ISSN 2278-9723
DOI:10.31838/ijccts/09.01.02

Research Article

Reliable Multiple Object Detection on Noisy Images by Using Yolov3

VASANTHI PONDURI[1*], LAAVANYA MOHAN[1]
[1]Department of Electronics and Communication Engineering, Vignan's Foundation for Science, Technology and Research, Vadlamudi, Guntur, Andhra Pradesh, 522213, India
*Corresponding Author
Email: vasanthi457@gmail.com
Received: 08.07.21, Revised: 10.08.21, Accepted: 15.09.21

ABSTRACT
Object detection achieved very good performance by using deep learning models but there is a problem with noisy images. Due to the presence of noise in images, it is difficult to detect the object accurately. The main objective is to detect multiple objects in noisy images by using YOLOV3 approach. Generally, the CNN and R-CNN family algorithms extract the feature maps by using convolution operation with the striding method and objects detected by using neural network. But YOLOV3 algorithm directly applied on entire image and predict the bounding boxes along with labels and scores. In this article, the input noisy images smoothened by using median filter then YOLOV3 performs detection operation on entire image. Hence, YOLOV3 detects the object faster as compared with the other deep learning algorithms.

Keywords: CNN, object detection, deep learning, YOLOV3, bounding box

Introduction

Object detection is exhaustive research area in computer vision. The function of object detection is, to detect the object in an image and to identify the location of the object in the image or video[1]. Object detection process achieved in two ways i.e. Two-step method and one-step method. R-CNN family(R-CNN, Fast R-CNN, Faster R-CNN) coming under the category of two-step method. In this two-step method, features are extracted by using sliding window technique and then classification is done by using convolutional neural network[2]. But where as in one-step method(YOLO, SSD) no need to extract selected regions from image. Instead that, it predicts class label, class score and bounding boxes of the entire image at one time and detects multiple objects in an image by using single neural network. This algorithm gives faster results compare with the remaining deep learning models[3]. YOLOV1, YOLOV2, YOLOV3, YOLOV4 and YOLOV5 coming under the category of YOLO.

YOLO model works by splitting the input image into grid cells. Where, each cell having a bounding box. YOLO model uses a ResNet architecture. In ResNet, network is learning from function of actual input (x). The main idea behind the Resnet is to make output is equal to the input[4]. The first layer of the YOLO algorithm, will have 32 filters with 3x3 size and get output 256x256. In second layer, 64 filters with size 3x3 and with stride 2, then get output size of 128x128. Finally at the last, it has Scale1, Scale2 and Scale3. That means YOLO algorithm gives output at three different scales. The different layers are layer 82, layer 94 and layer 106[5]. YOLO has 75 convolutional layers and 31 are other layers. YOLO has generally CNN, ReLU and maxpooling layer. Maxpooling layer used for reducing the size of the image[6].

Working Of Yolov3 Algorithm

The below figure shows the flow chart for multiple object detection on noisy images. Here the input image is the noisy image, this noise is removed and smoothened image by using median filter. Then CNN is applied on entire image to perform the transformations and convolution output is flattened by using fully connected layers. Score thresholding block used to get the score of the object and the score is showed on the object along with the label name. Non-maximum suppression(NMS) is a technique which is used to remove all bounding boxes which are having lowest accuracy[7]. Finally YOLOV3 performs the detection operation as follows.

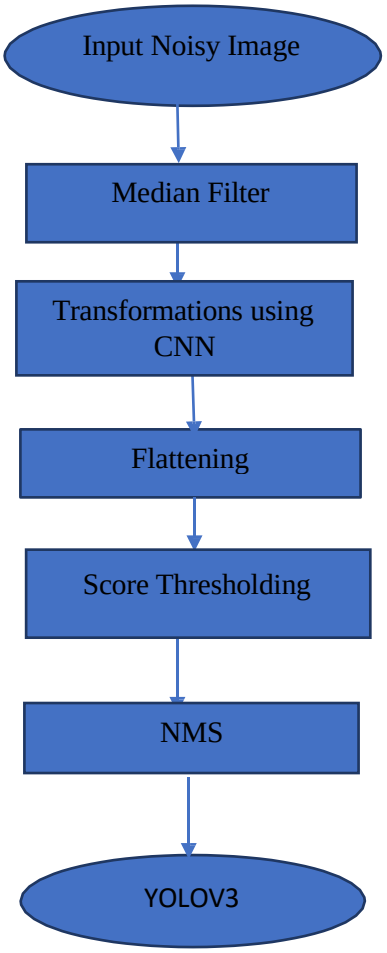


Fig.1: Flow chart for multiple object detection on noisy images using YOLOV3

To detect objects in an image, this approach using the pre-trained model weights. These weights are trained using darknet model on COCO dataset. COCO dataset has 80 classes. Download YOLOV3.weights and use weight reader class to read YOLOV3.weights. The 106 layers of the YOLOV3 trained by using YOLOV3.weights. Let us consider the height and width of the image is 416x416. then we have to draw the bounding box with parameters X_{min}, Y_{min}, X_{max}, Y_{max}. here, X_{min} and Y_{min} are the starting of the bounding box, Y_{min} and Y_{max} are the ending of the bounding box. Object ness variable is used to check the presence of object in the cell[8]. Get label is used to label the object and get score is used to identify the score probability of the object. It has two bounding boxes, those are actual and predicted bounding box. The intersection of union(IoU) is calculated by using the formula IOU=intersection/union. Then NMS(Non-maximum suppression) is an algorithm for cleaning up multiple bounding boxes which predicted for the same object. It can remove all bounding boxes with lower score and can get single bounding box , which has maximum accurate output[9].

Results and Discussions

The below figures give brief idea regarding object detection on noisy images. Here, figure 2 are noisy images which are smoothened by using median filter. The output of median filter is shown in figure3. Finally the smoothened images are detected by using YOLOV3 along with object score and lables which are shown in figure 4. YOLOV3 approach detected objects very fast which are aligned perfectly but YOLOV3 is unable to predict the mis-aligned objects in an image. In future work, we want to detect mis-aligned objects in an image by using YOLOV3 algorithm by adding of some modifications.

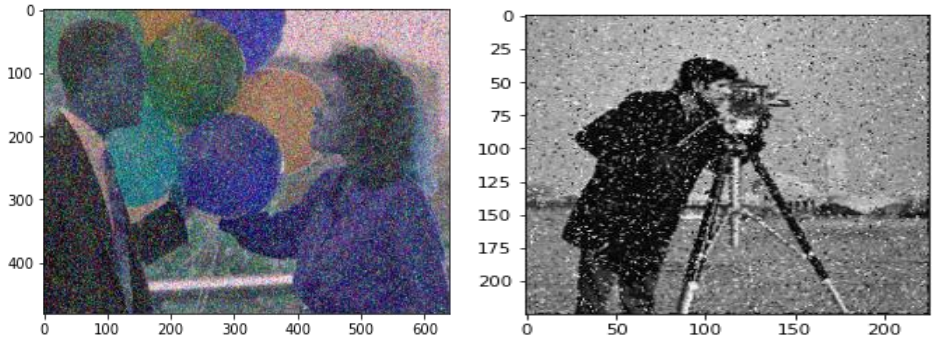


Fig.2: Noisy images

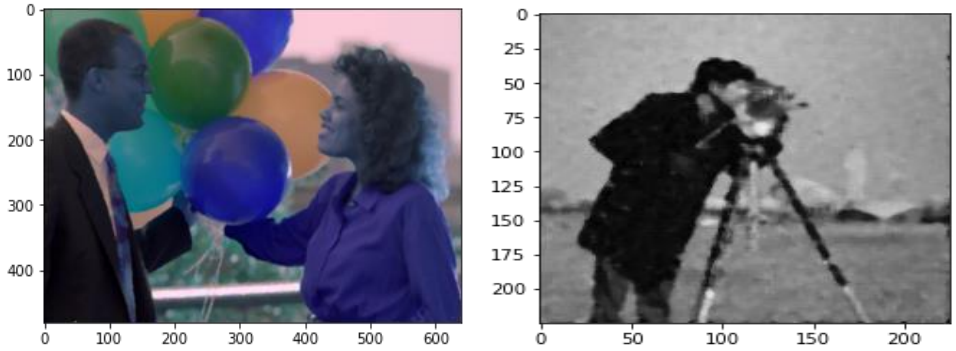
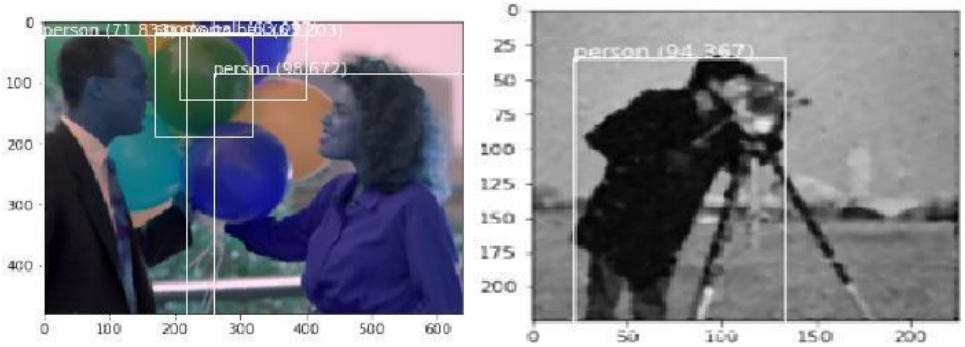


Fig.3: Smoothened images



sports ball 63.20256590843201 person 94.36735510826111
person 71.83326482772827
person 98.67169260978699
sports ball 63.09741735458374

Fig.4: Detected images along with labels and scores

Observations

Table: Multiple object detection results by using YOLOV3

S.NO	Images	Class Labels	Class Scores
1	Image1	sports ball	63.20256590843201
2		person	71.83326482772827
3		person	98.67169260978699
4		sports ball	63.09741735458374
5	Image2	person	94.36735510826111

Conclusion

In this article, we have applied median filter and proposed YOLOV3 algorithm on noisy images, for multiple object detection. Hence, input noisy images detected very accurately by using YOLOV3 with high confidence scores compared with the remaining deep learning models. Because of its advantages, YOLOV3 can be implemented in a variety of fields to resolve some real-life problems like security, monitoring traffic lanes.

References

1. Zhao, Z.Q., Zheng, P., Xu, S.T. and Wu, X., 2019. Object detection with deep learning: A review. IEEE transactions on neural networks and learning systems, 30(11), pp.3212-3232.
2. Sharma, K.U. and Thakur, N.V., 2017. A review and an approach for object detection in images. International Journal of Computational Vision and Robotics, 7(1-2), pp.196-237.
3. de Menezes, R.S.T., Magalhaes, R.M. and Maia, H., 2019. Object recognition using convolutional neural networks. In Recent Trends in Artificial Neural Networks-from Training to Prediction. Intech Open.
4. Yin, Y., Li, H. and Fu, W., 2020. Faster-YOLO: An accurate and faster object detection method. Digital Signal Processing, 102, p.102756.
5. Zhang, X., Wang, W., Zhao, Y. and Xie, H., 2020. An improved YOLOv3 model based on skipping connections and spatial pyramid pooling. Systems Science & Control Engineering, pp.1-8.
6. Hsu, W.Y. and Lin, W.Y., 2020. Ratio-and-scale-aware YOLO for pedestrian detection. IEEE transactions on image processing, 30, pp.934-947.
7. Padmanabula, S.S., Puvvada, R.C., Sistla, V. and Kolli, V.K.K., 2020. Object Detection Using Stacked YOLOv3. Ingénierie des Systèmes d Inf., 25(5), pp.691-697.
8. Masurekar, O., Jadhav, O., Kulkarni, P. and Patil, S., 2020. Real Time Object Detection Using YOLOv3. Student, Department of Computer Engineering, TEC, University of Mumbai, Mumbai, India.
9. Zhang, H., Qin, L., Li, J., Guo, Y., Zhou, Y., Zhang, J. and Xu, Z., 2020. Real-time detection method for small traffic signs based on Yolov3. IEEE Access, 8, pp.64145-64156.