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Facial Expression Recognition System Opinion Mining

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Abstract: Automated identification of facial expression has become necessary for the subject of psychological phenomena and the development of human being-computing machine interaction (HCI). In addition to that it also plays an integral part of computer visual sensation research. Robotized acknowledgment of facial reflection likewise assists with making applications that can be executed in security arrangement of rules and furthermore for other analytical point. It additionally emergently affects Commercial distinguishing proof and advertising. Look Recognition frameworks are for the most part founded on highlight following from a video source. the specific frameworks can be executed utilizing various algorithmic projects like nearby twofold Pattern and Viola-Jones calculation. This venture presents you a Facial Expression acknowledgment framework "opinion mining" which utilizes Viola-jones calculation to identify face from a picture and neighborhood paired design for demeanor acknowledgment. For arrangement of articulations Support vector machine is utilized. Utilizing look project we can recognize an individual's look and show climate the individual is grinning, miserable or stunned. This item system is planned to initially recognize and peruse a people face. The framework then registers different facial boundaries of the people face. Subsequent to recognizing and enlisting these boundaries, the framework groups the articulations for human misery, grin and human articulations. In view of these measurements the framework closes the individual's emotional state.

Keywords: Automation, Facial Expressions, Feature Tracking, Local Binary Pattern, Viola-Jones Algorithm.

I. INTRODUCTION

An image is an artifact that delineates visual discernment, for example a two-layered picture that has an equivalent appearance to some subject, generally speaking, an actual dissent or a man, in this way giving a depiction of it. "Picture" is similarly used as a piece of the greater sensation of any two-layered figure, for instance, an aide, a graph, a pie frame, or an imaginative creation. Pictures can moreover be delivered truly, for instance, by drawing, the art of painting, cutting, delivered normally by printing or PC plan development, or made by a mix of procedures, especially in a pseudo-photograph. Picture handling will be treatment of pictures using logical tasks by using any kind of banner planning for which the data is an image, a movement of pictures, or a video, for instance, a photograph or video frame; the yield of picture getting ready may be either an image or a course of action of characteristics or boundaries related to the picture. Picture dealing with generally implies automated picture taking care of, but optical and straightforward picture planning moreover are possible. The acquiring of pictures (making the data picture regardless) is insinuated as imaging

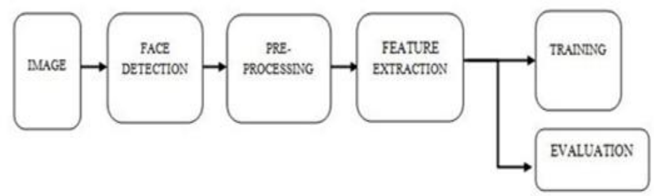


Figure1. Face Recognition Steps

From Figure 1 we can note that the complete process of face recognition covers in three stages, face detection, feature extraction and recognition. Facial expression audit has been attracting considerable attention in the advancement of human being machine interface since it provides a natural and efficient way to communicate between humans. Understanding the human seventh cranial nerve look and the study of formulation has many aspects, from information processing system audit, emotion recognition, lie detectors, airport security, nonverbal communicating and even the role of expressions in art. Some application area related to face and its expressions include personal identification and access control, video recording telephone set and teleconferencing, forensic applications, human-computer interaction, automated surveillance, cosmetology, and so on.

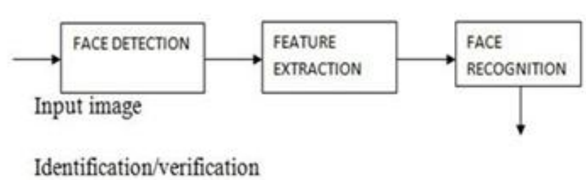


Figure2. ThreeMainPhaseofFaceRecognition.

From the Figure 2 we can see the three main phases of face recognition. A number of methods have been developed for representing face recognition. These include Gabor Wavelets, Linear Discriminate audit, and Support Vector Machine and

Ada boost algorithm. Also these techniques vary from various other surrounding factors suchas face orientation, expression, lighting and background.

II. FACEDETECTIONUSINGVIOLA-JONESALGORITHM

For the usage of Facial expression detection, it is important to recognize the facial figure first. Viola Jonescalculation is a standout amongst the most prevalent methods utilized for facial identification and analysis. It isbroadly wellknown since it is vigorous, Realtimeandhas ahighdiscovery rate. The violajones calculationcanbefundamentallyexecutedinfourstages.TheyareHaarFeatureSelection,CreatinganIntegralimage,AdaboostTraininingandCascadingclassifiers.The Viola-Jones estimation at first perceives the face on the grayscale picture and a short time later tracks down the region on the shaded picture. Viola-Jones approaches a case (as you can see on the right) and searches for a face inside the box. It is essentially searching for these haar-like features, which will be gotten a handle on later.

A. Motivation

From Instagram filters to self-driving cars, Computer Vision technologies are now deeply integrated into the lifestyle of many people. One important Computer Vision application is the ability to have a computer detects objects in images. Among those objects, the human face receives the most attention since it has many useful applications in security and entertainments. Hence, this article focuses on a popular face detection framework called the Viola-Jones Object Detection Framework. The aim here is to provide you with the understanding of the framework so that you can confidently use an open source implementation like the one provided by OpenCV. I want to help you understand what is going on under the hood and hopefully make you appreciate libraries like OpenCV more for handling all the complexities for you. If you want a “from-scratch” implementation, you can refer to this Python implementation by Anmol Parande. I also recommend you to check out this video by Ramsri on this topic.

B. The Concepts

Developed by Paul Viola and Michael Jones back in 2001, the Viola-Jones Object Detection Framework can quickly and accurately detect objects in images and works particularly well with the human face (Viola & Jones, 2001). Despite its age, the framework is still a leading player in face detection along side many of its CNNs counter parts. The Viola-Jones Object Detection Framework combines the concepts of Haar-like Features, Integral Images, the AdaBoost Algorithm, and the Cascade Classifier to create a system for object detection that is fast and accurate. Thus to understand the framework, we first need to understand each of these concepts individually and then figure out how they connect together to form the framework.

1. Haar-like Features: Often in Computer Vision, features are extracted from input images rather than using their intensities (RGB values, etc) directly. Haar-like features are one example. Other examples include Histogram of Oriented Gradients (HOG), Local Binary Patterns (LBP), etc. A Haar-like feature consists of dark regions and light regions. It produces a single value by taking the sum of the intensities of the light regions and subtract that by the sum of the intensities of dark regions. There are many different types of Haar-like features but the Viola-Jones Object Detection Framework only uses the ones in Figure 1. The different types of Haar-like features let us extract useful information from an image such as edges, straight lines, and diagonal lines that we can use to identify an object (i.e. the human face).

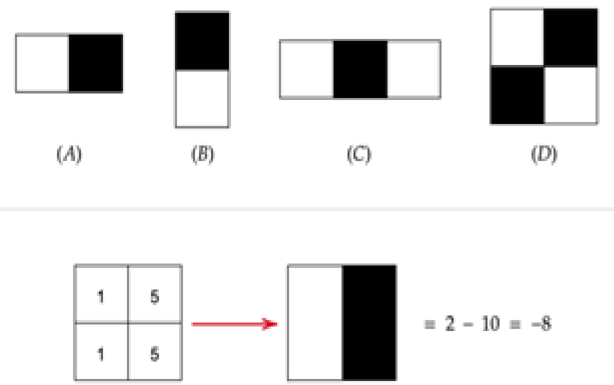


Figure3. Haar-like features (top) and how to calculate them (bottom).

2. Integral Images: An Integral Image is an intermediate representation of an image where the value for location (x, y) on the integral image equals the sum of the pixels above and to the left (inclusive) of the (x, y) location on the original image(Viola & Jones, 2001). This intermediate representation is essential because it allows for fast calculation of rectangular region. To illustrate, Figure 3 shows that the sum of the red region D can be calculated in constant time instead of having to loop through all the pixels in that region. Since the process of extracting Haar-like features involves calculating the sum of dark/light rectangular regions, the introduction of Integral Images greatly cuts down the time needed to complete this task.

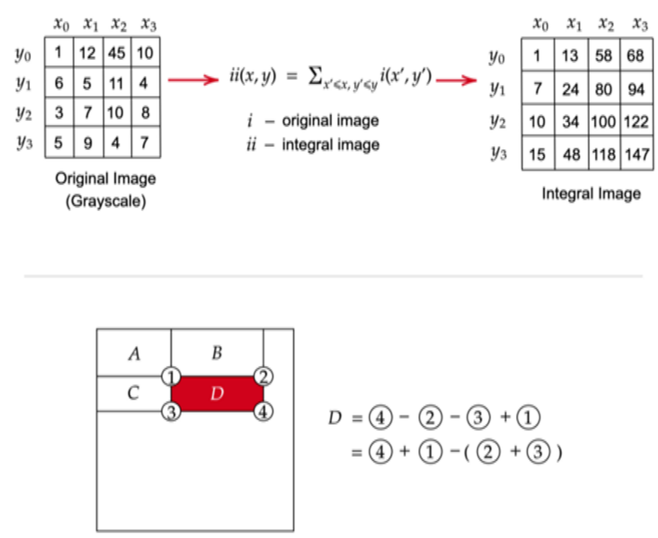


Figure4. Conversion of original image to integral image (top) and how to calculate a rectangular region using an integral image (bottom).

III. THE ADABOOST ALGORITHM

The AdaBoost (Adaptive Boosting) Algorithm is a machine learning algorithm for selecting the best subset of features among all available features. The output of the algorithm is a classifier (a.k.a Prediction Function, Hypothesis Function) called a "Strong Classifier". A Strong Classifier is made up of a linear combinations of "Weak Classifiers" (best features). From a high level, in order to find these weak classifiers the algorithm runs for T iterations where T is the number of weak classifiers to find and it is set by you. In each iteration, the algorithm finds the error rate for all features and then choose the feature with the lowest error rate for that iteration.

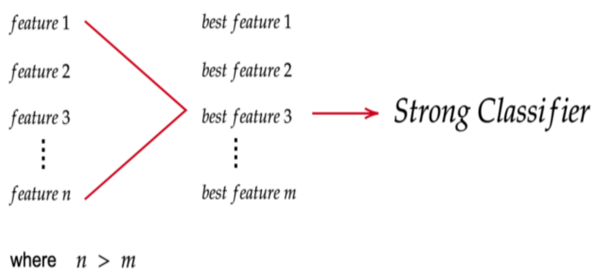


Figure5. The goal of using the AdaBoost algorithm is to extract the best features from n features. Note: best features are also known as weak classifiers.

IV. THE CASCADE CLASSIFIER

A Cascade Classifier is a multi-stage classifier that can perform detection quickly and accurately. Each stage consists of a strong classifier produced by the AdaBoost Algorithm. From one stage to another, the number of weak classifiers in a strong classifier increases. An input is evaluated on a sequential (stage by stage) basis. If a classifier for a specific stage outputs a negative result, the input is discarded immediately. In case the output is positive, the input is forwarded onto the next stage. According to Viola & Jones (2001), this multi-stage approach allows for the construction of simpler classifiers which can then be used to reject most negative (non-face) input quickly while spending more time on positive (face) input.

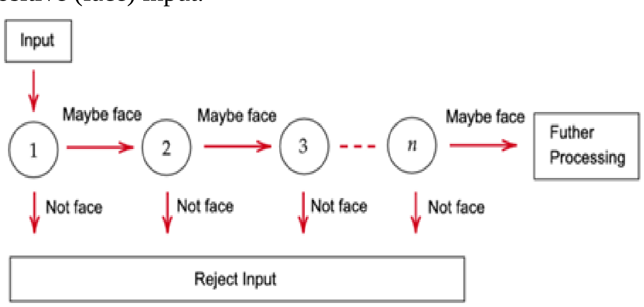


Figure6. The Cascade Classifier.

V. FACE DETECTION WITH THE VIOLA-JONES OBJECT DETECTION FRAMEWORK

After learning about the major concepts used in the Viola-Jones Object Detection Framework, you are now ready to learn about how those concepts work together. The framework consists of two phases: Training and Testing/Application. Let's look at each of them one by one.

A. Training

The goal of this phase is to produce a Cascade Classifier for a face that is able to accurately classify a face and discard non-faces quickly. To achieve that, you must first prepare your training data and then construct a Cascade Classifier by using a modified AdaBoost Algorithm on that training data.

B. Data Preparation

Concepts: Integral Image + Haar-like Features

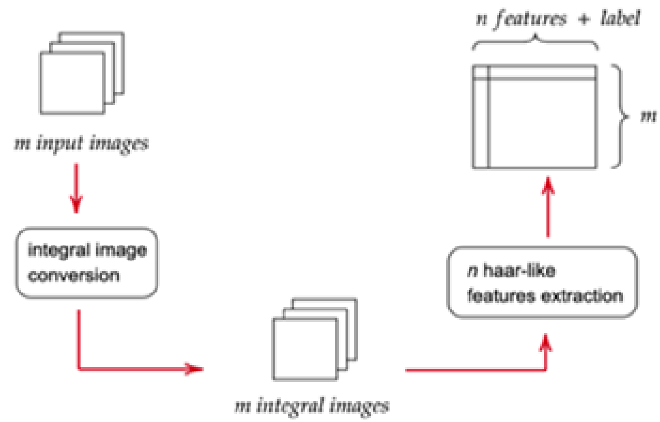


Figure7. The Data Preparation Process.

Assuming that you already have a training set consisting of positive samples (faces) and negative samples (non-faces), the first step is to extract features from those sample images. Viola & Jones (2001) recommends the images to be 24 x 24. Since each type of Haar-like features can have different sizes and positions in a 24 x 24 window, over 160,000 Haar-like features can be extracted. Nonetheless, in this stage all 160,000+ Haar-like features need to be calculated. Fortunately, the introduction of Integral Images helps speed up this process.

C. Constructing a Cascade Classifier with a modified AdaBoost Algorithm

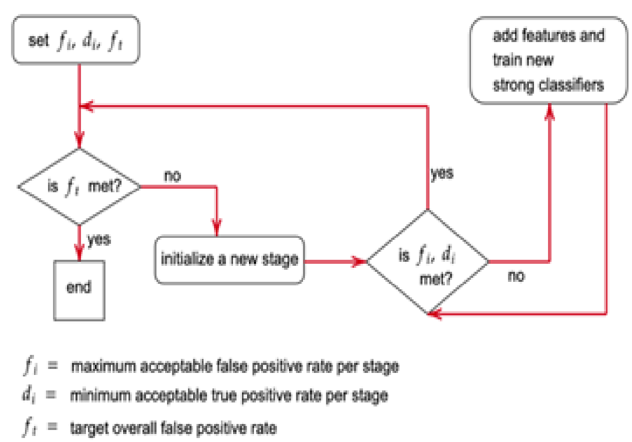


Figure8. The process to construct a cascade classifier.

Concepts: the AdaBoost Algorithm + the Cascade Classifier.

As you can imagine, using all 160,000+ features directly is computationally inefficient. Viola & Jones (2001) proposed two solutions that can solve this. First, reduce the number of features to only a handful of useful features with the AdaBoost algorithm. Second, split the remaining features into stages and evaluate each input in a stage by stage (cascading) fashion. Viola & Jones (2001) devised a modified version of the AdaBoost algorithm to be able to train a Cascade Classifier. Figure 6 shows a simplified version of the algorithm provided by Ramsri in his video (Ramsri, 2012).

VI. LOCAL BINARY PATTERN

The first LBP administrator was presented by Ojala et al. furthermore, was demonstrated intense methods for surface depiction. The administrator marks the pixels of a picture by thresholding a 3 neighborhood of every pixel with the inside esteem and considering the comes about as a paired number, and the 256-receptacle histogram of the LBP names processed over a locale is utilized as a surface descriptor. The determined parallel numbers (called Local Double Patterns or LBP codes) systematize neighborhood primitives including distinctive sorts of bended edges, spots, level ranges, and so on, so each LBP code can be viewed as a small scale texton. The restriction of the fundamental LBP administrator is its little 3 neighborhood which cannot catch predominant components with vast scale structures. Consequently the administrator later was stretched out to utilize neighborhood of various sizes. Utilizing round neighborhoods and bilinearly interjecting the pixel values permit span and number of pixels in the area. SeeFig9 for cases of the amplified LBP administrator, where the documentation ðP; Rþ indicates a neighborhood of P similarly divided testing focuses on a hover of range of R that shape a circularly symmetric neighbor set.

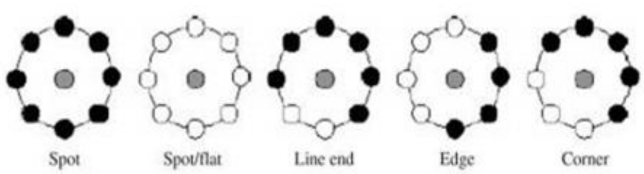
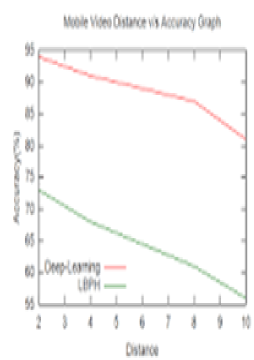


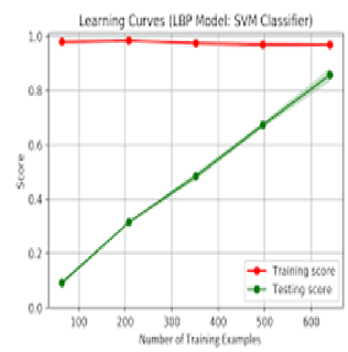
Figure9. Histograms Produced by LBP.

From the Fig9 we can understand that the histograms produced by LBP is dependent on a set of values .The LBP operator LB_{PP}; R produces 2^P different output values, corresponding to the 2^P different binary patterns that can be formed by the P pixels in the neighbor set. It has been shown that certain bins contain more information than others. Therefore, it is possible to use only a subset of the 2^P Local Binary Patterns [1][6] to describe the texture of images. A Local Binary Pattern is called uniform if it contains at most two bitwise transitions from 0 to 1 or vice versa when the binary string is considered circular. For example, 00000000, 001110000 and 11100001 are uniform patterns. It is observed that uniform patterns account for nearly 90% of all patterns in the (8,1) neighborhood and for about 70% in the (16,2) neighborhood in texture images. Accumulating the patterns which have more than 2 transitions into a single bin yields an LBP operator, denoted LBP_{u2} P;R, with less than 2^P bins. For example, the number of labels for a neighborhood of 8 pixels is 256 for the standard LBP but 59 for $LBP_{u2.}$ This LBP histogram contains data about the dispersion of the neighborhood small scale examples, for example, edges, spots and level ranges, over the entire picture, so can be utilized to measurably depict picture attributes. Face Images can be viewed as a piece of smaller scale designs which can be viably depicted by the LBP histograms. Hence, it is natural to utilize LBP components to represent face pictures.

VII. SUPPORT VECTOR MACHINES

A successful technique to presentation gathering is Support Vector Machine (SVM), so we got SVM as choice classifiers for articulation affirmation. As an extreme AI strategy for data request, SVM[4] plays out a comprehended planning of data into a higher layered part space, and subsequently tracks down a straight confining hyper plane with the maximal edge to isolate data in this higher layered space. SVM makes twofold decisions, so the multi-class course of action here is capable by using the one-against-rest methodology, which prepares twofold classifiers to isolate one articulation from all others, and yields the class with the greatest yield of twofold gathering. Concerning the boundary decision of SVM, as proposed in various papers, we finished lattice look for on the hyper-boundaries in the 10-wrinkle cross-endorsement. The boundary setting making best cross-endorsement precision was picked. We used the SVM utilization in individuals overall available AI library SPIDER1 in our examinations.





VIII. CONCLUSION

In this paper, an overview on opinion mining utilizing Facial Expression Recognition System has been performed and concentrated on exhaustively. This assessment digging can be utilized for security, Investigative purposes and furthermore to gain proficiency with the mentality of a worker of an establishment. Here the examination has been performed in view of Face acknowledgment utilizing Viola-Jones calculation.Also for Facial demeanor acknowledgment, Local Binary Pattern has been used. Support Vector Machines can be utilized for Classification of the articulations and furthermore for playing out the Analysis.

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