A REVIEW ON HUMAN AGE CLASSIFICATION SYSTEM

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Abstract

This paper identifies human age classification system with the help of literature survey and classification of research from 1999 to 2016 to explore about human age classification techniques and their applications. On the basis of study of various research papers, this paper identifies and categories human age classification techniques: Geometric Features and Wrinkles Feature based Approaches, SVM based Approaches, K-NN and NN based Approaches, Active Appearance based Approaches. This paper presents work a detailed study that projects direction for future research in designing and enhancing techniques for classifying human age.

Keywords: Age Classification, Computer Intelligence, Machine Learning

1. INTRODUCTION

Human face provides verbal and nonverbal information such as facial expression, gestures, moods and age. The age factor is very important information about human, which determine the person is how many years old. As human growth increases, the human face recognizes remarkable changes according to which they belong. Human age is changed by internally and externally types of factors. Environment changes from one place to other places. Therefore, surrounding environment effect on human skin are distinguishable. The texture of skin in human body different for everyone. There are lot of factors affecting the age such as eating routines, eating habits, life style, make up and health issues. The wrinkles may not clear the human age as it depends on above mention factors. But the age can be predicted with the help of wrinkles and another factor. Many researchers worked on aging factors. They designed different age estimation system. Now a day's many researchers are working on age classification system with using different databases. The age is not easy to determine through human face image for person but also difficult for a device and machine. The age information is very helpful and useful information in different types of areas such as biometric, medical science, security, digital significance and others. This information can be very helpful to those applications which take more time and difficult to gain better results in few times. Analysis by the researcher about age classification is very difficult. But the age classification categories age into different age group. Human age classification is measure challenge in human and computer vision. The classifications of human age into different age groups are based on the considering changes in human face images. Many authors provide their support and contribution in human age group classification. On the basis of human face, human age classifies into different age groups like as, baby, child, youth, adults and senior.

Here this paper studies various types of techniques, methods and algorithms. This paper represents various procedures and iteration such as preprocessing, feature extraction, fusion, regression and classification which are used in human age classification system. Main various techniques discuss which are such as Geometric Features and Wrinkles Feature based Approaches, SVM based Approaches, K-NN and NN based Approaches, Active Appearance based Approaches. The various types of databases used as FG-NET (Face and Gesture Recognition Research Network), PAL (Productive aging lab), IFDB (Iranian face database), PIE (Pose, Illumination and Expression) and HOIP (Human Object Interaction Processing) etc. databases.

Related Work

Kwon and Lobo [1] were first researcher to recognize the age group classification problem. The researcher categorized input face images into three grayscale face images age groups: babies, young adult and senior adult. This approach was tested on small database. The first primary features are eyes, nose, mouth, chin and virtual top of head are calculated and mentioned feature ratios differentiate babies from each other's. Other secondary feature, wrinkles are found and calculated. The mentioned secondary feature ratios differentiate seniors from two other age groups. The classifications of these classes are done by feature ratio and wrinkle analysis it is first achievement to categorized human age in different human age groups.

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Horng et al. [2] were another researcher to recognize the age group classification system. Researcher categorized input face images into four grayscale facial images age groups: babies, young adults middle aged adults and senior adults. The age group classification process is done in three phases, first phase is localization, second phase is feature extraction and third phase is age classification. Position of eyes, nose and mouth in the facial images were identify during initial steps. Next extraction of feature and analysis of wrinkle is done. Last neural network is used for classification system. So, each category is distinguished to one another. The author used privatized database.

Kanno et al. [3] identified an age group classification system. They used private database to categorized 440 face images of young males. They used mosaic features as well as neural network. Distinguished database into four age groups with 80% accuracy.

Iga et al. [4] utilized Human and Object Interaction Processing database to classify 101 face images into five different age groups. They used support vector machine and information about skin, Gabor wavelet, color etc. Analysis done with an accuracy of 58.4% accuracy.

Hayashi et al. [5] classified human age groups in a span of ten-year. First, researcher focused attention on skin areas which were extracted with the help of the face images. Histogram was applied for equalization the wrinkle enhancement and extracted face wrinkles through a special Hough transform. A look-up tabular was formed in final stage for classifying age and gender. 300 images were taken for analysis where 27% accuracy is achieved in analysis. Analysis neglect changes in age group below 15 despite having recognizable changes in the face.

Lanitis et al. [6] designed an age group estimation algorithm. The authors worked on many parts of face and function of aging. For gaining better function of aging, they developed various types of techniques. They took lower and upper part of face (including hairs). Including of hairs did not provide better results. The age estimation was confined between 0 to 35 years. Above the 35 years face did not give appropriate results.

Takimoto et al. [7] took face images from Human and Object Interaction Processing database of 139 female and 113 male images. They categorized these images into six age different groups with the help of Principal Component Analysis, neural network and Gabor wavelet. 54.7% and 57.3% accuracy were achieved for female and male face images.

Ueki, Kazuya et al. [8] took WIT database for age group classification system. The method used by two-phased approaches named 2DLDA and LDA. PCA used to determine a vector and for reduce dimension. LDA used to extract the futures and find out a projection for maximizing the ratio between within class and the class scatters. The Gaussian model classifier was used for classification. The accuracy rate obtained with different range such as 5-year, 10 year and 15-year range age group accuracy of 46.3%, 76.8% and 78.1%.

Yang and Ai [9] took multiple types of databases for an age group classification system. 3540 images took from Face recognition technology database and 696 images took from Pose, Illumination, and Expression database to classify into three different age groups. The method took the use of Local Binary Pattern histograms and classifier used by Adaptive Boosting classifier. Face recognition technology database achieved 92.12% accuracy and Pose, Illumination and Expression database achieved 87.5% accuracy.

Gunay and Nabiyev [10] used private database of 350 face images and made use of Face Recognition Technology database. They took Local Binary Pattern and Nearest Neighbour (k _ NN) classifier were used for categorizing images into a group of six age group with 80% accuracy.

Gao and Ai [11] took fuzzy classifier and Gabor features for grouping 6386 web images into four different age group. They achieved 91% accuracy.

Dehshibi and Bastanfard [12] presented an age group classification system for four different age groups. They took Iranian face database (IFDB). They used four different phrases in age group classification system namely pre-processing, feature extraction with help of geometric features, wrinkle analysis and age classification. First images converted in grayscale images, and then face region was cropped. Next eyes, nose, lip and chin were located. Then biometric ratios and wrinkles analysis were calculated. Last artificial neural network is used for age classification system. The significant improvement in the age group classification achieved up to 86.64% accuracy. The author took 498 images for age group classification system.

Tonchev et al. [13] dproposed an age group estimation system on basis of subspace projection algorithm and vector classifier. There were many phases such as Face Detection, Normalization of face, Subspace Projection, Support Vector Machine first, Face detection was done which consist Haar-like features and the Convolution Neural Network (CNN). After face normalization was done. The next, a subspace projection was done to reduce noise reduction by using Spectral Regression and Principal Component Analysis. Finally, SVM was used for classification.

Hajizadeh and Ebrahimnezhad [14] took Histograms of Probabilistic Neural Network and Oriented Gradients for analyzing 377 facial images, which were taken from Iranian face database. 87.025% accuracy was achieved in categorizing images into age groups.

Izadpanahi et al. [15] designed an age classification system. Face and Gesture Recognition Research Network database and Iranian Face Database were used for analysis. Classified facial image into seven age group. They took geometric ratios, wrinkle analysis and Support Vector Classifier. They obtained 92.62% accuracy.

Liu and Li [16] proposed an approach for age system. They classified images into five age-groups. First step is preprocessing, which convert image into gray level and after preprocessing normalization was done by histogram equalization. The feature extraction was done by Active Appearance Model. The space of features was more so the space of feature was reduced by using principal

component analysis. Support Vector Machine classifier used during last phase.

Table 1 Experimental analysis of age classification system with less than five age groups

Author	Features	Classifier	Age groups	Database	Accuracy (%)
Kwon and Lobo	Geometric ratios and wrinkle analysis	Similarity measures	3	Private	100
Yang and Ai	LBP Histrogram	Adaboost	3	FERET, PIE	PIE (87.5), FERET (92.5)
Kanno	Mosaic features	ANN	4	Private	80
Dehshibi and Bastanfard	Geometric ratios and wrinkle analysis	ANN	4	IFDB	86.64
Gao and Ai	Gabor features	Fuzzy LDA	4	web images	91
Horng et al.	Geometric ratios and wrinkle analysis	ANN	4	Private	81.58
Fard et al.	LBP and HOG	ANFIS	4	PAL	88.01
Hajizadeh, Ebrahimnezhad	HOG	PNN	4	IFDB	86.64

Nithyashri et al. [17] took for feature extraction Wavelet Transformation (WT) technique and classification of age was done by Adaptive Resonance Theory Network (ART) method. The researcher took FG-NET database to categorized facial image into multiple age groups like as child, young, adult and senior adult. First, by converting input face images into gray scale level images and then feature extraction were done by Wavelet Transformation. Coif feature and two-level Haar features were learned.

Thukral et al. [18] took FG-NET database to categorized images into several age groups and, separate regression model was applied on each age groups. For feature extraction was done by geometric features for extracting the features and regression technique was used Relevance Vector machine (RVM) method. Finally, they used Nearest Neighbor, μ-SVC, Partial least squares (PLS) classifiers.

Table 2 Experimental analysis of age classification system with five and above five age groups

Author name	Features	Classifier	Age group	Database	Accuracy (%)
Iga et.al	Gabor features	SVM	5	HOIP and Private	58.4
Gunay, Nabiyev	LBP	K-NN	6	FERET	80
Takimoto et .al	Gabor features	ANN	6	HOIP	57.3 (Male), 54.7 (Female)
Izadpanahi, Toygar	Geometric ratios and wrinkle analysis	SVC	7	FGNET and IFDB	92.62

Fard et al. [19] categorized 575 face images into different age groups. Productive Aging Lab face database were taken for analysis. Histogram of Local Binary Pattern, Oriented Gradients, and Adaptive Neuro-Fuzzy Inference System were used and 88.01% accuracy was achieved.

Lee et al. [20] categorized an age classification on basis of local age group modeling. Here the author used the concept of clustering to compute the distance between the training face. The distinctions between the clusters of different age groups were enhanced by above mention method. Feature extraction was done by LBP histogram features and classification of age group was done by hierarchical clustering and obtained 60% of estimation rate.
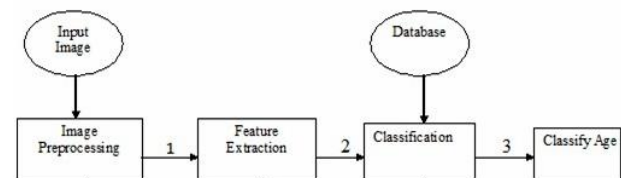

Figure 1 Process Flow of Age group classification system

Jagtap and Kokare [21] proposed method for human facial skin aging features. They classified input images into grayscale face images age groups. The authors took PAL face databases. The database classified into four age groups for both male and female. The feature extraction is done with the help of using local gabar binary pattern histrogram (LGBPH) and wrinkle analysis. LGBGH is designed for illumination, rotation, scale and translation invariant The ANN classifier is used two layers feed forward back propagation neural network. The proposed system provided better accuracy upto 94.17% for male and 93.75% for female for age classification system.

2. CONCLUSION

Use of facial images from database by applying different techniques is found to be the most effective way in analyzing human age. This paper reviews the investigation carried out by various researcher in order to enhance human classification using different techniques and methods. It can be concluded that there is a considerable enhancement in predicting human age from facial image. Correlation developed for feature extraction by different investigators is mention in this paper. This paper is very helpful for researchers in carrying out investigation to find out optimized new techniques for human age classification system.

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