



IMAGE BASED HUMAN AGE ESTIMATION USING PRINCIPLE COMPONENT ANALYSIS/ ARTIFICIAL NEURAL NETWORK

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ABSTRACT

Estimating age of a person from captured image of His/ Her face is a difficult task. In general the exciting technique to this problem is feature vector. Human Computer Interaction (HCI) for designing automatic age estimation systems via facial dynamics. The success of such research may bring in many innovative HCI tools used for the applications of human-centered multimedia communication. The aging patterns can be effectively extracted from a discriminate subspace-learning algorithm and visualize as distinct manifold structures. The existing method used is Principal component analysis. Artificial neural network is intuitive to apply manifold analysis to age estimation to bring out the advantage of manifold learning, such methods should combined with the appropriate regression models for a new testing image, fit extract low dimensional feature with the learned regression model to estimate the exact age or an age interval.

Keywords: age estimation, aging pattern, age grouping, PCA, ANN.

INTRODUCTION

Age estimation is one of the tasks of facial image classification. It can be referred to as determination of a person's age or age group from facial images. Human faces provide large amounts of information, such as identity, age, gender, expression, and emotion [1]-[2]. As a result, many research topics based on facial images have been extensively studied including face recognition, face reconstruction, expression recognition, gender and race classification, etc. [3] - [7]. In recent years, automatic human age estimation engage much attention due to its developing applications in soft-biometrics [8], human-computer interaction [9], security control [9], surveillance monitoring [10], and electronic customer relationship management [8].

Estimating age from human faces is a challenging task which is used in forensics, security, biometrics, electronic customer relationship management, cosmetology and entertainment [11] - [13]. The most often used measure of age estimation is the mean absolute error (MAE), and a recent study perform with frequent use of age databases that every humans have a MAE of 7.2-7.4 years for estimating the age of a person over 15, depending on the database conditions [14].

The main challenging factor of estimating age is facial factor alter due to aging of different humans. To estimate facial changes similar to age is a tough problem, because they are not only related to gender but also external factors like weather exposer, living conditions and health. Moreover facial cosmetics, surgical operation and presence of scare can be a diminishing factor of age estimation.

Implementation

PCA

Principal component analysis is used to estimate the age of subject that uses a sequence of images that show

the subject displaying a facial expression as input. To end this, we focus on the smile expression, because it is one of the most frequently used facial expression. Besides disgust expression is considered to evaluate the reliability and generalizability of the approach. The flow of the system is summarized as follows. Initially, a mesh model is fitted to face using 17 fiducial points, and tracked during the rest of the video. The surface distorting on different regions are computed using the tracked mesh points. Figure-1 provides age of an individual person with different age group. Temporal stages (onset, apex, and offset) of the expression are estimated using the mean displacement signal of the lip corners. Then, effective features for each regional patch are extracted from each phase. Appearance features are extracted using the first frame of the onset phase, in which the face is neutral. After acharacteristic selection procedure, the most factual effective features are selected and fused with appearance features to train Support Vector Machine classifiers.



Figure-1. Age of individual with different age group.

The analyzing of facial dynamics, surface deformations of seven facial regions (eyebrow, eyelid, eye-side, cheek, mouth-side, mouth, chin) are tracked in the videos. Patches for these regions are initialized in the first frame of the videos, using automated detector 17 landmarks (corners and center of eyebrows, center of upper eyelids, eye corners lip corners and nose tip) for precise tracking and analysis. For automatic facial landmark detection, the method proposed by Dibeklioglu *et al.* [15] is used. This technique models Gabor wavelet



features of a neighborhood of the landmarks using incremental combination of factor analyzers and enables a shape prior to ensure the integrity of the landmark constellation. It follows a coarse-to-fine strategy in which landmarks are initially detected on a coarse level and then fine-tuned for higher resolution. To trial the facial features and pose, we use a piecewise Bezier volume deformation (PBVD) tracker, originally proposed by Tao and Huang [16].

ANN

Recognition of the most facial variations, such as face expression, identity and gender, have been extensively studied. Automatic age estimation has hardly been explored. In contradiction to other face variations, aging variations represents several unique characteristics that make age estimation a challenging task. Since human faces provide a lot of information, many topics have drawn attention and thus it has been studied intensively. The most eminent thing of these is face recognition. Other researches that include predicting feature faces, classifying gender, and expressions from facial images, and so on. Figure-2 shows the estimated image of each group. However, little studies have been done on age estimation or age classification. In this research, we try to prove that computer can estimate/classify human age according to feature extracted from the human facial image using Artificial Neural Network (ANN).

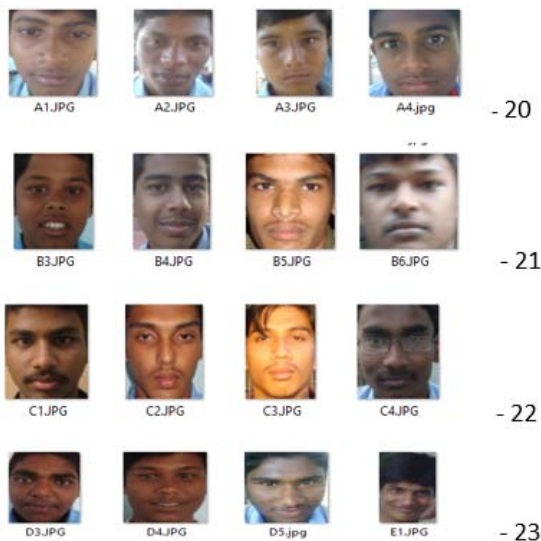


Figure-2. Estimation of each age group.

Age estimation

Age estimation is the tenacity of a person's age based on biometric characteristics. The determination of the age of a person from a digital camera is an intriguing problem. It involves understanding of the human aging process. People can't freely control aging variation; the collection of sufficient data for age estimation is extremely laborious. The tested age ranges are still considered to be

wide and in some cases exceed 10 years while in other cases reach 15 or 20 years. There are some open databases used for testing age estimation systems such as FG-NET [17] [18] [19] and Morph [20]. These datasets contain photos and ages of the people and there are usually ages from 1 year to 70 years.

The Artificial neural network is mainly uses a supervised neural networks with back propagation algorithm in which image is entered to the system, from which features vector are extracted, then a more specific age range class is specified. This process is shown in Figure-3.

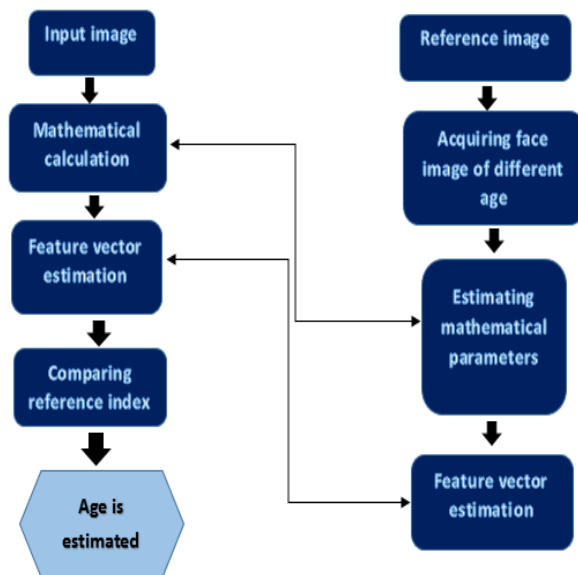


Figure-3. Stages of ANN.

Performance analyzer

Neural network is trained with age classification of each group. Each neural network (the five networks) has 68 pairs of inputs representing the face features of a person. Figure-4 shows training of neural network.

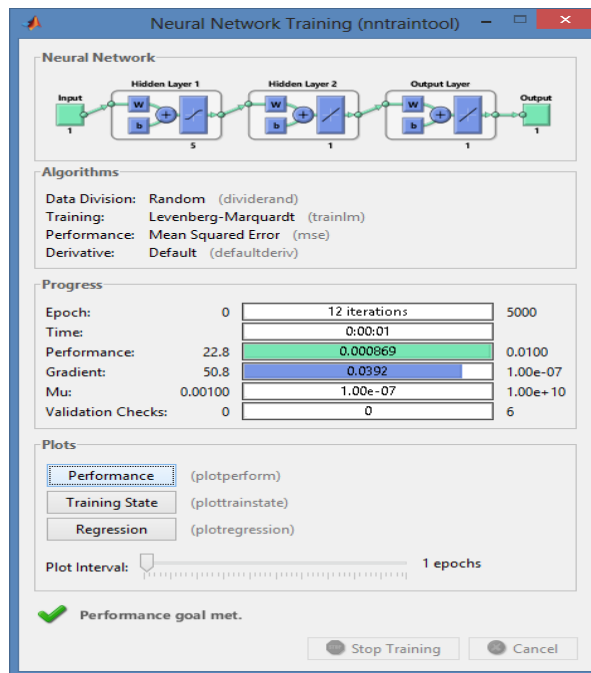


Figure-4. Training with neural network.

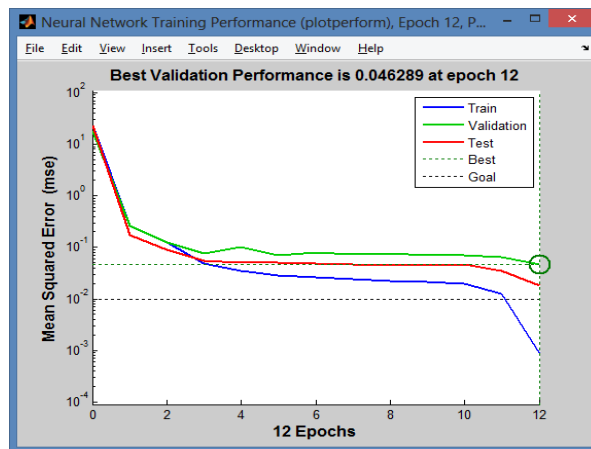


Figure-5. Performance of training.

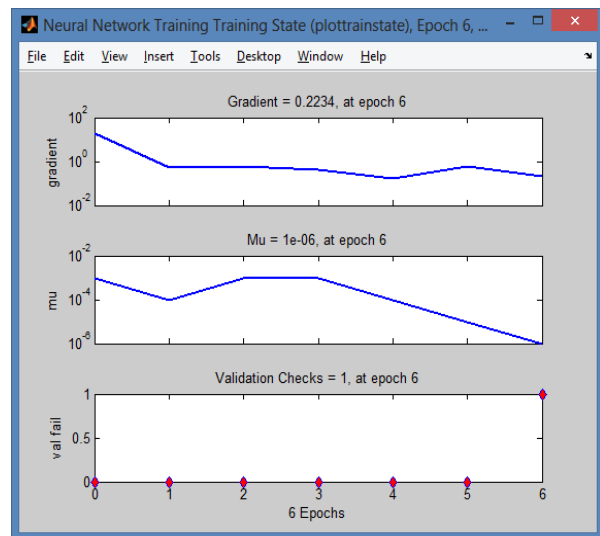


Figure-6. Plot train state with epoch.

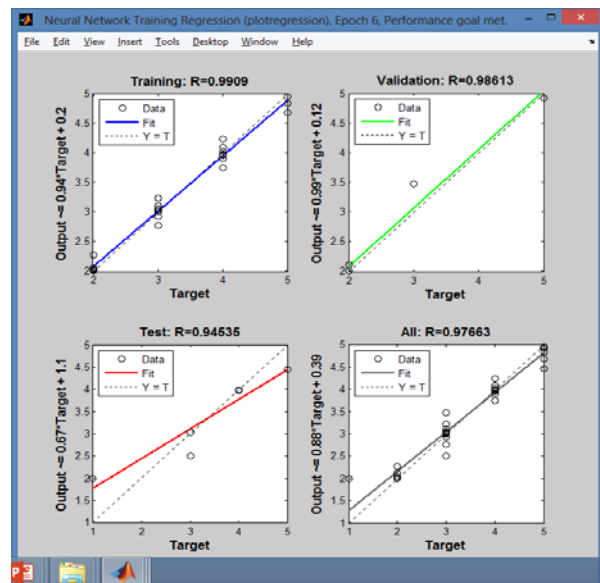


Figure-7. Plot regression with training with validation.

The each neural network that plotperform for neural network that are based on mean square error of each network that provides best validation performance of 0.046289 when compared with epoch 12. Figure-5 shows the performing of each training set of network. Figures 6 7 provides the training with each epoch 6 iteration. Each train that formulates with test performance provide plot train state that performs each training for test and validation with the target.



CONCLUSIONS

The study that shows approach of image based human age estimation is based on artificial neural network. With this approach we can easily estimate the age of the individual person based on the face expression. Using PAL, the estimated result is +3 or -3 of age, where as using ANN estimated result will be +1 or -1 of exact age.

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