Wrinkles Energy based age estimation Using Discrete Cosine Transform

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***Abstract*—Human's faces are true representative of a human and information like gender, age and origin about a human. Age estimation on the bases of facial image is a complex phenomenon for the computer vision systems to predict human's age effectively. Facial image based Age estimation analysis has a lot of real world applications e.g. human computer interaction (HCI) and multimedia communication. In this paper a new method to predict human's age is presented. The proposed method is focusing on cheek's area and wrinkles analysis using discrete cosine transform (DCT). As the wrinkles on human face increase with increasing age, so it has been used as discriminating factor for age estimation. DCT is applied on the wrinkle detected. The energy in higher coefficients of DCT increases with the increasing wrinkle in other words with increasing age.**

Keywords—Age Estimation; wrinkles; Discrete Cosine Transform; face detection.

I. INTRODUCTION

Human face can reveal significant information about age and our aim is to extract these information and estimate human's age [1]. There are a lot of applications of age prediction but some of potential applications are.

i. Automatic age estimation systems can help to determine the potential suspects more efficiently and accurately by filtering the gallery database using the estimated age of the input mug shot [2].

ii. An automatic age estimation system can be used to prevent minors from purchasing alcohol or cigarette from vending machines or accessing inappropriate web pages [3].

iii. Human-computer interaction (HCI): The system can adjust the contents presented to a user based on her age. For example, a smart shopping chart can be designed to provide recommendations according to the age of the customer [4].

Conventional facial based age prediction includes methods like Eigen face or principal component analysis (PCA) [5], and linear discriminate analysis (LDA) [6, 7]. Facial features are extracted using these techniques and perform search in the face database for images with matching features. Another approach aims to combine global and grid features for age prediction and Effective age estimation using face triangle from human face image [8].

Facial image based Age estimation is an ambitious process because the appearance of a particular face varies due to changes in expressions, pose, and other [9, 10].

Factors such as occlusions, make-up, image degradations etc. There are a lot of other problems of face recognition, as ageing is a very complex process which is extremely difficult to model: a group of people of the same age may look very different depending on factors such as ethnicity, lifestyle, environment [11].

As we mention above all problems for age prediction, but this research paper, focuses on the face area which is most affected by growing age not overall face, So the face area which is most affected by age progression is cheeks area just under the eye having less effect of the problem mention earlier [12]. With age progression wrinkles appeared mostly in that specific cheek's area so using DCT coefficients find the energy and upon which we decide the human age [13].

II. PROPOSED METHOD

In this section a wrinkle bases age estimation technique is presented. The main focus of this method is to calculate the wrinkle energy form the human image. As wrinkle increases the wrinkles energy also increases. The energy is calculated using DCT. The wrinkles energy concentrate in the high coefficients for DCT of the wrinkle detected. The wrinkle energy is calculated for different ages and the basis of the analysis made different energy band are assigned to each age group.

Check's area detected, mostly affected by age progression which reveal significant information for age estimation. Cheeks area has wrinkles and the wrinkles increases with the increasing age e.g. Childs has a wrinkle free skin and wrinkle increase with the age. Adults have more wrinkles in this cheek's area as compare to Childs. In this step eyes are detected at first and then the cheeks area is detected in an image as shown in Figure 1.

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Eyes Area Cheeks Area

Fig. 1. Eyes and Cheeks detection

After the cheeks detection the cheeks area is extracted as a spate image. Then the extracted cheeks image is normalized in order to remove noise textures as shown in Figure 2. Normalization is performed for the even distribution of illumination.

Fig. 2. Image normalization

After the normalization DCT is applied on the wrinkle image apply. The DCT coefficients are classified as low and high coefficient [13]. The higher DCT coefficients contain the wrinkles energy in it. The energy of higher DCT coefficients is calculated.

The process is applied on different images of different age groups and the energy band is defined for each age group. Then on the basis of the energy bands are used for the classification of new human images. The whole process is shown here in Figure 3.

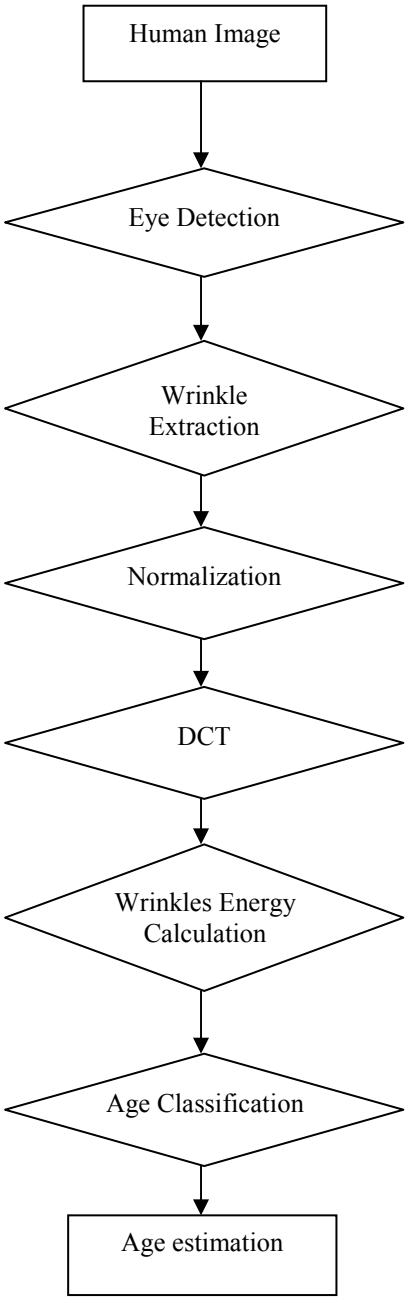

Fig. 3. Block diagram of age estimation

III. Experimental Results

The age estimation on the basis of wrinkles energy is applied on various images to defined different energy levels for different age groups. The proposed method was applied on different images of each age group. As the energy of any image mostly concentrate in low frequency components of DCT while the wrinkles corresponds to the high frequency components of DCT. The energy contained in the high frequency component, that represent wrinkles, is very small and difference between

the energies of different age groups is very small. To make the differences more prominent log energies are considered. So after calculating the energy of wrinkles log is applied on that. The energy band calculated for different age groups are given in Table I.

TABLE I. ENERGY BAND OF DIFFERENT AGE GROUPS

Group	Age (years)	Energy Band (dB)
Child+Teen	0-18	<54
Young	19-30	54-57
Mature	31-45	57-59
Old	>46	>59

On the basis of experimental results obtained the human are classified as child, teen, young, mature and old. And further using these energy bands age is estimated.

The experimental results given in Table 1 are used for classification of different age groups and age estimation. The proposed method of age estimation is applied on different images as shown in Figure 4. All the images are processed one by one and the eyes detected and cheeks are extracted from the image being processed. DCT is applied on the cheeks images after normalization. The DCT coefficients are classified as lower and high frequency coefficients and the energy of high frequency coefficients are calculated. The log of wrinkles energies are used for age predication and estimation. Each of the images is labeled as its estimated age. The experimental results are shown here in Figure 4.

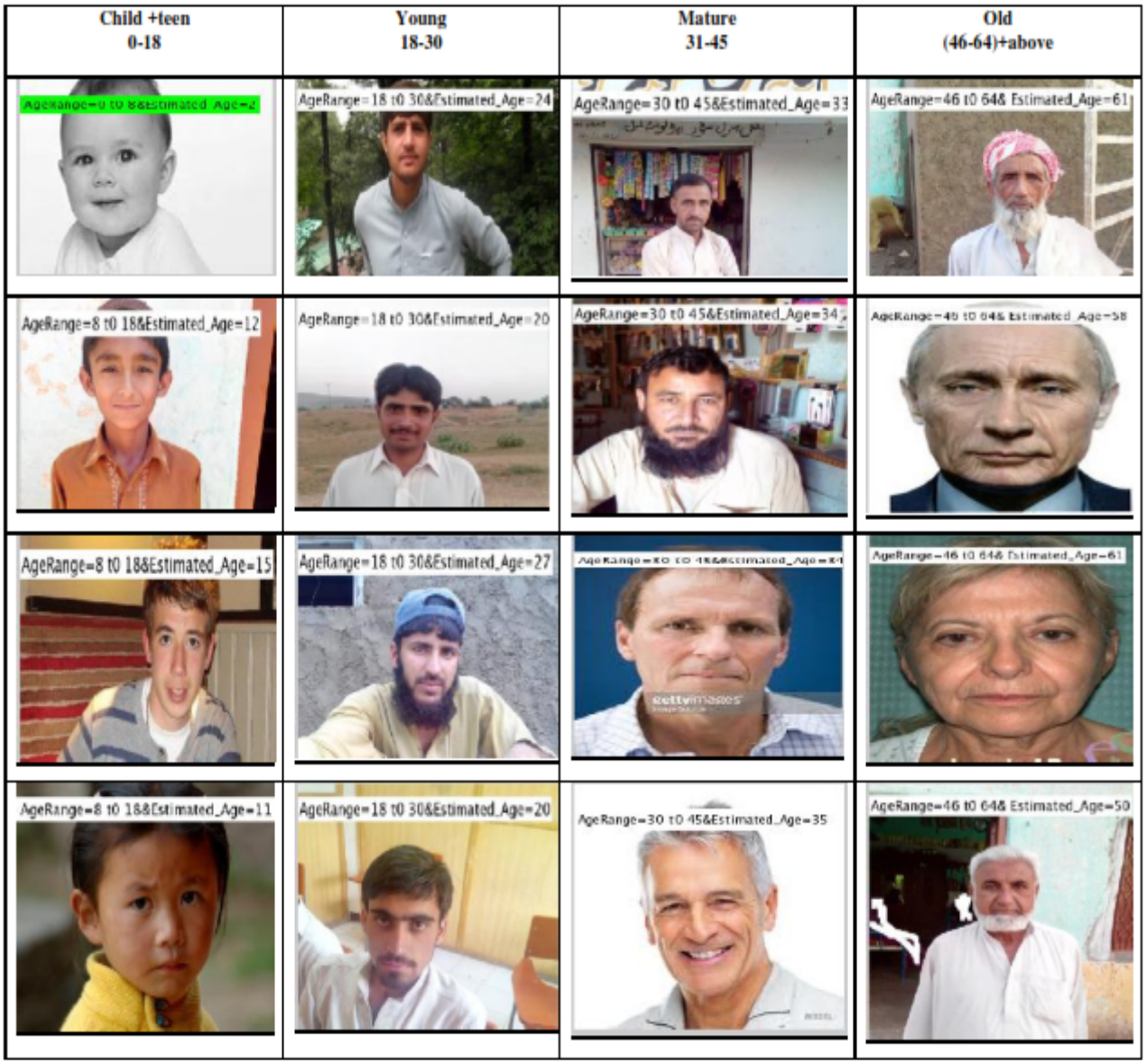

Fig. 4. Age estimation on the bases of wrinkle energy

IV. Conclusion

Facial image analysis can be used in many areas, like face recognition, age estimation and classification, gender recognition, etc. But the least exploited area is age prediction. Different techniques have been proposed for age prediction and estimation. The wrinkle energy based age estimation is a new technique used DCT. This technique solely focuses on wrinkle on human face i.e. cheeks. The wrinkle energy is the only classification factor used. The results obtained show that the proposed technique is very simple to implement and effectively estimate the age of different age groups.

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