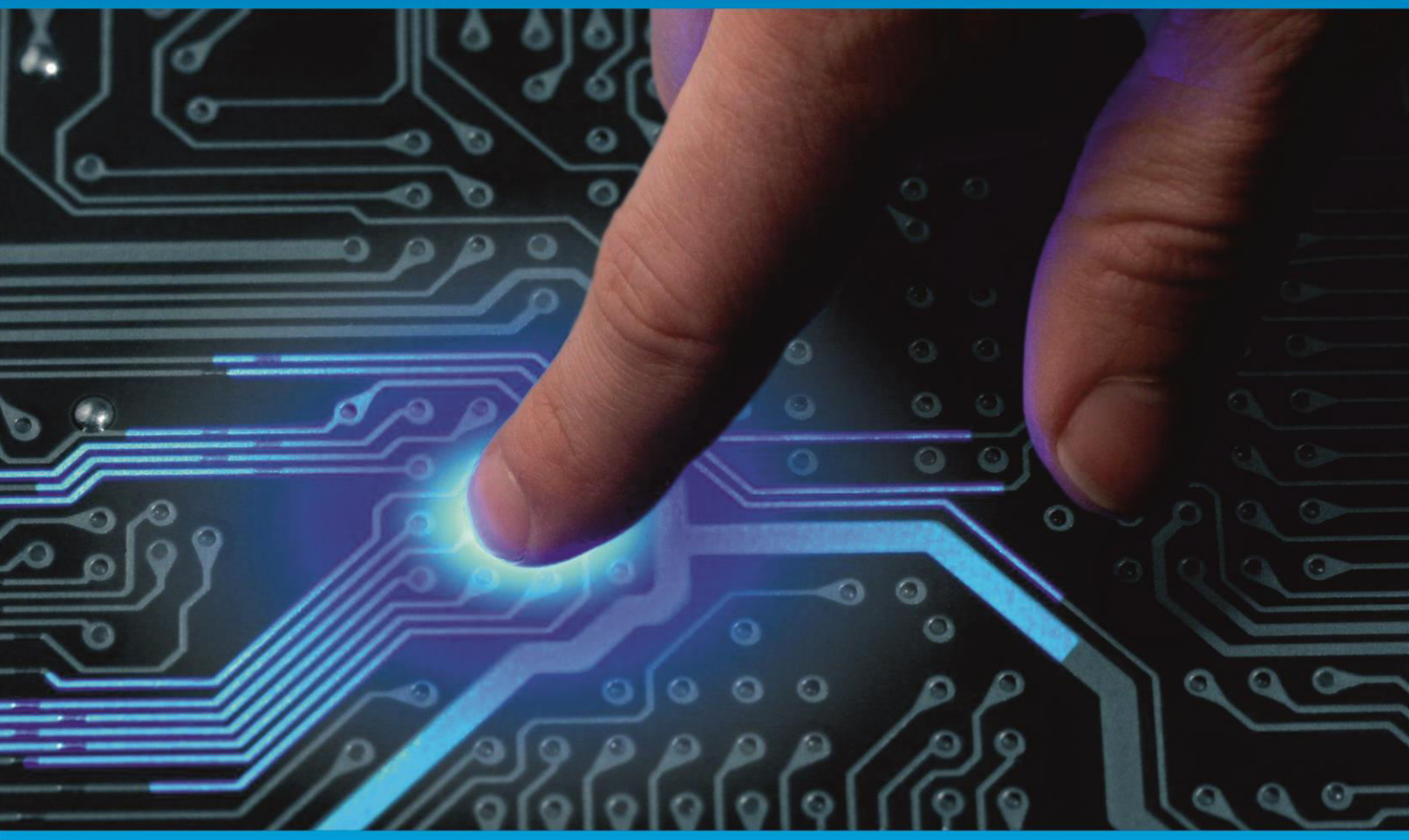
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 3, March 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.488

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 3, March 2021 ||

| DOI: 10.15680/IJIRCCE.2021. 0903101|

Object Detection in a Fraction of Second Using OPENCV

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ABSTRACT: Today the word automation is most common thing that we are using in the day to day life. In that way the object detection is the task of detecting instances of objects of a certain class within an image or with live video. Creating accurate Machine Learning Models which are capable of identifying and localizing multiple objects in a single image remained a core challenge in computer vision. But, with recent advancements in Deep Learning, Object Detection applications are easier to develop than ever before. It is the process of finding real-world object instances like car, bike, TV, flowers, and humans in still images or Videos. It is commonly used in applications such as image retrieval, security, surveillance, and advanced driver assistance systems (ADAS).

KEYWORDS: Artificial neural network (ANN), Deep Learning, Cancer

I. INTRODUCTION

Object Detection is a computer technology related to computer vision, image processing, and deep learning that deals with detecting instances of objects in images and videos. OpenCV is the huge open-source library for computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today's systems. By using it, one can process images and videos to identify objects, faces, or even the handwriting of a human.

This project focuses on detecting objects. And YOLO was trained to detect 20 different classes of objects (class means :: cat, car, person,….). For any grid cell, the model will output 20 conditional class probabilities, one for each class. While each grid cell gives us a choice between two bounding boxes, we only have one class probability vector.

II. LITERATURE REVIEW

Improving object detection with deep convolutional networks via Bayesian optimization and structured prediction

According to Y. Zhang, K. Sohn, R. Villegas, G. Pan, and H. Lee, Object detection systems based on the profoundly convolutional neural network (CNN) have recently made ground-breaking progress on many benchmarks for object detection. Although the characteristics learned from these high-capacity neural networks are egalitarian for categorization, a major source of detection error is still inaccurate localization. Built on high-capacity CNN architectures, we answer the position problem by 1) usinga Bayesian optimization search algorithm which sequentially proposes candidate regions for an object bounding box, and 2) training the CNN with a formal loss that specifically penalizes the inaccuracy of the position[1].

Subcategory-aware convolutional neural networks for object proposals and detection

According to P. Druzhkov and V. Kustikova, in methods of detection of artifacts based on CNN, area proposal becomes a bottleneck when artifacts show large variance in size, occlusion, or truncation. Moreover, these methods concentrate primarily on 2D object detection and cannot estimate accurate object properties. In this paper, we suggest subcategory-aware CNNs for the detection of objects. We implement a new area proposal network using subcategory

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information to direct the proposal generation process, and a new detection network for joint identification and classification of subcategories. We achieve state-of-the-art efficiency on both detection and pose estimation on widely used benchmarks by using subcategories related to object pose[2].

Low-complexity approximate convolutional neural networks

Following on from P. F. Felzenszwalb, D. McAllester, R. B. Girshick, and D. Ramanan, they think of the question of generic detection and localization Objects in static pictures, from categories such as people or vehicles. This is a bit of a difficult question since objects in these categories can differ considerably Semblance. Variations occur not only from shifts in the lighting and viewpoint but also because of non-rigid deformations and instability in intraclass Shape and other visual characteristics. People wear varying clothing, for example, and take a variety of poses as the cars come in various shapes and colors[3].

Object detection via a multi-region and semantic segmentation-aware cnn model

According to S. Gidaris and N. Komodakis, we propose a method for object detection that relies on a profoundly convolutional neural network (CNN) of multi-region that also encodes semantic segmentation-aware features. The resulting CNN-based representation attempts to capture a diverse collection of discriminative appearance variables and exhibits sensitivity to localization, which is important for the precise location of objects. By implementing it on an iterative localization system that alternates between scoring a box proposal and refining its position with a deep CNN regression model, we leverage the above- mentioned properties of our recognition module. Thanks to the efficient use of our modules, we are detecting objects with very high precision in localization[6].

III. OBJECT DETECTION

Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class (such as humans, buildings, or cars) in digital images and videos The object detection with YOLO Algorithm is done by calling few functions in OpenCV. Regarding the usage of OpenCV for object detection, it should be noted that the tutorial, example and documentation on YOLO DNNs written in python in OpenCV Documentaries and also other sources is fairly limited and few times are wasted on finding out how to use YOLO object detection using OpenCV.
Calling the functions from darknet itself is also not helpful especially using python since it doesn't have tutorials nor examples and documentaries on how to call the YOLO object detection's function. That is why the OpenCV is preferred rather than using and importing the darknet library directly.

a. Distance Estimation

There are limited sources of what is distance estimation is, but let's define it by firstly put definition on each word. What is the meaning of the word *distance* and what is the meaning of the word *estimation* ?
Distance is a numerical measurement of how far apart objects are.
Estimation is the process of finding an approximation, which is a value that is usable for some purpose even if input data may be incomplete, uncertain, or unstable.
By looking at both of these definitions, *distance estimation* roughly means the process of finding an approximation of distance.

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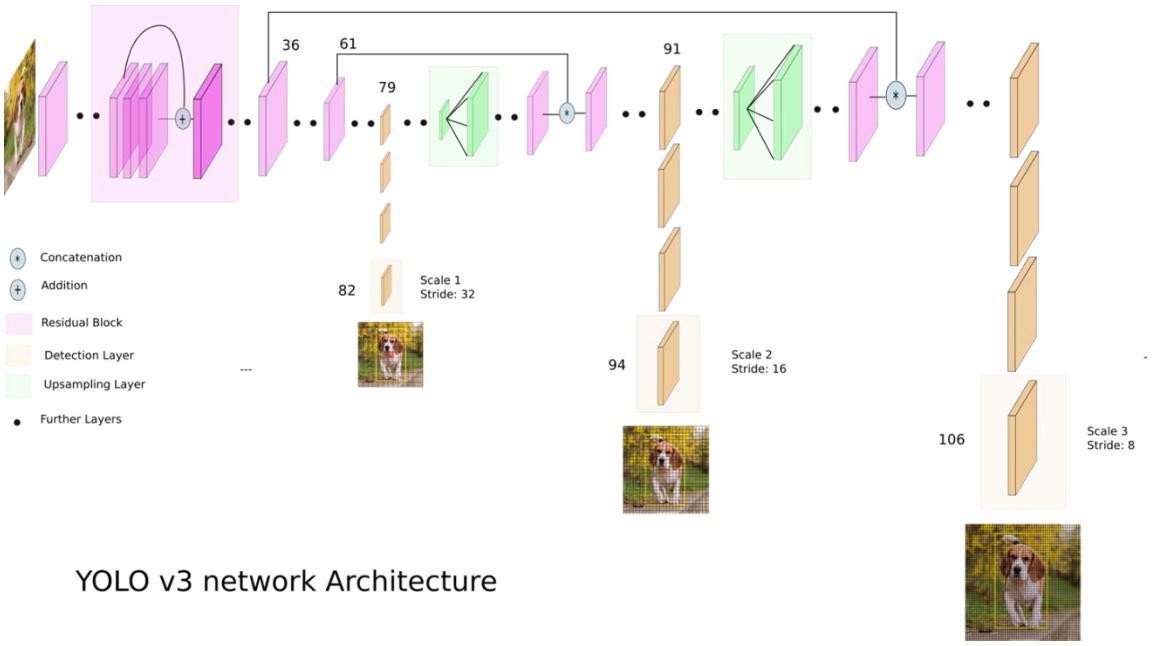

Figure 1.0

Illustration on how YOLO detection works.

Why using YOLO in this topic? YOLO has a very good balance between accuracy and speed of object detection. There are also other existing Neural Networks such as R-CNN, Fast R-CNN, Faster R-CNN, SSD MobileNet, and so on, but YOLO is a balanced network and also pretty easy to use and learn especially in this internship.

Detection Frameworks	Train	mAP	FPS
Fast R-CNN [5]	2007+2012	70.0	0.5
Faster R-CNN VGG-16[15]	2007+2012	73.2	7
Faster R-CNN ResNet[6]	2007+2012	76.4	5
YOLO [14]	2007+2012	63.4	45
SSD300 [11]	2007+2012	74.3	46
SSD500 [11]	2007+2012	76.8	19
YOLOv2 288 × 288	2007+2012	69.0	91
YOLOv2 352 × 352	2007+2012	73.7	81
YOLOv2 416 × 416	2007+2012	76.8	67
YOLOv2 480 × 480	2007+2012	77.8	59
YOLOv2 544 × 544	2007+2012	**78.6**	40

Table 1.0 Comparison between neural networks with PASCAL VOC 2007 and 2012

As seen from the table, YOLO has a good balance between speed and accuracy.

I had also done some test before and I can agree to the result of this table.

IV. CONCLUSION

In this paper, an accurate and efficient object detection system has been developed which achieves comparable metrics with the utilization of the Faster CNN. This project uses recent techniques within the field of computer vision and deep learning. A custom dataset was created using lableImg and also the evaluation was consistent. This could be employed in real-time applications that require object detection for pre-processing in their pipeline. A crucial scope would be to coach the system on a video sequence for usage in tracking applications. The addition of a temporary constant interface would facilitate smooth detection and more optimal than per-frame detection.

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Impact Factor:
7.488

ISSN INTERNATIONAL STANDARD SERIAL NUMBER INDIA

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