

ASSITANCE APPLICATION for VISUALLY IMPAIRED - VISION

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Abstract:

This model is developed in order to help visually impaired people in recognizing daily life objects which they may sometimes find difficult to detect. Today, with the help of technology various problems could be solved within fractions of seconds which earlier were seen as impossible. With the use of this platform of technology various applications are built today which helps the disabled people in making their lives easy and better. This application does the same by clicking a picture of the surroundings from your smartphone and detecting the objects present in it and the same is informed to the user. For achieving this task, machine learning algorithm – CNN (Convolutional Neural Network) has been used by using Tensorflow API. The proposed model is validated by implementation in Android platform.

Keywords —Android Application, Object Detection, Visually Impaired, CNN, Tensorflow API

I. INTRODUCTION

This application is a mobile application developed to be functional on Android smartphones which have a working camera in them. The intended users to this application are specially the visually impaired people. The application was developed to help these visually impaired people so that they do not find themselves behind other people and it could help them accept the challenges of life [1]. This application also helps in increasing their moral and a sense of self confidence in them. The application opens up and that very moment the camera starts working in the smartphone. The user then clicks the picture of the object which is in front of them. The application then detects the object

present in the picture with the help of the pre-trained model of Tensorflow API [2]. The application also gives the results of the closest matches to the objects and a percentage with them. This percentage tells how much the object in the picture symbolizes with the object detected by the application. The resulted object which symbolizes the most with the object present in the picture has the highest percentage amongst others. As the intended user for this application is a visually impaired person and they can not see the results on the mobile screen, the name of the object with the highest percentage is pronounced by the application which finally solves the problem for the user in detecting that object. The user can then know the object present in front.

II. RELATED WORK

A) *Choosing the Target Device*

Mobile phone has always been a popular and easily accessible device to the masses once it became accessible to the masses. Earlier phones used to be much more difficult to be operated by the blind people due to them being button operated but nowadays people are moving towards touchscreen phones. Today's generation of phones is what we call "smartphones". This is because in addition of normal phone features, they have several added features like good quality cameras, multimedia and navigation. These phones now have simple GUI (Graphical User Interface) which is easy to operate. Android OS based smartphones are currently the most widely available and used smartphones [3] which also offer various accessibility features. Talkback [4] is one such feature which basically read out the UI elements to the user and thus helping them navigate and understand what's on the screen. Similar features also exist on other mobile operating systems such as iOS[5]. Beside these features, these phones offer powerful GPUs and CPUs with features like recorder and GPS receivers which can be used to develop custom applications for the people with special needs. Even though there are devices available for such people but often they tend to be more costly to buy and use and they also add a burden of carrying an extra device for the person.

B) *Solutions already available*

Object detection and classification is a field which has been greatly explored by the experts. Researchers have already explored the idea of this technology being useful for the visually impaired people but earlier this approach required state-of-the-art hardware or in case of low power hardware the algorithm would not be running on the user hardware itself but on a powerful cloud server. With the recent development in the mobile phones becoming very powerful, there are several applications already available for the users which perform the algorithm required for detection on the user hardware itself.

The developer LookTel [6] had developed the application called Recognizer. This application is available on iOS devices and is useful to detect smaller object of daily use. The images are stored in a local database and hence is able to work on the user hardware itself. This application heavily rely on a sighted person to first preload the images of these items in a pre-determined orientation. This poses a big limitation on the usage of the application as the visually impaired person would require the assistance of a sighted person every time a new object is needed to be added.

Another such solution is the EyeRing [7] project. This is a device meant to be worn on the finger. This device consists of a VGA camera, microcontroller and a Bluetooth module for communication with an android phone. This device can be used as a replacement of a cane as it can help in determining object, currency note, distance calculation and text to speech. This device however is quite expensive and is thus out of reach of majority of people.

Object detection using Convolutional Neural Network (CNN) is an emerging concept but is not yet very mainstream in mobile applications.

Kanghun Jeong and Hyeonjoon Moon [8] had designed an object detection algorithm using Feature Accelerated Segment Test (FAST) algorithm for smartphones. FAST provides faster edge detection after which further nasalization can be applied to extract more details.

In 2016, Shivaji Sarokar [9] developed a navigation system for the visually impaired people to help them avoid obstacles while navigating. They utilized a buzzer and vibrator to inform the person about an object. This system was targeted for the people who are exploring a new environment about which they don't have much information beforehand.

III. PROPOSED ARCHITECTURE

Object detection has become a largely upcoming scope for detecting object using image processing techniques which are used for social applications and industrial applications. Purpose of this project is object detection for the visually impaired by

using object detection using camera clicked pictures and speech synthesis. Thus we conclude that object detection is useful in day to day life of visually impaired users. Following are the main components of this project which are explained briefly:

1. Image processing:-

Image processing [10] is a process of conversion of image into digital format and performing operations on it so that useful information could be extracted. It is usually present in form a video frame or a photograph and the result is an image. We treat that image as 2 dimensions and apply defined processing methods to it. It follows operations like image sharpening for better sharpened image, virtualization for clarity of image.

2. Object detection:-

Object detection [11] in this project has been implemented using the CNN algorithm [12]. A Convolutional Neural Network (CNN) is a an algorithm which takes image as its input, assigns importance to various aspects/objects in the image and is able to differentiate one from the other. Then, with the help of the trained model we are able to detect the object in the image captured.

3. Speech synthesis:-

Speech synthesis [13] is the artificial production of human voice/speech. Here the results generated are in the form of text which is given as input to this process. Synthesized speech can be created by concatenating pieces of recorded speech that is stored in database. This is generated after data extraction and detection in speech synthesis. The output will be in form of speech which will give the impaired users an idea of object which is detected.

4. Android application:-

Android application [14] is software that runs on the android OS. This android OS is compatible with

not only mobile devices, but with tablets, TVs, watches etc. This application is deployed on android platform because android OS is user friendly, easy to work with and the most powerful amongst other technologies in today's date.

IV. RESULTS

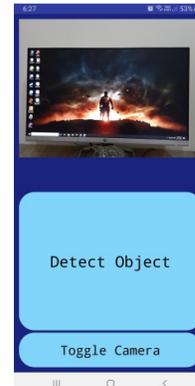


Fig. 1. Basic UI of the app

The above figure shows the basic UI layout of the application that will be shown to the user whenever they use the application.

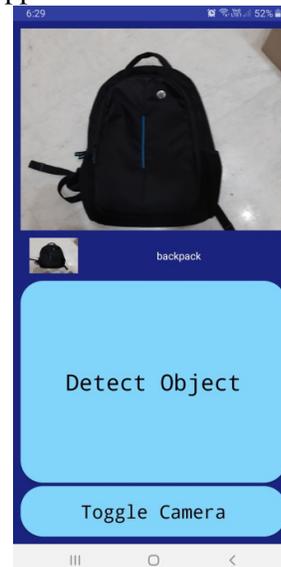


Fig. 2. First Example of the running application

The above figure shows the first example recorded while testing the application. In this example, we

have placed a bag on a plain background and the application is used for detection of the object.



Fig. 3. Second Example of the running application

The above figure shows the second example recorded while testing the application. In this example, we have used a wall mounted switchboard and the application is used for detection of the object.

V. CONCLUSION

The proposed model has been implemented in android OS. It was tested on Oneplus smart phone. The conclusions drawn from the proposed model are listed below:

- The model provides an easy way to help the visually impaired people by detecting the object present in front of them.
- The application not only shows the name of the object but it also pronounces the object's name.
- The application does not require a working internet connection to work. It has its own database which includes 80 classes of objects.

Currently the application developed is able to detect objects with enough accuracy to help a visually impaired person in his or her daily life. This application can detect daily life objects like cars, bike, laptops etc. The application with further development can be used for further enhancement for visually impaired people. It can be further used for its use in cybernetics, computing environment and developing systems in digital world on many aspects like for understanding human behavior based on their way of interaction and for further explores.

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