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Haar Cascade Algorithm And Local Binary Pattern Histogram LBPH Algorithm In Face Recognition

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A B S T R A C T

In Real TimeFace Recognition can be done using two methods such as “Face Detection ” and “Face recognition ”. This paper describe the use of Machine Learning algorithms in real time Face Recognition that is “Haar Cascade algorithm ” which is use for Face Detection and “Local Binary Pattern Histogram LBPH algorithm ” which is use for Face Recognition.

Keywords:Face Detection, Face Recognition, Machine Learning, Haar Cascade, Local Binary Pattern Histogram.

1. INTRODUCTION

Face Detection, a widely popular subject with a huge range of applications. Modern day Smartphones and Lap-tops come with in-built face detection software’s, which can authenticate the identity of the user. There are numerous apps that can capture, detect and process a face in real time, can identify the age and the gender of the user, and also can apply some really cool filters. The list is not limited to these mobile apps, as Face Detection also has a wide range of applications in Surveillance, Security and Biometrics as well. Face recognition is a real time image processing based technique. Face detection finds the position of the face of an individual. Detecting the face of a single person is considered for face recognition. Positive identification of individuals is very important in a group of images. After detecting faces its facial features are extracted and used in many applications like facial expression recognition, face recognition, observations system, etc., Different approaches have been tried by several groups working world wide to solve this problem**.**

Face recognition is a biometric software application adapted to identify individuals via tracking and detecting. The main intention of this paper is to recognize the faces of people. This approach can be executed practically in crowded areas like airports, railway stations, universities and malls for security. The main target of this paper is to enhance the recognition rate.Face detection is a computer coding technology that determines the location and size of human faces in a given image format. It detects only the facial features and ignores the rest. Here two algorithms, Haar cascades and Local Binary Pattern Histogram (LBPH) were evaluated based on.

2. HAAR CASCADE

The Haar Cascade algorithm is a set of classifiers used for object detection. Haar Cascade is a machine learning-based approach where a lot of positive and negative images are used to train the classifier. The images which we would like to be classified by the classifier are known as positive images and the images we would not want our classifier to classify are known as negative images.

Object Detection using Haar feature-based cascade classifiers is an effective object detection method. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, haar features shown in below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under white rectangle from sum of pixels under black rectangle.

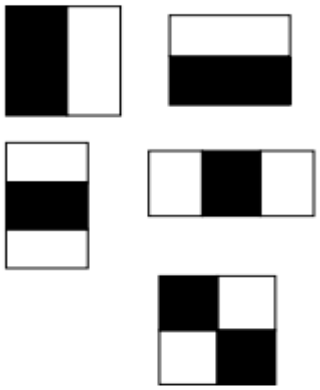

Fig. 1 Block Diagram.

Now all possible sizes and locations of each kernel is used to calculate plenty of features. (Just imagine how much computation it needs? Even a 24x24 window results over 160000 features). For each feature calculation, we need to find sum of pixels under white and black rectangles. To solve this, they introduced the integral images. It simplifies calculation of sum of pixels, how large may be the number of pixels, to an operation involving just four pixels. Nice, isn't it? It makes things super-fast.

The classifier of cascades has a group of stadiums, each stage is full of delicate pupils. Feeble beginners, who are often simple classifiers and are classified as option stumps. A technique called boosting is used to plan each level. Boosting involves a weighted level of preference made by frail learners. The most reliable classifier can be planned. The domain isidentified by each stage of the classifier as the pre-sent sliding windows condition. Maybe it's optimistic or bad. If positive, it was found at the pointed object. On the off chance, the negative article was not located at that time. The grouping of the zone is finished at the stage where the label is negative. At that point, windows are moved to the net location by the identifier. The classifier usually moves the area to the net level. At the earliest opportunity, the phases have detrimental examples open.

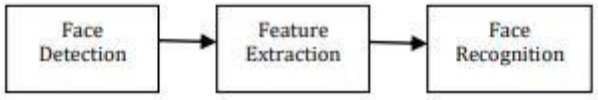

Fig. 2 Haar like features

Examples for Haar-like features are displayed in Fig.2, which is to identify dissimilarities in dark and white regions of the images. Fig. 2: Haar like features From this representation, light region explain "to add" and dark region is "to subtract".

3.LOCAL BINARYPATTERN HISTOGRAM

Local Binary Pattern Histogram (LBPH) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number . It was first described in 1994 (LBP) and has since been found to be a powerful feature for texture classification. It has further been determined that when LBP is combined with histograms of oriented gradients (HOG) descriptor, it improves the detection performance considerably on some datasets. The Local Binary Pattern is used for face recognition, which means identifying the captured image against the image already stored in the database. The algorithm makes use of four main parameters to recognize a face. The Local Binary Pattern is applied to the image and compared against the central pixel of the image, then we calculate the histogram value for the image.

Using the LBP combined with histograms we can represent the face images with a simple data vector. LBPH extracts local features in the face and match it with the most similar face image in the database. LBPH is a method that works by dividing the face image into several blocks. Histograms will be calculated for each block and in the matrix we compare the pixels with the centre pixel. At the end we will get a binary number which will be converted to decimal format. It will be combined together under one vector which will help to recognize the face in the database. To understand more about Local Binary Pattern algorithm, consider the following example.

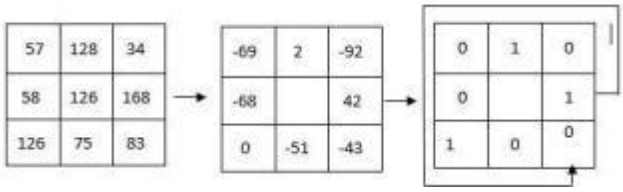

Fig. 3 The basic LBPH Operation

The original LBPH operator labels the pixels of an image by keeping the 3x3 neighborhood or it can be also said as a matrix. Each pixel has value which can vary depending upon the image and pixel quality.

Linear binary pattern histogram is mainly preferred for "Feature extraction". It operates with powerful discrimination. The features from the image will get extracted in live stream using this algorithm.

Linear Binary Pattern Histogram algorithm has two steps, training period and evaluation period. The process in training period is to train the image samples to be recognized and subsequently in estimation period, the image to be tested will be compared with the samples trained in dataset.

3.1 Working of LBPH algorithm

The LBPH algorithm typically makes use of 4 parameters:

Radius: The distance of the circular local binary pattern from the center pixel to its circumference and usually takes a value of 1.

Neighbors: The number of data points within a circular local binary pattern. Usually, the value of 8.

Grid X: The number of cells in the horizontal plane, is usually a value of 8.

Grid Y: The number of cells in the vertical plane, is usually a value of 8.

A data set is created by taking images with a camera or taking images that are saved, and then provisioning a unique identifier or name of the person in the image and then adding the images to a database. It is recommended to take many samples from a single individual. A portion of the data set is used for the training of the algorithm, while the rest is used for testing.

Using a circular neighborhood concept (which takes non-integer pixel points around a selected area), the number of appearances of LBP codes in the image is put together to form a histogram. The classification is then carried out through the calculation of the basic similarities of the histograms under comparison.

This histogram contains a description of an individual at three different levels: at a pixel-level, labels are combined in a small area to create a regional level, the regional histograms in combination build a general description of the person.

The application of the LBP operation is the first step of the computational steps. Here, an intermediate image has been created to better represent the original image through a sliding window concept, taking into account two parameters: the neighbor and the radius. New values are created in the form of binary by comparing the 8 neighbor values to the threshold value.

For each neighbor value greater than the threshold value, the value is set to 1 and 0 for every neighbor value less than the threshold value. This forms a matrix of binary numbers excluding the threshold. A central value of the matrix is created by the conversion of the binary number to a decimal value which corresponds to the pixels of the original image. For a better representation of the characteristics of the original image.

LBPH Application Areas

Face recognition by the LBPH algorithm can be used in the following areas:

- *Texture analysis:* applicable in research and in applications such as medical imaging. This has made image processing easy due to texture segmentation of images which, has led to a significant progress in analysis.
- *Biometrics:* used in biometrics, such as palm-print recognition, fingerprint recognition, iris recognition, gait recognition, the order of placement of recognition, and in the face of an age rating.
- *Computer vision:* used in computer vision such as motion analysis. LPH enables computer systems to be able to understand information on images and make meaning of this information.

Conclusions

Face recognition technology is one of the most popular application of artificial intelligence which is used in several places for security purpose. In this paper we describe the overall operations of Harr Cascade algorithm and Local Binary Pattern Histogram LBPH algorithm.This algorithms are effectively useful in Face Recognition technology.

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