Bionic Eyeglass Aid for Object and Optical Character Recognition

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***Abstract*— In previous Bionic Eye technology, it only measures the obstruction in the path. It is very difficult to navigate the blind people. Here we designed Bionic Eye Glass that will communicate with blind people and helps to guide the people in indoor and outdoor. The Bionic eye glass consists of two units, the first one has camera and ultrasound sensor clip on to the wearable eye glass it is connected by a cable to the laptop. It is placed in the pocket or laptop it gives audio feedback to mini earpiece speaker that is mounted on the eye glass. So that it act as an artificial vision for the blind people by recognizing the object infront of them.**

***Index Terms*—Optical character recognition, Object identification**

I. INTRODUCTION

The designed Bionic Eye Glass, that will communicate with blind people and helps to guide the people both in indoor and outdoor. The Bionic eye glass consists of two parts, one is the camera and ultrasound sensor clip on to the wearable eye glass it is connected by a cable to the second unit, the second part is a Raspberry board it acts as Artificial Intelligent (AI). When placed in the pocket it gives audio feedback to mini earpiece speaker that is mounted on the eye glass. This device can read the newspaper, books and even also text on the phones or computer. The optical character reading (OCR) technique helps to read printed materials. We added some features like Face recognition, Voice recognition, Object identification, Friend identification, and Color identification. It acts as an artificial vision for the blind people. This bionic eye glass device supports the blind people to "see" the surroundings and easily survive in this modern world with the simple Matlab algorithm and speaker.

II. SYSTEM MODEL

Image recognition is a classifier which takes an image as input and output contains the detail of the image which is called as a class label. Here the algorithm trains to differentiate the classes of the input image. The ultimate goal is to help the blind people, to get rid off from the dependency of neighbor people. To find the object in front of them, to identify the color of the object, to read the printed character like newspaper and so on.

III. METHODOLOGY

This Bionic eye glass uses the power of Artificial Vision to assist the blind people. So, the people can see the surrounding. The light weighted camera mounted on the frame and it will connect the second unit. The second unit consists of Artificial Intelligent unit which is fixed on the packet here we use laptop. This unit delivers the

audio feedback to the user via earpiece speaker. These glasses basically have four function by which it can read the text, Identify the object, Recognize face, and navigate the people, now we only fixed two recognition that are object detection and speech output. The spy camera captures the object or person that image converted in to RGB image format and it again converted into grayscale image finally it can be detected by canny edge detection method in this process done in the laptop. This canny edge detection identify the object, the result of this unit is deliver as sound signal. Here we can identify the object in front of the person; the object is already stored in the template so easily identify the object by comparing image and template image which is store array. The bionic eye glass can used to read the text and convert into speech. In future we use the Optical Character Reading (OCR) Technology it can read in printed material such as newspaper, books and even also text on the phones or computer.

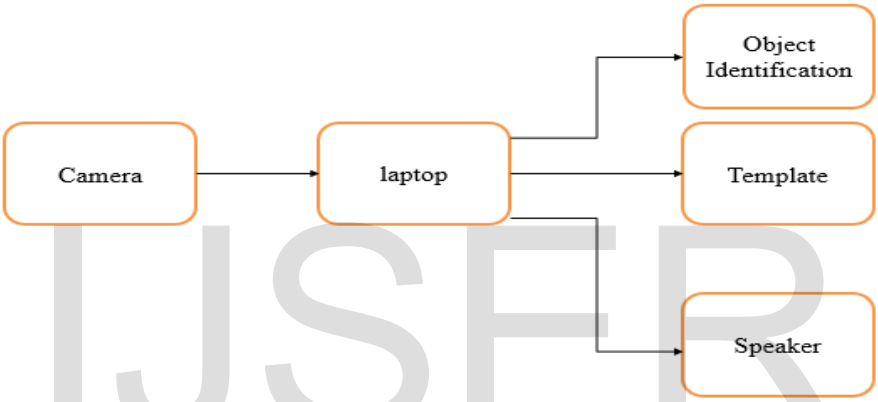


Fig.1 Block Diagram of Object Identification

Video and digital cameras use an electronic image sensor, usually a charge coupled device (CCD) or a CMOS sensor to capture images which can be transferred or stored in a memory card or other storage inside the camera for later playback or processing. Image recognition uses Deep Learning based techniques. That said, traditional computer vision approaches still power many applications. Many of these algorithms are also available in computer vision libraries like MATLAB and work very well out of the box.

Step 1: Preprocessing

In pre-processing, an input image or some part of an image is also cropped and resized to a fixed size which is performed because to perform feature extraction on a fixed sized image.

Often an input image is pre-processed to normalize contrast and brightness effects. A very common step is to gamma correction produces better results than subtracting the mean of image intensities and divide by the standard deviation.

In previous methods, several input pixel representations including Grayscale and RGB colour spaces is processed with power law (gamma) equalization. These normalizations have only a modest effect on performance, perhaps because the subsequent descriptor normalization achieves similar results.

Step 2: Feature Extraction

The first step in image classification is extracting the required information contained in the image. In traditional computer vision approaches designing these features are crucial to the performance of the algorithm. Turns out we can do much better than simple edge detection and find features that are much more reliable. In our example of shirt and coat buttons, a good feature detector will not only capture the circular shape of the buttons but also information about how buttons are different from other circular objects like car tires.

Some well-known features used in computer vision are Haar-like features introduced by Viola and Jones, Histogram of Oriented Gradients(HOG), Scale-Invariant Feature Transform (SIFT), Speeded Up Robust Feature (SURF) etc.

As a concrete example, let us look at feature extraction using Histogram of Oriented Gradients (HOG).

HOG is based on the idea that local object appearance can be effectively described by the distribution (histogram) of edge directions (oriented gradients). The steps for calculating the HOG descriptor for a 64×128 image are listed below.

Gradient calculation: Calculate the x and the y gradient images, g_x and gy from the original image. This can be done by filtering the original image with the kernels.

Gradient calculation

Using the gradient images g_x and g_y, we can calculate the magnitude and orientation of the gradient using the following equations.

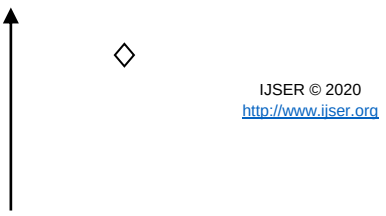
$$g=\sqrt{(g_x^2 + gy^2)}$$

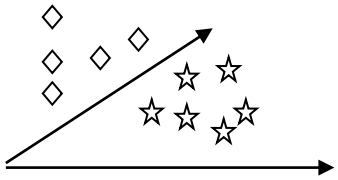
$$\theta = \arctan (g_y/g_x)$$

The gradients are "unsigned" and therefore θ is in the range 0 to 180 degrees.

1. Divide the image into **8×8 cells.**
2. Calculate histogram of gradients in these 8×8 cells
3. Block normalization
4. Feature Vector

Step 3: Separation of Two Classes and Optimizing SVM





Separation of two Classes

SVM is used as hyperplane by solving an optimization problem that tries to increase the distance of the hyperplane from the two classes and used to classify the two classes. This trade-off is controlled by a parameter called **C**.

When the value of **C** is small, a large margin hyperplane is chosen at the expense of a greater number of misclassifications. Conversely, when **C** is large, a smaller margin hyperplane is chosen that tries to classify many more examples correctly.

IV. RESULT ANALYSIS

The image is captured and then converted using edge detection, and the resultant image is compared with the already stored objects, after that the particular object is recognized and the analog output i.e. Audio can be hear using the speaker.

Grayscale to Edge Detection

The SSIM value is 0.2887.

The SSIM value is 0.1955.

The SSIM value is 0.0439.

val =0.2887

idx =1

Detected object:bottle

ans =bottle

The output delivered in the form of sound

V. CONCLUSION

By using Bionic eye, patients regain the information about eyesight up to maximum level which cost is within hands. So that it affordable for the poor and it gives hope to blind people. It is non-invasive method; hence it will not cause allergy. From this the person can able to recognize the object by the way they are crossing with the simple aid.

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