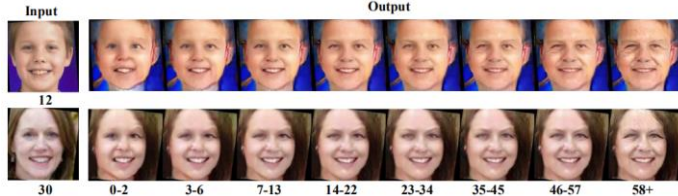


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Overview

Face age transformation aims to generate a face image in the past or future and has been receiving increasing attention for its significance recently. This paper proposes a local-global interactive framework for long-span face age transformation:

- A local generator to learn the local transformation of a human face.
- An interactive structure to integrate the local and global features of face changes.
- An age classifier C constrains the output face image to be like the one in the target age group.

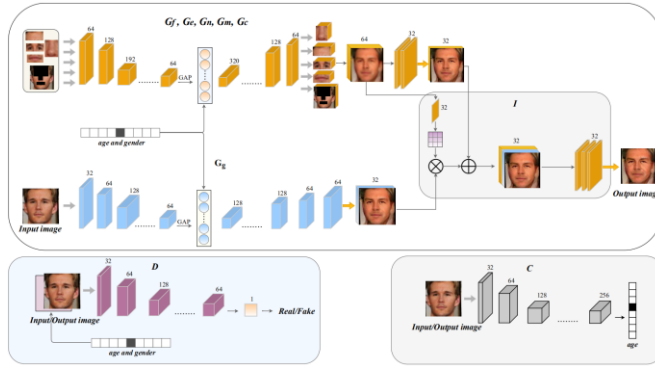


Given a face image, face age transformation is to predict variant face images of different age groups.

Model

Our model contains four major functional components: the generator, the discriminator, the interactive structure, and the age classifier. The generator is composed of a global generator G_g corresponding to the global face image and five local generators G_f , G_e , G_n , G_m and G_c , corresponding to the five local areas respectively. The face age transformation T can be represented as:

$$T = \{G_g, G_f, G_e, G_n, G_m, G_c, \beta\}.$$



Loss function

Adversarial loss

The discriminator is designed to judge the authenticity of a face image. Following GAN, L_d is defined as:

$$L_d = \mathbb{E}_{x \sim P_{data}(x)} [\log(D(x, l))] + \mathbb{E}_{x \sim P_{data}(x)} [1 - \log(D(T(x, l), l))]$$

The classifier C is introduced to judge the age groups of a face image. The classification loss is expressed as:

$$L_c = \mathbb{E}_{a, z} [-\log C(a, z)]$$

Local loss

In order to preserve the local personalized characteristics of the face, we introduce a local loss L_{local} which is defined as:

$$L_{local} = L_1(x_f - G_f(x_f, l)) + L_1(x_e - G_e(x_e, l)) + L_1(x_n - G_n(x_n, l)) + L_1(x_m - G_m(x_m, l)) + L_1(x_c - G_c(x_c, l)),$$

Variation loss

The total variation loss is a commonly used regularization term to maintain the smoothness of the generated image,

$$L_V = TV(T(x, l))$$

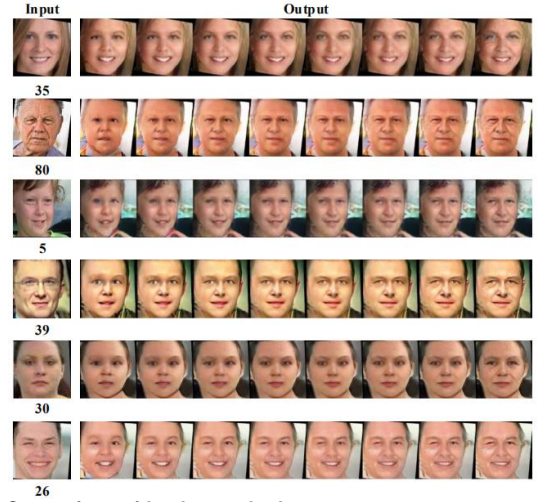
Identity loss

To preserve global personalized face features and promote the consistency of multi-scale image, we introduce an identity loss:

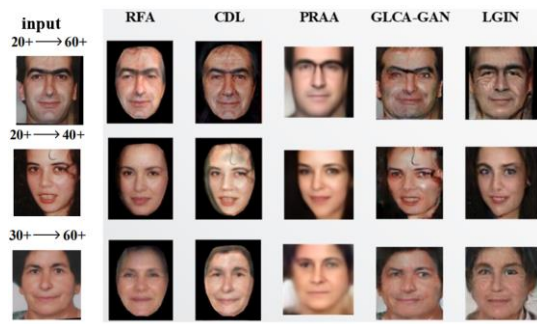
$$L_I = \sum_s \frac{1}{W_s H_s C_s} |G_g(x^s, l) - x^s| + \lambda |T(x, l) - x|$$

Result

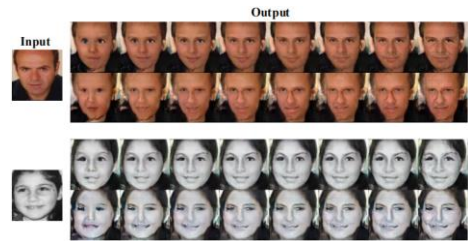
Face age transformation by LGIN model



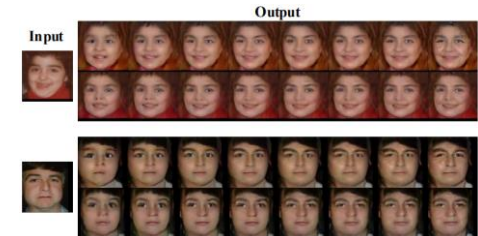
Comparison with other methods



Ablation



Effects of the interactive structure and the local generator. The first row of each group is about the results with the interactive structure and local generator and the second row is about the ones without them.



Ablation comparison for the age classifier. The first row of each group is about the results with the age classifier and the second row is about the ones without the classifier.