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Implementation of Gender Detection with Notice Board using Raspberry Pi

jagruti kailas ahire[1], sakshi sanjay deore[2], mayuri manohar jadhav[3], snehalata ramprsad katkade[4]

[1]*Jagruti Kailas Ahire, LOGMIEER, Nashik.*
[2]*Sakshi Sanjay Deore, LOGMIEER, Nashik.*
[3]*Mayuri Manohar Jadhav, LOGMIEER, Nashik.*
[4]*Snehalata Ramprsad Katkade, LOGMIEER, Nashik.*

Abstract - *Authentication, security, surveillance systems, social platforms and social media has many application for face detection. Convolutional neural network use computer vision and machine learning techniques which is used to extract the facial feature. First investigated facial feature and best features which is useful for training and testing dataset. This learning representation is come from use of convolutional neural network. Which publish that the system is tested different challenging levels of face and give good outcome efficiency of system with face detection rate for database. This is simple and easy hardware*

***Key Words*: *Machine learning, Gender Detection, Google Cloud Vision API, Raspberry Pi, Convolutional Neural Networks (CNN), Artificial Intelligence, Linux Platform, Embedded System*.**

1. INTRODUCTION

The human eye is the vital part of the human visual system which provides a three dimensional, moving image, normally colored in daylight. It also extracts some features from different images that the decision is to be taken for what the image is all about. Nowadays, the computer is being trained in such a way that it can predict some specific result by taking images as input which works like the human visual system, hence it refers to as computer vision technology. Computer vision technology can be defined as the science and technology of the machines which are able to collect and analyze images or videos with the aim of extracting image features from the processed visual data and concerned with the theory behind artificial intelligence system. This system seeks to apply its theories and models for implementation of computer vision. In recent year the cameras are becoming smart as they possess standard computer hardware and required features like mobile devices. Computer vision is useful tool to move toward wide range of applications with the aims of different algorithms and frameworks such as social media platforms, industrial robots, event detection, image analysis (e.g. face recognition, medical image analysis), information management systems as well as input for human-computer interaction devices.

This paper aims to review the Google's cloud vision technology which is used to compute the contents of the images through powerful machine learning processes. This solution permits users to extract some relevant information from the visual data containing image labeling, face and landmarks detection, optical character recognition (OCR). By using the REST API, it is then easy to interact with Google's cloud vision platform, called Google Cloud Vision API. In this paper we are going to exploit embedded system and software resources in order to fulfill the gap of gender detection for Google Cloud Vision technology. Here we elaborate the design and real-time implementation of the hardware as well as software solution we made by using low cost Raspberry Pi 3 model B+ board with Pi Camera module, which itself minicomputer like credit card size and like a portable device. The following embedded system includes a specialized software tool for image processing (e.g. python). Afterward best facial features are to be introduced for training and testing the dataset in order to achieve improved gender detection performance rate for each of the dataset. We propose that by learning representation through the use of convolutional neural network (CNN), there is sensual increase in efficiency or say performance can be obtained on this work. We show that despite the very challenging nature of the images in the Audience dataset, the proposed method outperforms existing innovation by substantial margins.

1.1 HISTORY

For the best outcome of noticeboard with the help of face detection there are different work perform with unique result with the help of different kind of database the all method are depend on following reason :which type of face feature use for the best result. we can access the number of faces then we extract the face feature and create the feature vector for a particular face then training and testing part will be proceed.

1.2 BACKGROUND

H.D. Vankayalapati[6]has accommodate his work for feature classification using MATLAB based on support vector machine(SVM)algorithm .for feature vector the facial edge feature has carried out using Laplace of gaussiam filter to determine the landmark position. For input data verification the GTAV database is used. classification may be differ with the human race is the major limitation of this work[6].to ejection of this limitation the race and ethnicity elham ariansab[7] the neural network –based classification algorithm will be present for a face detection and reliability is mainly based on feature vector value and facial features.

for the weakness of this system training and testing of on whole database is presented to recognize the face using neural network .

To resizing face image before and after alignment the classification accuracy was also affected. [8] the Erno Machine and Roope Raisamo[8] has developed four fundamental gender detection method i.e. SVM[6], LBP, Adaboost and neural network with their classification rate and sensitive analysis for classifiers by varying notation, scale and translation of the face image by using IMM face database as well as FERET database the Gil Levi[5] present the convolution neural network(CNN)

For a different face position, pixel resolution and size which shows noticeable increase in performance of gender classification rate. the Audience face dataset has been use for training and testing particular dataset

Finally, for real time application purpose most preferable and reliable board for gender detection system, raspberry pi3 model B+ board and camera module has been used by Davide Mulferi[2] for making and assistive technology system by using Google cloud vision platform's REST API to process image as facial feature extraction in form of JSON response[2][3]which is then used as a database for a learning purpose

Similarly, we will conduct the same implementation using cnn as well as raspberry pi platform which itself a mini computer for a real time application to close the gap of Google cloud vision technology.

2. RESULT AND ANALYSIS

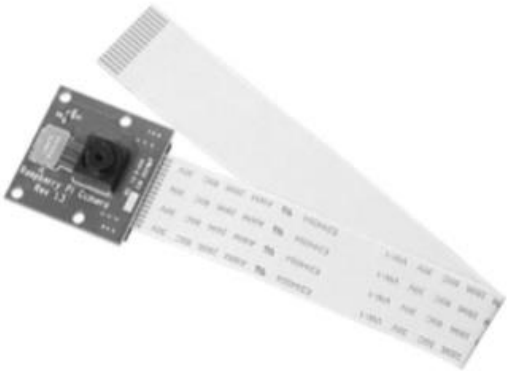

Fig. 1. Raspberry Pi Camera Module

Fig. 1 shows the raspberry pi camera module which has pixel resolutions of 2592 x 1944 pixel, connects by way of 15 pin Ribbon Cable to dedicated 15 pin Camera Serial Interface(CSI), specially design for camera module. This CSI bus is capable of extremely high data rate. Raspberry pi module weight is about 3g, dimension at 25mm x 20mm x 9mm, hence board itself is tiny and perfect about size and weight, which is very important for mobile and other applications.

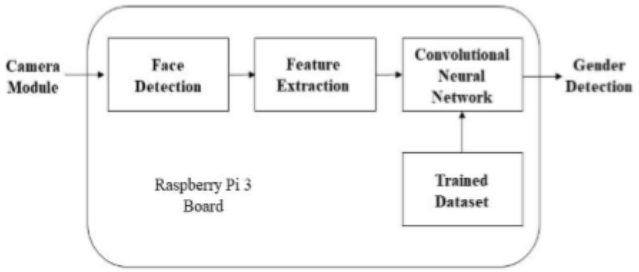

Fig. 2. A Block Diagram.

An RGB image is captured through Raspberry Pi camera module which is first scaled to 3 x 256 x 256 and then cropped to 3 x 227 x 227. This cropping is further detailed in the next session. Three convolutional layers and three fully connected layers are described as follows.

1. 96 filters of size 3 x 7 x 7 pixels are applied to the input image in the convolutional layer - 1 with 4 strides and zero padding, resulting output of size 96 x 96 x 56, which is followed by a ReLU, max-pooling to reduce the size to 96 x 28 x 28, and a Local Response Normalization (LRN).

2. The output of first is applied to convolutional layer - 2 with 256 filters of size 96 x 5 x 5 convolved with 1 stride and 2 padding, resulting output of size of 256 x 28 x 28. Which is further followed by ReLU, max-pool and LRN, reducing the output size to 256 x 14 x 14.

3. This second output is applied to convolutional layer - 3 with again 256 filters of size 256 x 3 x 3 are convolved with 1 stride and 1 padding, resulting in an output of 256 x 7 x 7 sizes.

The fully connected layers are described as:

4. The first fully connected layers which receives the output of third convolutional layer, has 512 neurons followed by a ReLU and dropout layer.

5. The second fully connected layer of 512 neurons fully connected to the 1 x 512 output of first fully connected layer followed by a ReLU and dropout layer.

6. The final fully connected layer with 2 or 8 neurons fully connected to the 1 x 512 output of second fully connected layer which maps to final classes of gender detection.

The technical details related to our network architecture and trained model are elaborate as below:

Local Response Normalization (LRN):

The Local Response Normalization layers are used here after first two pooling layers which is used to help the generalization of CNNs. The main reason behind LRN is for introduction of lateral inhibition between the various filters for the given convolution by making them "compete" for large activations over particular segment of their input. This affects to prevent repeated recording of the same information. Here, if ai x, y is the activation of a neuron by

applying kernel i at position (x, y), then it's LRN activation bi x, y is as follows:

Here

$$b^i_{x,y} = a^i_{x,y} / \left(k + \alpha \sum_{j=max(0,i-n/2)}^{min(N-1,i+n/2)} (a^j_{x,y})^2 \right)^{\beta}$$

Here, k, n, α, and β are the hyper-parameters. n is the number of "adjacent" kernel filters. N is total numbers of kernels in that given layer.

Soft max function:

Soft max function is used after the final fully connected layer for which is used to compute the loss term and also used to optimize during training and the class probabilities during a classification. This function is also known as multinomial logistic regression. Suppose we have zi, is the score assign to class i after the final fully connected layer, then the soft max function is defined as follows:

$$f_j(z) = \frac{e^{z_j}}{\sum_k e^{z_k}}$$

Because we want to maximize the log likelihood of the correct class. Now here we have to minimize the negative log likelihood.

Because the softmax function is used to takes real-valued score being output from f and normalizes them by their exponentiated sum, it suggests that the sum of all softmax scores is 1. It should be considered that the softmax loss is actually a particular form of a cross- entropy between an actual distribution p and an approximate distribution q is as follows:

$$H(p,q) = -\sum_x p(x) log q(x)$$

From this function we can see that softmax classifier is used to minimize the cross-entropy which would look like one predicted for actual class and zero predicted for everything else.

Stochastic Gradient Descent:

After finding the loss, we need to require how to minimize it in order to train an accurate classifier. For this experiment we are going to optimize this by using Stochastic Gradient Descent function. For this function first, we need to know about gradient which is basically derivative of loss function with respect to all the variables/ weights. Then we will have the direction along which we can move toward our minimum loss most quickly by following the negative of the gradient [8, 9]. Each of the time we will compute the gradient we take a small step in the opposite direction an we re- evaluate the loss, re-compute the gradient, and repeat. Hence, we will decrease our loss function by repeating this process iteratively therefore better its classification work. Mathematically we can describe this as follows:

$$w = w - \eta \, \delta_w L$$

where η is the learning rate or also called the step size and δwL is the gradient of the loss term with respect to the weight vector w.

3. CONCLUSIONS

Google has developed an extraordinary computer vision technology in the last year which has introduced a specialized REST API also called Google Cloud VisionAPI. By using this, Developer can remotely access in easy way to process the content of face images in order to extract some information from visual data with face and landmark data to explore their work. In this paper we have discussed the real-time application of gender detection to close the gap of Google Cloud Vision technology which has given the facial features only. But by using these features we have elaborated our work in the direction of CNN for implementation of gender detection to accurately predict the class of given data (either male or female) on very cheap and credit card sized processor Raspberry Pi board equipped with camera module. We believe that this project is a very innovative for the computer vision technology

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