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Real-time Blind Navigation System using Open CV

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Abstract: *Accompanying the visually impaired on their orientation is an arduous task that has attracted the attention of many researcher. Most blind people in the world use a white cane to get from one place to another. Because they are blind, they cannot perceive their surroundings. Therefore, the movement of visually impaired people is restricted. The aim of this project is therefore to build a navigation system that can safely and easily guide visually impaired people in indoor and outdoor environments. In this work, an assistive system based on yolo is developed to inform the blind how many persons are around and how far they are from the blind person. In this work, the support system for blind recommended, let him know what's around him, using YOLO to detect the object in the image and fast video stream based on deep neural network for correct detection and Open CV in Python and basically a Integrated Machine Learning System that allows the blind victim to identify and classify real time objects generating voice feedback and distance.*

Key Word: *Computer Vision, Object Detection, Machine learning, Deep learning, Open CV, YOLO, CNN,DNN.*

I.INTRODUCTION

Safe navigation and detailed perception in unfamiliar surroundings are challenging activities for people who are blind. This article proposes a visual and real time based navigation system for blind people. The purpose of the system is not only to provide navigation, but also to ensure that blind people perceive the world in as much detail as possible and live like normal people.

In our daily life, moving from place to place is a common term and easy to navigate everywhere. But for a blind person, especially a blind person, it is not easy at all. We asked blind people about their daily lives and how they move from place to place, then they answered while browsing that they had many problems. They do not know where they are, what obstacles are in front of them, what the object is, the face also has no information about the object and another important thing is that when they want to know something, they must ask for help other sget information. Statistics show that blind and visually impaired people have navigation problems in daily activities. According to the World Health Organization (WHO), there are about 385 million visually impaired people in the world disability, of which about 39 million people are blind, of which 82% are blind people aged 50 years or older [1]. According to WHO (2012), about 4.24% are visually impaired and 0.58% are blind. In total, of the 39 million, 15% from Africa and gradually 2.7 million (7%), 23 million (67%), 3.2 million (8%), 5 million (12.5%) from Europe, Asia, the Americas and the Eastern Mediterranean (re2015). And among them, 82% of them are over 50 years old, and in Bangladesh, the age of 30 and above is 750,000, 85% of them are blind due to cataract [2]. Today, it has become an important term for developing a system to help the blind orient like a normal person.

As for the development of the world around it, it is quite difficult for a blind person to move around independently and accurately identify surrounding targets easily. With the advancement of technology, there are several solutions, but most of them have disadvantages like low acceptance, high cost, difficult to use, etc. the development of the world around, very difficult for one visually impaired people to navigate independently and accurately place targets around with ease presented a real-time object detection system that uses CNN to recognize pre-trained objects based on Image Net dataset.

II.LITERATURE SURVEY

There are many systems designed to make navigation easier for the visually impaired.
A. Positioning systems using sensors or RFID:
1] SESAMONET (Safe and secure mobile network)
2] C5LaserCane

B.GPS-based navigation systems:
These systems are based on data from GPS maps and Geographic Information Systems (GIS)
1. Access Route Finder (AB Route Finder)
2. Trekker and Braille Notes GPS (Human Ware)

C. Navigation system using image processing another system using vision-based positioning to guide blind people has also been proposed. These systems use image processing techniques to allow the system to identify the path and obstacles in the way.
1. Computer Vision (Object Detection).

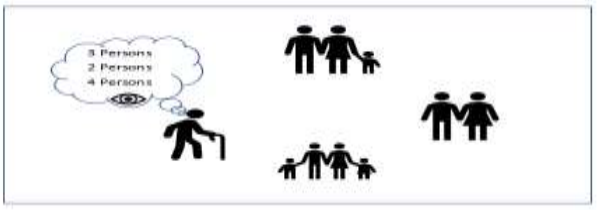
Computer vision is one of the popular technologies used to develop assistive systems for the visually impaired. So what is computer vision and why do we need it, you see computer vision is basically processing everything that humans can see and feel, there are so many tasks that we humans do unconsciously that we think are barely worth mentioning but let computers learn how to do or even trying to imitate things like that is very difficult to help you better understand what we are talking about. We are talking about imagining looking out the window you see what you might be sitting in an office building and seeing Traffic outside have you ever wondered how we get out? something or someone you know how you can look at someone and know who they are you see subconsciously we identify objects in any image you see so we try to try to find the relationship that exists between objects to identify the scene or place only then do we have an idea of what is happening in an image, sometimes we can also look at an image incomplete and use our previous knowledge and experience to determine what is missing, all of these tasks are seen by the computer vision.

The rapid advancement of organized data and technology has moved from the Internet to the application of innovations in life. One of the technologies to consider is the innovation of object recognition, later known as **objects detection**. Object detection is the ability to detect object or identify object in any given image correctly then we have **image classification** which basically means to identify what class the object belongs to image captioning is nothing but looking at an image and describing what is happening in an image last but not least we have **image reconstruction** in image reconstruction we basically have the ability to identify what is missing in an image in order to reconstruct it now that we have gone through object detection and gain knowledge of what we can do with it let's now see how it works there are two main approach for object detection that is machine learning approach and a deep learning approach both of these approach are capable of learning and identifying the objects but the execution of them is very different .

Machine learning is the application of Artificial intelligence for making computers learn from the data given to it here then make decisions on their own similar to human beings. It gives computer the ability to learn and make predictions based on the data and information that is fed to it through the real world interaction and observation.

Deep learning which is also referred to as deep structured learning is a class of machine learning algorithm. Deep learning uses multiple layer approach to extract high level feature from the data that is provided to it.Deep learning model does not require any feature to be provided manually for classification instead it tries to transform its data into an abstract representation. Deep learning is also influenced by artificial neural network present in our brain, most of the Deep learning method implement neural network to achieve the results. All the deep learning models require a huge amount of computation power and large volume of labeled data to learn from the features.

A) System overview:

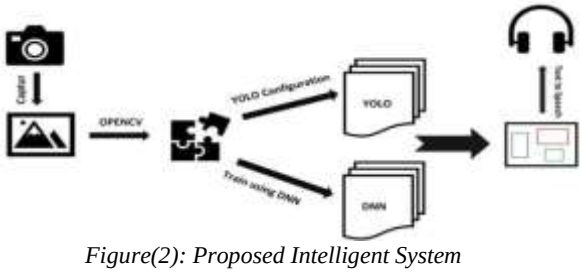


Figure(1): System Overview

The main objective of this work is to build a system for helping visually impaired people. It uses a camera within hardware for capturing the images. The image is then fed internally to the Processor where the data is processed using Open CV library, CNN, DNN and YOLO, the total number of people around will be identified along with the distance from the camera and the message will be announced by audio via earphones to the operator.

B) Real Time Blind Navigation System:

The software components of this intelligent navigation system are shown in Figure 2 and will be described in this section:



Figure(2): Proposed Intelligent System

In the software part, three methods are integrated for detecting objects in images, where the pre-trained YOLO model is used to recognize people, animals, vehicles, toys and traffic signs, helping Open CV and DNN to start detecting objects immediately.

1) Open CV- Open CV stands for "Open source Computer Vision Library" and represents an image and video processing library in Java, C++, C and Python based bindings. Open CV is applied to analyze all kinds of images and videos, such as object detection and recognition, license plate reading, enhanced robot vision, photo editing, optical character recognition.

Its applications are:

- Face recognition system
- Gesture recognition
- Mobile Robots
- Object recognition

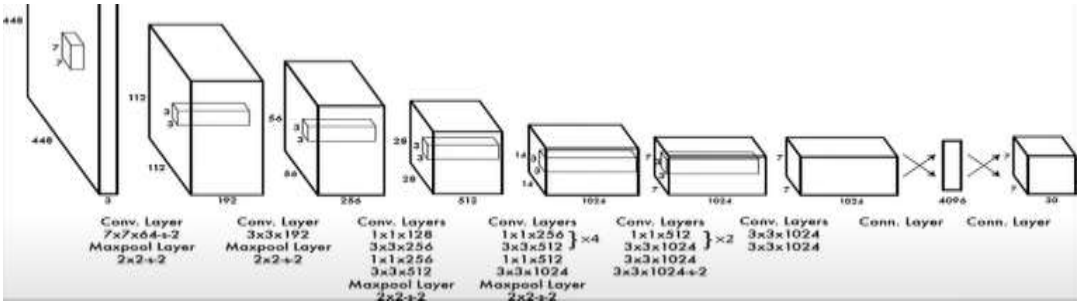
Open CV is a huge open source library for computer vision machine learning and image processing and now it plays a major role in real-time operation which is very important in today's system by using Open CV we can pre-process images videos to identify objects faces or even handwriting of a human being when it is integrated with various libraries such as numpy python is capable of processing the Open CV array structure for an analysis as we mentioned earlier we use Open CV tool to pre-process our data.

Fig. 3.1

Fig 3.2

Figure(3): Object detection (Multiple people& Object)

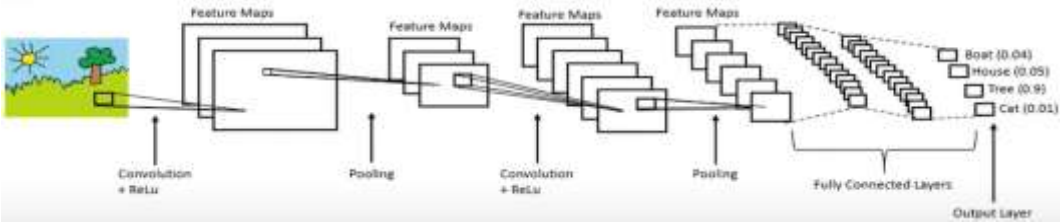
2) YOLO algorithms- YOLO is an algorithm based on regression, instead of selecting the interesting part of an image, it predicts classes and bounding boxes for the whole image in one run of the Algorithm.



Figure(4):YOLO

YOLO, which stands for "You Only Look Once", is a very fast method real-time multi-object recognition technique using neural network over the whole image [12]. Split network image in S x S grid and create bounding boxes. This is a frame drawn around the image, predict probabilities for each of these regions. Older frames used for detection searched for different parts of the image and repeatedly used image classification algorithms at different scales to detect the object, but this method was very slow, especially in real time. Inefficient application. YOLO uses a completely different approach, looking at the big picture for object detection and network testing only once.

3) CNN- CNN stands for Convolutional Neural Network, which like neural networks, consists of neurons with learnable weights and biases. Each neuron receives various inputs, adds them in a weighted fashion, passes them to an activation function and responds with an output. A CNN, as a machine learning algorithm mtakes an input image assigns importance to objects and is then able to distinguish one object from another. CNNs work by extracting features from images. Any CNN consists of the following three parts, an input layer which is a grayscale image, then we have an output layer which is binary or multiclass labels, then we have a hidden layer which contains the convolutional layer ReLU (rectified linear activation unit), then we also have a pooling layer.



Figure(5): CNN

4) DNN-DNN is a neural network with more than two layers and a certain complexity. DNNs use complex mathematical models to process data in complex ways.

5) ALGORITHM-This work was programmed using python and NumPy with the Open CV library using the anaconda browser and the anaconda prompt as shown in the flowchart in Figure 3 and the following steps:
Step 1: Import all necessary libraries
Step 2: Read the input image
Step 3: Configure YOLO
Step 4: Create pre-trained YOLO weights using DNN and Open CV
Step 5: Perform the classification

III.CONCLUSION

The objective of the article is to enable blind users to navigate unfamiliar indoor and outdoor environments using a user-friendly device-to-object recognition system. This work is implemented using python and when run provides accurate decisions for object detection and classification, whereas DNNs tend to be very accurate, the main problem with their family of networks is the speed, getting only 5 FPS on a GPU is very slow. In order to increase the speed of deep learning based object detectors, YOLO is used, which uses a one-step detection strategy, usually one-step detectors are not as accurate as two-step detectors, but are significantly faster. Therefore, three methods (YOLO, Open CV, DNN) were used, assuming latency increases as the image gets bigger. This work aims to help the blind to understand the things around him using the YOLO for detection, and tell the blind what he has detected, allowing him to have an indication and an imagination of the objects surrounding. Additionally, this project can be implemented in hardware to detect and recognize objects and vehicles on the road. It helps people not to cross the road while the vehicle is in motion it is also portable and compatible.

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