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Age Prediction with Digital Images-Review Paper

Shaikh Rana A. Akbar[1], Shaikh Saiqua Iram[2], Syed Nagma[3]
P.G. Student, Computer science & Engineering, Everest Educational Society's Group of Institutions, Aurangabad, Maharashtra, India[1 2 3].

***Abstract*— This paper concerns with providing a methodology to estimate age group using face features. This process involves three stages: Pre-processing, Feature Extraction and Classification. The geometric features of facial images like wrinkle geography, face angle, left eye to right eye distance, eye to nose distance, eye to chin distance and eye to lip distance are calculated. Based on this triangle, we can estimate age group.**

I INTRODUCTION

Human face has lot many features hidden in it which can be exploited for determining the identity of the person, age of the person, gender of the person etc. The proposed system is used to determine the human age. It has so many real world applications. The first and the main is in the internet usage. There are so many sites available nowadays which should not be allowed to access by children. Likewise vending machines. There are so many vending machines which lends drug related items like cigarettes, alcohols etc which should at least be not allowed to use by children. These systems are only examples which can make use of the proposed system. If these applications capture the image of the user and will be allowed to proceed only if the calculated age of the user is above an age limit, we could solve the problem to a limit. The age and gender of a person is categorized by visual observation of images, where it is difficult in the computer vision. The face is recognized by considering features like eye distance, nose length, lip distance etc. The gender is classified by determining the features like moustache region, eye distance, total number of pixels of skin color etc. The age is identified using forehead region, right and left cheeks, eyelid region etc. As our aim is to determine the age of a person, we can concentrate on the features that can be extracted for age estimation. As we all know, age of a person affect his face in two main forms. One is the Geometrical Feature Variation where the size and shape of the face changes as he grows. If we use this information of the face, we can see that this change is gradual and most of the size variation stops at certain age. Even worse condition occurs in some case where the facial size gradually decreases when he reaches the old age. So using this method of Geometrical Feature Variation is challenging. But of course, this method can be used to classify the age broadly into three main classifications like baby, youth and adult.

II PREVIOUS WORK

Age classification algorithms were first detailed and developed by Kwon and Lobo [1].They classified facial images to three age groups: babies, young adults, and senior adults. They utilized geometrical ratios to distinguish babies from two other groups after the facial features have been located. The results have shown that the performance to classify babies were less than 68%. Next, young adults were distinguished from senior adults by utilizing energy functions and so-called snakelets. Authors proposed a new framework for face-image-based automatic age estimation. A manifold learning method was introduced for learning the low-dimensional age manifold. The Support Vector Machine and Support Vector Regression methods were investigated for age prediction based on the learned manifolds. To improve the age estimation performance and robustness, a Locally Adjusted Robust Regressor (LARR) was also designed. Anil Kumar Sao and B. Yegnannarayna proposed analytic phase based representation for face recognition to address the issue of illumination variation using trigonometric functions. To decide the weights to the projected coefficients in template matching, eigen values were used. Authors in combined the local and holistic facial features for determining the age. They used combined features that roughly classify a face as young (0-20) or adult (21-69). In most of the previous studies the age groups are not arranged properly. Another related work in the age estimation selects discriminative features to estimate face age. Primary studies on age estimation coarsely divided human faces into groups based on facial landmarks and wrinkles.

Most recent approaches considered the continuous and temporal property of face age and formulated age estimation as a regression problem. the anthropometric models for determining the age of facial images. Their approach demonstrates that precise feature selection can help classifiers to categorize the images with high accuracy. They use geometrical ratios calculated based on the distance and the size of certain facial features to distinguish age groups. They evaluate the age differentiation capability of the individual features and various combinations of the features using three different classifiers, namely, neural network classifier (NNC), Support vector classifier (SVC), and normal densities-based linear classifier (LDC).The author proposed automatic age estimation of aging effects on face image. The age group labeling was based on the training data and testing data on 720 and 580 images respectively. The facial feature was extracted based on the

geometric feature based method and principal component analysis (PCA) method. Based on the study we could conclude that there can be three methods of classifications for age determination. First method, called Geometrical Variation extraction approach, which exploited the fact that geometrical ratios of human face changes as he grows from childhood to adulthood. Second method is Textural Variation extraction method, which exploited the act that facial skin texture changes gradually from childhood to adulthood. Third method utilized a combination of the above two methods.

III SYSTEM ANALSIS

Human face is one of the most important sources of the information, which can be utilized for personal verification and identification. This paper discusses the method of finding the human age using the facial image of a person. It has many real world applications like human computer interaction, internet security, multimedia communication, ending machines etc. During growth, aging is affected in two main forms, one is the size and shape variation and the other is the textural variation. In this paper, we use the textural variation of the face during the growth, which appear more in the adulthood in the form of wrinkles. Areas of the face where these textural variations occur more are identified, like forehead, cheeks, regions around eyes etc. Studying these areas, the human age is identified and classified. Here we use the method of Hough Transform for feature extraction and Polynomial Regression for age classification.

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The gender is classified by determining the features like moustache region, eye distance, total number of pixels of skin color etc. The age is identified using forehead region, right and left cheeks, eyelid region etc. As our aim is to determine the age of a person, we can concentrate on the features that can be extracted for age estimation. Face recognition is an important area of biometrics which is of great use in our daily life. Traditionally, it uses for identification of documents such as land registration, passports, driver's licenses, recognition of a human in a security area. Face images are being increasingly used as additional means of authentication in applications of high security zone [1]. But with age progression the facial features change and the database needs to be updated regularly which is a tedious task. So we need to address the issue of facial aging and come up with a mechanism that identifies a person in spite of the aging. Traditional, Face Recognition includes methods like Eigen face or principal component analysis (PCA), fisher face or linear discriminate analysis (LDA) etc. These techniques extract facial features from an image and using them perform search in the face database for images with matching features. 3-D technique uses 3-D sensors to capture information about the shape of a face. This information is then used to identify distinctive features on the surface of a face, such as the contour of the eye sockets, nose, and chin. This technique is robust to changes in lighting and viewing angles. Skin texture analysis technique uses the visual details of the skin, as captured in standard digital or scanned images, and turns the unique lines, patterns, and spots apparent in a person's skin into a mathematical space. Kwno et al. [1] developed a system to classify face images into one of three age groups: infants, young adults and senior adults. They extracted key landmarks from face images and calculated distances between those landmarks. Then ratios of those distances were used to classify face images as that of infants or adults. They also proposed methods for wrinkle detection in predetermined regions in face images to further classify adult images into young adults and senior adults.

The first real human age estimation theory was proposed Lanitis et al. . They proposed methods to imitate aging effects on face images. They developed an aging function (quadratic function) based on a parametric model of face images and performed tasks such as automatic age estimation, face recognition across age progression. They only considered database having face images of individuals less than 30 years of age.

Our method is based on a novel and effective age estimation using face triangle from human face image, face triangle which has three coordinate points between left eye ball, right eyeball and mouth point. The face angle between left eyeball, mouth point and right eyeball estimates the age of a human are proposed.

After detecting the face area, the eye area has been detected. The iris of the eye appears to be the darkest area. So, we detect right and left eyeball by searching from the eye area. After that mouth point has been detected from the face area. Now, we can form a triangle called face triangle with three coordinate points left eyeball, mouth point, and right eyeball as shown in Fig. 1. The angle between right eyeball, mouth point,

and left eyeball is called face angle. With age progression of a human the face angle changes. So, by calculating the face angle we can estimate the age group.

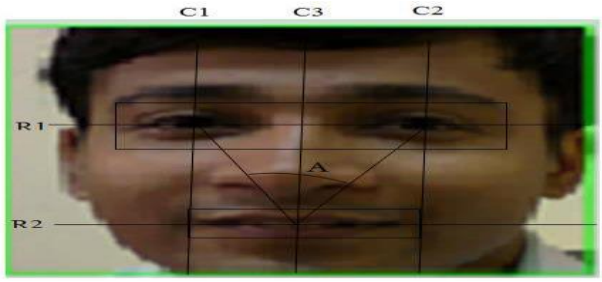


Figure 1 Face image with different coordinate points

- **Algorithm For Age Group Estimation**

For age group estimation the following algorithm has been proposed. This algorithm uses some coordinate point that is shown in Fig. 2.

Step 1: Detect the rectangular face area from input face image. If number of detected face is more than one, an error message will be displayed.

Step 2: Crop the detected rectangular face area and detect the significance eye-region

Step 3: The cropped rectangular face image is histogram equalized and then converted into binary image.

Step 4: The binary image of face is divided horizontally into two parts. Upper part that contains two eyes is denoted by UPART and lower part that contains mouth is denoted by LPART.

Step 5: Divide UPART vertically into two parts. One part that contains right eye is denoted by REYE and other part that contains left eye is denoted by LEYE.

Step 6: Find the row number R1 with minimum row sum of gray level in UPART. Find the column numbers C1 and C2 with minimum column sum of gray level in REYE and LEYE. So, (R1, C1) coordinate represents middle point of right eyeball and (R1, C2) coordinate represents middle point of left eyeball.

Step 7: Find the row number R2 with minimum row sum of gray level in LPART. So, R2 row represents the mouth row.

Step 8: Calculate the midpoint C3 of two eye ball. So, C3= (C1+ C2) /2 and the coordinate (R2, C3) is middle point of mouth.

Step 9: Draw a triangle by three coordinate points left eyeball (R1, C1), right eyeball (R1, C2) & mouth point (R2, C3).

Step 10: Calculate slope (m1) of triangle sides from mouth point (R2, C3) to right eyeball (R1, C1) and slope (m2) of triangle sides from mouth point (R2, C3) to left eyeball (R1, C2).

Step 11: Find the face angle (A) using formula: A = tan-1((m1- m2) / (1 + m1 * m2))

Step 12: Determine age group based on the face angle (A) as follows:

Table 1: Range of face angle with corresponding age groups

Face angle in degrees (A)	Age group in years
< 44	< 18
44 to 48	18 to 25
49 to 54	26 to 35
55 to 60	36 to 45
> 60	> 45

IV IMPLEMENTATION

There are several face detection and age group estimation have been proposed. This paper proposed a novel and effective age estimation using face triangle from human face image as shown in Fig. 1. After detecting the face area, the eye area has been detected. The iris of the eye appears to be the darkest area. So, we detect right and left eyeball by searching from the eye area. After that mouth point has been detected from the face area. Now, we can form a triangle called face triangle with three coordinate points left eyeball, mouth point, and right eyeball as shown in Fig. 1. The angle between right eyeball, mouth point, and left eyeball is called face angle. With age progression of a human the face angle changes. So, by calculating the face angle, we can estimate the age group.

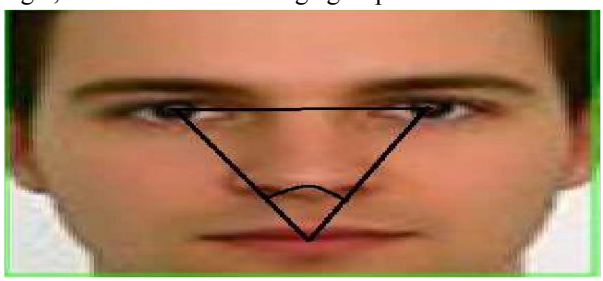
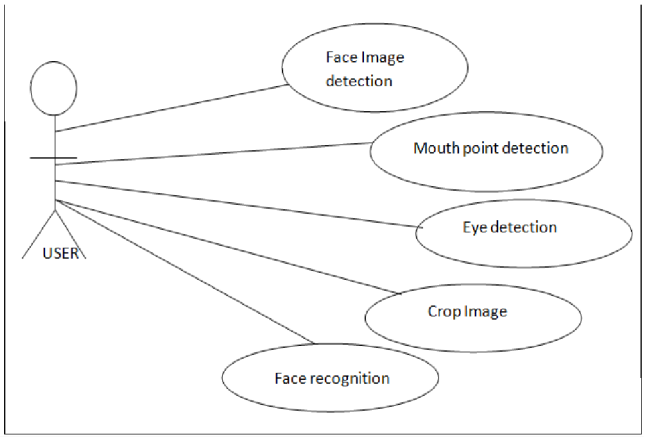


Figure 2 Face image with face triangle and face angle

Below figure illustrates the use case diagram. In this, the user is the actor, face image detection, mouth point detection, eye detection, crop image, face recognition are all the use cases.



V CONCLUSION

Age Prediction presents a challenging problem in the field of image analysis and computer vision, and as such has received a great deal of attention over the last few years because

of its many applications in various domains. A method for age group estimation is thoroughly described. So the paper provides a robust method for detecting the age of individuals. In conclusion, we have described our paper for age prediction with digital images. We have carried out research on the existing methods for performing face recognition and age prediction. The performance of existing methods and techniques is evaluated. We have presented an extensive survey of age prediction. Our paper is an excellent stepping-stone for further research in the areas of age prediction and simulating new face images to reflect age changes.

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