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ID Card Detection with Facial Recognition using Tensorflow and OpenCV

Kushal M
Dept.of ECE
CMR Institute of Technology
Bengaluru, India

Kushal Kumar B V
Dept.of ECE
CMR Institute of Technology
Bengaluru, India

Charan Kumar M J
Dept.of ECE
CMR Institute of Technology
Bengaluru, India

Prof.Pappa M
Dept.of ECE
CMR Institute of Technology
Bengaluru, India

Abstract—The main goal of computer vision is to identify and recognize different objects of various size, shape and position. The major problems faced by the computer vision is the illumination and the viewpoint of the object, Concerning this and by following multiple studies recurring to deep learning with the use of Convolution Neural Networks on detecting and recognizing objects that showed a high level of accuracy and precision on these tasks. To facilitate object detection in a college environment, the proposed work identifies the presence of a person wearing an ID card using tensor flow object detection API, detects and recognizes the face using haar cascade method of OpenCV.

Keywords—ID card, Face detection, Face recognition, Tensor flow, OpenCV.

I. INTRODUCTION

Object detection is used to recognize certain objects like tree, humans, vehicles etc. The object detection belongs to computer vision and depends on many factors like size, shape, scale and illumination. The image processing field of computer vision can interact to recognize a specific part of the image. The image used for processing can be obtained from an image captured from a camera or a video frame. Computer vision is widely used in these days for many applications including [1] detecting moving objects.

Object detection is a broad area in the field of computer vision and Image processing. Face detection is one of the major research fields under object detection. The motivation behind face detection algorithms is to locate whether there are any faces in an image or not. In an image to recognize the face in it, first, have to detect[2] whether there is a face in the image or not. An image has to be generated which can be manipulated and used for various identification is important in face area determination. Once the face is detected, using the location of the detected face, the face recognition algorithm can be used to find the person in it. Over time face recognition have been used in many security [3]applications, face recognition based attendance systemetc.

This paper discusses how tensor flow can be used for object detection technique to find if the person is wearing an ID card or not. If not then it will proceed for face detection which will identify the presence of the face and also provide the coordinates of the location. Using these coordinates of the detected face, it recognizes the person in that video frame.

II. DIGITAL IMAGE DETECTION

A. Digital image:

An image captured is called the digital image or an RGB image. A sample digital image is shown in Figure 1. A digital image which is a 2D matrix consisting of intensity values as the elements of matrix can be obtained by sampling a 3D object.

Figure 1: Digital Image

The digital image is basically a two-dimensional representation of any object, it is a collection of RGB colors which contain different patterns and abstracts. An image can be classified into two categories 1. Still image 2.Moving image. A still image is the one which doesn't move to time, whereas a moving image is a collection of still images which changes to time (single frame of a video). [2]

B. Image detection

From the digital image captured certain pattern, shape, letter, object etc is need to be detected. An efficient architecture for computer vision based on deep neural network namely, codenamed Inception. This includes increasing the depth[5] and its range. Image net can be considered as a beneficial method for visualization applications such as Object recognition, Image classification and localization of the

objects. Image detection deals with detecting the above-mentioned items in a given digital image. An example of image detection is shown in figure 2.

In the figure shown below, it is trained to identify the stop signboard in the digital image. The main problems faced by the digital image detection are the [4] changes in shape, size, scale etc. It also faces issues regarding the illumination of the image. The main function of the image detection is to identify if an object is present in that image or not, if yes then it has to provide the coordinates of that object.

Figure 2: Image Detection

III. RELATED WORK

Tran D proposed [1] a method that had chosen images with large variations in scale, pose and lighting. He has labelled them manually with LabelImg. He has analysed by converting them into csv file and created TFRecord and the detector was trained based on the single class.

Ali Sharifara, Mohd Shafry, et al. [2], described a review of recent methods of face detection such as template matching, knowledge, appearance and feature-based were discussed and used neural networks along with Haar-like features algorithm. This has an advantage that it decreases the classifier disadvantages.

R. Samet and M. Tanriverdi [3], discussed mobile-based face recognition system for classroom attendance management was developed using Euclidean distance calculation. Distance calculation was carried out by considering Eigenfaces, Fisherfaces and LBP.

Tsang Ing Ren, Joao Paulo Magalhaes, et al.[4] described a template matching based face recognition for dynamic faces which has either horizontal or vertical movements. The author has used an algorithm to identify the face by distinguishing the skin region and the non-skin region. He has detected and identified using a neutral position and rotating position.

Christian Szegedy, Wei Liu, et al.[5], had used neural networks for computer vision. He has proposed Inception architecture that makes use of local sparse structure in convolutional vision network that leads to optimum results.

Jia Deng, Wei Dong, et al.,[6] has suggested that ImageNet can be used as a large-scale database for most of the applications such as Object recognition, Localization and Image Classification in the field of visual recognition.

Koresh, M.H.J.D,[7] has developed a framework based on capsule neural network which provides high reliability in sensing compared to convolutional neural networks.

IV. IMPLEMENTATION METHODOLOGY

A. *Tensor flow Object Detection*

This process first includes the data [8] collection, the collection of various images[9] that are to be identified or detected is called a dataset. There are a few publicly available datasets, but to make the system identify a customized object our own dataset have to be built. All the images are given an ID of what it is (image labeling). This dataset can be used to get the object detection[10] model using tensor flow which is pre-trained. In the beginning, the datasets are in XML format, which is then converted to CSV format and in turn to TFRecord format, which is then label mapped and trained to obtain the inference graph which is used for object detection.

Similarly to identify the ID card, the system is trained with the number of ID card images in various positions and background. Using this ID card dataset a Tensor flow object detection model is created and is shown in Figure 3.

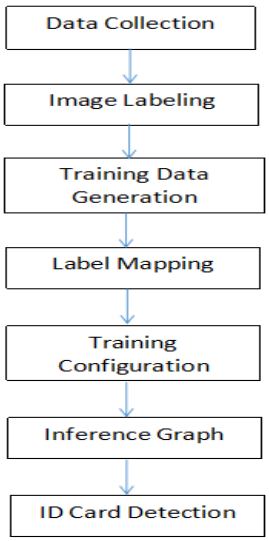


Figure 3: ID card detection flow

B. *Face Detection and Recognition*

This process is to find all the possible faces in the video frame. This procedure is only performed if the person is not wearing the ID. OpenCV hair cascade method is used to perform the concept of Cascade of Classifiers. The system is trained with a set of images which are to be detected [13]and with a set of

images which are not to be detected and to generate an XML file.

The collected dataset (frontal face images of a different person for face detection) is trained and an XML file is obtained using the detection process as shown in Figure 4.

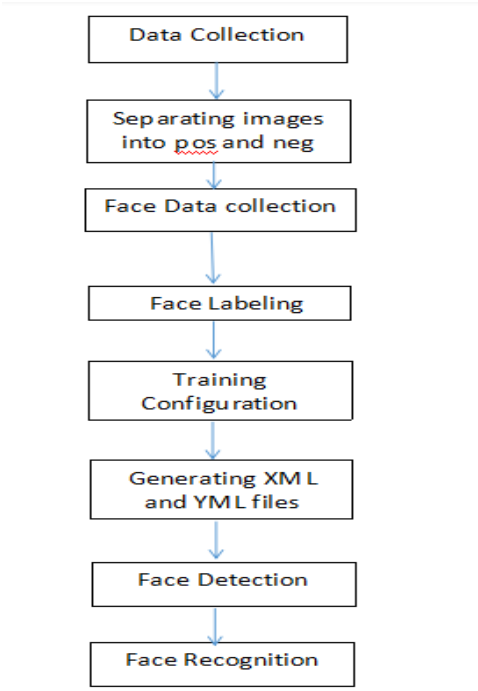


Figure 4: Steps involved in the face detection and identification method

For the recognition of the face, face data of a person who has to be recognized is collected. If more the number of images, the greater the efficiency, and here it is trained using 100 images. The face of the person is trained with an ID name. A YML file[12] is obtained after training. This file is used to recognize the person detected in the above part.

C. Framework

The outline of the proposed methodology is shown below in Figure 5.

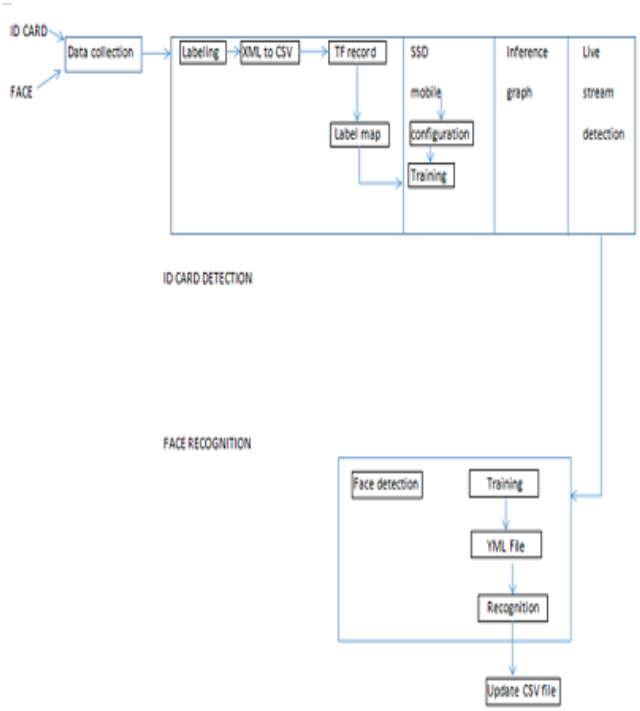


Figure 5: Framework

1. ID card detection:

In this process, if a person is wearing an ID card or not will be identified. This is done using a process called object detection using tensor flow. Here the system is trained with different ID card pictures and a trained inference graph is obtained which is used to identify the ID card in the reference image.

This process is achieved using the following steps:

- Data collection
- Image labeling
- Training data generation
- Label mapping
- Training configuration
- Inference graph
- ID card detection

2. Face Detection:

Face detection describes the process of determining whether there is a face in the image or not, and provide the coordinates of the face in the detected image[11] if it is detected. For this process, the system has to be trained with various face images. This process is performed using the haar cascade method. In this method two types of data are collected (i.e.) They are Positive images, which contain the images that have to be identified, and in this case, it is a face and Negative images which can contain any images apart from that have to be identified, that is anything else except for faces. The collected dataset is trained and an XML file is obtained

This process involves the following steps:

- Data collection
- Collecting positive images (images containing faces)
- Collecting negative images (images which do not have any faces in it)
- Training the system with the details of positive and negative images
- Generating an XML file
- Face detection

3. Face Recognition:

This process is to recognize the face which is detected as per the previous section. LBPH (local binary pattern histogram) is usually preferred face recognition and pattern recognition method in computer vision. It is appropriate for the feature because it describes the texture and structure of an image. In a grayscale image, a small part of the image is taken as a window of 3x3 pixels. It can also be represented as a 3x3 matrix containing the intensity levels.
The centre of the matrix is taken as the threshold, and a binary matrix is built using the threshold value, where the intensity value greater than the threshold is taken as 1 and the intensity values lesser are taken as 0. Using the binary value that is taken line wise is then converted into decimal value and set to the center of the matrix as shown below in figure 6.

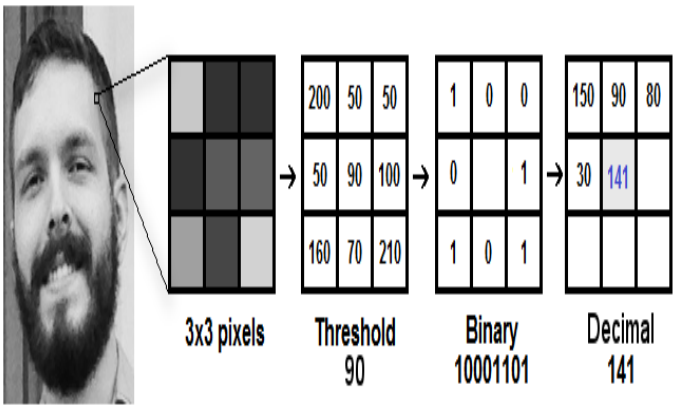


Figure 6: Local binary pattern

Once the above process is done the image is converted into grids. A histogram is formed for every grid and is combined to one histogram constituting all the grid histograms as shown below in figure 7.

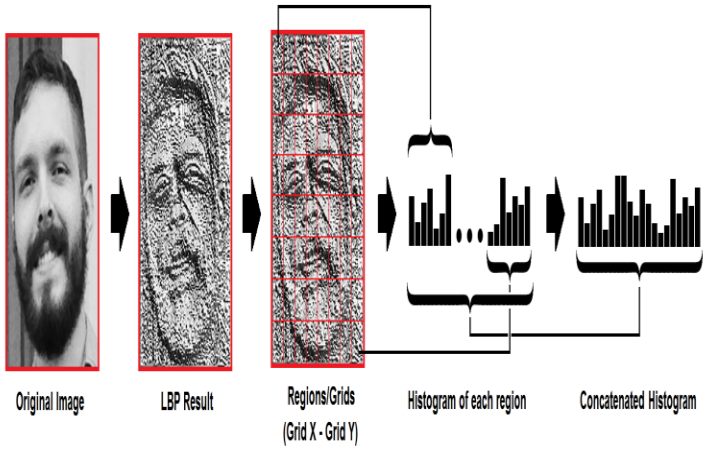


Figure 7: LBPH

The process is performed using the following steps:

- Collecting face data
- Labeling the face data
- Generating a YML file
- Face detection
- Face recognition

V. Result And Analysis

There are two cases in this system: case 1 is when the person is wearing an ID card and case 2 is when the person is not wearing an ID card. The results for both the cases are derived below.
Case 1: Person wearing an ID card
The proposed work is mainly designed to find out if the person is wearing an ID card or not and this is done by object detection using tensor flow. If the person is wearing an ID card, the system will mark the ID card with a green rectangle as shown in Figure 8.

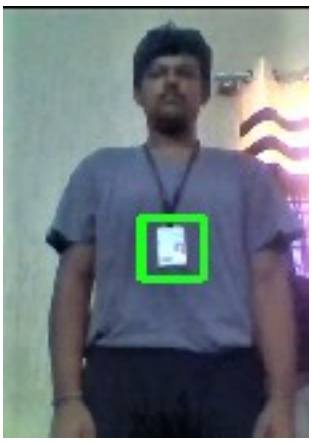


Figure 8: Person wearing ID card

Case 2: Person not wearing ID card.
The following steps are followed.
Step 1: ID card not detected.

Figure 9: Person not wearing ID card

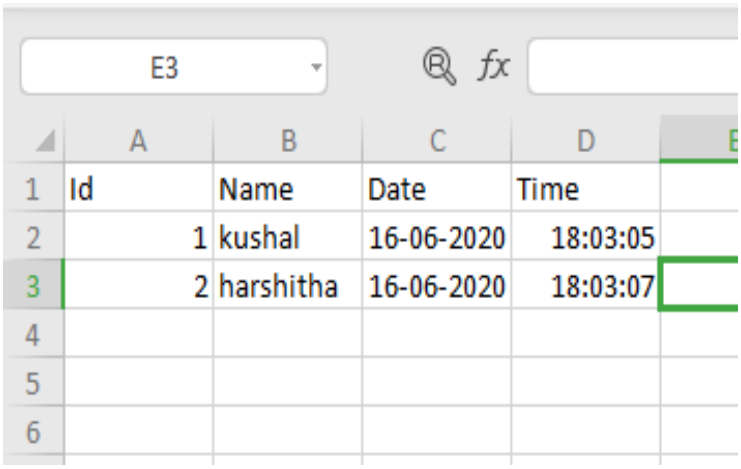
Step 2: Detect the face present in the image.

Figure 10: Detection of the face present in the image

Step 3: Identify the detected face in the image.

Figure 11: Recognition of the detected face

Step 4: Record the data of the person.



E3

	A	B	C	D
1	Id	Name	Date	Time
2	1	kushal	16-06-2020	18:03:05
3	2	harshitha	16-06-2020	18:03:07
4				
5				
6				

Figure 12: Recorded Data

The above figure shows that if a person is wearing an ID card then the person is identified and the details of that person are recorded into an excel sheet.

VI. CONCLUSION

The Proposed model was tested for detecting ID Cards, faces and to recognize faces. Model testing and training were done using Tensor Flow Object Detection API with the help of features provided for ID card detection, Harrcascade classifier for face detection and LBPH method for face recognition was implemented. To conclude by observing the results:

1) The system was able to detect the presence of an ID card in the image.
2) It was able to detect the presence of faces and provide their co-ordinates.
3) Problem areas were moving object and object of the same size.
4) Face recognition using LBPH is a tremendous success.

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