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RECOGNITION OF FACIAL FEATURES USING ARTIFICIAL INTELLIGENCE

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Abstract: This research paper is based on 'Physiognomy' – a practice of finding person's character or personality from their outer appearance, especially his / her face. In another words, we can simply say that 'Physiognomy' is the junk science or reading character from facial features extraction which have long history. The word 'Physiognomy' is made from two Greek words – "physis which means nature and gnomon which means to Judge or to Interpret". There is a popular saying on mind, "Face is the index of mind". Hence, one can judge the personality of someone by analyzing the facial features extraction. For face reading, one can consider different shapes of face, distance between eyes, length of ear, width of forehead etc. An efficient character and personality analysis system can be used to identify someone's personality or even more for different purposes. An application of the same can be used in military selection, selection of employees in a company. We have conducted this experiment on several people as well as conducted online survey and finally the results obtained from the implementation of the paper matches with the personality of the people involved in this experimentation and the online survey. It will be true to say that this method is cost effective and efficient as it is based on the measurement of facial features. In this research paper, we are going to introduce a new and efficient Character and Personality System namely SR v1.0, its internal mechanism, its applications, its importance / benefits as well as its future scope and advancement.

Keywords: Personality Judgement, Character Analysis, SR v1.0, Physiognomy, Face Reading, ED (Edge Detection) v1.0

1. Introduction

Character or Personality of an individual can be identified his / her facial features. Analysis of facial features or facial features extraction refers to Face Reading. Face shape, ear length, nose length, eye distance, forehead length and forehead width are the few facial features which we consider in Physiognomy. We can use SR v1.0 as Character and Personality Analysis Systems in various areas. Some of them are used in military selection, fraud detection, during interrogation of criminals, selection of actor / actress, recruitment process and many more.

Facial features of an individual can be used as biometrics for authentication. As per the internal mechanism of our own character and personality system SR v1.0, it does not require any expensive device for biometrics' retrieval. It only requires the passport sized photograph with white background of an individual whose personality has to be determined.

The working principle of SR v1.0 is based on the concept of Physiognomy. Physiognomy is the assessment of a person's character or personality from their outer appearance especially face. A detailed note on the various expressions and movement of head muscles was given in 1649 by John Bulwer in his book – "Pathomyotomia". Another interesting work on facial expressions (and Physiognomy) was by Le Brun, the French academician and painter. Le Brun gave a lecture at the Royal Academy of Painting which was later reproduced as a book in 1734. It is really surprising to know that the actors and artists of 18th Century referred to his book in order to achieve "the perfect imitation of 'genuine' facial expressions". The readers who are interested to know more about the origin and influence of Le Brun's lectures may refer to the recent work by J. Montagu.

As we all know, recruitment's traditional practice involves short-listing of candidates strictly on the basis of marks scored in previous examinations, written test, performance in group discussion, personal or technical interviews etc. In this way nobody can predict or conclude the true character / personality of a person as it may be possible that he / she would have mentally prepared himself / herself for the situation and circumstances which may arise in traditional practice of recruitment. No one can predict correctly about his / her mentality, thinking or vision. Hence, it's not an easy task to find the true suitability of a candidate in particular job role in profession. But, on the other hand, if we use this efficient character and personality analysis system on the basis of facial features extraction, we can easily conclude the real personality, mentality, thinking or vision of that very individual. We have evidence that might justify our statement, "SRv1.0 is solely sufficient for finding the true character or personality of an individual." Consider a case of a candidate who got rejected for getting less marks as compared to others, as he / she got nervous but the candidate might have a vast knowledge in that particular area, then in the case, rejection of the candidate will not be the right decision. No one can justify the decision by the recruiter, to be right and in favour of company. After various researches and surveys, it is found that thinking pattern of an individual forms physical features which in turn, helps to understand the personality of the individual.

2. Related Works

To identify a face, we usually pass a passport sized photo / image as input to a face recognition system. Three important steps are involved in process of recognizing a face. These are:

1. Face detection i.e. locating the face in the passport sized photograph.
2. Facial features extraction (here it should be noted that features may be the eyes, the nose or the chins etc.)
3. Recognition, comparing the image passed as input with the ones in the database.

The result of this process will hopefully be a set of images which are similar to the passed image. Finally, result will be returned to the system's user.

3. Proposed Methodology

In our proposed Personality and Character Analysis System SRv1.0, passport sized photo (or facial image) of the person whose character and personality of the individual is to be identified by grabbing it by scanning. After that we will use our own designed edge detection algorithm namely, SEED v1.0. We will extract the facial features, after applying this edge detection algorithm. Finally, we will come to a conclusion that will show the true character and personality of the individual whose passport sized photograph was passed earlier. Please refer

the internal mechanism of SR v1.0 for edge detection in the passport sized photo. All are obtained by analyzing / measuring the image in terms of pixels. Consider the following figure:

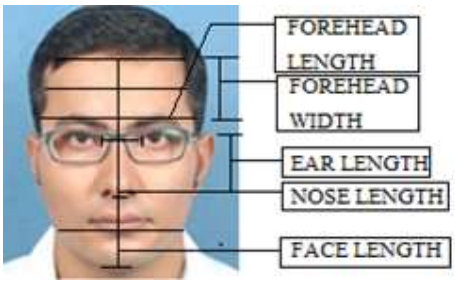

Figure 1: Showing measurements which will be considered for facial features extraction

As we can see clearly in the figure 1, measurements have been shown to extract the facial features. We are considering forehead length, forehead width, ear length, nose length, face length and distance between the two eyes for facial features extraction which will lead to a conclusion which reflects the true character and personality of the individual.

3.1 Ear Length and Nose Length

Ear and Nose length are one of the important aspects for analysis of facial features. Please refer figure 2 as given below. To determine the ear length, we have to measure the distance between the top most and bottom most tip of the ear. Likewise, we can find out the nose length by measuring the distance between the midpoint of the eyebrows, and the tip of the nose. As a result of different carried out surveys, it is found that length of ear is equal to that of nose in most of the cases. Suppose, length of ear is more than that of nose the ear is considered to be **BIG** otherwise **SMALL.**

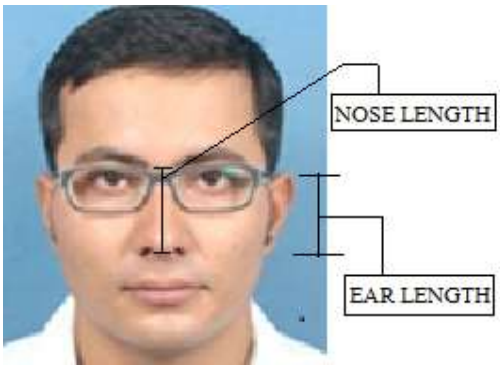

Figure 2: Image showing, how to measure ear and nose length

In our survey over 500 people, we found that an individual having small ear is honourable, well mannered and affectionate. On the other hand, person with big ear is generous and person with normal ear is materialistic.

3.2 Detection of Face Shape

To determine face shape, we have to determine the ratio of minor axis of the face and the axis drawn parallel to the eye level with the minor axis of the face and the axis drawn parallel to the lips level.

We can classify shapes of face on the basis of measurements into five categories which are mentioned below:

a. Circular Face

b. Triangular Face
c. Rectangular Face
d. Square Face
e. Oblong Face

Let us consider the following figure,

Figure 3: Different kinds of Face Shapes

If an individual has Round Shaped Face, then we can easily predict about his / her character or personality that he / she is very sensitive as well as caring. Likewise, person with Oblong Face is practical and methodical. An individual having triangular face is creative and have fiery temperament. Square Face reflects intelligence, analytical skills, decisive mind and boldness about an individual. Those people are dominant in nature, having Rectangular Face. People with Oval Shaped Face are well balanced and diplomats.

3.3 Detection of Forehead Length and Forehead Width

Forehead reflects the intelligence, analytical skills, imaginations and intuitive nature etc. On the other hand, forehead clarifies human qualities like honesty and sincerity.

We can determine the Forehead Length by measuring the distance between midpoint of eyebrows and the midpoint of upper line. Forehead width can be determined as the perpendicular to the forehead length and passes through the midpoint of forehead's length.

On the basis of our survey, we found that people having wide forehead (i.e. forehead length < forehead width) have intuitive nature and imagination. On the other hand, people with lengthy forehead achieve permanent success Square forehead reflects honesty and sincerity of the people.

3.4 Eye Distance Detection

Figure 4: Image showing distance between Eyes

Eyes distance signifies the concentration power of an individual. A person with small eye distance is considered to have powerful ability to concentrate and focus. They take too much tension and stress all the time. They wish don't to be disturbed by anyone. They believe in close to perfection. They show full dedication towards work assigned to them and complete it with perfection. These people are great thinker that is the reason why there is the possibility that they would become a scientist or researcher. They have high imagination power.

4. Working Principle of SR v1.0

Refer figure 5 as given below

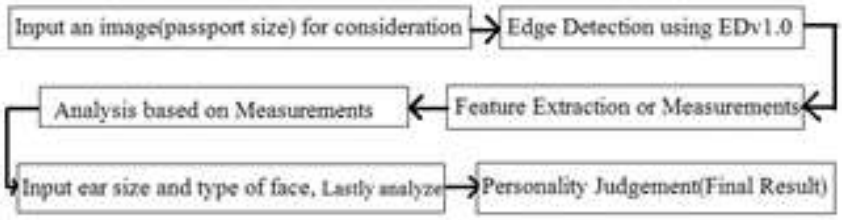

Figure 5: Shows how SR v1.0 works

This figure shows the working principle of SR v1.0, our own efficient personality and character analysis system. According to the internal mechanism, first of all, we will have to pass an image (passport sized photograph) as input from camera or scanning image with the help of a scanner. After that we will apply SEED v1.0, the edge detection algorithm to the image passed as input. Once we apply SEED v1.0, we will take the facial measurements. Then the user will be prompted to select the type of face as well as ear (Small, Big or Normal Sized), the individual have. Finally, we will analyze all the facial features as explained earlier and will come to a conclusion i.e. the true character and personality of that very individual.

5. All about ED v1.0, the Edge Detection Algorithm

Consider the following figure:

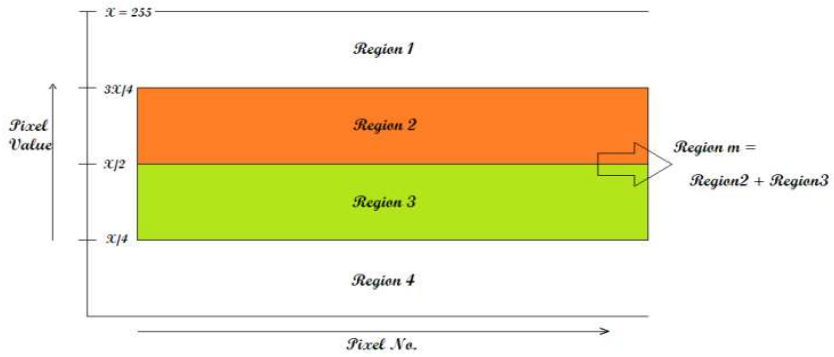

Figure 6: Pixel intensities of different pixels (from an image) falling in one of the four regions (on the basis of pixel values)

As we can see, there are four regions i.e. Region 1, Region 2, Region 3 and Region 4. A Pixel Intensity is said to fall into Region 1, if its value v satisfies the inequality equation. 0 <= v < 63. Similarly for Region 2, inequality equation is 63 < v <= 127. For Region 3, 127 <v <= 191, and finally, for Region 4, the inequality equation will be 191 < v <=255.

If the Pixel Intensity (i.e. Pixel Value) falls in Region 1, in that case,

$X_1(i, j) = X_1(i, j) - 40$

If the pixel value falls in Region 4, then

$X_1(i, j) = 255 - X_1(i, j)$

In case, if the pixel intensity lies in Region 2 or Region 3, then we will apply the following rule (or condition)

Case 1: if $X_1(i, j) < X_1(i, j+1)$ then

$X_2(i, j) = (255- X_2(i, j))$
$X_2(i, j+1) = 255 – (X_2(i, j+1) - 127)$
Case 2: if $X_1(i, j) > X_1(i, j+1)$ then
$X_2(i, j) = X_2(i, j) – 127$
$X_2(i, j+1) = 255 – X_2(i, j+1)$
Where,

$$X_1 = \begin{pmatrix} X_1(1,1), & X_1(1,2), & ....., & X_1(1,n) \\ X_1(2,1), & X_1(2,2), & ....., & X_1(2,n) \\ X_1(3,1), & X_1(3,2), & ....., & X_1(3,n) \\ : & : & ....., & : \\ X_1(m,1), & X_1(m,2), & ....., & X_1(m,n) \end{pmatrix}$$

$$X_2 = \begin{pmatrix} X_2(1,1), & X_2(1,2), & ....., & X_2(1,n) \\ X_2(2,1), & X_2(2,2), & ....., & X_2(2,n) \\ X_2(3,1), & X_2(3,2), & ....., & X_2(3,n) \\ : & : & ....., & : \\ X_2(m,1), & X_2(m,2), & ....., & X_2(m,n) \end{pmatrix}$$

Figure 7: X_1 is the original matrix (obtained from pixel intensities) whereas X_2 is the transformed Matrix (with all pixel intensities in the range 0-40 or 215-255)

Note: We transformed X_1 into X_2
i.e. $X_1 \rightarrow X_2$
Here in this, we are checking the tendency of two consecutive pixels with pixel intensities that lie in Region 2 and Region 3 (Rise or Downfall).
This will result in the following:

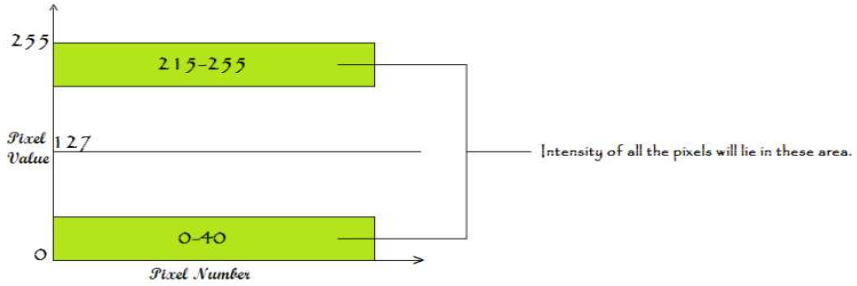

Figure 8: All the pixel values of X_2 lies in either range

From the above figure it is clear that the Pixel Intensity (or Value) of each Pixel will vary between the ranges 0 - 40, and 215 – 255.
Hence this will help in determining the edge of the Passport sized Photo of face for facial measurements.

6. Application of Face Recognition

In present days, importance of security and organization is our prime necessity which is increasing day by day. Methods of Identification and Authentication have been developed into key technology in various areas. Few of them are as follows:

1. Entrance control in different buildings such as Offices of MNC's, Resorts, etc.
2. Access control for computers in general or for automatic teller machines.
3. Our day to day affairs such as withdrawing money from banks, ATMs, dealing with post office and in the prominent field of Criminal Investigation etc. Such requirement for reliable personal identification has resulted in an increased interest of people in Biometric.

A face recognition system is efficient enough that it would allow any person to be identified or verified from a digital source or a video frame from a video source using pattern recognition techniques generally. Human Beings often recognize one another on the basis of unique facial characteristics analysis. Automatic face recognition system works beyond the ability of human vision and in this way it overcomes the limited vision of human eye in identifying used from the last 50 years and its craze is increasing day by day in Biometric Industry. It is still vast number of human faces. It is used as one of the biometrics which is being in the phase of research and development as several commercial systems are currently available along with various research organizations which are working on the development of more accurate and reliable systems.

7. Experimentation and Critical Analysis

In this research, we have considered four facial features to detect the character and personality of a person. Face shape, ear, forehead, and eye distance are these four facial features.

Here, it should be noted that we have considered 2 cases in our Research. Case 1 considers the image (as input) whereas in 2nd case, user is asked to input the ear and nose manually of the one whose, personality, is to be determined. The database provides the facial features extraction.

The experiment is conducted on 200 people and it is found that their character / personality match the research outputs by approximately 92 %. Evaluation of result generated was made by conducting a personal interaction with the people whose image was passed as input to the code. On the basis of literature survey, we are in a position, to state that in previous research works, researchers have not mentioned the percentage of accuracy their character and personality analysis system can attain.

8. Future Scope, Advancement and Conclusion

With the help of SR v1.0 (An efficient character and personality analysis system of facial features extraction) we can easily find out the character / personality of a person using facial features measurements from feature's extraction analysis more accurately than the others as available. At the last, we can feel to have rightly evolved a method to identify the true personality of an individual and match a belief that thinking traits from psychological features.

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