Deep Neural Network for Better Face Processing

P.Anjaneyulu, S.V.S Prasad, V.Syambabu, A.Vamshi Kumar

Abstract: ***This Paper represents the face detection using advanced method deep neural network which uses deep learning frame work. The old models used to detect the faces were like Haar-cascade method which detect the faces with good approaches but there is some uncertainty in the accuracy of the old models, so in this system we will use the latest deep neural network model which is embedded with latest open cv and by using the deep learning model frame work which is weighted with some other files. By using this model, we can achieve the better accuracy in face detection which can be used for further purposes like auto focus in cameras, counting number of people etc. This model detects the faces accurately and paves the way for better recognition systems which can be used in many face biometric applications. For this purpose, low-cost computer board Raspberry Pi and Camera Sensor will be used.***

Keywords: Raspberry Pi, OpenCV, Deep Neural Network, Deep learning, Camera Sensor.

I. INTRODUCTION

Face detection plays a very important role now a days in various applications. First, we need to know about the difference between the face detection and recognition. Face detection is nothing but detecting the face of any person present, if there is a face and first tries to detect the landmarks and then entire face, and face recognition is an application of face detection.This paper's Main aim is to achieve the better accuracy in face detection rate by using the deep neural network which uses neural network as its base for processing images which contain hidden layers and by using the deep learning frame work which comes with caffe model which is pre-trained.[2][4]

The deep neural network with the help of deep learning will be implemented on Raspberry Pi, we can also use the convolutional neural network for face detection but the convolution neural network requires more memory in the system and better hardware as the Raspberry Pi is limited in Hardware and Software we can use the deep neural network with the help of deep learning. The old models for face detection were using the Haar-cascade file which still performs better but when it comes to neural network these will outperform the existing methods.[3]

II. PROPOSED METHODOLOGY

The aim is to detect the faces in real time with maximum accuracy using Raspberry Pi, Camera Sensor and OpenCV with deep learning frame work in according with the deep neural network. Deep neural Network works accurately compared to the models like haar-cascades which gives fault rate some times. [4][2]Whenever there is a face present in front of the camera the system will detect the face and draw a box around the face on top of it, shows the confidence or the accuracy of the detection model in real time. [5] The model should detect many numbers of faces present at a time in front of the camera with accuracy possible.

III. HARDWARE IMPLEMENTATION

Hardware implementation plays a very important role in achieving the best results of face detection, we should use capable hardware which can process the camera frames while detecting the faces but with in expensive devices, to do so we can achieve the best result with following hardware which can be replaced with high performance devices for faster and more accurate results.

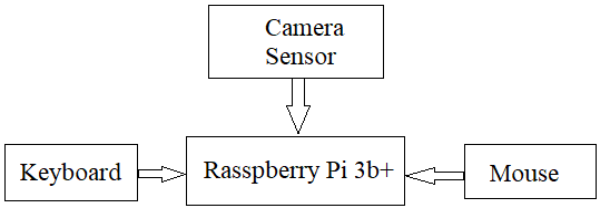

Figure 1 Block Diagram

Figure 1 shows the block diagram of hardware implementation of this paper.Raspberry Pi is a small board which acts as computer and it is developed by Raspberry pi foundation of United Kingdom. The Raspberry Pi board is coupled with 1gb of ram and it contains no internal memory so operating system needs to be separately installed in external SD card. [1] The board is powered by a Raspbian operating system which is developed based on Linux. The camera module is used for the purpose of detecting the faces and mouse, keyboard is required to control the Raspberry Pi. [1][3] Camera should be choose based on the better frame rate as this model reqires better frame rates to be processed.

IV. SOFTWARE IMPLEMENTATION

Software implementation plays major role in this face detecting system with new models for detection which are optimised with latest detection techniques like single shot detectors (SSD)

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and advanced methods such as Deep neural network.

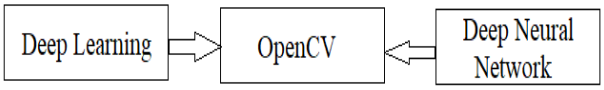

Figure 2 Software Implementation

Figure 2 shows the implementation of software for performing face detection, OpenCV plays very important role in detecting the faces it is developed by intel corporation for performing real time tracing projects which includes number of algorithms. For detecting the faces, we need to work with deep learning frame works and deep neural network, the previous versions prior to the 3.3 doesn't come with the support of deep neural network so that it requires OpenCV 3.3 or above versions. Deep learning supports many frames works and caffe model can be used for the face detection, this is a pre-trained face detection model. [4][2] The prototxt file actually defines the basic architecture for layers of deep neural network.

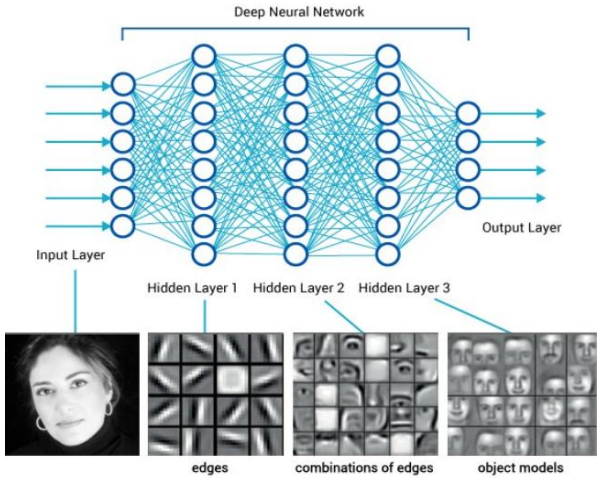

Figure 3 Deep Neural Network Layers

Figure 3 shows Deep Neural Network layers which is nothing but a neural network which contain more hidden layers along with one input and output layer, in this network each layer consists of different features of the processing image whereas a normal neural network consists of only one hidden layer, deep neural network processes the faces in better way using the more hidden layers.

V. ALGORITHM

The algorithm which is used for implementing the concept included in the paper is below, which explains important steps used while programming or coding to perform better operation using the face detector models.

```
#loading caffe model

ap.add_argument("-m", "--model", required=True,

        help="path to Caffe pre-trained model")

net = cv2.dnn.readNetFromCaffe(args["prototxt"], args["model"])

#get the frame dimensions and convert to blob pass through network

(h, w) = frame.shape[:2]

blob = cv2.dnn.blobFromImage(cv2.resize(frame, (300, 300)), 1.0,

                (300, 300), (104.0, 177.0, 123.0))

net.setInput(blob)

        detections = net.forward()

# loop over the detections, extract confidence and filter weak detections

        for i in range(0, detections.shape[2]):

                confidence = detections[0, 0, i, 2]

                if confidence <args["confidence"]:

                        continue

# compute the (x, y)-coordinates of the bounding box for the object

box = detections[0, 0, i, 3:7] * np.array([w, h, w, h])

(startX, startY, endX, endY) = box.astype("int")
```

VI. EXPERIMENTAL RESULTS

The Experimental results which are obtained after performing successful operation of face detection using the deep neural network can be seen below. Parameters which are used to obtain best result are listed below,

Face detector module = DNN (Deep Neural Network)

Type of face detector = SSD (Single shot detector)

Detector name = Caffe

Packages = Video stream, numpy, imutils, time

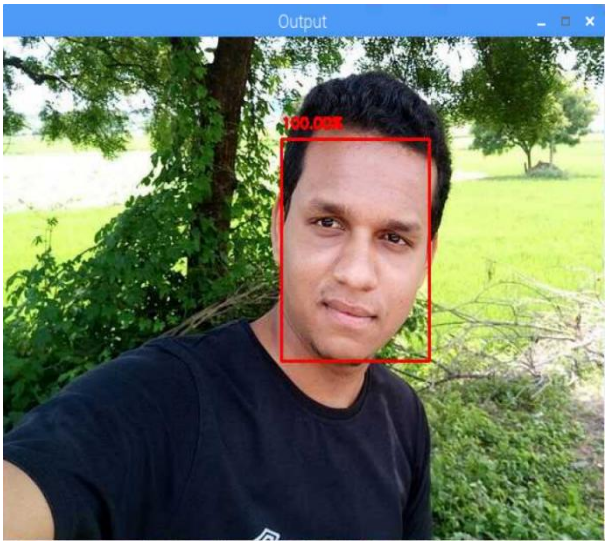

Figure 4 Face Detection

Figure 4 shows the detection rate of 100% which is achieved through proposed system, in this method whenever a face is present it will detect the faces and draws a rectangular box around the face and above the box it shows accuracy or confidence in detecting the face.

Figure 5 Multiple Face Detection

Figure 5 shows the model detecting the multiple faces present and it can detect many numbers of faces and the accuracy is maintained very better. This model performs good in both low light conditions and normal light conditions it can detect the face at maximum rate if the quality of the digital image or face in real time is high.

Table 1 Detection Rate

S.NO	Type of Face	Detection Rate (Approx.)	
		Low Light	Normal Light
1	Single Face	95-99%	98-100%
2	Two Faces	90-99%	95-99.9%
3	Multiple Faces	70-99%	80-99%
4	Blur(Min)	60-90%	70-90%
5	Blur(Medium)	55-90%	70-90%
6	Video File Faces	70-99.9%	80-99.9%

Table 1 shows the detection rates achieved in conditions like low light and normal light with various faces like blur normal, single and multiple faces. In maximum cases the model could achieve the 100% detection rate. And the lower detection rates might occur while moving the faces. The average face detection rate is maintained up to 90%.

VII. CONCLUSION

In this paper I used deep neural networks which contains more than one hidden layer to processing image for the better face detection which will be used for further purposes. Using the deep Neural Network along with deep learning library I could achieve the better accuracy in detecting the face in real time. The Better accuracy in face detection will be a way for better face recognizing and many applications which depend on the face detection just like the auto focus in cameras and counting the number of people and analysing the face etc.

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