A Survey on Pre Processing Techniques for Static Human Facial Emotion Recognition

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Abstract - **This research paper mainly focused on a various pre*p*rocessing techniques for human Facial Emotion Recognition. Now a days, Facial Emotion Recognition plays a major role in vast applications e.g. medical application such as security, psychological disorder problem, criminal identification, social needs like tutoring through computer. It needs a trained system for recognizing the human emotions like happy, sad, disgust, surprise, anger, neutral, etc,. The main problem in this research is accuracy. Preprocessing should be done for getting good accurate result. It normalizes the different ways of light illuminated images.**

Keywords: **Pre Processing, Light illuminated image, Emotion Recognition, accuracy and normalization**

I. INTRODUCTION

Facial feeling is one or additional motions or positions of the muscles to a lower place the skin of the face. This movement provides the knowledge regarding emotions of a private to observant person. Facial emotions square measure a sort of nonverbal communication. Humans will adopt a facial feeling voluntarily or involuntarily, and also the neural mechanisms answerable for dominant the feeling dissent in every case. Voluntary facial emotions square measure typically socially conditioned and follows a plant tissue route in human brain. On the opposite hand, involuntary facial emotions square measure believed to be innate and follow a sub plant tissue route in human brain.

Facial recognition is commonly AN emotional expertise for the brain and also the amygdale is very concerned within the recognition method. like each procedure apply, in have an effect on detection by facial process, some obstacles have to be compelled to be surpassed, so as to completely unlock the hidden potential of the general rule or technique used. The accuracy of modelling and trailing has been a significant issue, particularly within the early stages of emotional computing. The illumination drawback is essentially the variability of AN object's look from one image to a different with slight changes in lighting conditions. Psychophysical experiments show that the human sensory system will determine faces of constant person from novel pictures despite right smart variations in illumination.

Lighting variations could be a difficult drawback in an exceedingly face recognition research; it's considered one amongst the foremost important factors for sturdy face recognition [4]. constant person, with constant facial feeling looks terribly completely different beneath varied lighting conditions. Changes in lighting conditions manufacture a substantial decrease of recognition performances. A recognition system, supported computing the space between unprocessed gray-level pictures, can fail to acknowledge all the faces within the information and can confuse the faces.

to beat these disadvantage higher pre process strategies ought to be used before the extraction stage.

II. PREPROCESSING TECHNIQUES

It normalizes the image acquired from uncontrolled and uncooperative atmosphere. the necessity for pre process is: to overcome harmful effects of illumination, Eliminates effects rely on angle, distance & lightning conditions against every face.

The methods of pre process are as follows:

- Gamma Intensity Correction
- Logarithm Transform
- Histogram Equalization
- Discrete Cosine Transform

A. Gamma Intensity Correction

This method can control the brightness of a picture by dynamical the gamma parameter. it's used to correct the lighting variations within the face image.

Procedure

- Let the input image be I(x,y)
- To calculate gamma correction parameter f(I(x,y)), take exponential of the input image I(x,y)

$$f(I(x, y)) = I(x, y)^{1/\gamma} \qquad \text{...eq.n 1}$$

Where, γ – value of the image depends on the darkness or brightness.

To find the value of 'γ'

Assume a canonically illuminated face image be Ic(x, y). The difference between the transformed image and also the predefined canonically light image should be reduced

$$\gamma = \arg\min_{\gamma^*} \sum_{x,y} [I(x, y)^{1/\gamma^*} - I_c(x, y)]^2 \qquad \text{...eq.n 2}$$

Now, if $1/\gamma < 1$ the process is thought as gamma compression. If $1/\gamma > 1$, then it's referred to as gamma growth.

B. Logarithm Transform

This transform uses associate additive compensation term to get the normalized face image. It provides associate intensity improvement of the shaded region.

Procedure

- Let a grey level image be f(x, y)

- Its coefficient of reflection and illumination square measure r(x, y) and e(x, y) respectively

Assume the image is proportional to the product of the reflectance and also the illumination

$$f(x, y) = r(x, y) \bullet e(x, y) \qquad \text{...eq.n 3}$$

while taking logarithm transform,

$$\log f(x, y) = \log r(x, y) + \log e(x, y) \qquad \text{...eq.n 4}$$

To obtain a desired uniform illumination the parameters should be noted are:

- incident illumination e(x, y)

- desired uniform illumination e'

Then,

$$\log f'(x, y) = \log r(x, y) + \log e'$$

$$= \log r(x, y) + \log e(x, y) - e(x, y)$$

$$= \log f(x, y) - e(x, y) \qquad \text{...eq.n 5}$$

Where

e(x, y) = log e(x, y) − log e' is that the additive compensation term.

Hence, the normalized face image are often obtained from the initial image and this additive compensation term.

C. Histogram Equalization

An image histogram may be a graphical illustration of the tonal distribution during a digital image. It plots the amount of pixels for every tonal value. The horizontal axis of the graph represents the tonal variations, whereas the vertical axes represent the number of pixels therein specific tone. significantly, a picture histogram of a gray-scale image has within the horizontal axes the 256 brightness levels, and within the vertical axes the number of times this level seems within the image. the matter of the first approach is that the output isn't forever realistic, however during this case the illustration of the face image should be invariant to lighting variations and not a practical image.

D. Discrete Cosine Transform

In this technique illumination variation may be considerably reduced by truncating low frequency DCT coefficients. Consider 2D M × N discrete cosine transform,

$$c(u,v) = a(u)a(v)\sum_{x=0}^{M-1}\sum_{y=0}^{N-1} f(x,y)\cos\left[\frac{\pi(2x+1)u}{2M}\right]\cos\left[\frac{\pi(2y+1)v}{2N}\right]$$

…eq.n 6

The inverse transform,

$$f(x,y) = \sum_{u=0}^{M-1}\sum_{v=0}^{N-1} a(u)a(v)c(u,v)\cos\left[\frac{\pi(2x+1)u}{2M}\right]\cos\left[\frac{\pi(2y+1)v}{2N}\right]$$

...eq.n 7

Where,

$$a(u) = \begin{cases} \frac{1}{\sqrt{M}}, u = 0, \sqrt{2/M}, u = 1,2,...M-1 \end{cases}$$

$$a(v) = \begin{cases} \frac{1}{\sqrt{N}}, v = 0, \sqrt{\frac{2}{N}}, v = 1,2,...N-1 \end{cases}$$

...eq.n 8

To remove low frequency components: Set low frequency components to zero for e.g: Set (p, q)th DCT coefficient to zero. The desired normalized face image in the logarithm domain F ’(x, y) is given by,

$$F'(x, y) = F(x,y) - E(p,q)$$ …eq.n 9

Where,

F’(x, y) is the difference between the original image F(x, y) and the illumination compensation E(p, q). Set DCT coefficient value as zero.

Where,

$$C(0,0) = \log \mu.\sqrt{MN}$$ ...eq.n 10

μ - middle level value of the image

By discarding DCT coefficients of the original image, only brightness can be adjusted. To adjust the illumination, DCT coefficients of logarithm image should be discarded.

III. EXPERIMENTAL RESULTS & DISCUSSION

The first step is the image acquisition and these obtained images are subjected to RGM to grayscale conversion. The output of the above four methods are given below.

C. RGB to GRAY Conversion

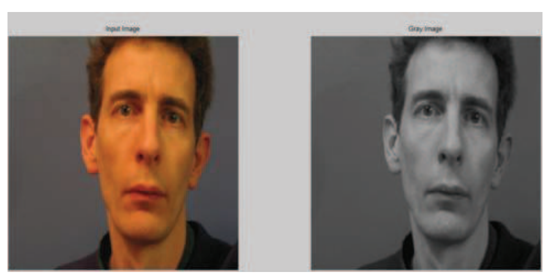

Fig.1 Anger

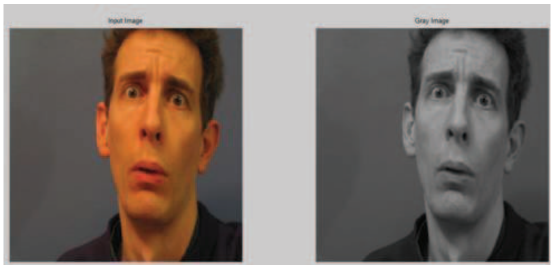

Fig.2 Fear

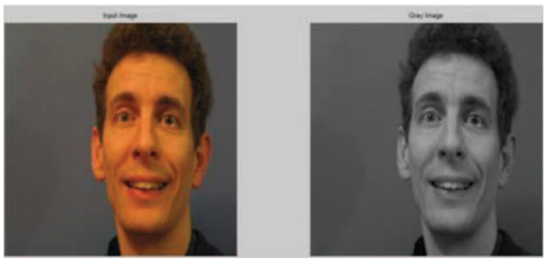

Fig.3 Happy

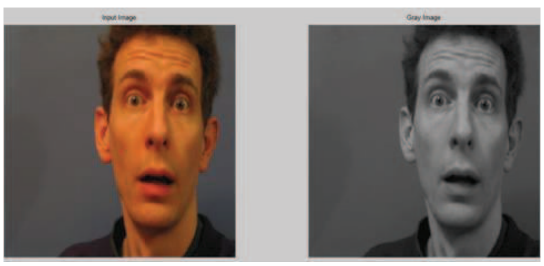

Fig.4 Surprise

This process is done for four various emotions in the dataset and outputs are obtained. The above figures show the output of RGB to gray scale conversion.

D. Gamma Intensity Correction

This process is employed to select totally different gamma values to get darkness or brightness within the image. Fig.5, Fig.6, Fig.7 shows the output of gamma value equals to 0.3. Fig.8 shows the output of gamma value equal to 0.4.

Fig.5 Intensity corrected image with darkness in gamma value (Anger)

Fig.6 Intensity corrected image with darkness in gamma value (Fear)

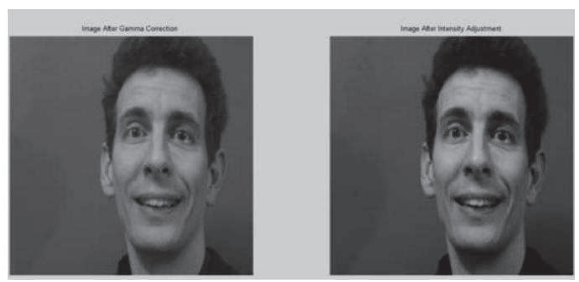

Fig.7 Intensity corrected image with darkness in gamma value (Happy)

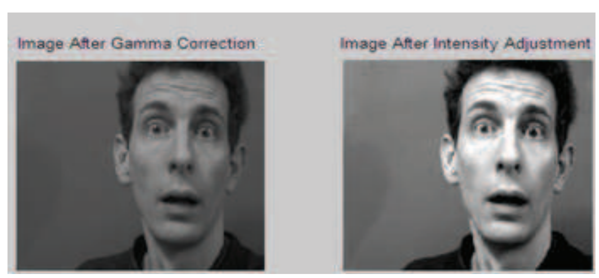

Fig.8 Intensity corrected image with brightness in gamma value (Surprise)

C. Logarithm Transform

These are the output of the Logarithm Transform.

Fig.9 Logarithm Transform for Anger

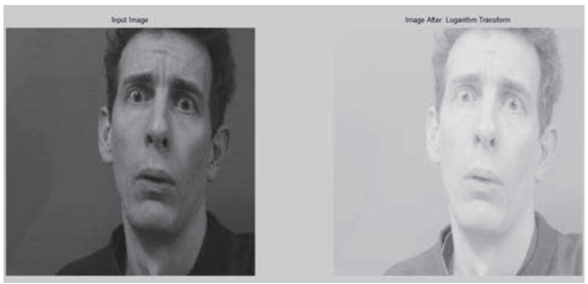

Fig.10 Logarithm Transform for Fear

Fig.11 Logarithm Transform for Happy

Fig.12 Logarithm Transform for Surprise

D. Histogram Equalization

These are the output of Histogram Equalization.

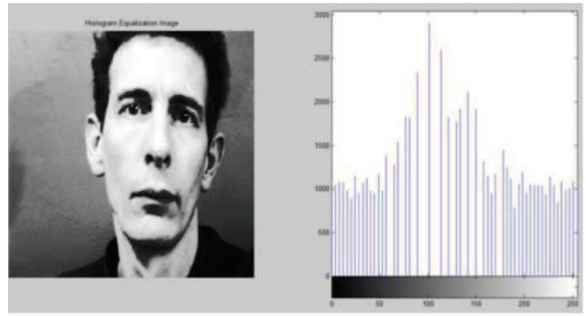

Fig.13 Histogram Equalization (Anger)

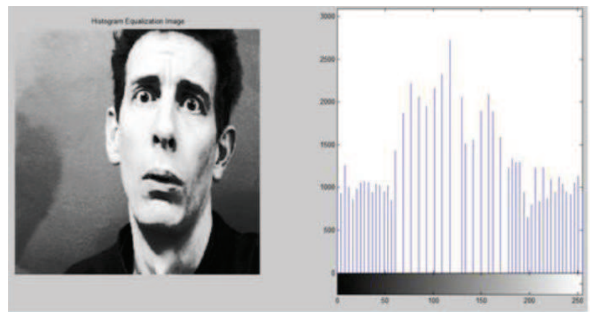

Fig.14 Histogram Equalization (Fear)

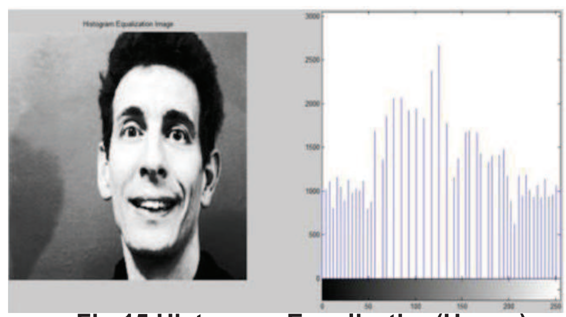

Fig.15 Histogram Equalization(Happy)

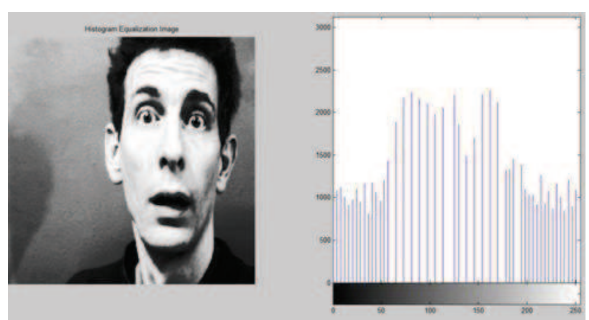

Fig.16 Histogram Equalization (Surprise)

D. Discrete Cosine Transform

It is somewhat complex. In DCT transform, values cannot be varied only smoothening can be done.

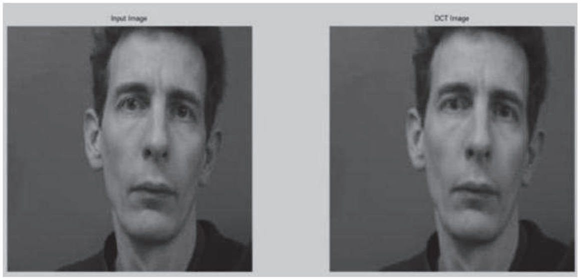

Fig.17 DCT output (Anger)

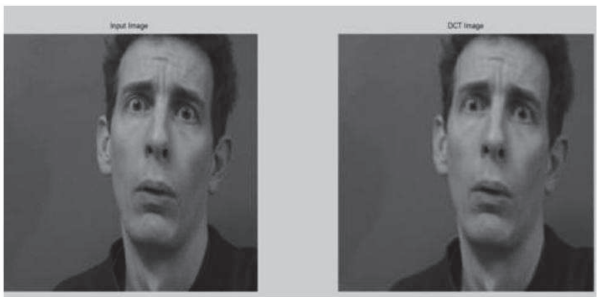

Fig.18 DCT output (Fear)

Fig.19 DCT output (Happy)

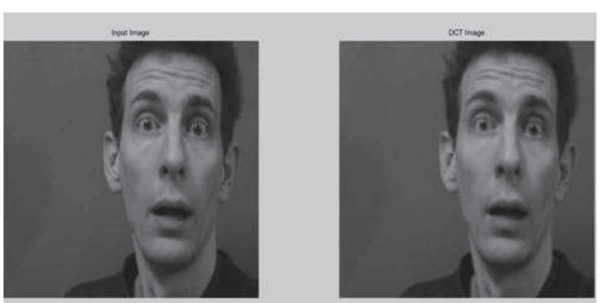

Fig.19 DCT output (Surprise)

IV. CONCLUSION

This paper proposes, four preprocessing methods for illumination normalization in face images: they are, the Gamma Intensity Correction method (GIC), the logarithm transform method, the discrete cosine transform technique (DCT), the histogram equalization technique (HE). It will usually improve the image, and consequently the facial expression detection performance, compared with a non-preprocessed image. A additional advanced technique, like HE, also provides sensible leads to a feature detection system, though the face image is not realistic. The strategies are only tested for pictures with a similar head pose and facial emotion. in a future work, it will be planned to create tests with face pictures without these restrictions.

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