwater target detection involves considering the unique challenges and requirements of the underwater environment. Here's a conceptual framework for a proposed system:

1. **Advanced Sensor Integration**: Utilize state-of-the-art underwater sensors such as highresolution sonar, acoustic cameras, and LiDAR (Light Detection and Ranging) systems to capture comprehensive data about the underwater environment. These sensors should be capable of operating effectively in various water conditions and depths.
2. **Data Fusion and Preprocessing**: Implement robust data fusion techniques to integrate data from multiple sensors, creating a comprehensive and accurate representation of the underwater scene. Preprocess the fused data to enhance quality, remove noise, and correct distortions, ensuring optimal input for subsequent analysis.

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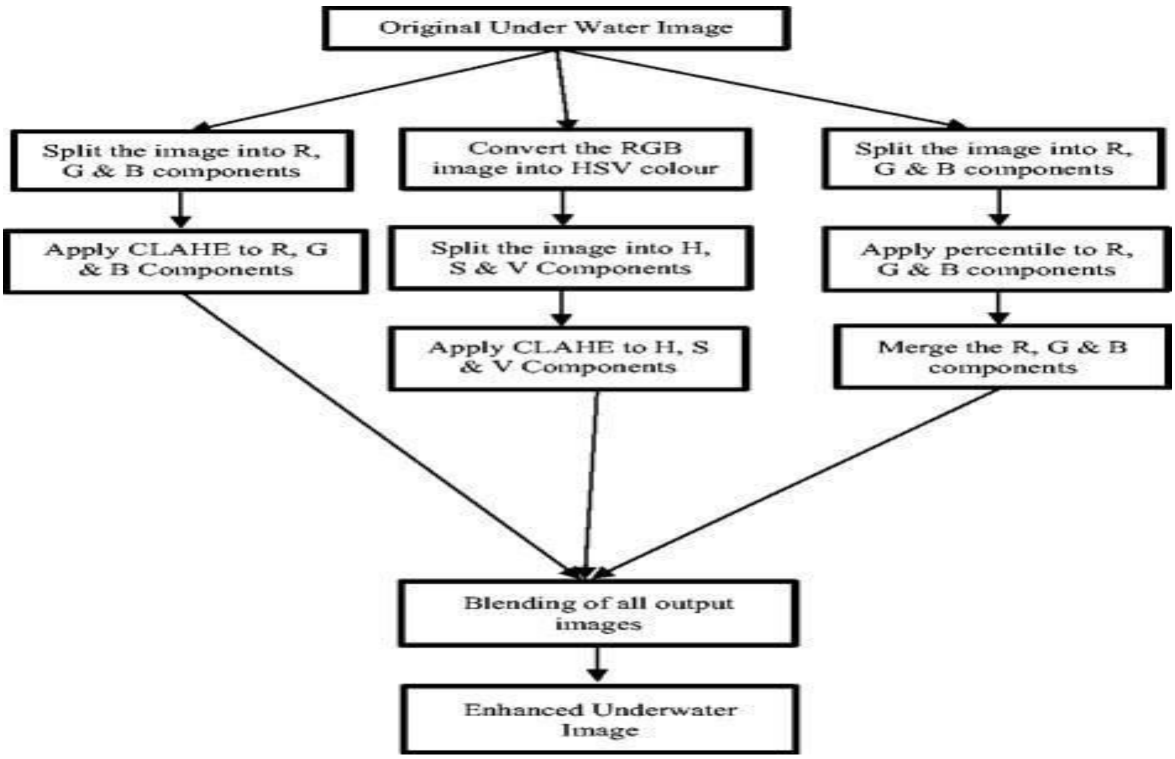
Fig . Divers using a net bag to pick trash object in the underwater of Oceans and seas

VI. FLOW DIAGRAM



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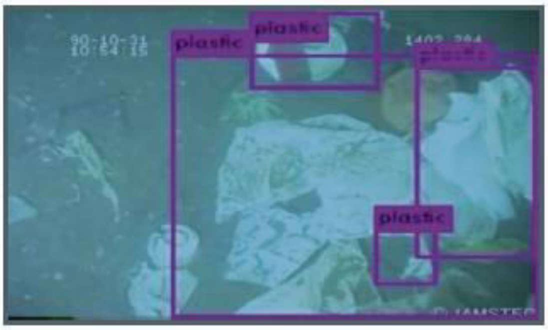
VII. RESULT AND ANALYSIS

EXPERIMENT RESULTS:

After conducting training process to the algorithm, the YOLO algorithm was able to detect trash objects accordingly with the high accuracy rate of 99 % in the underwater environment. The performance metrics are chosen to study the deep learning model (YOLO algorithm) are Accuracy, Precision, Recall, F1 score, Training time and Detection speed.



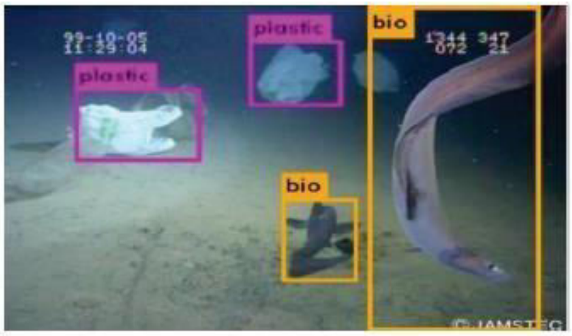


FIGURE: DETECTION OF TRASH OBJECTS

FASTER R-CNN RESULTS.

The detection results of trash objects underwater of the algorithm Faster R-CNN are presented. The algorithm was able to detect the trash objects underwater with accuracy of 97% in different conditions like lightening, turbidity, different angles, and different position conditions. The algorithm was able to detect trash objects in most cases. The total number of true positives, true negatives, false positives and false negatives are shown below:

Algorithm	Accuracy (%)	Precision (%)	Recall (%)	F1 Score (%)	Training time (mean)	Training time (standard)	Detection time (mean)	Detection time (standard)
Faster R-CNN	87.82%	87.22%	90.01%	85.45%	7 hours	1 hours	3 seconds	0.2 seconds

Table

1 Confusion Matrix Results Using Faster – RCNN Method

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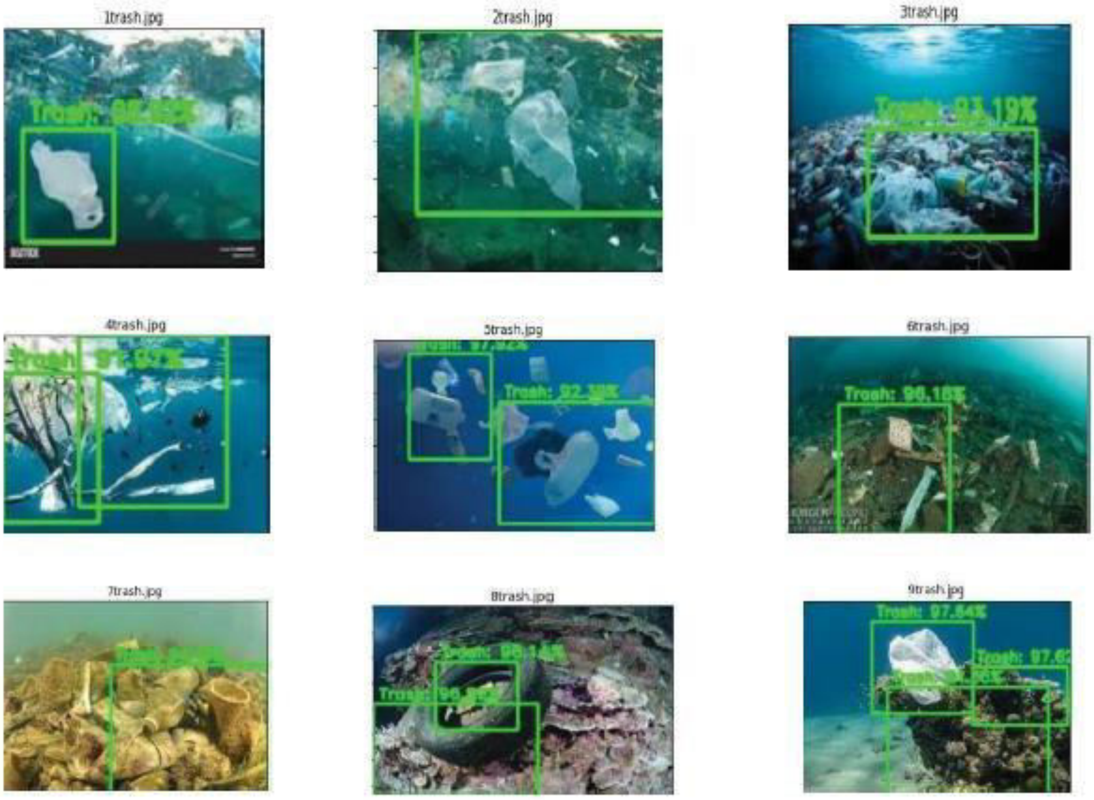

FIGURE: RESULTS OF DETECTION IN FASTER RCNN

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