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Implementation of Automatic Human Age Estimator

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Abstract: *In this, paper review a new automatic age estimation framework is proposed. A single image is required to estimate the age of the subject of interest as a input. By using three main modules we are composed a framework which are:- 1) module of the face detection; 2) module of enhancement; and 3) the classification module. In case of classification module we are used unsupervised classification technique. K means algorithm is used which classified the features obtained from the Gabor filters of 6 directions and 4 scales. In the enhancement module of the proposed framework, the key for age estimation are facial regions which are identified by using a more detailed analysis. Finally, by utilizing the FG-net database we can calculate the application of human age estimation. The face detection module comprises the learning for age estimation and main blocks of image representation a. For age image representation, a technique named Adaboost which is modification of viola Jones algorithm is used.*

Keywords: *Estimation of Age, Adaboost algorithm, gabber filter, Detection of face, feature extraction, Classification of Feature.*

I. INTRODUCTION

Mostly peoples are able to easily recognize by using theirs human traits like state of emotion, where they can tell if the person is sad, angry or happy from the face. As like, it is very easy to determine the gender of the person. The signs of age progression are normally displayed on faces which cannot be controllable and personalized such as whitening of hair, dropping of muscles and wrinkles. Depending upon the many external factors such as life style and degree of stress we can easily see the signs of age. An old person whose age is 30 years smokes a box of cigarettes each day when we compared his other facial characteristics such as gender, expression and identity then he will look like a 42 years old one. Our main work is revolving around the three modules: detection of face, extraction of features and classification of features.

1.1. Overview of Proposed Age Estimation System

Considers the effects of gender and/or facial expression are an overview of our age estimation system. Our First step is to detect the eye and face positions from the input image by using an adaptive boosting (Adaboost) method. By using an Adaboost method we will select the face region used for extraction the features which will mainly exclude the hairs, and then we will using the histogram equalization of facial image for counting the non Illumination of light. Biographical features of image like center of left eye to nose, eye to eye distance, center of right eye to nose and face angle is calculated along with wrinkles features on images which are global features. These features are global features and Global features are obtained by using Gabor filters with specific number of orientations and angles. Amongst algorithms of classification, algorithms of clustering serves better. So fuzzy-K means approach will be used for it and results will be obtained in terms of MAE.

1.1.1 Adaboost Method

By implementing an algorithm for detection of faces in an image the basic problem to be solved. In 1996 Freund and Schapiro was developed the Adaboost algorithm. Adaboost is a machine learning boosting algorithm which is capable of constructing a strong classifier by using a weighted combination of weak classifiers. (In mostly cases a weak classifier classifies correctly in only a little bit.) Each feature is considered to be a potential weak classifier to match this terminology to the presented theory. A weak classifier is mathematically described as:

$$h(f, p, x, \theta) = \begin{cases} 1 \text{ if } p\theta < pf(x) \\ 0 \text{ otherwise} \end{cases} \quad (1)$$

Where x is a 24*24 pixel sub-window, f is the features applied p the polarity and θ the threshold which decides whether x should be classified as a negative (a non-face) or a positive (a face). Since only a small amount of the possible 160.000 feature values are expected to be potential weak classifiers. We modified the Adaboost algorithm only for selecting the best features. The face detector is ready for implementation by using Adaboost algorithm, but Viola-Jones has one more ace up the sleeve.

1.1.2 Gabor filter

The impulse response of a Gabor filter (linear filter) is defined by a Gaussian function multiplied by a harmonic function. In many applications, Gabor filters have been used, like segmentation of texture, detection of target, management of fractal dimension, analysis of document, detection of edge, identification of retina, and coding of image and image representation. as

a Like a sinusoidal plane of particular orientation and frequency we can be viewed Gabor filter, which is modulated by a Gaussian envelope.
s(x, y): Complex sinusoid
h(x, y) = g(x, y)s(x, y)
g(x, y) : 2-D Gaussian shaped function, known as envelope

$$g(x,y) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{1}{2}(\frac{x^2}{\sigma_x^2}+\frac{y^2}{\sigma_y^2})}$$

$$s(x,y) = e^{-j2\pi(\omega_0 x + v_o y)}$$

The Gaussian envelope looks as follows:

$$\omega_r(x,y) = K \exp[(b^2(y-y_0)_r^2) + (-\pi(a^2(x-x_0)_r^2)$$

1.2 LBP&MLBP

Nguyen, D.,T. et. al [2014], by using support vector regression (SVR) method investigated the effects of gender and facial expression on age estimation. This research is process in the following four ways. First, the age estimation accuracies by using a LBP (single-level local binary pattern) and MLBP (Multilevel LBP) are compared, and better performance as an extractor of texture features globally is shown by MLBP. Then second, we compare the accuracies of age estimation, using local features extracted by Gabor filtering, global features extracted by MLBP and the combination of the two methods. The third approach is the most accurate which is shown by results. Third, we compared age estimation accuracy with and without pre classification of expression of face are compared and then it analyzed. Fourth, we compared with and without pre classification of gender and analyzed. In the gender pre classification of age estimation experiment showed the results which are more effectiveness.

The contents of this paper Review are structured as follows: Chapter II Literature survey. Chapter III Problem formulation and objective. IV. Proposed work. V. Results & Discussion. VI. Conclusion. VII. Future Work. VIII. Acknowledgements. IX. References

II. LITERATURE SURVEY

[1] Lazarus, M.Z. et. al [2013]proposed in this article the given input images is capable of segregating into three clusters namely: Senior; Adult; Baby. The database which is used in this FG-NET database is available online and whose results shown the 100 percent accuracy.

[2] Nguyen, D.,T. et. al [2014] by using support vector regression (SVR) method investigated the effects of gender and facial expression on age estimation. This research is process in the following four ways. First, the age estimation accuracies by using a LBP (single-level local binary pattern) and MLBP (Multilevel LBP) are compared, and better performance as an extractor of texture features globally is shown by MLBP. Then second, we compare the accuracies of age estimation, using local features extracted by Gabor filtering, global features extracted by MLBP and the combination of the two methods. The third approach is the most accurate which is shown by results. Third, we compared age estimation accuracy with and without pre classification of expression of face are compared and then it analyzed. Fourth, we compared with and without pre classification of gender and analyzed. In the gender pre classification of age estimation experiment showed the results which are more effectiveness.

[3]. Dib. Y. El et. Alex ended BIF by incorporating fine details features of facial, by using active shape models automatic initialization and by including the forehead details analyzing a more complete facial area.

[4] Jana, R. et. al. [2012] concerned To estimate age groups using face features with providing a methodology. This paper proves that we estimate face angle and human age classify according to features of face which are extracted from human facial images. Age ranges are classified into five categories. Those are up to 17 years (child), 18to 25 years (young), 26 to 35 years (adult), 36 to 45 years (middle aged) and more than 45 years (old). The obtained results were significant. This paper can be used for expressions from facial images, classifying gender, and predicting future faces.

[5] Otto, C. et.al [2012] propose a component based method for age invariant face recognition.

[6]. Ubaid, S. et.al [2013] discussed By using the facial image of a person we are finding the human age. It has many real world applications like interaction of human computer, security of internet, multimedia communication, vending machines etc. During growth, two main forms of aging is affected, one is the shape and size variation and the other is the

variation in textural. In this paper, we use the variation in textural of the face during the growth, which appear more in the adulthood in the form of wrinkles.

[7] Iraji, M.S. et.al [2014] to estimate the age of face image presented an intelligent mod. They used shape and feature of texture extraction from FG-NET landmark image data set using AAM (Active Appearance Model), CLM (Constrained Local Model), tree Mixture algorithms. Experimental results showed that in proposed system, fuzzy SVM has less errors and system worked more accurate and appropriative than prior methods. Our system is able to identify age of face image from different directions as is.

[8]Chang, K.U. et.al [2010] proposed a ranking-based framework consisting of a set of binary queries.

[9] Jana, R. et. al. [2013] estimated age group using face features. This process involves three stages: Pre-processing, Extraction of Feature and Classification. Based on the texture and shape information age classification is done using K-Means clustering algorithm. Age ranges are classified dynamically depending on number of groups using K-Means clustering algorithm. The obtained results were significant.

III. PROBLEM FORMULATION & OBJECTIVE

By using facial features we can classified the age by using two categories which have been constructed for features: Global features, local features. Among global features, many researchers are used Active appearance models (AAM) is frequently. But it Causes of many drawback that they don't provide any information about features of skin and wrinkles. Many researchers are also used Based on the classification of wrinkle features .But it suffers setback in case of scar on face. Due to causes scar area a large (highest) number of edge points will come and that can lead to misconception. To eliminate this problem local and global both features are used for estimate the age. But there is one more hindrance due to which the correct estimation is measurably affects and this is less tackled by researchers for face non- uniform illumination. When we are not used it, then results are doubted. After extraction of features, we used the classification techniques for featured classified in different age groups. SVM is good in classifications is shown by researchers

Keeping above points into consideration which we will be followed these key objectives in our work:

- For selecting the face region we will used Adaboost method, this method is used for extraction the features in which we will mainly exclude hairs, and then we will done the histogram equalization of facial image to counter light non illumination.
- Geographical features of image like center of left eye to nose, eye to eye distance, center of right eye to nose and face angle are calculated along with wrinkles features on images which are global features. By using Gabor filters with specific number of angles and orientations we will obtain the features which are global features.
- Amongst algorithms of classification, algorithms of clustering serves better. So we will be used fuzzy-K means approach for it and we will obtained the results in terms of MAE

IV. PROPOSED WORK

Our work is revolving around the three modules: detection of face, extraction of features and classification of features. By using a Adaboost algorithm we detect the faces. By using strong classifier and multiple iterations we detect the face and results which are obtained by this algorithm have been approaches proven 99 % correct in favorable conditions. The pseudo code for Adaboost algorithm is given in table 4.1.

Given input image (x_l, y_l)……. (x_n, y_n)

- initialize weights $w_{,l} = \frac{1}{2m}, \frac{2}{2l}$

- For t=1…..T

1) Normalize the weights $w_{i,l} \leftarrow \frac{w_{i,l}}{\sum_{j=1} w_{i,j}}$
2) Select the best weal classifier with respect to the

$$\varepsilon_i = \min_{f,p,\theta} \sum_i w_i |h(x_i, f, p, \theta) - y_i|$$

3) Define

$$h_i(x) = h(x, f, p, \theta)$$

4) Update the weights

$$w_{i+1,i} = w_{i,i} \beta^{1-e_i}$$

Where e_i=0 if example x_i is classified correctly and e_i=1 otherwise and $\beta = \frac{\epsilon_l}{1-\varepsilon_l}$

5) The final strong classifier is

$$c(x) = \begin{cases} 1 \text{ if } \sum_{i=1}^{T} \alpha_i h_i(x) \geq \frac{1}{2} \sum_{i=1}^{T} \alpha_i \\ 0 \quad \text{otherwise} \end{cases}$$

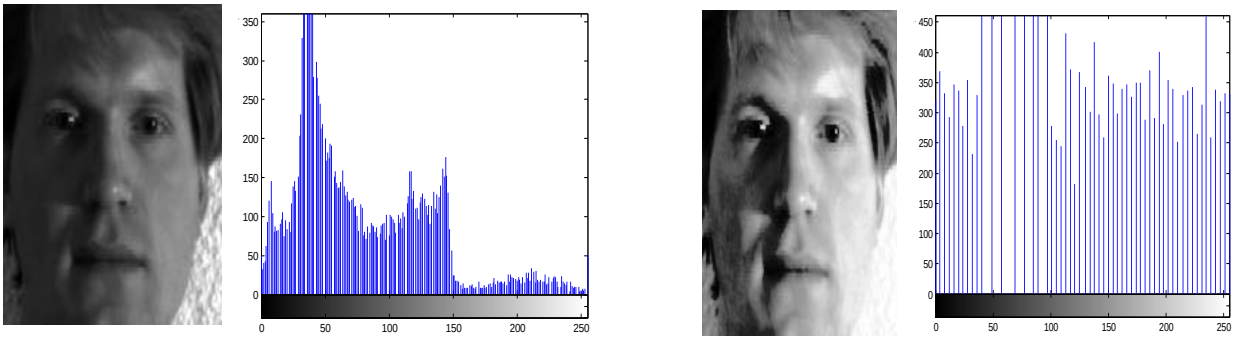


Figure 4.1: Histogram before compensation and after illumination compensation

In our work k-means clustering algorithm is used as unsupervised learning for of clustering of features.

Begin

{

-Load the test image

- By using algorithm to detect the face image using Adaboost method is described in table 4.1

-Crop the face part and run histogram equalization part to normalize the image

-Illumination variation.

-Generate Gabor filter coefficients at 4 scale and 6 orientations using 2 dimensional Gabor

-filter equation discussed in section1.1.2.

-filter the image by using real part of Gabor filter

-concatenate the image features obtained from Gabor filtering into single dimensional matrix

-execute k means classification module by clustering the age groups into 10 sub groups and after multiple iterations, minimum mean square error is saved.

}

End

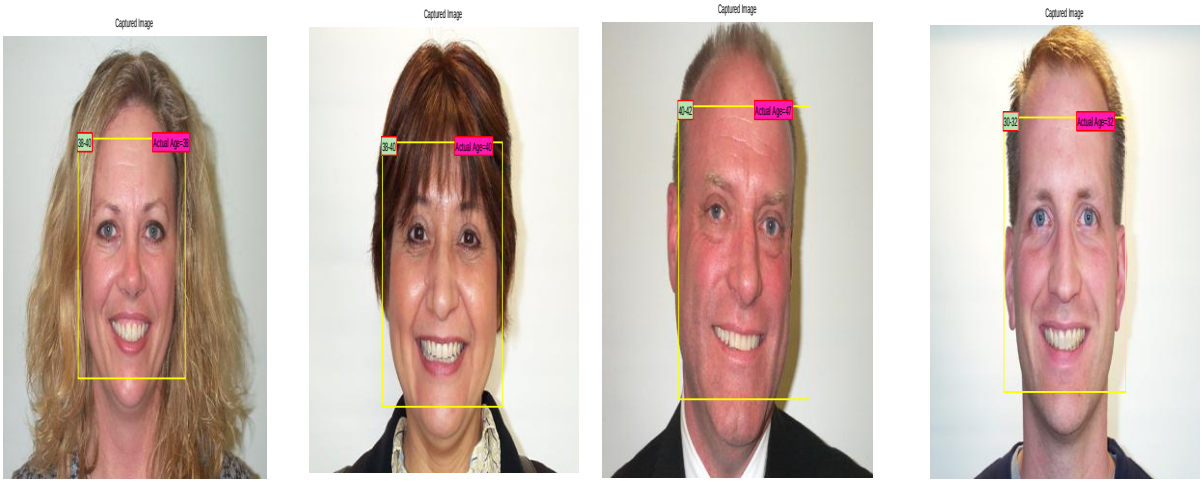
V. RESULTS & DISCUSSION

In our proposed work we have considered the FG-Net age data base of male and female. The FG-NET aging database is publically available. It contains 1,002 high-resolution color or grey scale face images of 82 multiple-face subjects with large variation of lighting, pose, and expression. Proposed work has been implemented in MATLAB 2013a as its computer vision and image processing toolbox provides a wide range of inbuilt functions which eased our work's simulation. For example the complex Adaboost algorithm used in the first step of face detection is provided in the computer vision toolbox of MATLAB as a function which is used in our work. It provides the option to detect the face area or any part like eyes, nose etc. After detection of face area, features using the Gabor filter are extracted. The accuracy of result is determined by the means square. error, as we are aware with the actual age of subject in the image. The data base named the image such as 'EJWfemale42happy', in which 42 is the age of subject in the particular image. Results are compared with the Nguyen et.al (2014) and presented in table 5.1 below. Like the reference paper we have also taken the male and female images and age has been calculated for that. Table 5.1 inherits average MSE for both cases as shown.

Table 5.1: Mean Square Error for comparison with the reference

	Using MLBP Only	Nguyen, D.T. (ref)	Proposed
Female Data	6.816	6.699	2.7
Male Data	5.796	5.783	3.2

The calculated age range and actual image is shown in boxes on the top of images.



VI. CONCLUSION

The evaluation of proposed method is done using mean square error and compared with Nguyen et.al (2014) work. The mean square error difference in proposed work and reference work for male and female data is up to 2.5 and 3.5, which is quite a good achievement.

VII. FUTURE WORK

In light of the good results obtained by applying the feature selection method on age recognition problems, it follows that similar efforts can be employed to improve face recognition problem. Thus, instead of using a single visual descriptor, a possible solution would be to apply feature selection scheme on different regions of the face image.

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