

Age Estimation Guided Age-Invariant Face Recognition

ZHENG TIANYUE, WEIHONG DENG, AND JIANI HU

BEIJING UNIVERSITY OF POSTS AND
TELECOMMUNICATIONS



Directory

- Background
- Method
- Results
- Discussion

Background

Definition

- Recognize people at different ages

Applications

- Find missing children
- Identify criminals using photos taken many years ago
- verify passport

Difficulty

Large intra-class variations



Age 02



04



10



12



17



18



21



24



28



31

Photos of Cristiano Ronaldo at different ages

Traditional methods

Generative Methods

- Methods:

- Construct a 2d/3d model to compensate for the face variations

- Disadvantages:

- Complex parameters

- Hard to compute

- Perform bad in real-world face recognition

Discriminative Methods

- Methods:

- Powerful feature and classifier

- Disadvantage:

- Not specific for age-invariant face recognition problem.

Basic Idea

- Different people's faces in the same age share characteristics in common such as wrinkles.
- The same person's faces keep features stable across ages (gender).
- The face image can be expressed as a combination of an age-specific component and a person-specific component[1].

•[1] D. Gong, Z. Li, D. Lin, J. Liu, and X. Tang. Hidden factor analysis for age invariant face recognition. In The IEEE International Conference on Computer Vision (ICCV), December 2013.

The Formulation:

$$\begin{aligned}y &= f(t - g(x)) \\g(x) &= W_1x + b_1 \\f(x) &= W_2x + b_2\end{aligned}$$

t : $d \times 1$ vector, the whole face feature

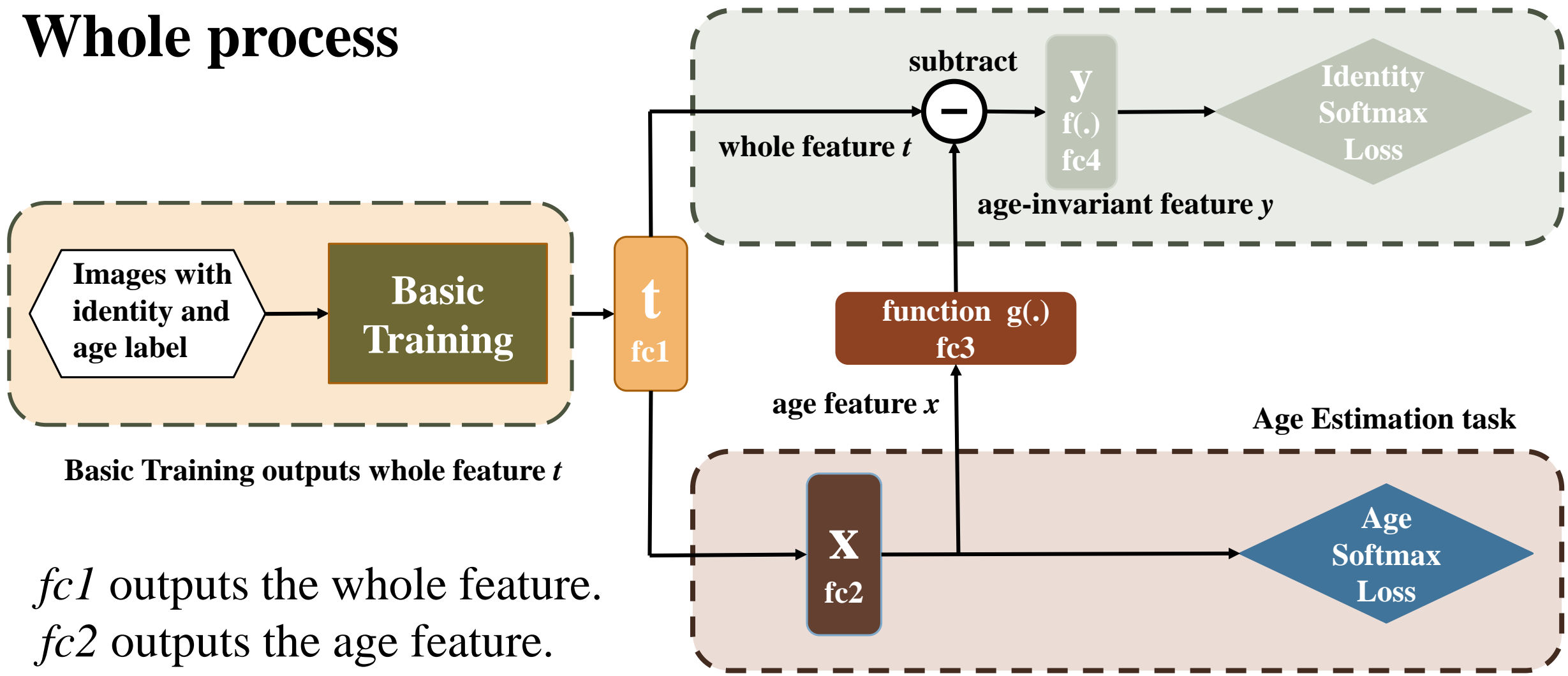
x : $d \times 1$ vector, the age feature obtained by age estimation

y : $d \times 1$ vector, the latent identity feature which we need

$f(\cdot)$, $g(\cdot)$: functions to better handle the relationship between x , y , t .

- [1] D. Gong, Z. Li, D. Lin, J. Liu, and X. Tang. Hidden factor analysis for age invariant face recognition. In The IEEE International Conference on Computer Vision (ICCV), December 2013.

Whole process



Basic Training outputs whole feature t

$fc1$ outputs the whole feature.

$fc2$ outputs the age feature.

eltwise layer subtracts age feature from whole feature.

$fc4$ outputs the person-specific feature.

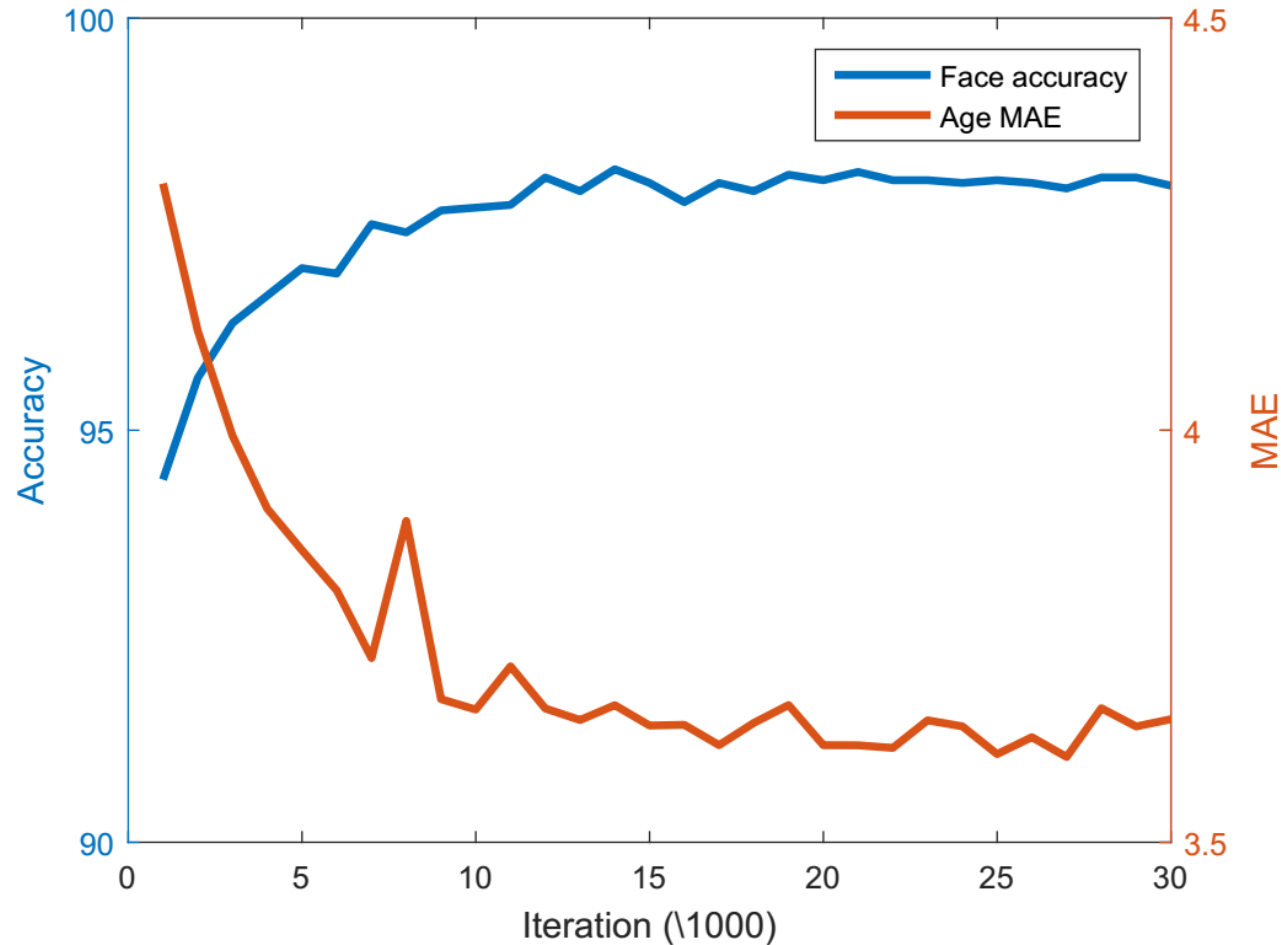
Features of our method (AE-CNN)

1. The subtraction operation to separate age factor from the person-specific features which are stable for recognition.
2. The use of age estimation task for obtaining age-invariant features using deep learning.

The results on MORPH

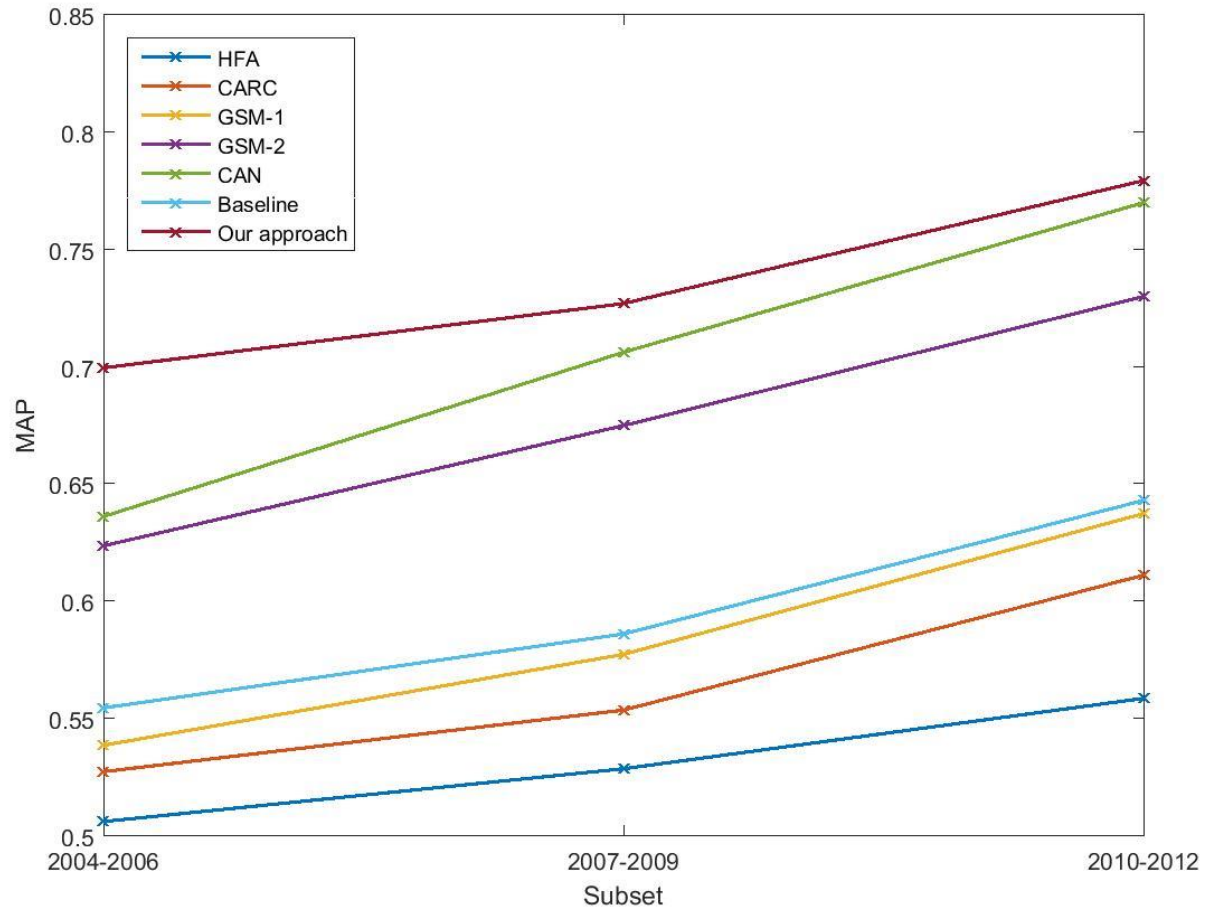
The Methods	Results
HFA	91.14%
CARC	92.80%
MEFA	93.80%
MEFA+SIFT+MLBP	94.59%
LPS+HFA	94.87%
GSM	94.40%
LF-CNNs	97.51%
CNN baseline	96.30%
Our methods	98.13%

Performance of age estimation and face recognition



The MAE of age estimation and the accuracy of face recognition improve at the same time.

The Results on CACD



Discussion

- To get good results in age-invariant face recognition, we need person-specific feature. However, the feature we get by common face recognition structure always contains age-related factor, so we add age estimation task to obtain age factor and subtract it from the whole feature.

THANKS