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Rice QA using Deep Learning

Aesha Ganatra[1], Aakash Jadhav[2]

[1]Computer Engineering, Madhuben and Bhanubhai Patel Women Institute of Technology, Gujarat, India
[2]Computer Science and Engineering, MGM's Jawaharlal Nehru Engineering College, Maharashtra, India

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Abstract - We predict Rice-Paddy quality by extracting knowledge from custom trained model using Deep Learning. In this paper, we scrape and parse Rice-paddy quality checking system to overcome various faults in traditional methods of quality analysis. We compare their qualities in purity format as ratings. Few grams of Rice-paddy chosen at random from a sack, is placed in front of a camera which recognizes quality of rice for price categorization.

1. INTRODUCTION

Industrial Factories converts Rice-paddy into actual Rice but checks Paddy quality using Traditional methods (Hand-held). This method cannot judge the right quality analysis. We can predict it using Deep Learning. We build a model using Google's Tensorflow Object Detection API[5] to determine Rice-Paddy rating based on various classifications. In building our model, we use custom tensorflow model which gives output as custom classifiers are Pure, Impure and Partial Impure. The fresh rating is given to the Pure with highest rating and a threshold of 80% have lowest ratings. Rice Mills can classify rice-paddy into different qualities depending on their need to avoid faults.

1. RELATED WORK

Several challenges has occurred while creating the dataset of rice-paddy, we tackled it by using meaningful information from an image. Literature Survey has given a knowledge of making own dataset of rice-paddy at industrial level. Our approach is to give efficient way of classification task for predictive analysis which attempts to get collective score for recommendation of rice-paddy. This image classification network could be promising framework for detecting specific feature that differentiate image from each other. We classified our dataset using new convolutional neural network called as Pascal VOC[1]. The bounding box is a rectangle drawn on the image which tightly fits the object in the image. A bounding box exists for every instance of every object in the image. For the box, 4 numbers (center x, center y, width, height) are predicted. This can be trained using a distance measure between predicted and ground truth bounding box.

2. CLASSIFICATION AND REGRESSION

The bounding box is predicted using regression and the class within the bounding box is predicted using classification. The overview of the architecture is shown in the following figure.

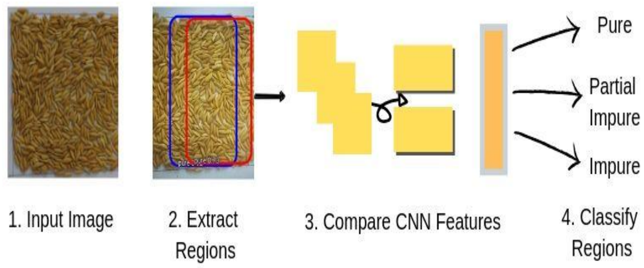

Fig -1: Architecture

3. METHOD

We have created our own dataset depending upon the literature survey. We gathered thousand of images for each classifier i.e. each object label. After creating dataset we have labeled our dataset using online tools for labelling an images. After labelling[5] an images, we have converted it into csv format because of tensorflow[3] requirements. CSV format is converted into tfrecord format(which is actual for training the dataset which includes feature points). Tfrecord[5] file are divided into two files as train.record and test.record. Train.record is a file which goes into tensorflow training purpose and test.record is required for evaluation purpose. After the completion of training, protocol buffer file is created by generating inference graph using python. This graph file can be implemented on android as well as web framework to design user interface where a camera is used to detect the object from trained tensorflow model.

4. APPROACH

The network used in this project is based on Single shot detection (SSD).The SSD normally starts with a VGG [6] model, which is converted to a fully convolutional network. Then we attach some extra convolutional layers, that help to handle bigger objects. The output at the VGG network is a 38x38 feature map (conv4 3). The added layers produce 19x19, 10x10, 5x5, 3x3, 1x1 feature maps. All these feature maps are used for predicting bounding boxes at various scales (later layers responsible for larger objects) as shown in following figure.

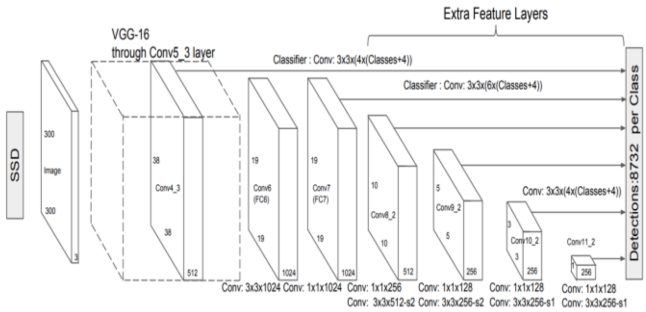

Fig -2: SSD Architecture

5. ALGORITHM AND IMAGE ANNOTATION

The PASCAL VOC[1] (pattern analysis, statistical modelling and computational learning visual object classes) provides standardized image data sets for object class recognition and provides a common set of tools for accessing the data sets and annotations. Our PASCAL VOC dataset includes 3 classes and has a challenge based on this dataset. The PASCAL VOC dataset is of good quality and well-marked, and enables evaluation and comparison of different methods. And because the amount of data of the PASCAL VOC dataset is small, compared to the imagenet dataset, very suitable for researchers to test network programs. Our dataset is also created based on the PASCAL VOC[1] dataset standard as shown in following figure.

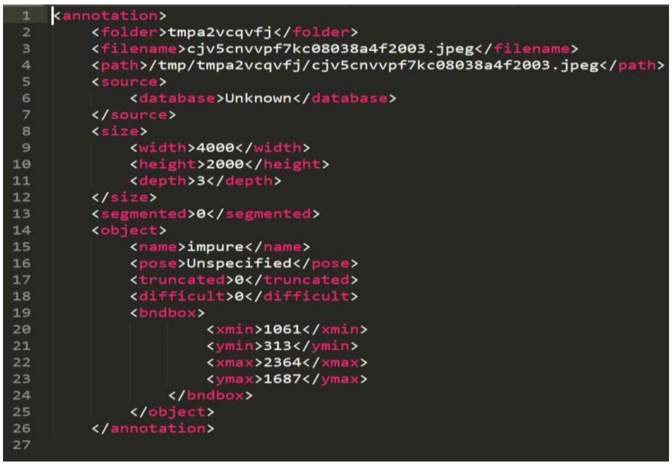

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Fig -3: Image Annotation

Faster-RCNN is one of the most well known object detection neural networks. It is also the basis for many derived networks for segmentation, 3D object detection, fusion of LIDAR point cloud with image, etc. An intuitive deep understanding of how Faster-RCNN works can be very useful[2].

The speed for Fast R-CNN training stage is 9 times faster and the speed for test is 213 times faster. The speed for Fast R-CNN training stage is 3 times faster than SPP-net and the speed for test is 10 times faster, the accuracy rate also have a certain increase

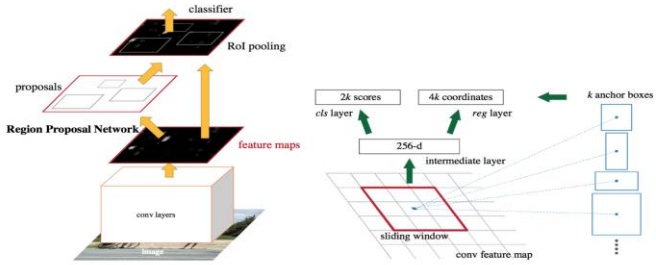

Fig -4: Faster RCNN

6. RESULT AND DISCUSSION

After training the images, the number and quality of the dataset will affect the accuracy of the neural network output, and the choice of neural network or the network architecture[2] will also affect the accuracy. Deep learning approaches[4] are increasing in their popularity every day.

Deep learning provides fast and effective solutions especially in the analysis of big data.

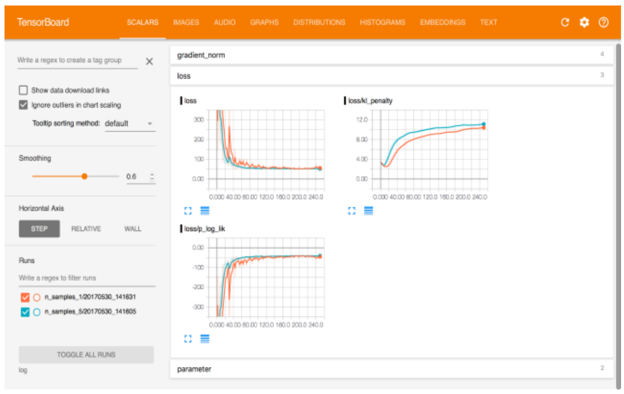

Fig -4: Tensorboard

In this study, a classification task was carried out on the custom data set which we used in deep learning applications. Tensorflow was used for this purpose.

Fig -5: Results

Rice mill factories can use this system to check their quality rice product.

7. CONCLUSION

An accurate and efficient object detection system has been developed which achieves comparable metrics with the existing state-of-the-art system. This project uses recent techniques in the field of computer vision and deep learning to detect Rice-paddy for industrial purpose. Custom dataset was created and the evaluation was consistent. This can be used in real-time applications which require object detection for pre-processing in their pipeline. An important scope would be to train the system on a video sequence for usage in tracking applications. Addition of a temporally consistent network would enable smooth detection and more optimal than per-frame detection.

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https://github.com/aeshaganatra/RiceTensorflow