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Transfer Learning-Based Object Detection by Using Faster Region Based Convolution Neural Networks

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ABSTRACT: Object detection has become an important task for various purposes in our daily lives. Machine learning techniques have been used for this task from earlier but they are used for the classification of image based species to extract the feature set. This task of deciding the feature set helps to decide the desired object detection. To overcome the object classification problem, this paper proposes a transfer learning-based deep learning method. The different convolution neural networks (CNN) are studied in this work. Here for the improvement in the result, the majority voting scheme is used. The overall work is carried out on the CUB 200-2011 dataset. The results obtained have shown incredible improvement in the accuracy of the proposed work when compared to the different CNN models.

KEYWORDS: CNN, RCNN, F-RCNN, RPN, CUB 200-2011.

I. INTRODUCTION

In this digital era, there is a tremendous growth in the area of artificial intelligence and machine learning. The aim of doing such experiments is to build machines that mimic the detection capability of humans. This growth has provided various options to the researchers. Also, the introduction of machine learning started using deep learning approaches to provide a big field for research. The fields like artificial intelligence, speech recognition, face recognition, object detection are the various areas of the applications of deep learning [1]. The convolution neural network has been widely used for object detection work. The pre-processing tasks needed to perform very much lower as compared to other classification algorithms. Object detection is used in various fields, especially for face recognition. Here in the proposed work, various types of birds are classified. CNN is used for the classification task. The detection of object has become a crucial topic nowadays of managing various activities such as anomaly control, congestion control and bandwidth control.

This object detection helps in controlling and using the computer network optimally [1]. This task also used for planning the computer network and managing the system. The various data centers use this detection to build a stronger and efficient computer network. Previously various algorithms have been designed for the proper object detection. The techniques like ARIMA and RNN were applied earlier. But this all algorithms did not perform as per expectations. So, to get fine results as compared to earlier algorithms we designed the LSTM framework. The error found in earlier algorithms can be decreased by our presented work.

II. LITERATURE WORK

Existing Work: The authors have worked with the CNN model for object detection. Here they have worked on the fine granularity for detection of objects. They have developed a model to detect almost 200 types of objects (birds). The dataset used by them is the CUB-200-2011. The results have shown that they achieved a higher mean average precision of up to 71.5%. [3]

The authors in this paper have used the region based on CNN. Here they have used a faster CNN method which works on the detection of based on the full image. The results have proved that the faster CNN works well as compared to other CNN models. [4]

Here the authors worked to improve the mostly used algorithms like YOLO and faster CNN. TO do this, they used two techniques that are separable convolution and the filter pruning. The results obtained have improved the results at a great extent. [5]

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The authors introduced a cascaded convolution neural network that does object detection. To do this, the authors have used airborne videos. The framework uses three deep levels CNN that does the object detection in a course to excellent manner. They have proved that their model achieves netter results. [6]

Here the authors worked on the detection of the areas where the snow has been seen. For this, they have used the CCTV cameras. Here the authors have used the CNN with the transfer learning model. The CCTV footage was taken from the japan website, which is publically available. They have achieved an average sensitivity of 80.90% and the snow detection specificity of 98.54%. [7]

Here the authors proposed a model for object detection based on the CNN. They have used the transfer learning to provide the granularity to the system. They have used the image dataset of COCO. They have proved that the fine-tuned network is more effective. [8]

Here the Japanese comics (manga) are used for the evaluation. They evaluated the R-CNN and SSD for the evaluation of the manga objects. And the authors have shown that the fast RCNN works well for this object detection which detects the character face and the text. [9]

III. PROPOSED WORK

What else can we do to reduce the computation time a RCNN algorithm typically takes? Instead of running a CNN 2,000 times per image, we can run it just once per image and get all the regions of interest (regions containing some object).

▪ Ross Girshick, the author of RCNN, came up with this idea of running the CNN just once per image and then finding a way to share that computation across the 2,000 regions.

▪ In Fast RCNN, we feed the input image to the CNN, which in turn generates the convolution feature maps.

▪ Using these maps, the regions of proposals are extracted. We then use a RoI pooling layer to reshape all the proposed regions into a fixed size, so that it can be fed into a fully connected network.

▪ Faster RCNN is the modified version of Fast RCNN. The major difference between them is that Fast RCNN uses selective search for generating Regions of Interest, while Faster RCNN uses “Region Proposal Network”, aka RPN. RPN takes image feature maps as an input and generates a set of object proposals, each with an abjectness score as output.

Advantages of Proposed Solution

The proposed system overcomes the existing system problems and provides an efficient way to overcome the problems. Object analysis helps in the detection of anomaly as well this task is done with the help of the proposed method. The proposed system takes data set that is taken on basis of per 5 min, hourly and per day basis, this dataset helps us to take proper analysis of the given problem. Some more advantages seen in proposed system are stated below:

1) The proposed system overcomes the existing problems of previous algorithms like ARIMA and RNN.
2) The proposed system obtains the root mean square error as lowest from the previously applied techniques.
3) The system is able to get more efficient object detection.

IV. IMPLEMENTATION

The dataset used here in our experiment was the Caltech-UCSD Birds (CUB) 2000-2011 dataset which contains images. The details of this dataset are as follows: Category of Image = 20 32

- Total Images = 11,788
- Annotations per image = Part locations:15, Binary Attributes:312, Bounding Box: 1 Experiment: Here, the dataset is applied on the proposed F-RCNN model. This decreases the learning rate.
- The hardware used for the experiment consists of an Intel(R), CPU N3540 @2.16GHz, 64bit OS. The rescaling of images is done as the pre-trained F-RCNN works on a fixed-size image. The accuracy parameter is used to evaluate the proposed approach. The tabular form is used to present the numerical value obtained from the experiment.

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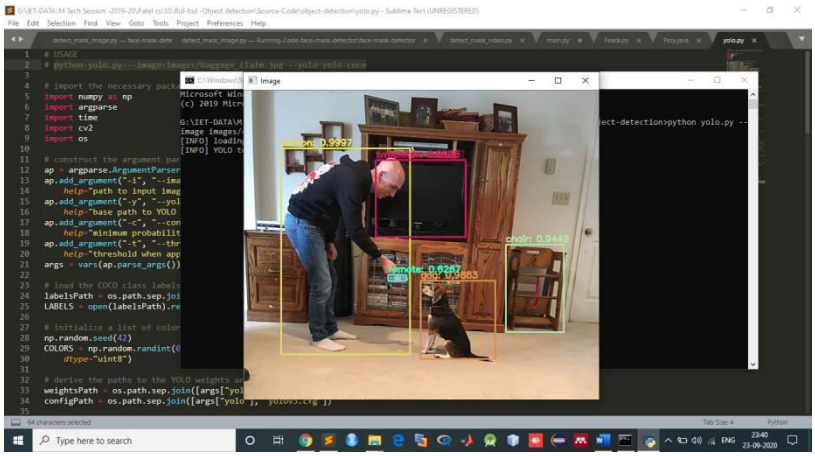

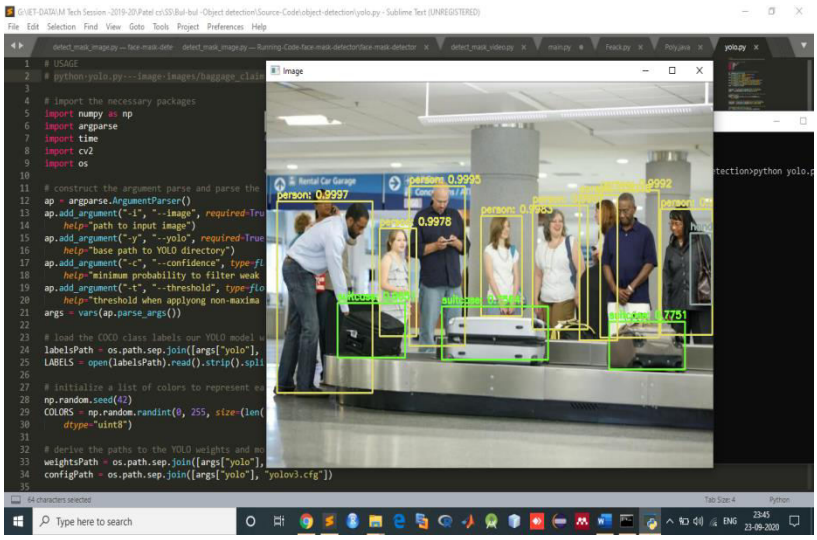

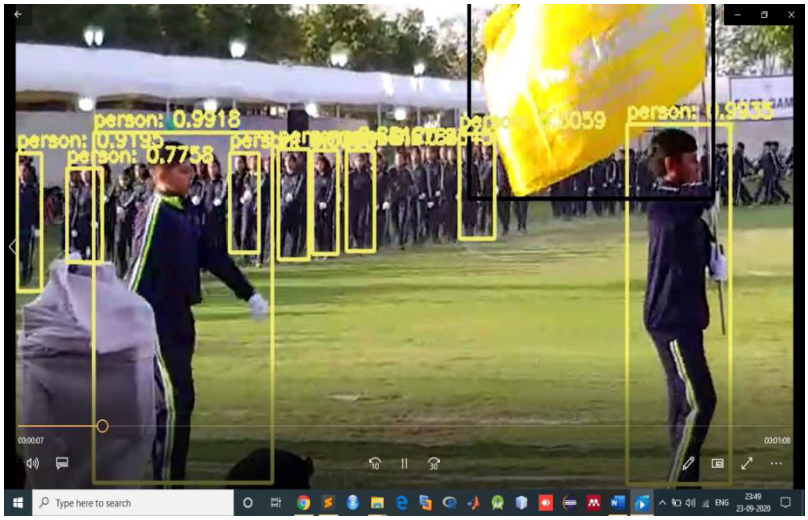

V. RESULTS

The performance and result analysis of the proposed system is done in this chapter. To do this we need some parameters on which we can make the analysis.

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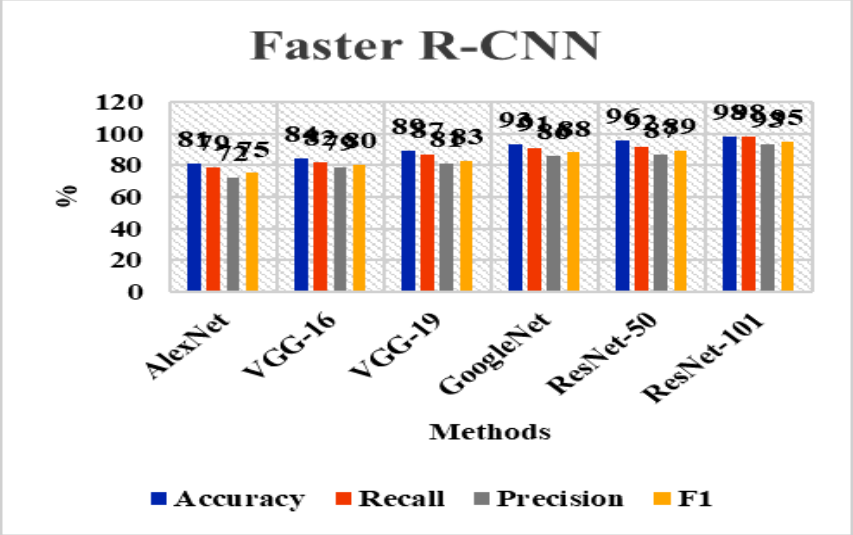

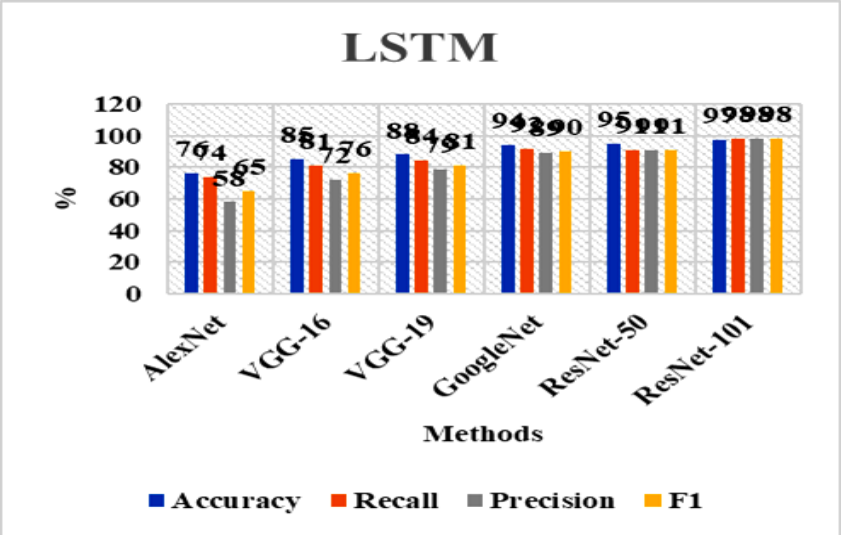

Giving an approach to improve the results is an easy task but when it comes to prove the results then it becomes a complicated task because we need to measure every step and at the same time, we need to compare it with the existing system. So, this chapter gives a detailed explanation of the result analysis done for the proposed work. And at the same time, it proves the effectiveness of the proposed method.

VI. CONCLUSION AND FUTURE WORK

The experimental results show that the proposed work performs well in comparison with the previous work like Arima and RNN. The LSTM based approach for the object detection worked well in terms of NRMSE. There is a remarkable decrement in the NRMSE of the system which results in the efficient object detection. The predicted values are up to a point. The special techniques applied to the proposed approach have improved the results at a great extent. The feature-based clustering used for the time series data provided a valuable role in improving the results.

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