Detection of Fish and classifying their Species using Mask R-CNN

B Vinod Reddy[1], B Sreekanth[2], Naveen Chandra Gowda[3], B Jaswanth Reddy[4], Hari babu T[5] 1,2,4,5

[1, 2, 4, 5] UG student, School of computer science and engineering REVA University, Bengaluru, India

[3] Assistant professor, School of computer science and engineering REVA University, Bengaluru, India

1 baddiputivinodkumarreddy123@gmail.com 2 sreekanthbandi10@gmail.com , 3 ncgowdru@gmail.com ,

4 bhemmajaswanthreddy130@gmail.com , 5 itisbabu1098@gmail.com

Abstract

The aim of the study was to develop a model for “fish identification and classification of species through the RCNN Mask.” The exception to Faster R-CNN is Mask R-CNN. Object detection operations usually use the fast R-CNN. Provides links to binding boxes and class name in the picture for each item. The Mask R-CNN was easy for installing also provides R-CNN quick start up. There are two sides to the R-CNN mask. Based on the image from 1st paragraph, that givesan idea regarding locations that are possible.
From the concept of the main character in the second phase, the project phase is estimated by this, filters the binding box, also creates a mask at pixel level of object. From the basic shape ideas, it guesses category of the object, filters the binding box, and creates a mask exactly at pixel level of object. The algorithm proposes the classification of species and the identification of Albacore tuna, Bigeye tuna, Yellowfin, Moonfish, Dolphinfish, and Shark. Some of the principles in the index areAcquisition and Regional Proposal. Mask R- CNN, Resnet101, Network, Tie Box.

Keywords: Object detection, Bounding Box,Region Proposal Network, Mask R-CNN, Resenet101.

1. INTRODUCTION

The oceans have long attracted the curiosity ofhumans as an unusual natural system. People fishing for cucumbers in the sea, sea urchins, scallops, and other marine animals harm the coral reefs. We are developing software that can automatically detect and identify different types of images. In-depth learning has been one of the most important breakthroughs in practical over the past decade. Convolutional neural networks, an in-depth learning approach, are used in a variety of fields.

In general, a method based on the convolution network of neural image recognition is easy to develop. In-depth learning is an invention in the field of image processing that has gained much interest. In order to identify the types of animals in the images, a comprehensive learning-based systemknown as the Mask Regional convolutional network has been used. The RCNN Mask Frame was used to run our model. It is a multi-layered Faster Regional Convolution Neural Network includes a temporary fragmentation. This does so upon enlisting the use of a highly efficient such as Resnet, powered by FPN. It uses the most productive RPN (Regional Suggestion Network) by highlighting planning, which puts something already in the ROI (Region of Interest).

1.1 Problem statement

Due to fast technological advancement and humanincrease, fish populations in the oceans are quicklydeclining. As a result, underwater ecosystem conservation is critical. The most major problem facing fish conservation is the accumulation of resources and the organisation of massive volumesof data on marine life. In this scenario, a CNN model is utilised to extract different quantities of information from photos at different levels. Many datasets of photographs taken by boat-cameras would have to be collected in order to implement such a system. And then running them through the programme to identify fish and classify species. A surveillance camera mounted on boats feeds photosinto the system. Its job is to categorise the image into one of six categories: big eye tuna, dolphin fish, moonfish, shark, yellow fin tuna, and albacoretuna, and then inform the fishing team.

1.2 Our Contribution

This project's goal is to make it easier for people to recognise different types of fish. The model will be given photos from security cameras deployed on the boats to identify fish belonging to specific species. The initiative aids in the detection and classification of fishes belonging to species that arequickly becoming extinct in the seas. It will be ableto recognise species that have been trained using the Mask RCNN model.

1.3 Organization of paper

The whole paper is organized into different sections, where section 2 describes in detail the literature research, section 3 focuses on the Description of the Approach. Section 4 describesthe test. Section 5 discuss result.

2. LITERATURE SURVEY

1. B.S. in 2020. This study by Shravan Kumar Reddy and colleagues [2] uses a neural convoluted network to identify object and classification, and involves growth, acquisitionand classification divisions in the system. To address the problem of overuse, augmentation surgery was performed. A variety of data sets are used to produce standard pre-processing and growth that develops a professional model and binary classification. The fish were separated using VGG-16 section.

2. By 2020, Aditya Agarwal et al [3] Product aims for catch fish like an object. The model has many layers and stages of investigation, including growth, division, face mask and other methods. They used the F-RCNN framework, the modern version of the R-CNNframework, to build it.

3. In 2020, X. Yang et al [5] will present their findings. The Resnet101 network model was used as a feature release in this article, also the main pillar network is created by collaborating Resnet101 by pyramid network.

4. R. Mandal and colleagues [8] In this work, themask is taken to categories, also to locate area of interest (Roi). It furthers the previous framework by predicting the separation mask in the Reproductive Region (Roi) and providesthe best possible performance of in-depth learning models.

5. G. Gkioxari, K. He, and others [9] have described RPN (Regional Suggestion Network) and Fast RCNN strategies for MaskR-CNN in this study. Roi (areas of interest) collect the elements of the object and use the fast R-CNN to insert a binding box into the object, while the mask structures are created using fully integrated layers.

3. METHODOLOGY

The product was assembled using Python. The model was trained for identifying fish using a dataset. Each fish bounding box is determined by RCNN and when it is pushed beyond the limit, certain fish characteristics are easily noticed. Is it afish? Then algorithm starts dividing what type of fish it is, and result would reveal which type of fishit is. Furthermore, as a result.

a. DATA COLLECTIONS

The images are loaded out of dataset and then transformed six times. This dataset is utilized in the training process. The collection originally contained 1043 pictures, however, thereafter escalation, 7301 pictures. Data escalation the amount of data collected, permitting for greater guidance and reducing neural network summarization.

b. DATA PRE-PROCESSING

The data is pre-processed before being entered intothe suggested model. The first step is to resize the original image to the appropriate pixel size. The data is then produced at random. Usually, this is done to improve the stability of the model. Dataset used to alter and produce training on photographs with varying contrast levels easier for the model.

c. PROPOSED SYSTEM

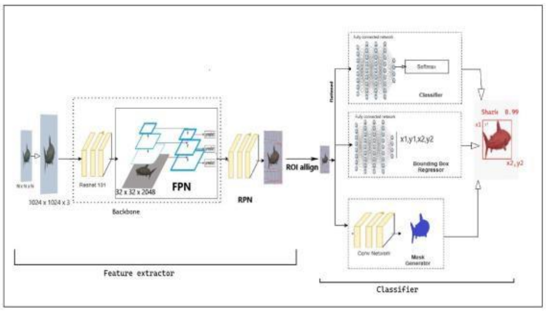
A well-planned strategy and ordered layout for every module are included here. This section also delves into the specifics of the various modules while considering the characteristics, such as information and yield. In this piece, the components that make up the attempt are thoroughly discussed. This section places a strong emphasis on the undertaking's back-end operations. The goal of this section is to clarify the assumptions and standards that underpin each.

d. MODEL TESTING AND TRAINING

The goal here is that to train the CNN design to anticipate which fish type will be caught. For the training and testing of the model, the acquired dataset is randomly bifurcated. The photos are used for 69 percent of training and 31 percent of validation. The trained data is delivered straight towards CNN model, which is then fine-tuned for the task at hand. The tuning model is next tested for correctness using the testing data. As classifiers, the preparing phase is separated within two parts: fully connected layers and convolutional networks. Every element of these structures has a distinct function. Convolutional layers are used to pull out attributes from a photograph.

3.1 ***System Architecture***

The R-CNN mask is a comprehensive framework for visualizing the object on the image while providing for every event a separation mask. A two-step encryption method is used by R-CNN. Marking is the first step. The second step is to sort the items, binding boxes and masks into categories. The network receives an image of NxNxN parameters. Originally 1024 x 1024 x 3. This means that the width and height of the image is 1024 pixels and three channels (RGB). CNN is photographing this extended image (Resnet in this case). This method removes image elements. The feature pyramid network is used to advance retrieval features (FPN). A map of the collected area is sent to the Regional Proposal Network (RPN), which determines which regions may have the properties. Because the output of this module does not have a fixed size, we use Roi direction to change its size. The second part of the model starts here. After Roi, a 2d matrix is flattened and consumed in a fully connected network, still distributing opportunities for each class. Any number can be used for this possible distribution. The SoftMax function is used to get these integers into the range of 0 to 1. The object belongs to the class with the greatest score. Another fully connected network receives the identical flattened 2d array, which returns the bounding box coordinates. These are the bounding box's genuine coordinates, so no SoftMax function. Another CNN predicts the mask for the object based on region suggestions. Which is then scaled up to a bounding box and placed in the object's centre.



Mask RCNN Model

Figure 3.1

The task's many segments have unique limitations and professions. To make a module operate, it must be tweaked to meet a certain goal. As a result, the focus points of the various modules are depicted in this section.

3.2 ***Sequence Diagram***

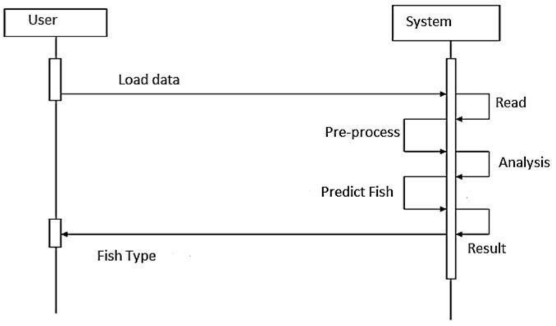


Figure 3.2

Figure 3.2: The sequence diagram is a UML diagram's interaction diagram. The graphic depicts the interactions between the system's numerous objects. The sequence diagram depicts how the things cross paths in the order in which they have an impact. The sequence diagram depicts interaction in sequential order. The arrangement- like box denotes that the thing is connected to the internet and may communicate with other objects. The straight line shows that the item is no longer online and communicating. The arrow's label indicates the direction of interaction. The object user connects to the system, sends a load data message, and then disconnects. The system becomes online and receives the data at this moment. It pre-processes the information, analyses it, and predicts the species/fish type.

4. TESTING

HARDWARE REQUIREMENTS:

Processor: Intel core i5 or equivalent, Hard Disk: 100GB, Monitor: Standard Display, Ram: 8GB, Input devices: Keyboard, Mouse, GPU: 2GB.

SOFTWARE REQUIREMENTS: Operating system: Windows 10 or ubuntu, Programming Language: python, CUDIA toolkit, Python Package: TensorFlow, H5py, Keras, OpenCV.

5. RESULT

The model was tested on a few photographs that were chosen at random. The results of the test arelisted below.

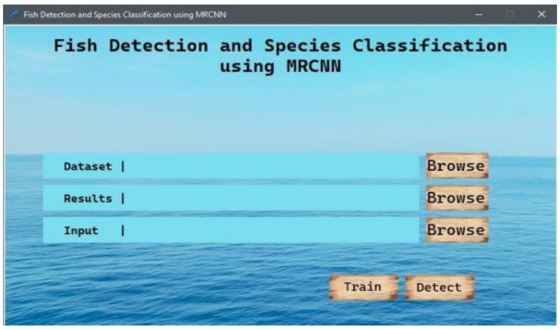


Figure 5.1

Figure 5.1: The connection provided by the userinterface with the system are shown and highlighted in the image above.

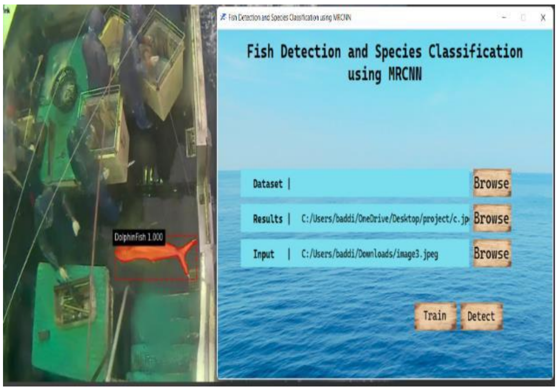


Figure 5.2

Figure 5.2: The user will select an input image using the same browsing button. The final image storage method must also be selected.

Figure 5.3

Figure 5.3: After clicking the view button, the viewer will open it to display the resulting imagecontaining the fish found in the square box.

Figure 5.4 Moonfish

Figure 5.5 Dolphinfish

Fish species	precisions	Recall	F1_score	support
Albacore tuna	0.83	1.00	0.91	30
Bigeye tuna	0.96	0.77	0.85	30
Dolphinfish	1.00	1.00	1.00	30
moonfish	1.00	1.00	1.00	30
Shark	0.97	1.00	0.98	30
Yellow fin Tuna	1.00	0.97	0.98	30

- Number of photos in Table 1 serves as support. There are 30 photographs in each class, for a total of 180 images.

6. CONCLUSION

Overfishing has resulted in the extinction of a few species of fish. Fishing for such species is the onlyway to earn money for several fisherman. In order to maintain the balance of the environment, great efforts must be made, including the possibility of illegal fishing on the verge of extinction. It is difficult to track down illegal fishing. We can use surveillance cameras on fishing boats, collect photos from time to time, and upload them to a model based on current findings. The aim of the model shows for identifying which type of fish caught, also to warn experts if it has been caught illegally. The model works best when trained on alarge, diverse database.

7. REFERENCES

[1] Knausgård, K.M., Wiklund, A., Sørdalen, T.K. et al. "Temperate fish detection, and classification: a deep learning-based approach. Appl Intell (2021).

[2] Rekha B.S., Srinivasan G.N, Reddy S.K., Kakwani D., Bhattad N. "Fish Detection and Classification Using Convolutional Neural Networks, " Computational Vision and Bio- Inspired Computing. ICCVBIC 2019. Advances inIntelligent Systems and Computing, vol 1108. Springer,2020.

[3] Aditya Agarwal, Tushar Malani, Gaurav Rawal,Navjeet Anand, Manonmani S, "Underwater Fish Detection," In International Journal Of EngineeringResearch andTechnology(IJERT), Volume 09, Issue 04,2020.

[4] Ben Saminiano, Arnel Fajardo, Ruji Medina, "Feeding Behavior Classification of Nile Tilapia (Oreochromis niloticus) using Convolutional Neural Network, "In International Journal of Advanced Trends in Computer Science and Engineering,2020.

[5] X. Yang et al., "Instance Segmentation and Classification Method for Plant Leaf Images Based on ISC-MRCNN and APS-DCCNN," in IEEE Access, vol. 8, pp. 151555-151573, 2020.

[6] Suxia Cui, Yu Zhou, Yonghui Wang, Lujun Zhai, "Fish Detection Using Deep Learning", Applied Computational Intelligence and Soft Computing, vol. 2020, ID 3738108, 13 pages, 2020.

[7] Kristian Muri Knausgård et al, "Temperate Fish Detection and Classification: a Deep Learning based Approach, " in IEEE,2000.

[8] Shalini L, Manvi SS, Gowda NC, Manasa KN, "Detection of Phishing Emails using Machine Learning and Deep Learning", 7th International Conference on Communication and Electronics Systems (ICCES), pp. 1237-1243, Jun 2022.

[9] Rekha KB, Gowda NC, "A framework for sentiment analysis in customer product reviews using machine learning", International Conference on Smart Technologies in Computing, Electrical and Electronics (ICSTCEE), pp. 267-271, Oct 2022.

[10] S. Ren, K. He, R. Girshick and J. Sun, "Faster R-CNN: Towards Real-Time Object Detection withRegion Proposal Networks," in IEEE Transactions on Pattern Analysis and Machine Intelligence, 2017.

[11] Abdullah Albattal, Anjali Narayanan, "CLASSIFYING FISH BY SPECIES USING CONVOLUTIONAL NEURAL NETWORKS. "