OPEN ACCESS INTERNATIONAL JOURNAL OF SCIENCE & ENGINEERING

AGE ESTIMATION FROM FACE IMAGES:A REVIEW

Ashwini L.Ingole[1], Kailash J.Karande[2]

Department of Electronics and Telecommunication Engineering,SKN Sinhgad college of Engineering, Pandharpur. Tal-Pandharpur. Dist- Solapur. State- Maharashtra. India. Pin code- 413304.[1,2]

Abstract: **In recent trends estimating human age automatically from face images have lot of potential in real world applications, such as vending machine, security system/network access control, human computer interaction, multimedia communication, video surveillance, customer profiling, demographic statistics collection etc. Security applications have atmost importance in this area.The biometric features of each human being are unique. Age estimation is determines a person's age or age group using facial images. A database of facial images is trained to extract features using algorithms such local binary patterns [LBP], active shape models [ASM], histogram of oriented gradients [HOG], Support Vector Machine[SVM]. Age estimation can be done using 3 age groups: child, adult, senior. Age estimation can be used as part of a face recognition process. This paper presents a comprehensive comparison of state-of-the-art research techniques. We have divided the classification process into three stages and have presented a categorical review of existing literatures. Their analysis has been presented.**

Keywords: Age Estimation, Pre-processing, Feature Extraction, Classification, Comprehensive Review.

I INTRODUCTION

Automatic age estimation of a human is an interesting, challenging and important task, in many real time applications in market intelligence, visual surveillance, human –computer interaction, image and video retrieval, ad-agency can find out what kind of scroll advertisements can attract the passengers in what age ranges using a latent computer vision system , age specific human computer interaction system, secure network/system access control. Face image based automatic age estimation is an important technique, it is still a challenging problem to estimate human ages from facial images. Human ages may affected by many external factors , such as living style ,make ups, living locations, health and weather conditions, accessories, movement, lighting, facial expressions. These variant factors may lead to changes in color, illumination, shadows and contours.

For better performance, the geometric features of face images like wrinkle geography, face angle, left to right eye distance ,eye to nose distance ,eye to lip distance, eye to chin distance will be calculates. We can develop automatic age estimation system using wrinkle features to represent age progression. The general age estimation system has two stages

1) Training stage
2) Testing stage.

In training stage the training feature database will be developed which contains the feature extracted from the different facial images of the person from different age group. In testing stage feature extracted from input facial image (test image) will be compared with training features. In training feature database the feature of the matched age group will be taken as a result age of the test image using K-NN Classifier. It provide individual advertising and services to clients of various age groups, security control and surveillance monitoring. Age estimation system can warn or stop underage drinkers from enters bars or wine shops, prevent minors from purchasing tobacco products from vending machines, biometrics (when age estimation is used as a part that provides ancillary information of the user's identity information and thus decreases the whole system identification error rate) etc. Besides, age estimation can be applied in the field of entertainment e.g. to sort images into several age groups, or to build an age –specific human computer interaction system, etc.

Guodong Guo et al. [5] investigated the biologically inspired features (BIF) for human age estimation from faces. Manifold learning techniques are adopted to embed face images into a low-dimensional aging manifold. The age

manifold based regression [5] produces a MAE of 5.07 years on the FG-NET aging database. More recently, Cao et al. [10] argued that these local descriptors use manually designed encodings, and it is difficult to get an optimal encoding method. As shown in [10], the existing handcrafted codes are unevenly distributed, and some codes may rarely appear in face images. This means that the resulting code histogram is less informative and less compact. They used a learning-based encoding method, which adopts unsupervised learning methods to encode the local micro-structures of the face into a set of discrete codes. With Principal Component Analysis (PCA) and normalization, their learning-based descriptor achieves superior performance on face verification.

II LITERATURE REVIEW

The topic of face image processing has been active and much interest has been shown. Face image processing is a broad topic and has been active for many years. There have been various contributions and different approaches that attempt that to solve or improve age estimation.

Ranjan Jana et al. [1] provided a methodology to estimate the real age of a human by analyzing wrinkle area of face images Wrinkle geography areas are detected and wrinkle features are extracted from face image. Depend on wrinkle features, each face image is clustered using fuzzy c-means clustering algorithm. Then, estimated age is calculated using their clustering membership value and average age of each cluster.

Rajan Jana et al. [2] age ranges classified dynamically depending on number of groups using K-means clustering algorithm and used for predicting future faces ,classifying gender and expression detection from facial images “Age group Estimation Using Face Features”.

Hu Han et al. [3] presented a generic framework for automatic demographic (age gender and race) estimation via boosting algorithm A side-by-side comparison of the demographic estimates from crowd sourced data and the proposed algorithm provides a number of insights into this challenging problem.

Method proposed by Eran Eidinger et al. [4] generic framework for automatic demographic estimation ,extract demographic informative features via boosting algorithm and employ a hierarchical approach consisting of between group estimation in “Age And Gender Estimation Of Unfiltered Faces”.

Guodong Guo et al. [5] introduced the age manifold learning scheme for extracting face aging features and design a locally adjusted robust regressor for learning and prediction of human ages in “Image Based Human Age Estimation By Manifold Learning And Locally Adjusted Robust Regression”.

Ivan Huerta et al. [6] presented two novel approaches first, a simple yet effective fusion of descriptors based on texture and local appearance and second, a deep learning scheme for accurate age estimation in “A Deep Analysis On Age Estimation”.

Method Proposed by Vinod G. Khetade et al. [7] developed efficient methods for facial age estimation based on label distribution Learning. The learning algorithms named IIS-LLD and modified CPNN for label distribution learning are proposed and applied to the problem of facial age estimation.

Dhiraj S. Dabi et al. [8] presented an efficient age estimation system based on facial image using 2-D gabor filter and multilinear principle component analysis in “A Robust Age Estimation System For Indian Facial Image Using 2D Gabor Filter and Multilinear Principle Component Analysis”.

Arun Kumar et al. [9] developed working model of an age classifier that is more efficient than the existing models Apart from geometric shape features, wrinkle analysis is also incorporated in classifying the age. Multiple algorithms are applied for different phases like feature extraction, illumination correction, image fitting and edge detection etc. The experimental results show that 93.01% recognition rate.

Method proposed by Fares Alnajar et al. [10] extracted robust and discriminative facial features and used soft encoding in “Learning –Based Encoding with Soft Assignment for Age Estimation under Unconstrained Imaging Conditions”.

Chn Teng Lin et.al [11] presented a novel and reliable framework for automatic age estimation based on computer vision, exploits global face features based on the combination of Gabor wavelets and orthogonal locality preserving projections the proposed system has more potential in applications compared to other semi-automatic systems. The results obtained from this novel approach could provide clearer insight for operators in the field of age estimation to develop real-world applications.

Jingting Zeng et al. [12] provided detailed and rigorous experimental analysis, which helps understanding roles of different factors taken at different ages in “Analysis of Facial Images Across Age Progression By Humans”.

III GENERAL SYSTEM

Human face image contains huge information. It is very important in revealing the personal characteristics including identity, emotional expression, gender, pose etc. Human face is robust because it changes in a short period. Age estimation technique is widely used. The main aim is to design and develop the system for estimation of age group.

Pre-processing

Classifiers are sensitive to variation like illumination, poses and inaccuracies. To reduce this sensitivity some pre-processing steps are performed. Ivan Huerta et.al[6] detected the facial region of each image with face detector.ASM and AAM models which rely on tens of facial landmarks for accurate alignment invariance of local descriptors based on joined cell histograms to work with simple eye-aligned images. Dhiraj S.Dabi [8] is used basic steps for preprocessing which are given below:

1] Input color image is read from the database.

2] After that it is resized to 250*250 size.

3] And then it converted into gray scale.

4] Histogram equalization is applied on this gray scaled image to highlight the different part.

C.Arun Kumar et.al [9] is transformed into frequency domain using Discrete Cosine Transform and is used to get the areas affected by illumination. Those areas are normalized using power law transformation using the gamma values.

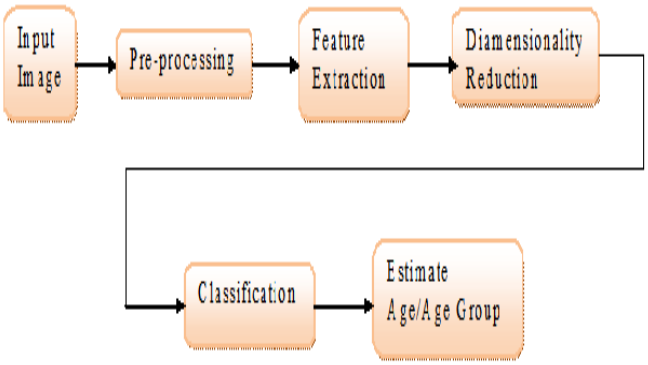

Figure 1 General Block diagram of age group estimation system

feature extraction

It is the second step of age estimation method.

Ranjan Jana et.al [2] is extracted global and grid features from face images. The global features such as distance between two eye balls, eye to nose tip, eye to chin, eye to lip etc .and grid features calculates wrinkles in forehead portion, eyelid regions, upper portion of cheeks and eye corner regions. C.Arun Kumar et.al [9] used AAM for analyzes the gray level of particular feature points. Ivan Huerta et.al[6] is extracted visual features which need to be discriminative among different classes, robust within same class, and with a minimal dimensionality. Bio-Inspired and HOG features also used for age estimation. Dhiraj S.Dabi[8] is used 2D gabor filter for feature extraction which detects line endings and edge borders over multiple scales and with different orientation.

dimensionality reduction

It is the third step of age estimation method. Dhiraj S.Dabi [8] is used MPCA [Multi linear principle component analysis] for dimensionality reduction. It is the extension to PCA, which operates linearly whereas MPCA operates multilinearly The PCA requires to reshape multidimensional object into the vector, whereas MPCA operates directly on multidimensional object through two mode processing. The output of MPCA is dimensionally reduced feature projection matrix of face images.

classification

The Classification is the last step of age estimation in which the face is successfully classified as that of age group. In classification different classifiers are trained and tested by different extracted features. Different classifiers are combined to minimize the classification error rate. In pattern recognition the k-nearest neighbor algorithm (K-NN) is more widely used method for classifying objects based on majority votes of its neighbors. There are various Classification methods which are Support vector machines/regressors, neural networks. PLS and CCA subspace learning algorithms also used for classification.

IV CONCLUSION

In this paper we have to discuss on what the pre-processing techniques are and which type of features can be extracted for age estimation and what various classification methods are. We conclude that during age estimation process only three steps are important and that are pre-processing, feature extraction and classification.

REFERENCES

[1] Ranjan Jana, Debaleena Datta, Rituparna Saha, "*Age Estimation From Face Images Using Wrinkle Features*", International Conference on Information and Communication Technologies, 46, 2015, pp.1754-1761.

[2] Ranjan Jana, Debaleena Datta, Rituparna Saha, "*Age group Estimation Using Face Features*", International Journal of Engineering and Innovative Technology, Vol 3, Issue 2, August 2013, pp.130-134.

[3] Hu Han, Chorles Otto, Xiaoming Liu, Anil K. Jain, "*Demographic Estimation from Face Images Human Vs Machine Performance",* IEEETransactions on Pattern Analysis and Machine Intelligence, 2014, pp.1-18.

[4] Eran Eidinger, Roee Enbar, Tal Hassner, "*Age and Gender Estimation of Unfiltered Faces*", IEEE Transactions on Information Forensics and Security, 2013, pp.1-10.

[5] Kailash J. Karande,Rajashree N. Badage, "*Facial Feature Extraction using Independent Component Analysis*", Annual International Conference on Intelligent Computing, Computer Science and Information Systems, April 2016.

[6] Guodong Guo, Yun Fu, Charles R. Dyer,Thomas S. Huang, "*Image Based Human Age Estimation By*

Manifold Learning And Locally Adjusted Robust Regression", IEEE Transactions on Image Processing, Vol 17, no.7,July 2008, pp.1178-1188.

[7] Ivan Huerta, Carles Fernandez, Carlos Segura,Javier Hernando, Andrea Prati, "*A Deep Analysis On Age Estimation*" Science Direct Journal of Pattern Recognition Letters, July 3, 2015, pp.1-10.

[8] Vinod G.Khetade , S.B Thakare, "*An Efficient Method For Human Age Estimation By Label Distribution Learning*", International Journal of Advance Research in Computer Science and Management Studies, Vol 2, Issue 9, September 2014, pp.70-75.

[9] Haibin Ling, Stefano Soatto, Narayanan Ramanathan, David W.Jacobs, *"A Study of face Recogntion as eople Age"*, IEEE 2008.

[10] Jinali Suo, Feng Min, Shiguang Shan, *"A Muli-Resolution Dynamic Model For Face Aging Simulation*" ,IEEE 2007.

[11] Dhiraj S.Dabi, S.B. Patil, "*A Robust Age Estimation System For Indian Facial Image Using 2D Gabor Filter and Multilinear Principle Component Analysis*", International Journal of Advance Engineering and Global Technology, Vol 2, Issue 10, October 2014, pp.67-71.

[12] C.Arun Kumar, Praveen Kumar R.V, Sai Arvina R, "*Age Group Estimation Using Facial Features*", International Journal of Emerging Technologies in Computational and Applied Sciences 8(2), March-May 2014, pp.182-186.

[13] Fares Alnajar, Calfeng Shan, Theo Gevers, Jan-Mark Geusebroek, "*Learning –Based Encoding With Soft Assignment for Age Estimation under Unconstrained Imaging Conditions*", Science Direct Journal of Image and Vision Computing, 30(2012), pp.946-953.

[14] Chin-Teng Lin, Dong-Lin Li, Jian-Hao Lai, Ming-Feng Han, Jyh-Yeong Chang, "*Automatic Age Estimation System For Face Images*", International Journal of Advanced Robotic Systems, Vol 9, Aug 2012, pp.1-9.

[15] Jingting Zeng, Haibin Ling, Longin Jan Latecki, Shanon Fitzhugh, Guodong Guo, "*Analysis of Facial Images Across Age Progression By Humans*", International Scholarly Research Article,2012, pp.1-7.

[16] Xiaoguang Lu, Anil K. Jain, "Ethnicity Identification from Face Images," ResearchGate, The International Society fo Optical Engineering, May 2004.

[17] Ramesha K, Raja KB, Venugopal KR, Patnaik LM. *Feature Extraction based Face Recognition, Gender and Age Classification* G. R. Faulhaber, "*Design of service systems with priority reservation,"* in Conf. Rec. 1995 IEEE Int. Conf. Communications, pp. 3–8.

[18] Lanitis A, Taylor CJ, Cootes TF. "*Toward Automatic Simulation of Aging Effects on Face Images"*. IEEE Transactions on Pattern Analysis and Machine Intelligence, 2002; 24(4): p. 442-455.

[19] Lanitis A, Draganova C, Christodoulou C. Comparing "*different classifiers for automatic age estimation"*. IEEE Transactions on Systems,Man, and Cybernetics Part B: Cybernetics, February 2004; 34(1): p. 621-628.

[20] Siwei Lyu, Eero P.Simoncelli, Howard Hughes, . "*Nonlinear Image Representation Using Divisive Normalization",*IEEE 2008.