International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 3, Issue 12, pp 47-51, December - 2019

Online Blind Assistive System using Object Recognition

[1]Abdul Muhsin M, [2]Farah F. Alkhalid, [3]Bashra Kadhim Oleiwi

[1,2,3]Control and Systems Engineering Department, University of Technology, Iraq

***Abstract* - Everybody deserve to live independently, especially those who disabled, with the last decades, technology gives attention to disabled to make them control their life as possible. In this work, assistive system for blind is suggested, to let him knows what is around him, by using YOLO for detecting objects within images and video streams quickly based on deep neural network to make accurate detection, and OpenCV under Python using Raspberry Pi3. The obtained results indicated the success of the proposed model in giving blind users the capability to move around in unfamiliar indoor outdoor environment, through a user friendly device by person and object identification model.**

Keywords: Object detection, YOLO, Deep neural network, OpenCV, Python, Raspberry Pi3.

I. INTRODUCTION

Several deep learning techniques have been recently enhanced object detection models. Object detection is a computer vision filed that concentrates on detecting the position of multiple objects in an image that has been used in several applications from biomedicine and agriculture to security. However, traditional object detection methods have been successfully applied to solve problems like face detection, or pedestrian detection. However, those methods are suffering from slow, lack the notion of aspect ratio and are error prone. These problems have been greatly overcome using deep learning methods.

For the development of the world around, it is quite difficult for a visually impaired person to move around independently and identify surrounding objectives correctly with ease. With the advancement of technology, there are several solutions but most of them have demerits such as low acceptance, high cost, difficult to usage etc. For the development of the world around, it is very difficult for a visually impaired person to navigate independently and correctly set the surrounding goals easily. With technological advancement, there are many solutions but most have disadvantages such as low acceptance, high cost, difficulty of use, etc.[1] presented real time object detection system using a CNN in order to recognize pre-trained objects based on the Image Net dataset. The required calculation time for detection was low. Hence, the model applied recognize objects real time in vicinity and produced the result in a JSON format to convert to braille texts or auditory format.[2] employed an electronic scanning system based on optical sensors as talking stick for objects detection in 1 meter range in front of the visually impaired. The detected or received signals converted to voice by a control circuit, to be provided through earphones attached to the stick handle. A portable aid device using a cell phone for blind people is introduced in [3].

The captured images by the phone have been analyzed to classify the environment information about moving objects around the person provided in the audio output form. Intelligent glasses to describe the environment around a blind person based on image analysis invented in [4]. Object detection device in images captured by a camera module has been described in [5]. Images have been captured by a camera and sensor put on glasses, and then for analysis purposes will be transferred to a remote server machine to produce the voice signal in the users' output device. A coarse description technique is presented in [6] to detect objects in captured images using a camera. A real time object detection and recognition model based on SURF feature descriptor is proposed in [7].

A two-camera, ultrasonic sensor and GPS are used. Extracted features of the images based on SURF feature descriptor [7] are tested using a data base model.[8] Introduced object recognition algorithm to assist visually impaired people. Gabor-recursive neural network with convolutional recursive neural network based on less number of maps have been proposed to achieve better accuracy with less time complexity as compare to convolutional recursive neural network, the extracted feature vector is used to train.[9] proposed glasses system based on two cameras of blind. The proposed system has a stick of blind and an infrared sensor using circuit of detection to scan the surroundings of a person and provide audio information about it. [10] Proposed detection system to detect different types, size and distance of obstacles in front of the user. The output of the proposed system in audio and vibration format. Hence, an ultrasonic

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 3, Issue 12, pp 47-51, December - 2019

sensor connected to the vibrating motor sensor to detect objects in its range and vibrate the motor. Multiple objects detection system in an image is presented in [11]. But because many detectors are using on one image, this system will be a bit slower than other systems.

In order to improve the performance of the detection system several object detectors can be used for running in parallel. From previous studies, many methods had been discovered and applied including both hardware and software which are discussed in literature review of this paper. But most of the previous methods lack the maximum efficiency of combination among the accuracy of data processed output with the user appliance.

In this paper, the general concept is to build a system providing the user with information like object detection and people identification with better computational time and accuracy. The proposed system based on deep learning techniques is user friendly hardware and compatible in the practical applications. This paper proposes object recognition system that utilizes deep learning to assist blinds recognize objects in vicinity.

II. SMART NAVIGATION SYSTEM

The hardware and software parts in this smart navigation system are shown in figure 1 and will be explained in this section.

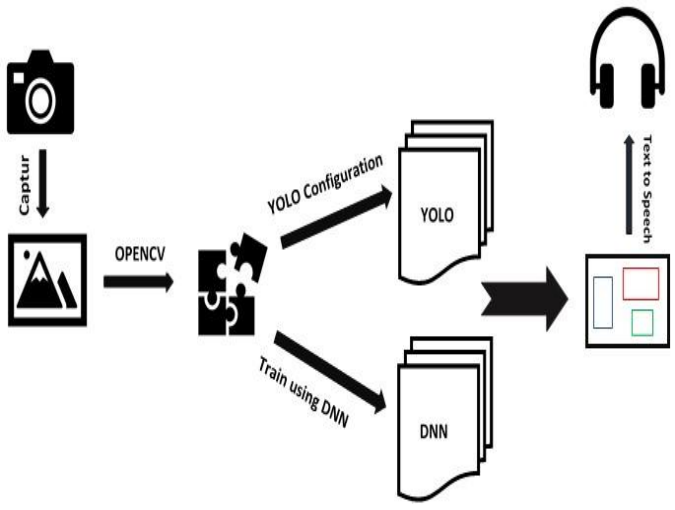

Figure 1: Proposed Navigation System

In software part, three approaches are integrated for object detection in image, where pre-trained YOLO model is used, to recognize human, animals, vehicles, toys, and traffic sign aided with OpenCV and DNN in order to start detecting objects right away.

A) YOLO

YOLO means "*You Only Look Once*" is an extremely fast real-time multi object detection technique using neural network to an entire image [12]. The network divides the image into an S x S grid and comes up with bounding boxes, which are boxes drawn around images and predicted probabilities for each of these regions. The old frameworks used for detection searched for many different parts within the image and several times with different scales and repurposed image classification algorithm for detecting the objects, but this method is very slow and inefficient, especially for real time applications. YOLO takes totally different technique by looking at the whole image and look at the network only once for objects detection [12].

YOLO system bounding boxes as anchor boxes based on dimension clusters [13], the network estimates 4 coordinates for each bounding box tx, ty, tw, th. If the cell represents offset of the top image left corner by (cx, cy) and the bounding box prior has width and height pw, ph, then the estimations considered to [14]:

$$bx = \sigma(tx) + cx$$

$$by = \sigma(ty) + cy$$

$$bw = pwe\ tw$$

$$bh = phe\ th$$

As shown in Figure 1:

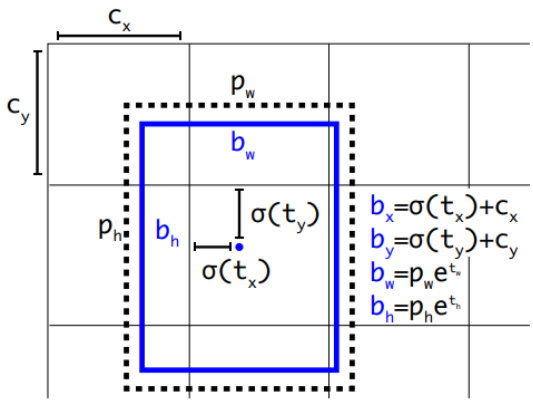

Figure 2: Bounding boxes with dimension priors and location prediction [14]

B) OpenCV

OpenCV means "Open Source Computer Vision Library", and represents processing library of an image and video within bindings based on Java, C++, C, and Python. OpenCV applied for analyzing all types of image and video, such as object detection and recognition, reading of license plate, advanced robotic vision, editing of photo, optical character recognition [15].

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 3, Issue 12, pp 47-51, December - 2019

Its applications are:

- Facial Recognition Systems
- Gesture Recognition
- HCI
- Mobile Robot
- Object Identification
- Motion Tracking

C) Deep Neural Network (DNN)

A DNN is a neural network includes more than two layers with certain level of complexity and. DNN uses complicated mathematical model for data process within complex ways.

D) OpenCV and DNN module

DNN module gives the ability for running inference based on pre-trained deep learning models within OpenCV. It runs much faster than other libraries, and conveniently, it only needs OpenCV within the environment. Accordingly, OpenCV DNN can be run on a CPU's calculation power with great speed. The best use case of OpenCV DNN is performing online detection based on a Raspberry Pi. This process can be run within any environment; hence OpenCV can be installed independently on the hassle for installing deep learning libraries with GPU support.

E) Algorithm

This work programmed using python with NumPy and OpenCV libraries using anaconda navigator and anaconda prompt, as can be expressed in flowchart in figure 3 and in the following steps:

Step1: Import all needed libraries

Step2: Read input image

Step3: YOLO Configuration

Step4: Use DNN and OpenCV to make pre-trained YOLO weights

Step5: Make classification

In the Hardware part, the main processor has been used in the proposed navigation system represents Raspberry Pi 3 B which represents a mini computer board based OS, within wireless LAN and Bluetooth connectivity, and powered based on a portable battery or power bank. In order to detect and recognize the persons and objects of the captured image the USB camera will be used.

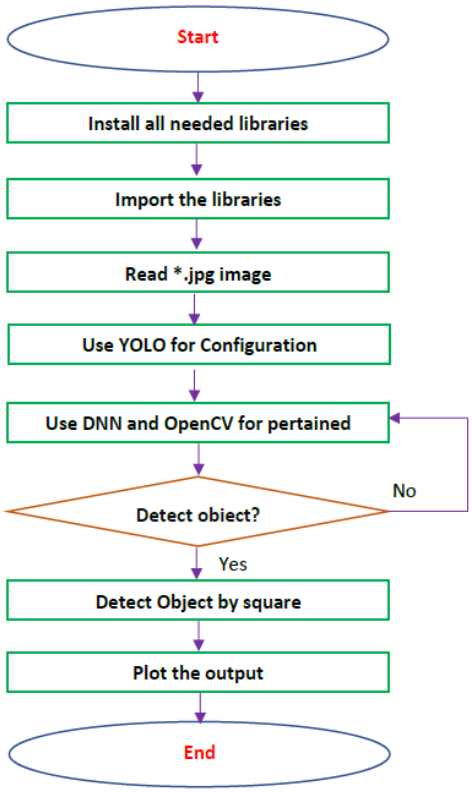

Figure 3: Flowchart of the proposed navigation system

The results of image recognition will be transferred to the blind users based on text-to-speech library. So an earphone has been used for user convenience.

III. EXPERIMENTAL RESULTS

The proposed navigation system can inform blind what are in range and describe it. Thus, for the input information gathering of on-line image capturing and the output signal will be a voice signal as the intended users are visually impaired. The basic step diagram of the hardware implementation as shown in figure 4.

Figure 4: Hardware wiring of the proposed system

International Research Journal of Innovations in Engineering and Technology (IRJIET)

ISSN (online): 2581-3048

Volume 3, Issue 12, pp 47-51, December - 2019

The experiments of the proposed systems were conducted as can be seen in figures below:

Figure 5: Object detection (multiple entities)

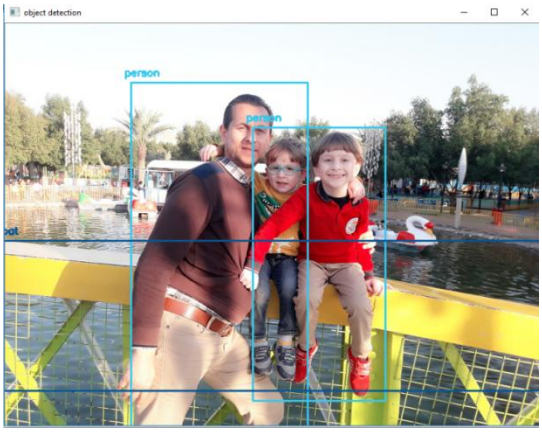

Figure 6: Objects detection (multiple persons)

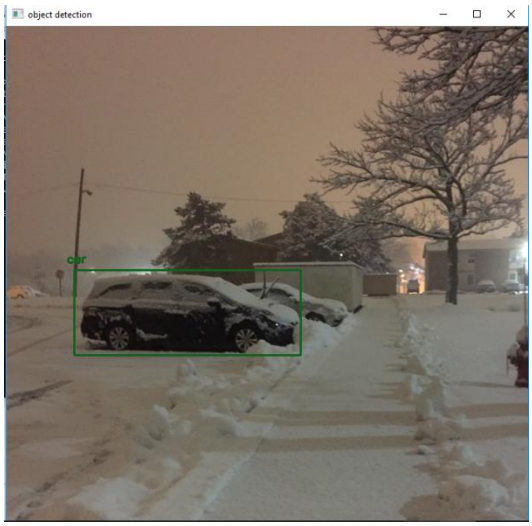

Figure 7: Objects detection (car)

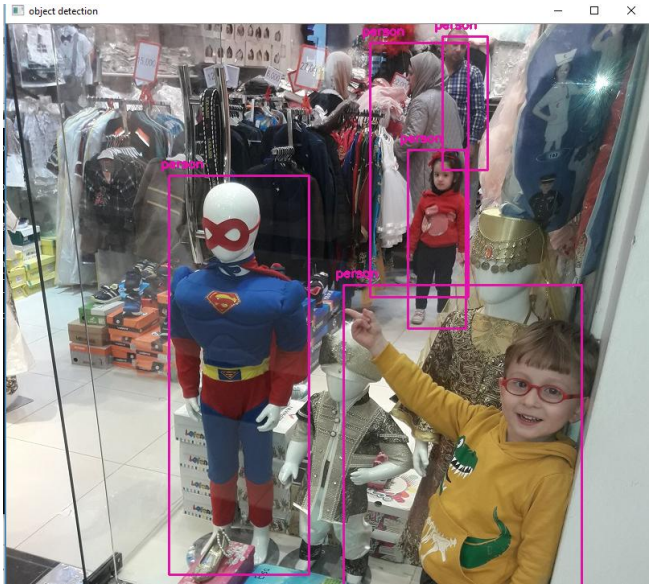

Figure 8: Objects detection (multiple entities)

A sample of experimental results is demonstrated above by analyzing the results. It can be conclude that some categories like cars, animals, persons are identified accurately in all cases. These category objects were placed in different positions and the model predicted the categories with varying probabilities. The proposed model used here detects objects with hundred percent accuracy. If the bounding box contains person, the model will be focused on the person and will not be detected the other objects in the bounding box. If two objects overlap each other, the category is identified correctly but the number of objects detected is not accurate as seen in figure 6.

IV. CONCLUSION

The objective of the paper is to give blind users the ability to move around in unfamiliar indoor and outdoor environment, using friendly device by object identification system. This work implemented using python and when run gives an accurate decision for object detection and classification, while DNN tend to be very accurate, the most important problem with its family of networks is speed, it was incredibly slow for obtaining only 5 FPS on a GPU. To improve the speed of deep learning-based on object detectors, YOLO is used which uses a one-stage detector strategy, generally, one-stage detectors is less accurate than two-stage detectors but are significantly faster. Hence three approaches are used (YOLO, OpenCV, DNN) with accepted delay increased when the image get larger. This work aims to assist blind to take an idea of what is around him, by using raspberry to make detection and tell the blind what does he detected, to give him indication and imagination about the objects in his place.

ISSN (online): 2581-3048
Volume 3, Issue 12, pp 47-51, December - 2019

ACKNOWLEDGMENT

The authors gratefully thank Prof. Jawad K. Ali, Department of Electrical Engineering, the University of Technology, Baghdad, Iraq for helping and supporting in successfully completing our research.

REFERENCES

[1] Kedar Potdar, Chinmay Pai and Sukrut Akolkar, "A Convolutional Neural Network based Live Object Recognition System as Blind Aid", *arXiv:1811.10399v1 [cs.CV]* 26 Nov 2018 https://arxiv.org/pdf/1811.10399.pdf

[2] Chi-Sheng, Hsieh. "Electronic talking stick for the blind." *U.S. Patent No. 5,097,856*, 24 Mar. 1992.

[3] Evanitsky, Eugene. "Portable blind aid device." *U.S. Patent No. 8,606,316*, 10 Dec. 2013.

[4] Cervantes, Humberto Orozco. "Intelligent glasses for the visually impaired." *U.S. Patent No. 9,488,833.* 8 Nov. 2016.

[5] Jothimani, A., Shirly Edward, and G. K. Divyashree. "Object Identification for Visually Impaired." *Indian Journal of Science and Technology* 9.S1, 2016.

[6] Zraqou, Jamal S., Wissam M. Alkhadour, and Mohammad Z. Siam."Real-Time Objects Recognition Approach for Assisting Blind People", 2017.

[7] Bay, Herbert, Tinne Tuytelaars, and Luc Van Gool. "Surf: Speeded up robust features." *Computer vision ECCV* 2006 (2006): 404-417.

[8] Rahul Kumar and Sukadev Meher, "Assistive System for Visually Impaired using Object Recognition, M.Sc. Thesis at Department of Electronics and Communication Engineering, *National Institute of Technology Rourkela, Rourkela, Odisha-769 008, India,* May 2015.

[9] Prof. Seema Udgirkar, Shivaji Sarokar, Sujit Gore, Dinesh Kakuste, Suraj Chaskar, 2006, "Object Detection System for Blind People," *International Journal of Innovative Research in Computer and Communication Engineering.*

[10] Daniyal Rajput, Faheem Ahmed, Habib Ahmed, Engr Zakir Ahmed Shaikh, Aamir Shamshad, 2014, "Smart Obstacle Detector for Blind Person," *Journal of Biomedical Engineering and Medical Imaging.*

[11] Khushboo Khurana, Reetu Awasthi, 2013, "Techniques for Object Recognition in Images and Multi-Object Detection," *International Journal of Advanced Research in Computer Engineering & Technology.*

[12] Learning OpenCV 3by Gary Bradski, Adrian Kaehler Publisher: *O'Reilly Media, Inc. Release Date:* December 2016.

[13] Joseph Redmon, Santosh Divvala, Ross Girshick, Ali Farhadi, "You Only Look Once: Unified, Real-Time Object Detection", *University of Washington, Allen Institute for AI , Facebook AI Research,* 2016.

[14] J. Redmon and A. Farha, Yolov3: An incremental improvement. *arXiv*, 2018.

[15] J. Redmon and A. Farhadi. Yolo9000: Better, faster, stronger. In Computer Vision and Pattern Recognition (CVPR), *2017 IEEE Conference on, pages 6517–6525. IEEE*, 2017.

[16] A.Culjak, D. Abram, T. Pribanic, H. Dzapo and M. Cifrek, A brief introduction to OpenCV," *2012 Proceedings of the 35th International Convention MIPRO*, Opatija, 2012, pp. 1725-1730.

Citation of this Article:

Abdul Muhsin M, Farah F. Alkhalid, Bashra Kadhim Oleiwi, "Online Blind Assistive System using Object Recognition" Published in *International Research Journal of Innovations in Engineering and Technology (IRJIET)*, Volume 3, Issue 12, pp 47-51, December 2019.

****

