Fish recognition using deep convolutional neural network and data augmentation

An Exploration of Complexity

Ziqiang Zheng
Ocean University of China
zhengziqiang1@gmail.com

Abstract

Nowadays, as a sub topic of computer vision and fishery industry, fish recognition is still a challenging work not only because of various kinds of fish, but also because of the complex background of images. In this paper, we aim to classify different fish images obtained from cameras of fishing vessels. Fish detection is different with the best known and the most well-investigated object detection - face detection. Fish has more different shapes than human faces. And fish always take only a small part of the whole image. For these two reasons, it's a challenge for us to detect and classify the fish. Our work is done with Kaggle dataset. The Kaggle dataset aims to detect and classify the species of fish. The competition provides a train dataset which contains six species of tuna fish, fish but not tuna and no fish. Eight target categories are available in the dataset. The dataset is critically imbalanced, the Albacore tuna has thousands of images while the Opah has only sixty images. In order to overcome these problems we introduced two methods to improve our accuracy for the fish classification. Our approach can avoid over-fitting caused by the imbalance of training dataset. We employ the AlexNet, GoogLeNet, Caffenet and VGGNet neural network for the classification. As a result of the small dataset, the VGGNet architecture performs worse than AlexNet. We propose a local region based the fish area modeling approach so that the local feature can be modeled. In order to obtain more image information and realize imbalanced datasets classification, we have done some data augmentation. In order to get better performance, we also have done some image preprocessing, and it really works.

Introduction

In this paper, we will introduce two methods to improve the classification accuracy. Our methods can be described with the Fig. **??**. We have done some data preprocessing before training our model. First we make a mask in the fish region and make the fish region black, which we regard as the NoF fish images. Then we use some methods to achieve data augmentation. At last we use the convolutional neural network(CNN) as the classifier. The first method is based on data augmentation. In consideration of the imbalance of the dataset, we got some new images by rotating the selected images. Through this method, we can increase the number of some species of fish images, which can help avoid that our model is over-fitted with some categories of fish images, and rotating the fish images can improve the robustness of detection and achieve sophisticated detection. We increased the size of our datasets in this way and the validation accuracy increased two percent.

Main Objectives

1. First we make a mask of the fish region.
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3. Praesent tortor libero, vulputate quis elementum a, iaculis.
4. Phasellus a quam mauris, non varius mauris. Fusce tristique, enim tempor varius porta, elit purus commodo velit, pretium mattis ligula nisl nec ante.
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7. Nullam at mi nisl. Vestibulum est purus, ultricies cursus volutpat sit amet, vestibulum eu.
8. Praesent tortor libero, vulputate quis elementum a, iaculis.

Methods

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Results

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Database	Model	Accuracy
full+rotating	alexnet	0.9673
full+rotating	googlenet	0.964
full+rotating	vgg16	0.45

Table 1: The validation accuracy in Kaggle database

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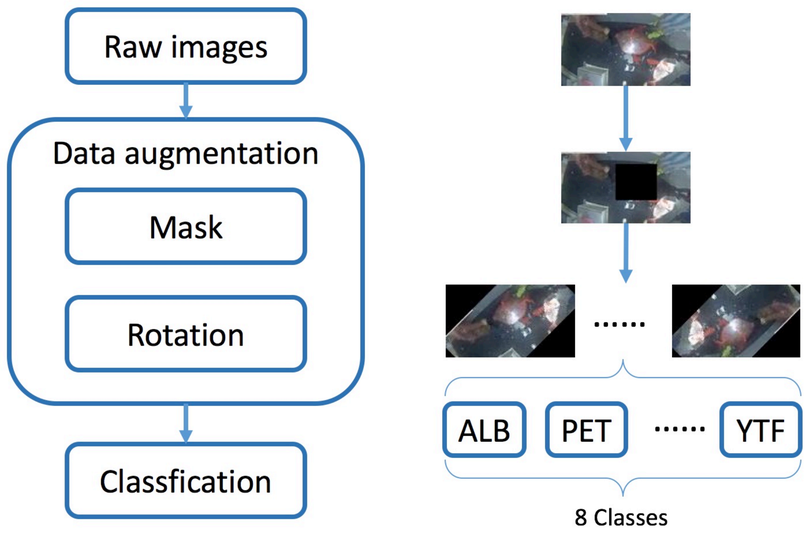

Figure 1: First we make a mask in the fish region, then we rotate the processed images at different angles and get some new different images. After the data augmentation, at last we use the CNN to fish the fish classification.

In hac habitasse platea dictumst. Etiam placerat, risus ac. Adipiscing lectus in magna blandit:

Method	Model	Test loss
None	Caffenet	1.92
None	GoogleNet	2.56
Rotating	Caffenet	1.77
Rotating	GoogleNet	1.93
Mask	Caffenet	1.87
Mask	GoogleNet	2.25
Rotating + Mask	Caffenet	1.71
Rotating + Mask	GoogleNet	1.85

Table 2: The test loss in the Kaggle competition

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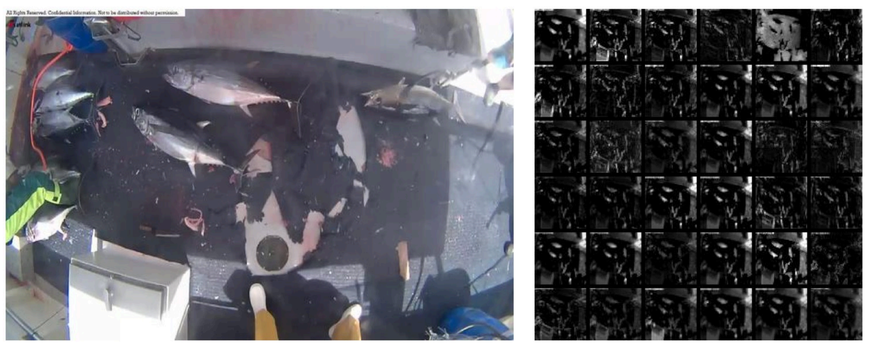

Figure 2: There are 36 pooling images in the final pooling image. Considering that the size of the pooling images and the number of them, we make them smaller by resizing the images and merge them into one image. By comparing the two images, The region of fish are brighter than other regions in the most of the pooling images, which can prove that the fish has more influence on the classification than other regions.

Conclusions

- The two methods we have used improved the deep neural networks to detect the fish more efficiently.
- The image processing methods such as rotating and making mask can also work to get the better performance.
- Data augmentation methods can solve the imbalance of the dataset well and it can also improve the accuracy of our model..