

Underwater Fish Species Classification Using Alexnet

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Abstract- There has been a constant need for the classification of fish species for a better understanding of the underwater ecological balance. Identifying the characteristics of different fish species plays a significant role in knowing the insights of marine ecology and is a great deal to many fisheries and industries. Manually classifying fish species is time-consuming and requires high sampling efforts. The behaviour of fishes can be well understood using an automated system that accurately classifies various fish species effectively. The classification of underwater images has difficulties like background noise interruption, image disruption, lower quality of images, occlusion. The proposed model lights up on the assortment of fish species using Alexnet. The knowledge of the previously trained model is given to the alexnet for improving the system. The performance of our improved model is demonstrated with real-world data from a research organization called Kaggle. CNN has used several layers trained for precise identification of the distinct features of a species and classify them accordingly. This paper ensures increased accuracy than the existing systems.

Keywords- Convolutional Neural Networks, Alexnet.

I. Introduction

Identifying the characteristics of different fish species plays a significant role in knowing the insights of marine ecology and is a great deal to many fisheries and industries. Fish populations are strongly influenced by various environmental factors such as global warming, overfishing, exploitation of marine resources, and the impact of marine life on pollution and climate change. Classifying fish species using manual methods is time-consuming and requires high sampling efforts. The study and behaviour of fishes can be well understood using an automated system that accurately classifies various fish species effectively. Although there have been many advances in the existing system for fish classification, there is no significant breakthrough in recognizing the species under various underwater challenges such as distortion, colour shifting, noise, segmentation error, and occlusion. Fish categorization methods based on underwater videos and photos are becoming more popular in recent years due to their low cost and high-quality results. In-depth reading algorithms are used in processing and analyzing the obtained data.

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CNN necessitates the accessibility of large datasets, as well as their correctness. The extent and standard of training have an impact on the models using CNN. The utilisation of transfer learning helps in minimising these drawbacks. The proposed model uses a transfer learning approach to classify different types of fishes based on their colours and patterns. Input data is processed to remove any unwanted noise and then the digital image is partitioned into sets of pixels with common properties. We may complete the feature detection from local areas using CNN, and then merge all of the feature detection from the spatial neighbourhood to create the picture. Alexnet is described in the pre-trained model to improve reliability. The goal of this study is to use AlexNet, a transfer learning method for better classification of underwater fish species using real-world datasets gathered by a research organisation called the “Kaggle”.

2. Related Work

PeiqinZhuang et al [1] proposed an automated system using wildfish++ and CNN to achieve Fine-Grained Recognition with Comparison Texts, Open-Set Classification, Cross-Modal Retrieval, and Automatic Fish Classification. Wildfish++ is a Comprehensive Fish Benchmark for Multimedia Research. The datasets used for the training are taken from fish4knowledge. Knausgård et al [2] proposed an automated system wherein to detect the temperate fishes individually irrespective of their sex and species YOLO (You Only Look Once) algorithm is used. For classifying the fishes according to their species CNN and Squeeze-and-excitation (SE) model have been used. Transfer learning has been used to improve the accuracy of the model.

SnigdhaaHasija et al [3] proposed a model to classify underwater fish species based on their colour patterns and colour-based features that are so prominent. However, colour features are sometimes distorted in underwater images, but the shape and texture are more likely to be stable. So these features have been exploited for the assortment of the target species.

S.O.Ogunlana et al [4] proposed a model for fish classification using Support Vector Machine(SVM) based on the bodily features of the fish species. This new technique overcame many limitations and proved to give more accuracy than the existing systems. Bhanumathi et al [5] proposed a model for the detection of heart diseases using Convolutional Neural Networks with the combination of the random-tree algorithm. 12 parameters were considered for the prediction of heart diseases. SaiRamesh et al [6] proposed the techniques for classifying the fishes from underwater images. The segmentation plays an important role in enhance the classifying accuracy.

3. Proposed System

This section goes through the approaches utilised to design the proposed system in great depth. The proposed technique is appropriate for carrying out this research since it supports transfer learning. The model that has been pre-trained can be utilised to improve a broad generalisation regarding a different task. Mcrypt language, which is based on C programming, was employed to carry out this research. The image identification challenge is performed using Matlab, which is a multi-programming

paradigm and numeric evaluating environment developed by MathWorks. Alexnet is used to classify fish images. This is the favoured method as bigger models can be trained easily and also it reduces the amount of time spent training. The steps required to complete the investigation are outlined in Figure 1. The examination of requirements is the first step. The literature review is used to examine the constraints of previous work at this stage. The goal of the system is to improve the accuracy of fish species classification using transfer learning via Alexnet.

The existing database will then be preprocessed. When data is collected from several sources, the process is usually messy. Images of various fish species are being collected at this time. Each pixel in an 8-bit grayscale has a range of 0 to 255. The pixel colour is represented by the RGB colour scheme which is a combination of red, green, and blue. Each colour ranges from 0 to 255. This RGB colour generator explains how RGB can create any colour. The image was originally trained on 227x227 images in this project.

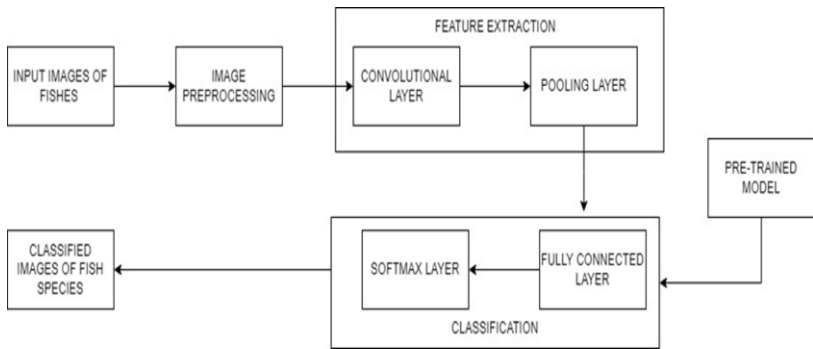


Figure 1. The implementation of the current model is as shown.

Cleaning, standardization, and data augmentation are all steps in the cleaning process which is necessary before feeding the data into a neural network model. Data augmentation is a general pre-processing strategy that necessitates the building of a current database of disturbed copies of existing images. This function is used to boost the data set and neural disclosure network's performance across a wide variety of visual changes. As a result, the visual detection model can be used in every context and in any form. The data is separated into two categories: training data and test data. A total of 400 photographs from three different fish species were used in this investigation. Distribution of the database is depicted in Table 1.

Table 1: Fish Species Data Distribution

Species Name	No of Species
Dasyatiscentroura	136
EpinephelusCaninus	132
Tetrapterus Belone	132

After the dataset has been pre-processed, the CNN is utilized to pre-train the model. The pre-trained model is implemented using MatLab. Then the developed system is trained using AlexNet. AlexNet is a well-known strong strategy in computer vision since it is economical and increases the accuracy of the system. Transfer learning retains the knowledge of the already trained model which is not feasible in other machine learning techniques. So the time required to train the model is fast and gives precise outcomes. Here we do not train all the layers of the model instead we train only the lower layers using weights of the trained model and freeze the remaining layers. This process is done indefinitely to improve the model. The achieved target output is displayed on MatLab stating the name of the species that has been classified.

4. Functional Requirement

4.1. Data Collection

The required data have been collected and analysed. Here, the relevant data has been collected each of a specific size 227×227 , from the Kaggle dataset which uses the following species: *DasyatisCentroura*, *EpinephelusCaninus* and *Tetrapturus Belone*.

4.2. Data Visualisation

The requirement of the visualisation process is to provide better interpretation and also to improve understanding. Visualisation can be done by various means such as in graphs, diagrams, slides, etc. Here we represent using the graph, which displays the accuracy comparison between CNN and AlexNet models which we have used.

4.3. Data Preprocessing

The raw data acquired for the training is converted to an useful and efficient format that is understandable by the machine learning models. For data preprocessing the data will be normalised and categorical features are converted into numerical form by data encoding method.

4.4. Dataset Splitting

After the dataset has been preprocessed, it will be split into 2 sets namely the training and testing data sets. Training data is modeled into a form where it fits into the algorithm. Whereas, the testing data is used to compare the outcomes of the training data with the expected data.

4.5. Model Training

After preprocessing and data splitting methods are successful, a deep learning model ie. CNN & the AlexNet are applied respectively to the training data and thus we get our trained models.

4.6. Model Evaluation

We compare the obtained trained model with the testing data set and determine the accuracy of the respective models and hence the comparison is done.

5. Results and Discussion

In every phase of the system, the current database was partitioned into training and testing sets of data. After analyzing the results, it was discovered that the fish species classification using convolutional neural networks had an accuracy of 86 percent, while the proposed model obtained accuracy of 90 percent, which is greater compared to CNN. As a result, AlexNet has proven to be more accurate than CNN in classifying fish species. Figure 2 shows the contrast between CNN and Alexnet.

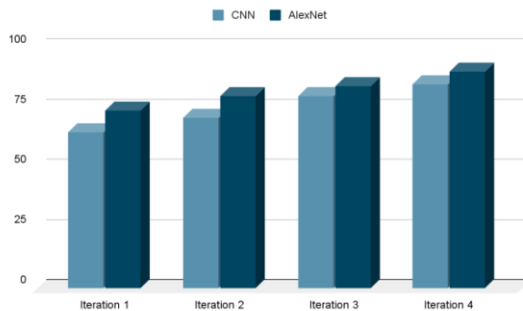


Figure 2. Graph showing the comparison between CNN and AlexNet.

6. Conclusion and Future Work

The need for fish species classification is growing rapidly in various areas. In comparison to existing systems, the proposed model attempts to improve fish species categorization accuracy. AlexNet is employed to classify the fish species. In future, the following work will include: advanced approaches may be applied to improve accuracy, and this proposed model can be improved to identify various fish diseases, Scuba divers can use it to explore the underwater world and be aware of various underwater dangers, Species with a higher number of photos for each species are necessary to improve model validation.

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