# FISH RECOGNITION AND DETECTION BASED ON DEEP LEARNING

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**Abstract:** This paper aims at detecting and recognizing various fish species from underwater images by means of deep learning, R-CNN (Region based Convolutional Neural and Networks) features with open cv tools. RCNN uses selective search algorithm to extract the top 2000 region proposals among millions of Regions of Interest (RoI) proposals from an image and feed it to a CNN model. Fish recognition is based on deep learning, which is a subset of machine learning. The Fish detection achieved is 85% accuracy by deep learning. We focused on fish recognition for investigating fish species in a natural lake to help protect the original environment. This paper proposes a scheme for segmenting fish image and measuring fish morphological features indicators based on R-CNN. Firstly, the fish body images are acquired by a home-made image acquisition device. Then, the fish images are preprocessed and labeled, and fed into the R-CNN for training. Finally, the trained model is used to segment fish image, thus the morphological features indicators of the fish can be obtained.

**Introduction:**

The fundamental objective of this paper is to detect the fishes from the given datasets. The images of the subject (fish) first obtained using a Pi camera interfaced with Raspberry Pi3. The hardware setup is simple such that Pi camera is interfaced with raspberry pi3 board Then the images are used as input datasets. Then the images are preprocessed where the resizing and background removal is done and then by using deep learning R-CNN algorithm the processed datasets are trained and tested to get the final output. IoT cloud is used to save the datasets.

**Key Concepts:** Datasets, Fish recognition, Deep Learning, R-CNN, Open CV

**LITERATURE SURVEY:**

**Table 1: Literature survey under fish detection**

| LITERATURE SURVEY | | | | |
|---|---|---|---|---|
| **S.no** | **Title** | **Author & Year** | **Content** | **Inference** |
| **1.** | Fish Shoals Behavior Detection based on Convolutional Neural N/W and Spatiotemporal Information | Fangfang Han, Junchao zhu, Bin Liu, 2020 | Fish behaviour Deep learning Spatiotemporal information CNN | A simple convolutional neural network is constructed to quickly identify the behavior state of fish shoals. Some pressure environments are made in laboratory, the behavior states of fish shoals are recorded, and the sample database of shoals' behavior state is established. |
| **2.** | Underwater Fish Detection | Aditya Agarwal, Gaurav Rawal, Tushar Malani, Prof.Manonmani S,2020 | Mask RCNN CV Image processing ResNet | They are utilizing convolutional neural systems to order the fishes. Following the preprocessing step, the Faster Regional Convolutional Neural Network design is utilized to remove the highlights of pictures. |

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|---|---|---|---|---|
| **3.** | Detection, Localization and Classification of Fish and Fish Species in Poor Conditions using CNN | Jesper Haahr Christen, Roberto Galeazzi,2019 | Object detection Fish detection Deep learning CNN | A Deep CNN OFDNet is introduced. The task of fish detection, localization and classification is carried out using visual data obtained from cameras |
| **4.** | Fish Detection and Tracking in Pisciculture Environment using Deep Instance Segmentation | C.S.Arvind, R.Prajwal, Prithvi Narayana Bhat, A.Sreedevi, K.N. Prabhudeva ,2019 | Pisciculture Mask-RCNN RP N/W FP N/W UAV | In this research paper, a deep instance segmentation algorithm called Mask R-CNN along with GOTURN tracking algorithm is employed for real time fish detection and tracking. |
| **5.** | A Fish Classification on Images using Transfer Learning and Matlab | Suryadiputra Liawatimena, Yaya Heryadi, Lukas,2018 | Image classify Machine Marine classify | This paper proposed a fish classification on fish images using transfer learning and Matlab as the first stage of tackling the problem FishNet is a modification from AlexNet to classify 3 types of fishes. |
| **6.** | Realtime classification of fish in underwater sonar videos | Ludwig Bothmann, Michael Windmann, GoeranKauermann,2016 | Sonar Videos Video tracking | This paper focuses on automatic fish classification based on sonar videos. After preprocessing the videos, it shows how can we classify fishes based on shape and movement. |

**Proposed Model:**

In the Proposed method the camera is interfaced to the raspberry pi to capture the images.The captured images are used as input datasets which is then processed using deep learning RCNN algorithm by Open CV tool. The input datasets are pre-processed which contains background removal and resizing of the images. Then the input datasets are trained and tested. The datasets acquired are grayscale images. Then by using the RCNN algorithm the input datasets are processed and the fishes in the datasets are recognized and detected. The detected results are then stored in IoT cloud which can be used further.

**Raspberry pi:**

The Raspberry Pi board contains a processor and graphics chip, program memory (RAM) and various interfaces and connectors for external devices. Some of these devices are essential, others are optional. RPi operates in the same way as a

Standard PC,requiring a keyboard for command entry, a display unit and a power supply. It also requires 'mass-storage', but a hard disk drive of the type found in a typical PC is not really in keeping with the miniature size of RPi. Instead, we will use an SD Flash memory card normally used in digital cameras, configured in such a way to 'look like' a hard drive to RPi's processor. RPi will 'boot' (load the Operating System into RAM) from this card in the same way as a PC 'boots up' into Windows from its hard disk.

**Pi cam:**

The Pi camera module is a portable light weight camera that supports Raspberry Pi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects. It is commonly used in surveillance drones since the payload of camera is very less. Apart from these modules Pi can also use normal USB webcams that are used along with computer.

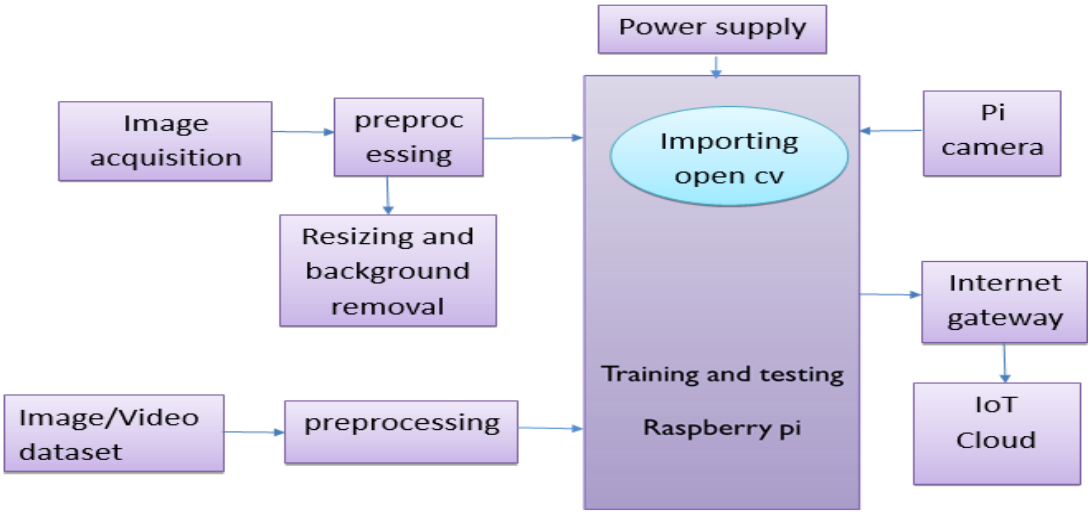


**Fig.1 Block diagram of proposed system**

**Block diagram Description:**

The raspberry pi is interfaced with camera which is used to capture the images. The captured images are used as input datasets. The actual images are fed into the training network, this training network involves resizing, background removal. The R-CNN algorithm is used to detect the fishes in the given datasets. By keeping open cv as a tool in python the first step is building the datasets, then training the datasets and the construction of R-CNN model for the detection of fishes and to display the desired outputs. The plot between training loss and test loss is displayed. The plot between loss and accuracy is displayed. The processed datasets and labelled outputs are stored in IoT Cloud using internet gateway.

**RCNN Algorithm:**

Instead of working on enormous number of regions, this RCNN algorithm proposes a number of boxes in the image and tests if any of these boxes contain any object. This algorithm uses selective search to extract boxes from the images. These boxes are can also be called as regions. The primary step in this algorithm is to build the fish detection dataset using selective search. The next step is to fine tune classification model on dataset. During inference run selective search on the input image dataset. The next step is to make predictions on each proposal using fine-tuned model. The final step is to return the final fish detection results.

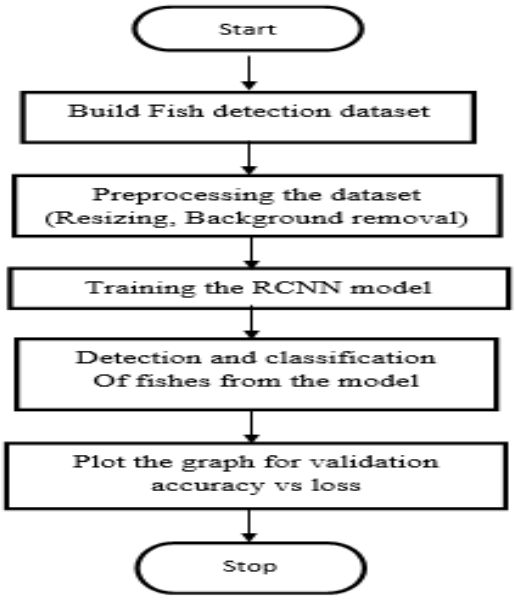


**Fig.2 Flowchart of the algorithm**

## OUTPUTS:

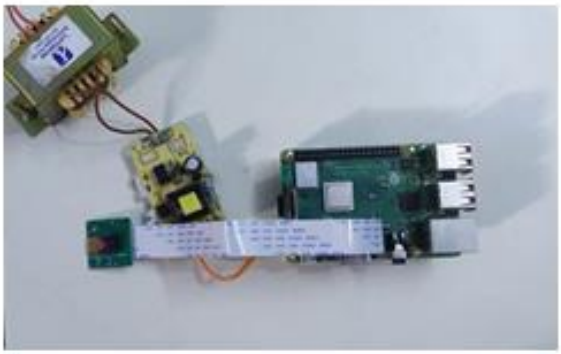

**Fig.3** Hardware Implementation

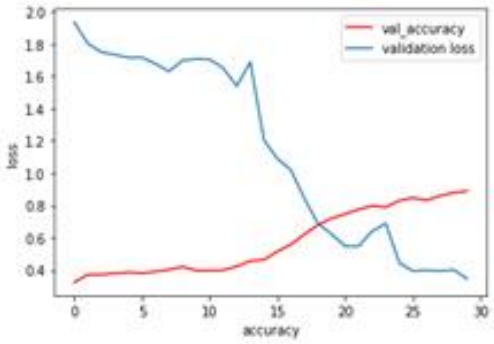


**Fig.4** Accuracy vs loss plot

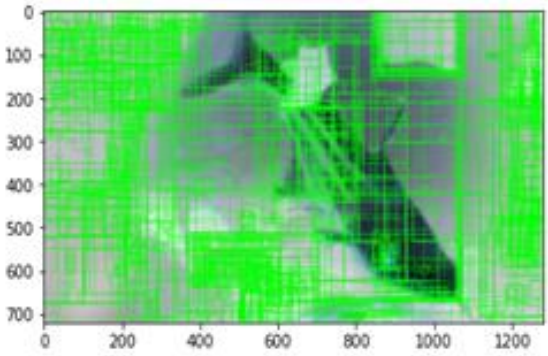

**Fig.5** Region Selection

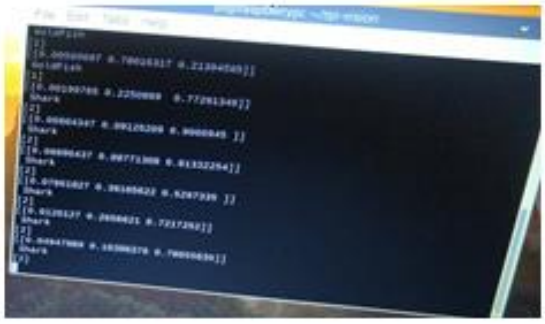

**Fig.6** Fish recognition results

**Fig 7**. Datasets of the fishes

**Fig 8**. Datasets stored in IoT Cloud

**Advantages:**

- High accuracy of fish detection
- Less human intervention

**Disadvantages:**

The main disadvantage of this project is the camera which can't be implemented in underwater due to high cost of panoramic camera.

**Conclusion:**

Thus the obtained datasets were preprocessed .By using deep learning and Open CV as tool to detect the fishes in the datsets were detected and the accuracy was displayed .The type of fishes were displayed.The regions of the fishes were displayed in the image dataset. The datasets were then stored in the iot cloud .85% of accuracy was achieved by this algorithm. This fish recognition and detection can be used to detect the fishes, recognise the species in the water and also for commercial purposes.Being implemented in real time it can be enhanced by use of high end undewater cameras to get more accuracy in the output.

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