

Personalized Age Progression with Aging Dictionary

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Introduction

Age Progression

- **Age progression** is the process of modifying a photograph of person to represent the effect of aging on their appearance
- Applications of age progression
 - Cross-age face analysis, authentication systems, finding lost children, entertainment, and etc.



Previous solutions

- **Prototyping**-based age progression
 - It transfer the differences between two prototype age group into the input face
- **Modeling**-based age progression
 - It models the facial parameters of the shape/texture synthesis with the actual age
- Both age progression models can **not** well preserver **personalized facial characteristics**, such as birthmarks, moles, and etc.
- Also modeling-based age progression requires dense **long-term** face aging sequences

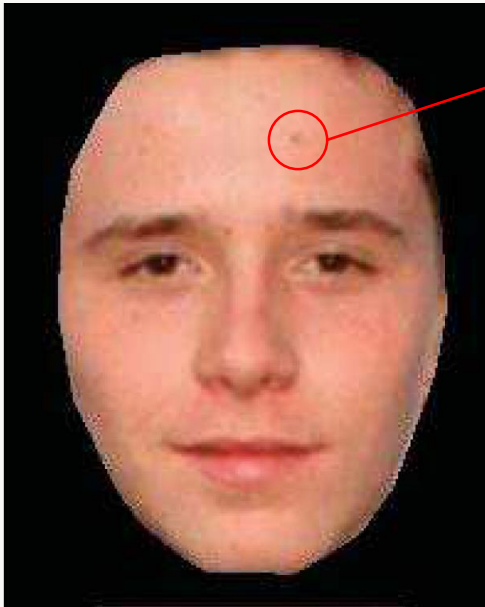
Main contributions

- A personalized age progression method
- They propose the method that only requires the available short-term face aging pairs to learn all aging dictionary bases of human aging

Main idea

Aging process

- Two aspect of aging process
 - The natural aging process of a specific human usually follows the general rules in the aging process of all humans
 - But it should also contain some personalized facial characteristics

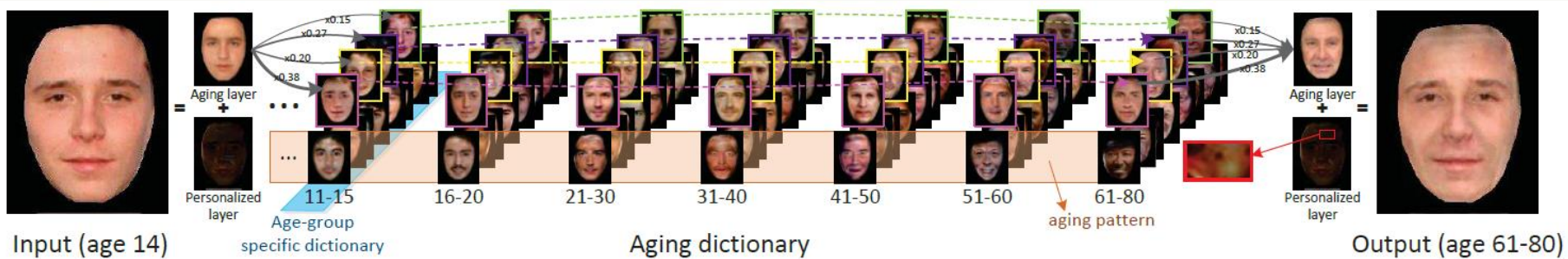


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Aging process

- Aging layer
 - It shows the general aging characteristics
- Personalized layer
 - It shows some personalized facial characteristics

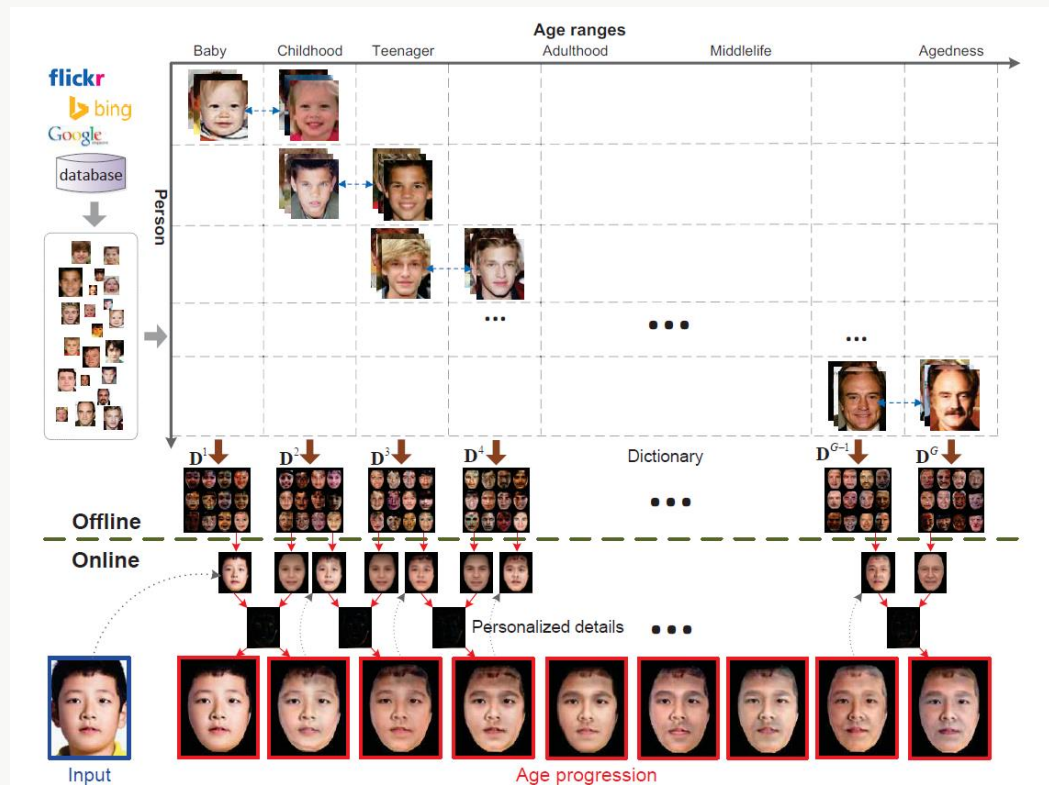
Aging layer



Personalized layer

Framework

- Offline phase – collecting short-term aging face pairs and train the aging dictionary
- Online phase – construct the aging face in the nearest neighboring age group and use it as input of next age group



Experiment & results

Experiment strategies

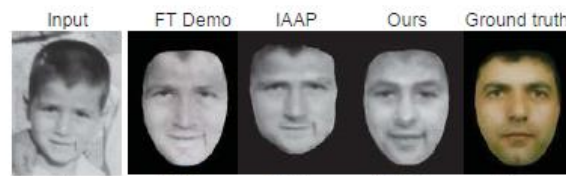
- 3 strategies to comprehensively evaluate the proposed age progression
 - ① Qualitatively evaluate the proposed method on the FGNET database
 - ② Conduct user study to test the aging faces of proposed method compared with the prior works
 - ③ Cross-age face recognition and cross-age face verification

Qualitative Comparison with Ground Truth

- Take each photo in FGNET as the input
- Compare the results with the released results:
 - Face Transformer demo
 - Illumination-Aware Age Progression



(a) Textual change



(b) Shape change



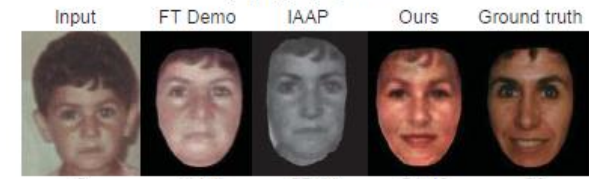
(c) Aging speed



(d) Aging speed



(e) Shape change



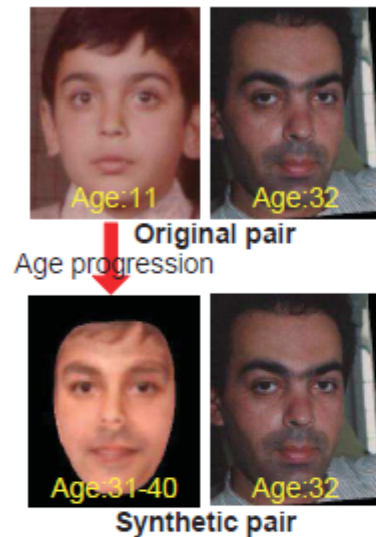
(f) Shape change

Quantitative Comparison with Prior Works

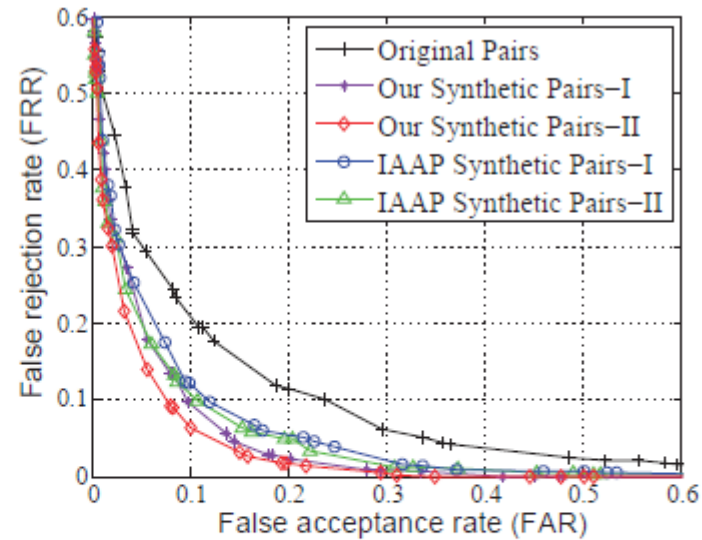
- Conduct user study to compare aging result with the published aging results
 - Participants are asked to observe each comparison group including an input face and two aging results
 - Compare aging face is better in terms of Personality and Reliability
- 50 ratings for each comparison, 246 comparison groups -> 12300 ratings
 - Result: 45.35% proposed method is better; 36.45% for prior works better; 18.20% for “comparable”; 0 for “neither is accepted”



Evaluation on Cross-Age Face Verification



(a) Pair setting.



(b) FAR-FRR curve.

Pair settings	Original Pairs	IAAP Synthetic Pairs		Our Synthetic Pairs	
		I	II	I	II
EER (%)	14.89	10.91	10.36	9.72	8.53

(c) Equal error rates (EER) (%).

Quiz

- Q1. What are two layer that an individual face can be decomposed into?
 - ① **Aging** layer and **personalized** layer
 - ② **Dictionary** layer and **key** layer
 - ③ **Progression** layer and **regression** layer
- Q2. What can be preserved using the personalized age progression?
 - ① **Age**
 - ② **Personality characteristics**
 - ③ **Height**