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A Survey on Facial Feature Extraction and Age Estimation using Wrinkle Analysis

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Abstract—Human age detection is on the most important study while considering the physical features of any human being. The difficulty of age detection task originates from many reasons such as the lack of enough labeled samples to model the aging patterns of subjects, as well as uncontrolled conditions in data collection such as illumination, pose, occlusions and other environmental variables. To eliminate all the issues faced in traditional system, the method of human age classification using filter techniques and wrinkle analysis has been designed. Our system proposes a novel age classification by analyzing human skin detected through skin texture. We extract facial features using wrinkle analysis. By using the facial feature extraction methods, human age is classified into four groups namely infants, young adults, adults, senior adults. The facial features are extracted using Artificial Neural Network & wrinkle analysis using sufficient large amount of database to increase the credibility of results. An attempt is made to eliminate the external factors generated due to photography, hence giving a high accuracy. Our methodology provides a more accurate means of human age classification and eliminates the tedious task of maintaining and managing the facial database which has to be updated at regular intervals. In this methodology we use age estimation classifiers for each age group. Our results indicate that machines can estimate the age of a person almost as the reliably as humans.

Keywords—Wrinkle Features, Artificial Neural Network, Filter Techniques and Wrinkle Analysis.

I. INTRODUCTION

Human face conveys considerable amount of non-verbal information for day- today communication such as gender, age, expression etc[1]. Human face image also reflects such type of information. This type of information can be extracted from face images by applying suitable algorithms. Age is one of the crucial factors in deciding various attributes such as type of medical treatment suitable for a person, targeted advertisement has a lot to benefit from it by displaying advertisement personalized to age groups of user or customer, who is looking at a website [2]. Traditional methods such as dental and skeletal examination to determine age are often imprecise, so there is a need to develop a more accurate system. Automated age estimation from facial images is one of the most difficult challenges in face analysis. It can be very favorable in a number of real life applications such as age based authorization system, demographic data mining, business intelligence and video surveillance system. Many researchers have worked in this field but have not been able to produce the expected results due to various factors. Accuracy was also increased by using different pre-processing techniques. It depends on various aspects such as database used, photography techniques, number of features extracted and techniques used to extract the features. Some other aspects such as the state of emotion the person is in while capturing the photo or angle taken into consideration while taking the image has a huge role to play in feature extraction.

II. LITERATURE SURVEY

"Age estimation from facial images using biometric ratios and wrinkle analysis": Age estimation becomes difficult due to

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individual's internal and external factors. Lack of accuracy in age estimation is mainly due to increasing number of classes used in age classification, in-accuracy even by human evaluation, lack of proper large dataset. This methodology includes

- Facial age classification
- Facial age simulation as follows :

a). Feature Extraction

Pre-processing was applied on areas such as top of head, bottom of head i.e chin, left Eye, right Eye, tip of the nose, and middle of the lips [3]. Cascade classifier is used to capture the above region of interest (ROI). The 6 identity points are top of the head, bottom of the head(chin), left eye, right eye, tip of the nose and middle of the lips.[3] Once the eye-pair region has been identified, halves of it are used to identify individual eyes using a separate Cascade Classifier for each[4].

b). *Biometric Ratios*

By using ROI the ratios of these regions can be calculated.

c). *Wrinkle Analysis*

Wrinkle analysis was done by using above biometric ratios.

d). Classifiers

The classifiers used are:

- Knn classifier which works on the nearest neighbor principle
- Decision tree classifier(ID3) which contains a set of questions
- Naïve Bayesian classifier which measures probability.

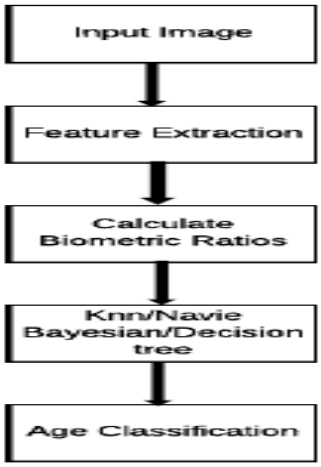

Fig. 1. Age Estimation Using Knn.

"Age Estimation from Face Image using Wrinkle Features": Process involves four stages: pre processing, facial feature extraction, and classification and age estimation using Fuzzy C algorithm.

i. *Pre-processing*

Calculation of wrinkle features is done using forehead portion, upper portion of cheeks, eyelid portion and eye corner regions. The distance between two eyeballs d is calculated using formula: $d=\sqrt{(Xr-Xl)+(Yr-Yl)}$[5]. Based on geometric structure of face the vertical distance between eyebrows is set to 0.4×d.The forehead portion above the eyebrow is a rectangle of size 0.5×d[6].

ii. Feature Extraction

Using the distance values between these regions seven features are extracted. Feature 7= (sum of pixel values in forehead area / number of pixels in forehead area) + (sum of pixel values in left eyelid area / number of pixels in left eyelid area) + (sum of pixel values in right eyelid area / number of pixels in right eyelid area) + (sum of pixel values in left eye corner area / number of pixels in left eye corner area) + (sum of pixel values in right eye corner area / number of pixels in right eye corner area)[7]

iii. Classification

Fuzzy C means clustering is used to find maximum membership value.

iv. Age Estimation

Average age of cluster j (AVGj) is calculated as:

$$AVGj= (\Sigma AGEi) /Nj \quad \ldots\ldots(1)$$

Where AGE i is the age of training face image i that belong to cluster j Nj is the number of training face images those belongs to cluster j.

Age estimation AGi of test face image is calculated as estimated

$$AGEi= \Sigma (Pij * AVGj) \quad \ldots\ldots(2)$$

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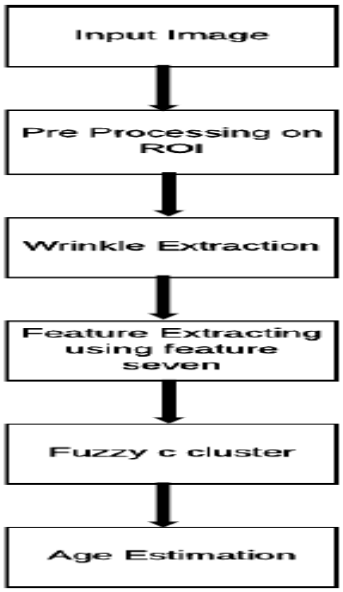

Fig.2. Age Estimation Using Fuzzy C Cluster

”A of Gender and Age Estimation based on Facial Knowledge”: proposed Advance Retinal Sampling Method (ARSM) and feature extraction method for age detection. Skin texture and features are extracted by using Gabor Wavelet Transform in various periodicity and directionality by filter convolution. As the dimension of Gabor wavelet feature is huge Simple Principle Component Analysis (SPCA) is used [9].

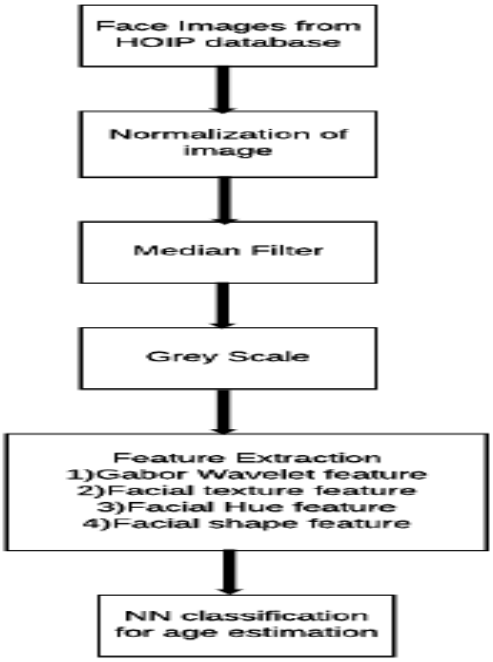

Fig.3. Age estimation using Neural Network

“Wrinkle Feature-based Skin Age Estimation Scheme”: has used watershed algorithm for wrinkle detection and non linear multi class SVM classifier for age estimation, pre-processing on microscopic skin images, including contrast stretching, noise reduction, and binarization. Watershed algorithm was applied to get wrinkle skeleton and used it for extracting wrinkle features. Using the selected skin features like length, width, depth a non-linear, multi-class SVM was trained with RBF(Radial Basis Function). Here the feature values were normalized to [0,1] accuracy of 83% achieved.

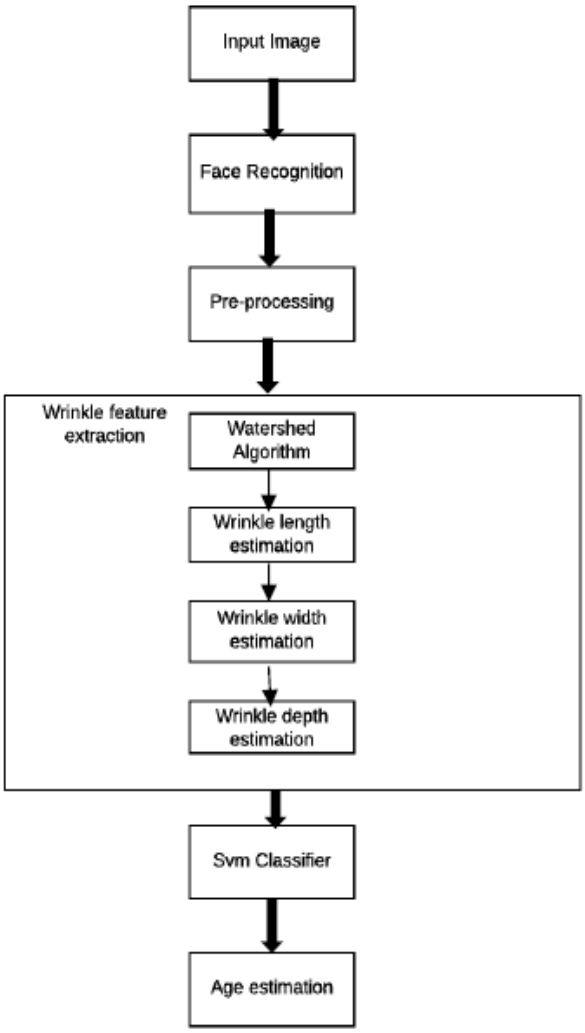

Fig.4. Age Estimation Using Watershed Algorithm and SVM Classifier.

III. CONCLUSION

In this literature survey, we have given a brief summary of some of the techniques used for the feature extraction for age estimation using wrinkle analysis. In each of the technique

different ways of pre-processing and feature extraction along with different classifier is used. Each of the methodology used has some merits and demerits and gives varying results due to various factors such as the Database used, size of image, Pre-processing feature used and so on.

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