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PREDICTING AGE USING HUMAN FACIAL IMAGES

(ARTIFICIAL INTELLIGENCE)

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Abstract— *Age estimation plays vital role in human computer interaction where the image is given as input to the system after which, with the applied techniques the system provides result. An age group prediction system is estimated through AAM (Active Appearance Model) which calculates the texture and shape. The wrinkle is identified as a part of the shape information and the features such as eye, nose, chin, lip, cheeks are extracted using PCA(Principle Component Analysis) of AAM which then calculates the distance between the features are stored as facial landmark points. The points are fed as input to the Mean Classification Algorithm which classifies based on two age group adult and old. Finally the Mean Absolute Error(MAE) value is estimated to determine the accuracy.*

Keywords- *Age Group Identification, Active Appearace Model (AAM), Wrinkle Analysis, Facial Landmark Points, Mean Classification Algorithm.*

I. INTRODUCTION

Image processing with facial images is one of the biometric trait to identify individuals by features of the face. A problem of person verification and identification is an actively growing area of research. Face, voice, fingerprint, iris, ear, retina are the most commonly used authentication methods. Traditionally, face recognition had been used for identification of documents such as land registration, passports, driver's licenses, and 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. But with age progression the facial features changes 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's aging pattern. In this paper, effective age group estimation using texture and shape information from human face image are proposed. For better performance, the geometric features of facial image like facial landmark point including face angle, left to right eye distance, eye to nose distance, eye to chin distance and eye to lip distance are calculated with the help of Active Appearance Model approach. Age ranges are classified dynamically depending upon the number of groups using Mean Classification Algorithm. Age prediction is concerned with the use of a training set to train a model that can estimate the age of the facial images. The paper aims to identify the age for different facial features for different age group and to incorporate age adaptive human machine interaction.

II. RELATED WORK

The methodology of the paper incorporates number plate recognition system which has been designed using the ant colony optimization technique. Ant colony optimization technique gives better results in edge detection while applying image segmentation with the inspiration for the Ant colony optimization (ACO) algorithm. This system classification neural network in pattern recognition, artificial neural network (ANN) and gives the number plate area extracted from the image with improved accuracy [1]. Presents a systematic approach has been developed to detect boundaries using edge detection algorithm. These algorithms are helpful to detect the boundary and to evaluate the further investigation. The research results are beneficial and vital to practitioners to detect the edges of any images [2]. To evaluate the classification of pixel performance in order to detect the skin color spaces had been performed in this paper along with lookup table and Bayesian decision theory [3]. The paper had been presented with the techniques of extracting the landmark in accordance to calculate the appropriate age wisely. The distance ratio of the age groups are clustered with which the child, adult and old is grouped [4]. The formulated concept of the paper enhances that larger the training set collected accurate will be the result of age progression. The features of input images of face are identified with the help of Canny edge operator. On the basis of shape and texture information the age classification takes place with robust changes [5]. It is human's nature and a obvious fact that a person's age can be judged by simply looking at their face but it is right in all situations which may lead to misconception. In order to make the prediction accurate the systematic way has been proposed in the paper which uses vital techniques like PCA, ANN [6]. The study had been worked on multi-layer neural network (MLP) using Neural Network back propagation algorithm using features like ability to learn, high accuracy, faster processing [7]. Proposed a novel method in order to make a perfect match in the appearance of statistical model images. With the use of iterative matching algorithm the parameters ad attributes of the input image after which the RGB to GRAY scale deviations are performed for precise age accuracy [8]. The study evaluated the method of estimating age on the AIBO (Autonomic entertainment robot) alog with the use of HOIP facial images database. The images are captured in accompany with AIBO which used Genetic Algorithms (GA), Self Organizing Map (SOM) algorithm in order to select the features and to use them in neural network. [9]. It is to be noted that gender deviations

makes difference in the aging pattern of a person naturally. To overcome such misleading Aging pattern Subspace method had been undertaken representing the local and global facial landmarks for concise age progression accuracy [10]. Investigation of biologically inspired features comprised of Gabor filters to determine all the positions in facial images, and made use of either Support Vector Machine (SVM) for evaluation. Approaches involving manifold learning scheme for exact age prediction [11]. The study had been developed by two authors namely Kwon and Lobo. Their concentrated on analyzing the wrinkle features of the facial images and the distances of the geometric features which are detected by deformable contours. The paper classifies the age groups based on computational theory with two main steps such as image representation and age prediction [12]. Proposed method such as Fisher Discriminant method and Euclidian distance which is used for matching the appropriate age with the precise age group categorized [13]. A methodology to improve accuracy of labeled ad unlabelled data. Eigen face based approach had been applied to reduce the dimensionality of the image space and to enable the methods to obtain the classification of unlabelled data. The experiments had been performed using k-nearest-neighbor, Artificial Neural Network (ANN) and linear regression learning [14]. [15] Proposed that the frontal face view form an isosceles triangle combining the two eyes and mouth. This isosceles triangle is quite useful for face recognition and age range estimation. The face triangle is unique for every person and this face triangle can be used for face recognition with age.

III. PROPOSED SYSTEM

The proposed paper provides an effective estimation of age group using facial images of human. Approximately 2500 images had been captured and trained into the system. The process involves the following phases: Pre-processing, Feature Extraction and Classification.

A. Pre-processing

Preprocessing acts as a base for face recognition which involves cropping that is detected with rectangular face area. Then the true color image is translated to gray image and it is of a single color after which the conversion of gray to binary image takes place that provides a result of segmentation. The next step is filtering in which the study utilizes Gaussian Filtration technique to blur and to remote noise from images. Then the extraction of facial features is detected.

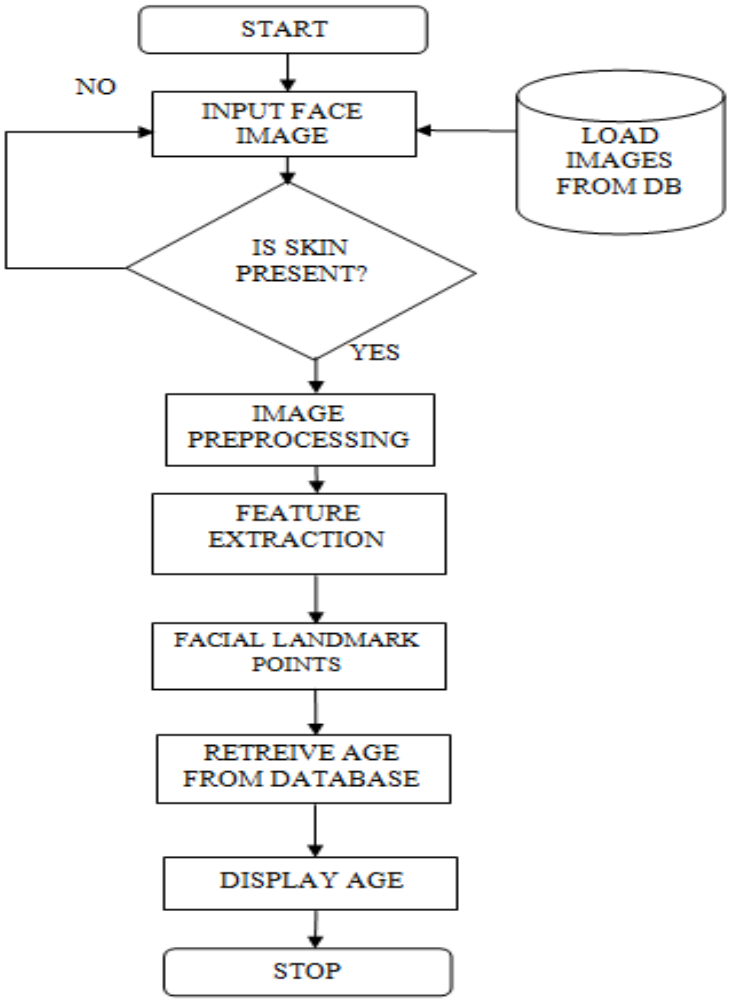


Figure 1. FLOWCHART

B. Feature Extraction and Facial Landmark Points

Extraction of facial features is done using Active Appearance Model (AAM) which is a combined approach of statistical shape model and intensity model. AAM has been expanded to facial aging with a suggestion of an aging function defined as age = f (b), in order to explain the variation of ages in years. *Age* is the age of a person in the picture, *b* is a vector parameters learned from AAM, and *f* is an aging function. The function defines the relationship between person's age and facial description parameters. There AAM is not oriented only to younger people unlike anthropometric model, but deals with assessment of the age of people of all ages. It concentrates on all aspects of the human face to estimate the age more accurately. The parameters obtained from the face images are center of eye, nose tip, top of forehead, chin, and differet sides of face. Skin color also plays a vital role in differentiation of images. The distance between these points are calculated.

F1= (distance from left to right eye ball) / (distance from eye to nose)

F2= (distance from left to right eye ball) / (distance from eye to lip)

F3= (distance from eye to nose) / (distance from eye to chin)

F4= (distance from eye to nose) / (distance from eye to lip)

F5= (sum of pixels in forehead region / number of pixels in forehead region) + (sum of pixels in left eyelid region / number of pixels in left eyelid region) + (sum of pixels in right eyelid region / number of pixels in right eyelid region)

S1=140<|Pxy|<120

Where, F1, F2, F3, F4 - distances from different angles,

F5 – facial landmark points

S1 - for the skin color analysis

Studies related to facial growth have shown that the face shape changes as a person grows. These changes cause slight changes in the position of the primary facial features. The distance between these parameters has been calculated.

C. Classification using Mean Classification Algorithm

Age ranges are obtained from the features (parameters) F1 to F5, S1 are determined from the above mentioned techniques and approaches. After which the mean age is calculated for categorization into appropriate age group. To get happen the clustering of age group, the Mean Classification Algorithm is made use. It is one among the member of supervised learning algorithm that solves the well known binary classification problem. The procedure follows a simple way to classify the given data set through a number of clusters. It generates a specific number of disjoint or flat clusters. This results in the segregation of data into groups from which the metric to be maintained can be deliberated.

D. Objectives

- Aims to identify the age of different facial features for different age group.
- To accomplish different bio-metric traits
- To incorporate age adaptive human machine interaction
- For age invariant person identification

E. Equations

MAE (Mean Absolute Error) is a measure of difference between two continuous variables. It is assumed that x_i is the actual age and x is the predicted age. Then the equation follows as:

$$\mathrm{MAE} = \frac{1}{n}\sum_{i=1}^{n} |x_i - x|$$

where, n = number of errors

$|x_i - x|$ = absolute errors

F. Figures and Tables

Figure2: RGB image

Figure3: Binary image

Figure4: Filtered image

Figure 1 is the original image (True Color Image)

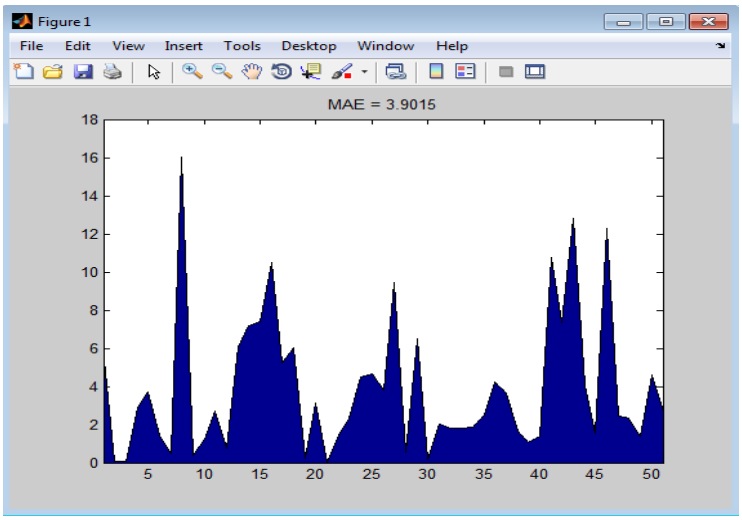
Figure 2 explains the conversion of RGB to Grey and Binary Image
Figure 3displays the normalized and the noise free image

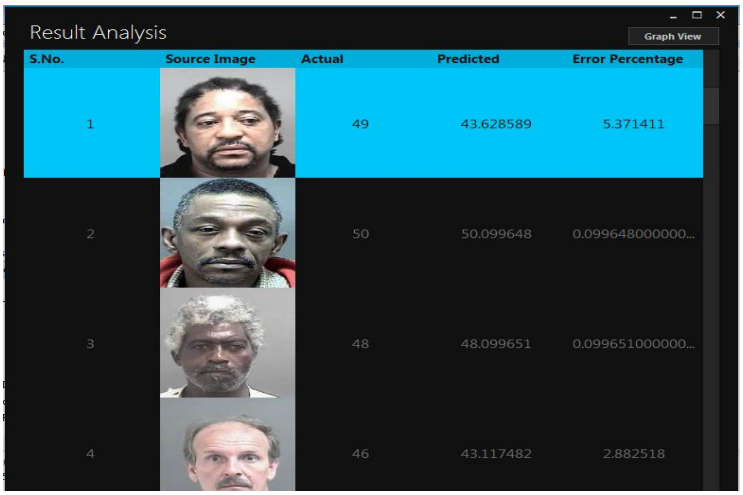
TABLE I. MAE VALUE

ALGORITHM	MAE
Active Appearance Model	3.9

Using the Active Appearance Model(AAM) the shape, texture and the landmark points of the facial image has been extracted after which based on the obtained landmark points the age is predicted. The obtained age is taken average using MAE(Mean Absolute Error) which estimates the actual error percentage of the paper. As of now the project provides 3.9% which can be still reduced to zero by training more images.

IV. RESULT AND CONCLUSION





The paper focuses on creating and using Indian Aging Database and involves extracting features from the facial image. The images are trained into MATLAB after which the facial landmark points are detected and noted for further calculation. The obtained 68 landmark points are given as inputs to the Mean Classification Algorithm which groups them according to their aging pattern and calculates the Mean Absolute Error (MAE) value. From the MAE result of 3.9, it is recommended that Active Appearance Model in image processing using MATLAB provides an enhanced methodology of age prediction which could effectively be employed in many application which involves major use of Biometric trait, Age-Specific Human Computer Interaction, Other Web sites in order to prevent the old from indulging in risking rides and minors from purchasing tobacco products. The age prediction system can be more accurate if more images of adult and old are trained into the database.

V. FUTURE SCOPE

The experiments and research has been observed that the aspects of the proposed work can be accomplished with more accuracy by training additional images. The future enhancement of the work ca be carried out with video images through web camera. This increases the efficiency of the project in a wider range. Comparison of different algorithms using variety of techniques can be employed for accuracy of age prediction.

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