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# Efficient Face Recognition and Object Detection Using Viola Jones Algorithm

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**Abstract-** Starting in the end of 20th century, face recognition has become one of the most researched topics in computer vision and research. Conventional methods based on rigorous human data features construction and traditional machine learning techniques have recently been outdated by deep neural networks trained with large datasets. In this paper we provide a way to use machine learning and with deep learning methods on face and object recognition using cascade layers with Viola Jones algorithm.

**Index Terms-**Machine learning; computer vision, python; raspberry pi

## 1. INTRODUCTION

As the population increase the size of the cities increase. With the increase in size of cities, the population of the city comes into picture.

We can use computer vision to find features of the human body and face which can be used to detect them. However, in a short span of moment, many photos and videos are being uploaded on search engines and social networking platform which consist of many constraints like objects, faces, scenes and places etc. Well this information can be used in managing the dataset.

The detected features can be passed on to the trainer where the model can be trained from the video and images passed on to it. The two main uses that we found for this projects is that.

1. This is especially useful for the task of pedestrian detection and guiding them through a specific route. This type of detection are especially required when dealing with a larger crowd as the crowd size increase logarithmically we need an robust way to guide them through a specific direction as jam or deadlocks wouldn't occur.
2. For security purposes in supermarkets and mall where the object tracking can be done preventing theft and finding lost goods.

## 2. THREE PHASES IN FACE RECOGNIZATION AND ONE PHASE IN OBJECT DETECTION

- Face Detection and Data Gathering
- Train the recognizer
- Face recognition
- Color detection of the object

### *2.1. Face Detection And Gathering*

The first and most basic task is face detection. Before anything else can be done you must complete this phase. For face detection/ object detection can be done by using Haar feature-based cascade classifiers. It is an effective method to categorize data. The algorithm is based on the paper of Paul viola and Michael jones.

### *2.2. Train The Recognizer*

The method is based on a cascade function which is trained from a set of confident and undesirable images. This is a machine learning method. It is then used to recognize objects in other images. Here we can go with face recognition, the algorithm needs a proportion of positive images which are images of faces and negative images which are images without faces to train the classifier. Then we need to extract structures from it to have a better accuracy at our desired result.

### *2.3. Face Recognition*

As you train the model the model will increase its efficiency depending on the classifier. Here cascade classifier detection is based on stages the number of stages increase the features of images also increases as with 38 stages, the detector had 65000+ features.

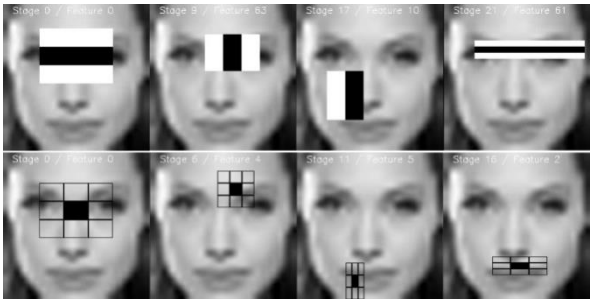


***Fig 2.1 :*** **Face recognition through cascade**

### *2.4. Color detection of objects*

The detection and tracking of a certain color object depends on computer vision. Normal camera uses RGB as standard to interpret color 0-FF in hexadecimal. Open CV works with HSV(Hue,saturation,value) color model designed in 1970 to more closely mimic with the way human eye perceives color-construction features.

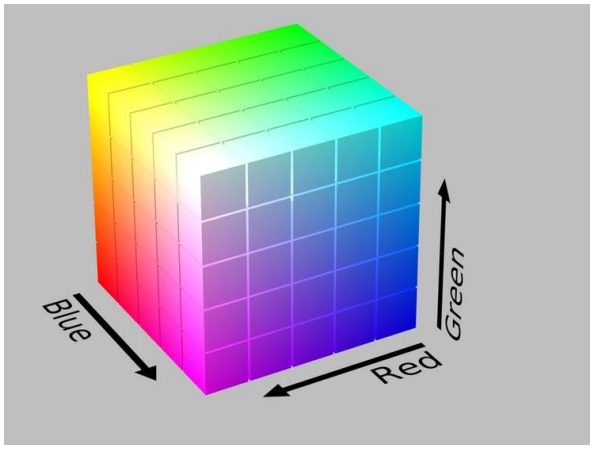



Fig : 2.2 Object detection through saturation hue contrast rather than RGB.

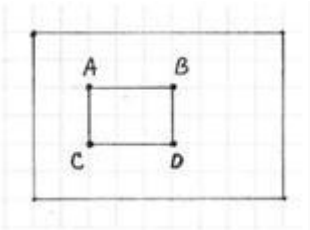
## 3. EQUATIONS

The Viola-Jones algorithm is a extensively used tool for object detection. The main advantages and drawback of this algorithm is that training of the data is slow. But it can come up with the shortcoming with detection which is fast. This algorithm uses Haar basis feature filters which is one of the major filters in detection of the objects. As it is using Haar filters where multiplication isn't necessarily done.

$$II(y,x) = \sum_{p=0}^{y} \sum_{q=0}^{x} Y(p,q)$$

$$C_m = \begin{cases} 1, & \sum_{i=0}^{I_m-1} F_{m,i} > \theta_m \\ 0, & \text{otherwise} \end{cases}$$

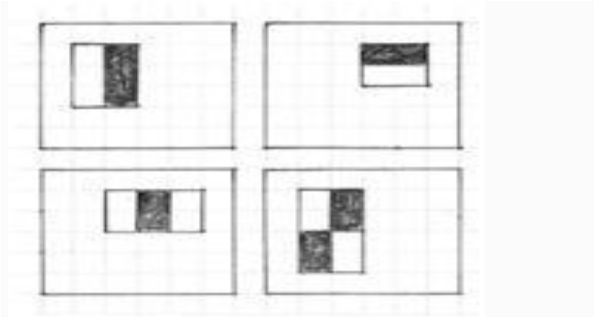
$$F_{m,i} = \begin{cases} \alpha_{m,i}, & \text{if } f_{m,i} > t_{m,i} \\ \beta_{m,i}, & \text{otherwise} \end{cases}$$



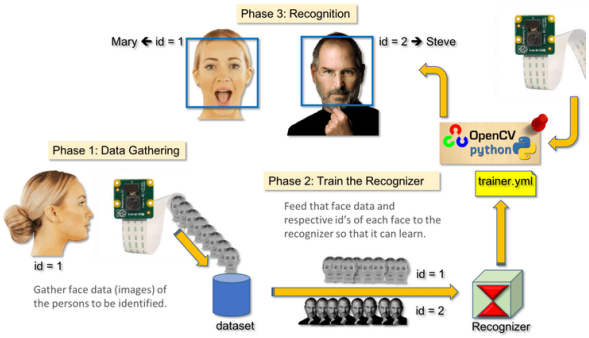

Haar extractors can be calculated with the intergral with just four numbers. For example, the image integral of area ABCD (Fig.1) is calculated as $II(y_A,x_A) - II(y_B,x_B) - II(y_C,x_C) + II(y_D,x_D)$.

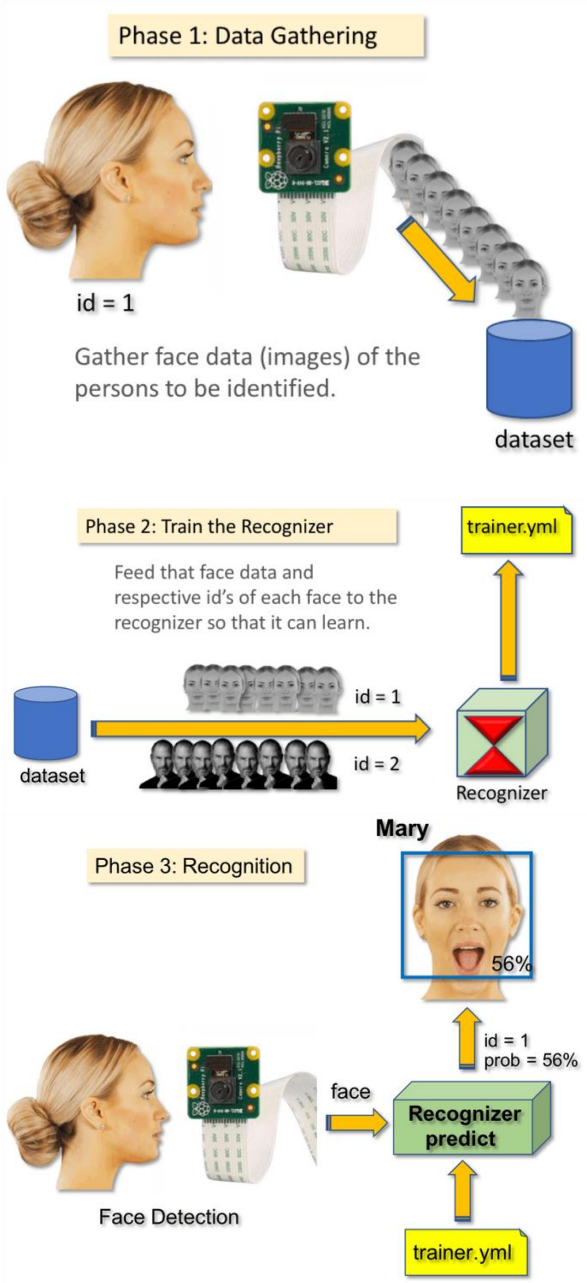
Detection happens inside a detection window. A min and max window size is chosen, and for each size of the window a sliding step size is chosen. Then the detection window is moved over the image as follow:
First to set the min window size, and sliding step equivalent to that size.

For the chosen window size, move the window vertically (up) and horizontally (down) with the same step. At every step, a set of *N* which is defined by the user, N here is number of filters face recognition filters are applied. If one of the filter gives a confident answer, the face is detected in the displaying window.
If the size of the window is the maximum size stop the procedure. Or else need to reconfigure the window size and the corresponding sliding step.
Each face is recognized from the set of *N* filters. This contains a set of cascaded classifiers which are interconnected to detect each face. Each classifier looks at a rectangular subset of the detection window and decides if it looks like a face. If it does, the next classifier is functional. If all classifiers give a confident answer, the filter gives a positive answer and the face is recognized with greater accuracy. Otherwise the next filter in the set of *N* filters is run. Each Haar feature classifier is the weighted sum of 2-D integrals of small rectangular areas attached to each other.



**Results: Finding and recognizing the face of humans and object detection through viola jones algorithm is efficient are results in more accuracy.**






.Conclusion: From the above paper author made an attempt to bridge the gap between processing power and data collection of the set. As if data set is less more processing is needed for the desirable results and if the data is more getting the desired output is less intensive. Through paul viola algorithm this gap can be bridged.

**REFERENCES**

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