Automated detection of aquatic animals using deep learning techniques

Aakansha Soy[1*]; Sutar Manisha Balkrishna[2]

Received: 02 August 2024; Revised: 03 September 2024; Accepted: 01 November 2024; Published: 10 December 2024

Abstract

Deep learning-based approaches have arisen as promising devices for mechanizing the recognition and characterization of oceanic creatures, offering critical progressions in marine biology, fisheries the board, and natural checking. This paper gives a far-reaching survey of the difficulties and potential open doors related with executing profound learning techniques in sea-going science. Picture grouping undertakings have seen an ascent with the presentation of profound learning strategies. In this paper, we have proposed a crossover Deep learning system that is utilized for highlight extraction and profound learning strategy for characterization. Both the proposed structures are tried on various dataset. Our trial results show that our system gives improved results than the majority of the customary as well as existing profound learning procedures. The vital advances of DL calculations applied to the visual acknowledgment and location of oceanic creatures are summed up, including datasets, calculations and execution. Besides, the difficulties are summarized and characterized in the item acknowledgment and identification space for oceanic creatures.

Keyword: Deep learning, Underwater fish species, Aquatic animals

1*- Assistant Professor, Department of CS & IT, Kalinga University, Raipur, India. Email: ku.aakanshasoy@kalingauniversity.ac.in, ORCID: https://orcid.org/0009-0002-1955-6909
2- Research Scholar, Department of CS & IT, Kalinga University, Raipur, India. Email: sutar.nilesh.tanaji@kalingauniversity.ac.in, ORCID: https://orcid.org/0009-0003-8881-3638
*Corresponding author
DOI: 10.70102/IJARES/V4S1/1

Introduction

Hydroponics has turned into a rich examination field for its significant commitment in worldwide food creation and monetary development. Expanding worldwide populaces implies hydroponics gives a more economical and harmless to the ecosystem approach to delivering creature protein than conventional fishing. What's more, hydroponics offers a reasonable option in contrast to wild fish stocks, in this manner adding to food security and supportable administration of sea-going assets (Bohara *et al.,* 2024). As far as worth, hydroponics creation arrived at a record USD 263.6 billion of every 2019, representing 48% of the complete worth of worldwide fish creation (Yassir *et al.,* 2023). Also, hydroponics can have financial advantages by making position and animating nearby monetary turn of events. Roughly 20 million individuals are utilized in the hydroponics area around the world. Thus, hydroponics assumes a critical part in upgrading food security and mitigating neediness in different districts across the globe (Chen *et al.,* 2023). Plan, activity, and enhancement of downstream entry offices that are monetarily and organically powerful requires information on eel conduct during their downstream movement including when eels are drawing closer hydropower offices, their pathways of approach and section, and their close field social reactions to office designs, for example, admissions, direction designs, and sidesteps. Notwithstanding, such data on how out moving eels collaborate with dams is generally obscure. Besides, the outmigration of grown-up eels is wordy and extended, normally stretching out over a time of a while every year (Kandimalla *et al.,* 2022). Since advancements are missing to naturally distinguish relocating eels, dam administrators might be expected to reduce turbine activity and spill water around evening time all through the outmigration season to guarantee safe eel section. Given the extended idea of grown-up eel outmigration, practical checking of eel entry requires a serious level of computerization for information handling. Large volumes of data regarding aquatic animals are being thanks to newly developed image-capturing technology and scientists' growing interest in this field (Assegid and Ketema, 2023). The majority of aquatic animals appear to be the same to a human observer, despite differences in size, shape, and colour. Therefore, the presence of a skilled biologist was always necessary
for accurate aquatic animals' identificati
on. To identify the various kinds of aquatic animals that can be found in the marine environment, a precise automatic coral classification system is therefore required. When compared to manual processing, our automatic classification technique saves time.

Problem Statement

The great diversity of background aquatic objects makes aquatic object detection challenging in underwater environments. The wide variety of underwater mine types, variations in my deployment, and mine–background interaction over time as a result of water currents are the main causes of the variability of aquatic objects (Hou *et al.,* 2013). Establishing a system that can identify and track mines in an

underwater environment is essential to guaranteeing that people are not impacted in any way. The mines help protect top-tier defence installations and stop confidential data from leaking. Battle groups will be helped by a dependable and economical system to pinpoint the precise placement of mines and prevent casualties. As a result, this thesis discusses the application of supervised deep learning algorithms for mine detection and the potential for more accurate mine detection in an underwater setting. Modern object detection and reconstruction methods based on high-resolution post-processing techniques have been around for a while (Li and Du, 2022). Recent developments in data science and analytics are still being worked on, providing a near-high probability version of identifying the object of interest with a high likelihood of being in the pipeline (Dixon, 2003). The goal is to obtain experimental simulation data records that demonstrate how deep learning can recognise and identify objects of interest with a comparatively high degree of resolution, all of which are clearly described and supported by multiple chapters of narrative.

Materials and Methods

Aquaculture is one of the many industries that have successfully adopted deep learning (DL) technology as a result of its quick development. Many studies are being conducted to improve the current techniques using convolutional neural network technology (Ozturk *et al.,* 2020). The works that are done in image processing for image identification and categorisation are listed below. Marine Object Detection uses underwater robots to find and fish for aquatic objects. The main focus of aquatic product detection research is sea urchins. Image processing, fuzzy logic, and the k-nearest neighbour classifier are used to determine the gender of a crab. A crab larval counter tool that detects and counts crab larvae by employing image processing with digital imagery as input. Differentiating Visual characteristics including size, shape, and colour can be used to identify different kinds of fish. arranging fish according to a number of fundamental morphological characteristics, such as scales, body shape, and head region. A CNN with 32 deep layers is the foundation of a deep learning system for fish species identification that extracts information from the input image. The greatest substitute for manual identification is a classification system that uses films to identify, monitor, and categorise fish and other marine species underwater. Fish categorisation utilising a single, general trained architecture that eliminates the need to use many fragmented image processing approaches to specifically extract features from the fish's raw images. Using the sounds made during spawning, a transfer learning technique is used to categorise grouper species.

The study project offers a website that contains all of the important data on freshwater crabs in India that has been gathered from multiple sources. The data was gathered from a variety of sources, including databases on freshwater crabs in India, online articles, and research articles written by different scholars. Since the information that is now available is dispersed, a web site has been created to store and retrieve all of the pertinent data about freshwater crabs in India. The data has been gathered,

organised, and digitalised so that users may access it online from a single location. In order to conduct this research, information about 120 freshwater crab species in India is gathered and categorised from a variety of sources, including databases, research articles, and websites that are relevant to the topic. There was discussion of three distinct web portal features: the admin/approver module, the editor module, and the user access module. The web portal has three distinct components: the Editor Module, the Admin/Approver Module, and the Web Portal User Access Module. The user can upload an image to the portal's search page, use the taxonomic filter choices, or search by using the species name as a keyword to obtain results. It was described how to use a CNN and deep learning model to identify crabs using image processing attributes. For those interested in conducting additional research in this field, the website provides background information. The creation of such a database for other species is still being worked on.

Experimental Result

The system's ability to detect and identify animals on the roads is known as accuracy. It can be improved by reducing the false positive rate and false negative rate. When the system produces a false warning (false positive) without an animal in the area, it can divert and interfere with a driver's ability to drive. False negatives, on the other hand, occur when an animal is present in the scene but the system is unable to recognise or detect it travelling across the road. Sequential frames containing false negatives could be extremely hazardous for both drivers and animals in Figure 1.

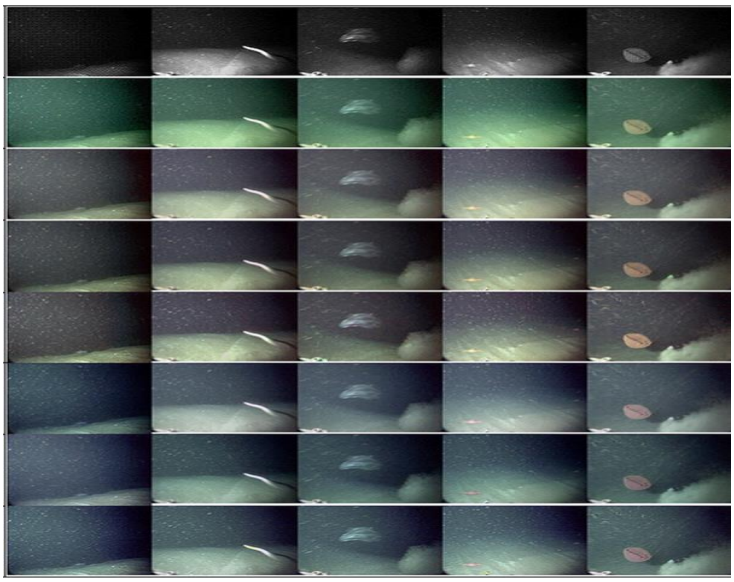

Figure 1: Sample image datasets.

Concerning visual viewpoint, the greenish variety that portrayed the pictures to which methods. The pictures produced by the leftover organization did in any case keep a pale blue tone, yet the shades of the noticeable creatures were more articulated. Regardless, at a straightforward visual examination, the pictures produced by Profound learning were to some degree blurrier contrasted with those handled by CV strategies.

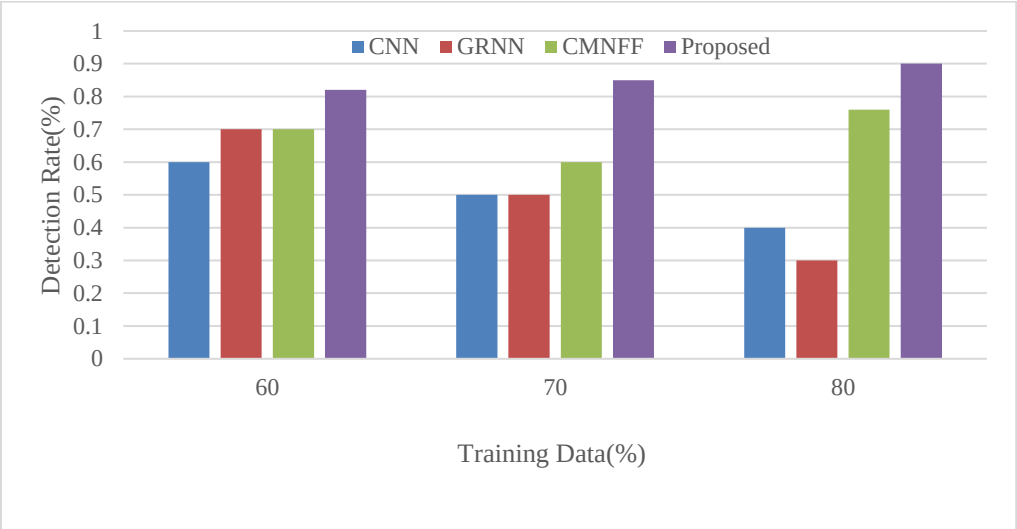

Figure 2: Comparative analysis of detection rate.

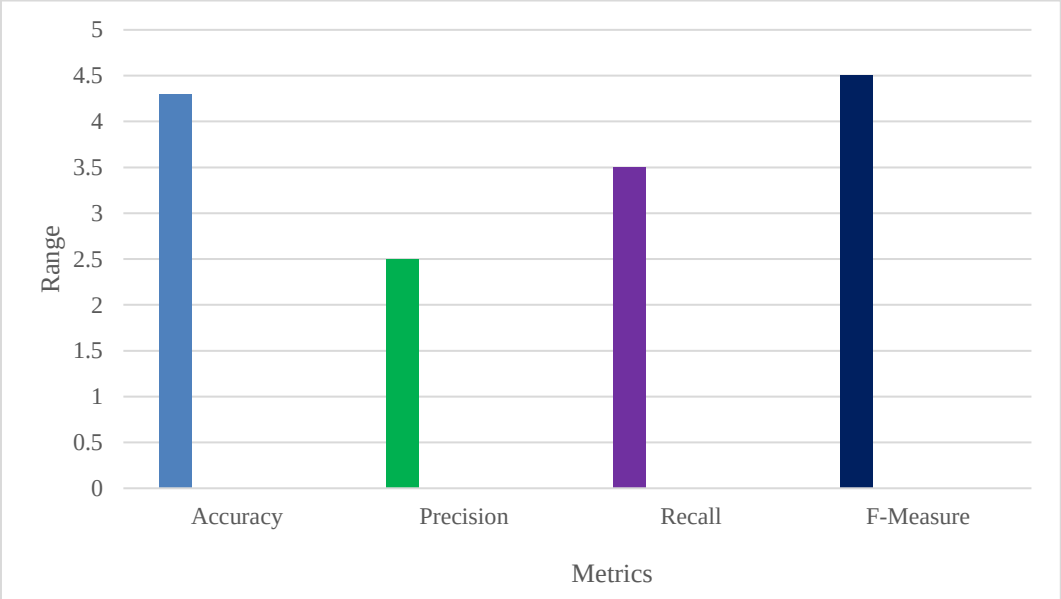

Figure 3. Improved R–FCN validation of performance metrics.

Figure 2 and 3, these results support the proposed R-FCN model's predominant presentation in object discovery, exhibiting its excellent exactness and accuracy.

Conclusion

This concentrate successfully recognized the land and water proficient animals using significant learning. Results from the public data showed that the examination of establishment allowance and wavelet denoising redesigned sonar pictures and extended CNN portrayal precision's. The portrayal precision of field data was practically identical with that refined by human subject matter experts. The arranged picture overhaul and gathering methodology will engage the robotization of fish ID. With anticipated that applications should fish noticing close hydropower projects, this procedure will work with imaginative work associated with eel segment at hydropower workplaces and addition the viability of hydropower errands while shielding a very much arranged

environment for fish section and migration.

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