容颜渐失！GAN来预测?

原创 bryant8 机器学习与生成对抗网络 2019-12-28

欢迎点击上方蓝字，关注啦~

相关阅读：

GAN整整6年了！是时候要来捋捋了！

弱水三千，只取你标！AL（主动学习）结合GAN如何?

异常检测，GAN如何gan ?

虚拟换衣！速览这几篇最新论文咋做的！

脸部妆容迁移！速览几篇用GAN来做的论文

【1】GAN在医学图像上的生成，今如何?

01-GAN公式简明原理之铁甲小宝篇

这次整理的是人脸**容颜老去**、或者**年轻化**的方向！来速览GAN怎么做的吧~

1 2017-FACE AGING WITH CONDITIONAL GENERATIVE ADVERSARIAL NETWORKS

FACE AGING WITH CONDITIONAL GENERATIVE ADVERSARIAL NETWORKS

Grigory Antipov[*†] *Moez Baccouche*[*] *Jean-Luc Dugelay*[†]

[*] Orange Labs, 4 rue Clos Courtel, 35512 Cesson-Sévigné, France
[†] Eurecom, 450 route des Chappes, 06410 Biot, France

生成对抗网络（GAN）擅长图像生成，该论文提出基于GAN的自动容颜老化的方法。在此之前，大多数工作用GAN来改变面部属性。

而本工作强调的是在老化的容颜中保留原来的个性特征，为此，提出潜在向量的“个性保留”优化方法。通过最新的人脸识别和年龄估计解决方案对生成的衰老和恢复年轻的人脸图像进行客观评估，表明该方法极具潜力。

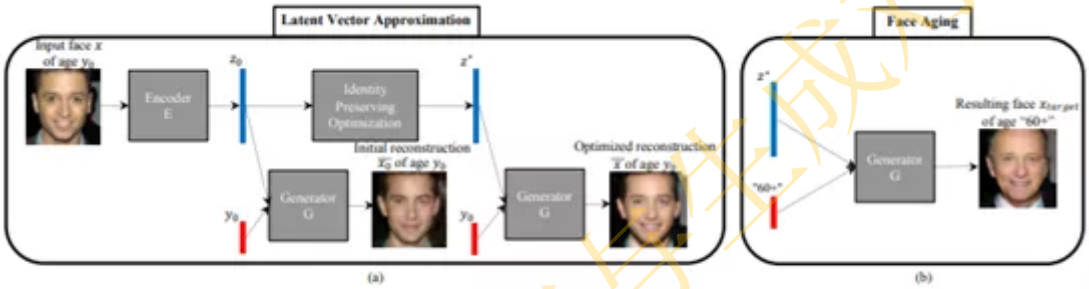


Fig. 1. Our face aging method. (a) approximation of the latent vector to reconstruct the input image; (b) switching the age condition at the input of the generator G to perform face aging.

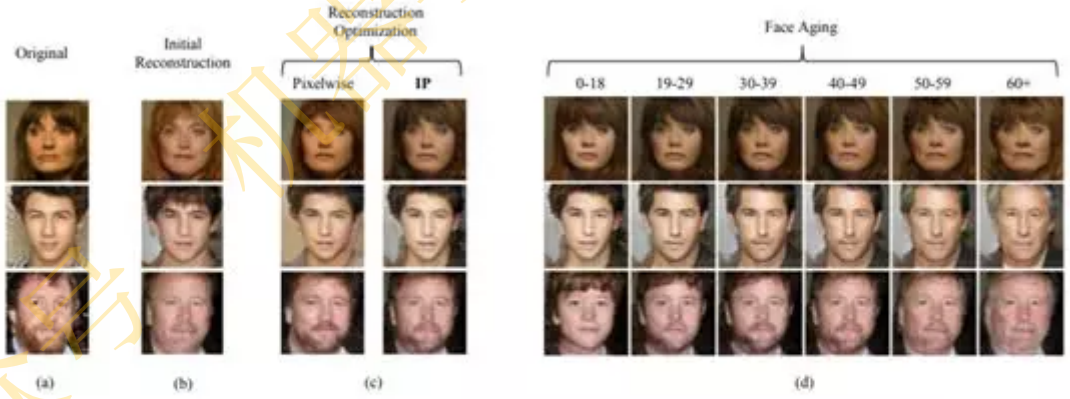


Fig. 3. Examples of face reconstruction and aging. (a) original test images, (b) reconstructed images generated using the initial latent approximations: z_0, (c) reconstructed images generated using the "Pixelwise" and "Identity-Preserving" optimized latent approximations: z^*_{pixel} and z^*_{IP}, and (d) aging of the reconstructed images generated using the identity-preserving z^*_{IP} latent approximations and conditioned on the respective age categories y (one per column).

Reconstruction type	FR score
Initial Reconstruction (z_0)	53.2%
"Pixelwise" Optimization (z^*_{pixel})	59.8%
"Identity-Preserving" Optimization (z^*_{IP})	**82.9%**

Table 1. "OpenFace" Face Recognition (FR) scores on three compared types of face reconstruction.

2 2017 CVPR - Age Progression/Regression by Conditional Adversarial Autoencoder

http://openaccess.thecvf.com/content_cvpr_2017/papers/Zhang_Age_ProgressionRegression_by_CVPR_2017_paper.pdf

Age Progression/Regression by Conditional Adversarial Autoencoder

Zhifei Zhang*, Yang Song*, Hairong Qi
The University of Tennessee, Knoxville, TN, USA
{zzhang61, ysong18, hqi}@utk.edu

本文假设人脸图像处于一种高维流形（high-dimensional manifold）中，而年龄的变化就是图像在这个流形中沿着某个特定方向移动所得，实现手段是通过一种条件对抗自动编码器（CAAE）。

该算法可学习面部流形，通过在上面"遍历"实现平滑的年龄变化。在CAAE中，首先通过卷积编码将人脸映射到潜在向量，然后通过反卷积的生成器将向量投影到以年龄为条件的人脸流形。潜在向量保留个性化的面部个性身份特征。

另外，两个对抗网络分别施加在编码器和生成器上，强制生成更逼真的人脸。

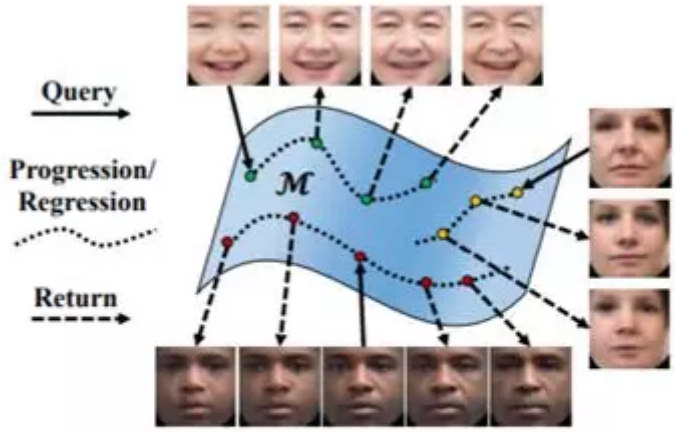


Figure 1. We assume the face images lie on a manifold ($\mathcal{M}$), and images are clustered according to their ages and personality by a different direction. Given a query image, it will first projected to the manifold, and then after the smooth transformation on the manifold, the corresponding images will be projected back with aging patterns.

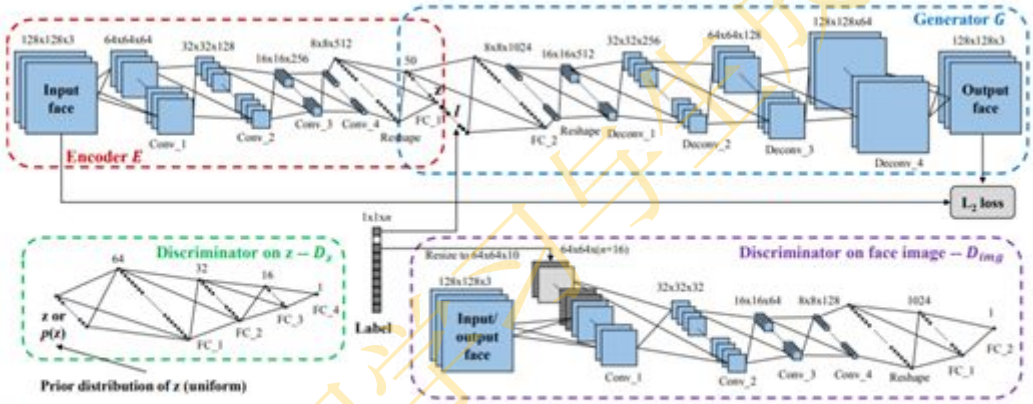


Figure 3. Structure of the proposed CAAE network for age progression/regression. The encoder E maps the input face to a vector z (personality). Concatenating the label l (age) to z, the new latent vector $[z, l]$ is fed to the generator G. Both the encoder and the generator are updated based on the L_2 loss between the input and output faces. The discriminator D_z imposes the uniform distribution on z, and the discriminator D_{img} forces the output face to be photo-realistic and plausible for a given age label.

3 2018 CVPR-Face Aging with Identity-Preserved Conditional Generative Adversarial Networks

Face Aging with Identity-Preserved Conditional Generative Adversarial Networks

Zongwei Wang
Shanghaitech University
wangzw@shanghaitech.edu.cn

Xu Tang
Baidu
tangxu02@baidu.com

Weixin Luo, Shenghua Gao*
Shanghaitech University
{luowx, gaoshh}@shanghaitech.edu.cn

脸部衰老对于跨年龄识别和娱乐相关应用至关重要。但由于缺乏同一个人在较长年龄范围内的脸部数据，极具挑战。由于不同人的衰老速度不同，本文的人脸衰老方法旨在合成目标年龄在某个给定年龄组中的人脸，而不是合成具有特定年龄的人脸。

鉴于合成人脸应该与输入人脸具有相同的身份，提出了一种身份保留的条件生成对抗网络（IPCGAN）框架，其中条件生成的对抗网络生成逼真的、符合目标年龄的面孔，身份保留模块保留身份信息，年龄分类器保证生成的人脸在指定的年龄组。

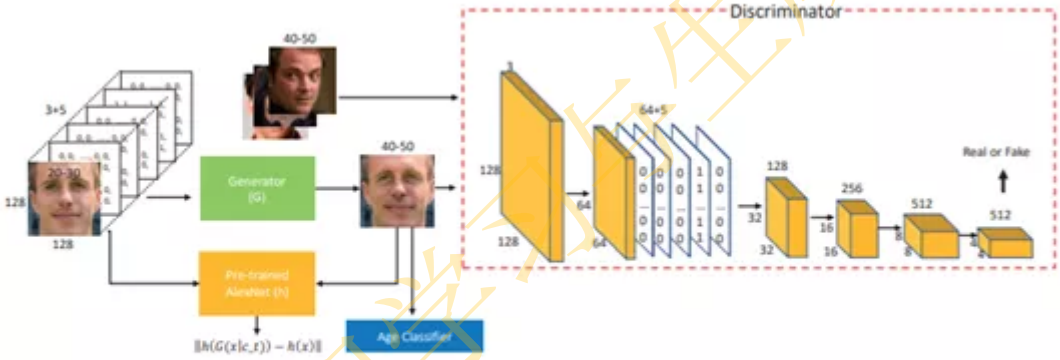


Figure 1. The pipeline of our proposed IPCGANs for face aging. The input image and target age label are concatenated together and then is fed into the generator G. The label is of size $128 \times 128 \times 5$. The discriminator D tries to separate the synthesized faces and faces within the target age group. To preserve the identity information, we enforce the features of synthesized face and input to be similar. We also use an age classifier to force the synthesized face to be with the target age.

Table 1. The performance of different methods.

	CAAE	acGANs	IPCGANs
Face verification (%)	91.53	85.83	**96.90**
Image quality (%)	68.85	39.67	**71.74**
Age classification (%)	24.84	**32.70**	31.74
VGG-face score	19.53±1.76	23.42±1.82	**36.33±1.85**
Time cost (s)	0.71	38.68	**0.28**

4 2018 CVPR - Learning Face Age Progression: A Pyramid Architecture of GANs

Learning Face Age Progression: A Pyramid Architecture of GANs

Hongyu Yang[1] Di Huang[1*] Yunhong Wang[1] Anil K. Jain[2]
[1]Beijing Advanced Innovation Center for Big Data and Brain Computing, Beihang University, China
[2]Michigan State University, USA
{hongyuyang, dhuang, yhwang}@buaa.edu.cn jain@cse.msu.edu

提出了一种新的基于GAN的年龄老化方法，结合人脸验证和年龄估计技术，解决年龄效果的生成和身份的保留问题；

强调与感知年龄密切相关、但在其他研究中被忽略的面部前额和头发成分的重要性：它确实提高了合成年龄的准确性；

在已有实验的基础上，建立新的验证实验，包括基于商业人脸分析工具的评价和对表情、姿势、妆容变化的不敏感性评价等。

Figure 2. Framework of the proposed age progression method. A CNN based generator G learns the age transformation. The training critic incorporates the squared Euclidean loss in the image space, the GAN loss that encourages generated faces to be indistinguishable from the training elderly faces in terms of age, and the identity preservation loss minimizing the input-output distance in a high-level feature representation which embeds the personalized characteristics.

5 2018 IJCAI-Dual Conditional GANs for Face Aging and Rejuvenation

Dual Conditional GANs for Face Aging and Rejuvenation

Jingkuan Song[1], Jingqiu Zhang[1], Lianli Gao[1], Xianglong Liu[2], Heng Tao Shen[1*]
[1]Center for Future Media and School of Computer Science and Engineering,
University of Electronic Science and Technology of China, Chengdu 611731, China
[2]Beihang University, Beijing, 100083, China,
{jingkuan.song,jingqiu.zhang}@gmail.com,
lianli.gao@uestc.edu.cn, xlliu@buaa.edu.cn, shenhengtao@hotmail.com

面部衰老和年轻化主要有两个问题：1）缺少年龄顺序序列的训练数据；2）如何同时渲染老龄面容和保留个性（身份）。

为了解决这些问题，本文提出双重条件GAN（Dual cGAN）机制，该机制可以从不同年龄的、未标记的人脸图像中训练模型来完成人脸衰老和年轻化。所提架构中，原始条件GAN会根据年龄条件将人脸图像转换为其他年龄，而双重条件GAN则还可以完成反过来的任务。

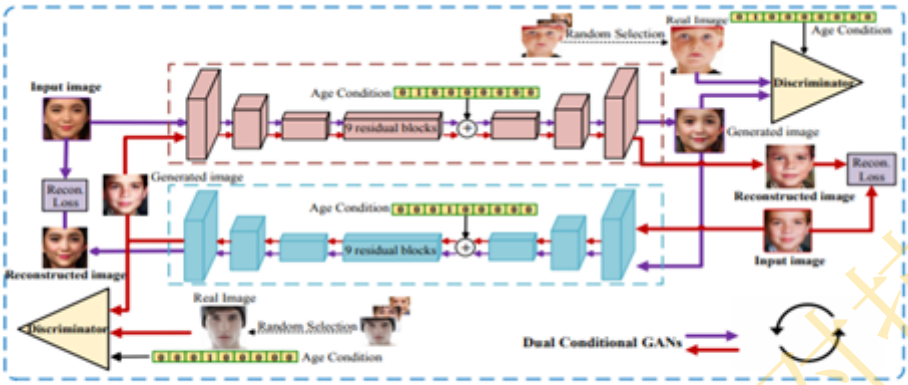


Figure 2: The main structure of our Dual cGANs. The purple flowchart shows the primal cGAN, and the red flowchart shows the dual cGAN. In each of them, an input image is first transformed to other ages based on the age condition, and then it is reconstructed. .

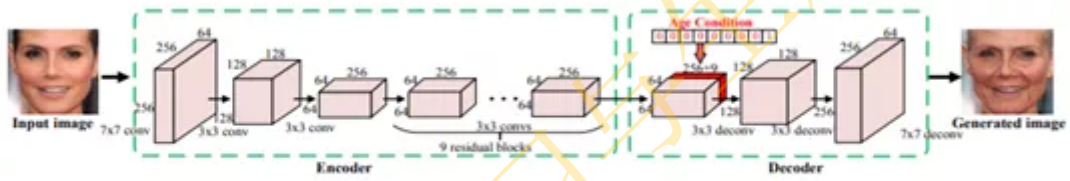


Figure 3: The framework of our generators. It has three major components, i.e., encoder, age condition and decoder.

6 2018 CVPR - Generative Adversarial Style Transfer Networks for Face Aging

Generative Adversarial Style Transfer Networks for Face Aging

Sveinn Palsson
D-ITET, ETH Zurich
spalsson@ethz.ch

Eirikur Agustsson
D-ITET, ETH Zurich
aeirikur@ethz.ch

Radu Timofte
D-ITET, ETH Zurich
Merantix

Luc Van Gool
D-ITET, ETH Zurich
ESAT, KU Leuven

提出从图像风格迁移的角度来研究问题：将人的年龄上的容颜视为图像的风格元素。

论文表明对于较大的年龄差异，可以通过一组生成对抗网络（CycleGAN）进行训练来获取令人信服的面部衰老效果。

此外，还提出了CycleGAN的变体（并协同预训练的年龄预测模型），当期望的年龄差异较小时，该变体模型表现更好。

上述两方法具有互补性，而它们的融合对于任何期望水平的老化效果都表现良好。最后通过用户研究进行定量评估，表明该方法优于现有的面部衰老技术。

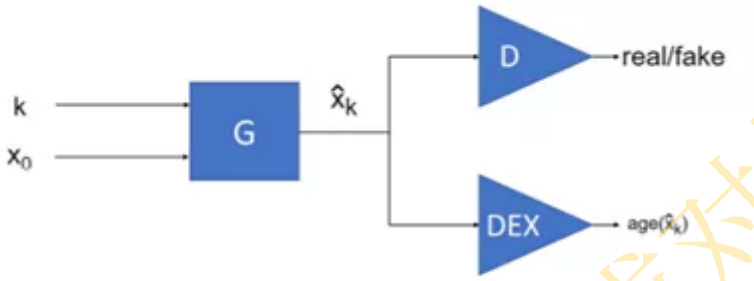


Figure 2. Diagram of proposed FA-GAN model.

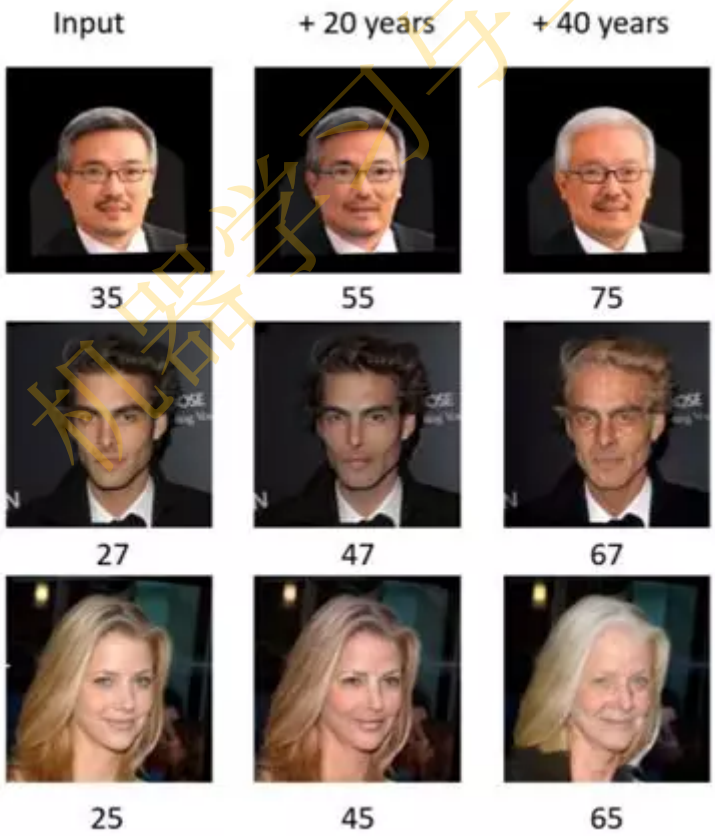


Figure 1. Face aging results of our methods.

7 2019 - How Old Are You? Face Age Translation with Identity Preservation Using GANs

How Old Are You?
Face Age Translation with Identity Preservation Using GANs

Zipeng Wang, Zhaoxiang Liu*, Jianfeng Huang, Shiguo Lian, Yimin Lin
Cloudminds
{kohou.wang, robin.liu, jianfeng.huang, scott.lian, anson.lin}@cloudminds.com

与最近使用生成对抗网络（GANs）的最流行的面部衰老网络不同，所提方法不只是将年轻的面孔转换为老化面孔，本文还使用边缘图作为中间表示：

先提取年轻面孔的边缘图，用基于CycleGAN的网络将其转换为老化面孔的边缘图，

然后采用另一个基于pix2pixHD的网络将合成的边缘图、拼接上个性身份信息变成老化面孔。

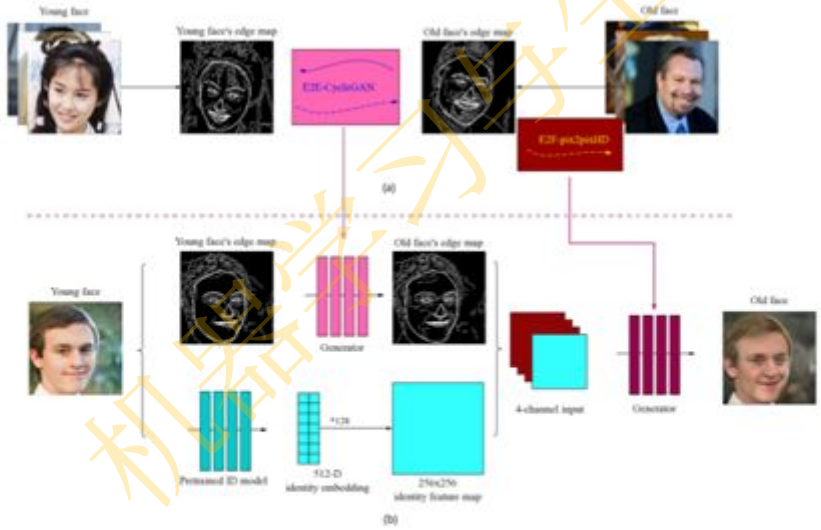


Figure 1. Our method. (a): Training procedure. Firstly edge maps of old face and young face are calculated, then these corresponding edge maps are utilized to train a E2E-CycleGAN model; meanwhile, edge maps and identity information of old face are utilized to train a E2F-pix2pixHD model, where original old face is the ground truth; (b): Inference procedure of translating young face into old face. Firstly, edge map of the young face will be calculated, then pretrained E2E-CycleGAN is utilized to generate corresponding old face's edge map, and finally pretrained E2F-pix2pixHD is utilized to generate the old face.

8 2019 - LOOK GLOBALLY, AGE LOCALLY: FACE AGING WITH AN ATTENTION MECHANISM

LOOK GLOBALLY, AGE LOCALLY: FACE AGING WITH AN ATTENTION MECHANISM

Haiping Zhu *Zhizhong Huang* *Hongming Shan* *Junping Zhang*

Shanghai Key Lab of Intelligent Information Processing,
School of Computer Science, Fudan University, China, 200433
{hpzhu14, zzhuang19, hmshan, jpzhang}@fudan.edu.cn

现有基于cGAN的方法通常采用逐像素级别的损失来保持个性身份特征和背景一致。但这种逐像素损失可能会导致幻影或模糊。

为此，本文介绍了一种针对面部衰老的注意力条件GAN（AcGAN）方法，利用注意力机制仅关注与面部衰老相关的区域。这样可使合成的面部可以很好地保留背景信息和个人身份。

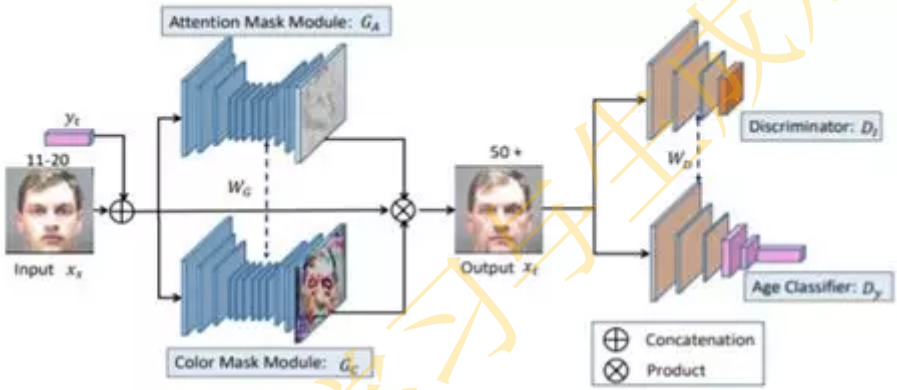


Fig. 1. The architecture of the proposed method. In our network, color mask module G_C and attention mask module G_A share parameters W_G, except for the last layer. Similarly, discriminator D_I and age classifier D_y share parameters W_D.

9 2019-12-20 CONTROLLABLE FACE AGING

本文基于以下两个观察：1）人们在时间流逝老化时，会因在不同条件下显得面部特征多变。例如，在外面工作时肤色可能变暗；2）在老化过程中需要保持一些不变的面部特征，例如，种族和性别。该工作提出通过可属性分解的生成对抗网络完成可控的容颜老化方法。

Fig. 1. Model structure of our method. The left is the structure in training stage while the right is for testing.

先到这吧~（整理不易，劳烦记得点个赞啦~

最后附上、一些人脸年龄变化相关的论文供参考（没有全细看，可能有个别不一定紧密相关2333）

001 (2019-12-20) Controllable Face Aging
https://arxiv.xilesou.top/pdf/1912.09694.pdf

002 (2019-11-18) DebFace De-biasing Face Recognition
https://arxiv.xilesou.top/pdf/1911.08080.pdf

003 (2019-11-16) What Will Your Child Look Like DNA-Net Age and Gender Aware Kin Face Synthesizer
https://arxiv.xilesou.top/pdf/1911.07014.pdf

004 (2019-11-15) A3GAN An Attribute-aware Attentive Generative Adversarial Network for Face Aging
https://arxiv.xilesou.top/pdf/1911.06531.pdf

005 (2019-10-24) Look globally age locally Face aging with an attention mechanism

https://arxiv.xilesou.top/pdf/1910.12771.pdf

006 (2019-09-11) How Old Are You Face Age Translation with Identity Preservation Using GANs
https://arxiv.xilesou.top/pdf/1909.04988.pdf

007 (2019-11-25) Interpreting the Latent Space of GANs for Semantic Face Editing
https://arxiv.xilesou.top/pdf/1907.10786.pdf

008 (2019-08-30) Degenerative Adversarial NeuroImage Nets Generating Images that Mimic Disease Progression
https://arxiv.xilesou.top/pdf/1907.02787.pdf

009 (2019-06-17) Exemplar Guided Face Image Super-Resolution without Facial Landmarks
https://arxiv.xilesou.top/pdf/1906.07078.pdf

010 (2019-05-31) Reconstructing faces from voices
https://arxiv.xilesou.top/pdf/1905.10604.pdf

011 (2019-05-16) FH-GAN Face Hallucination and Recognition using Generative Adversarial Network
https://arxiv.xilesou.top/pdf/1905.06537.pdf

012 (2019-05-3) FlowSAN Privacy-enhancing Semi-Adversarial Networks to Confound Arbitrary Face-based Gender Classifiers
https://arxiv.xilesou.top/pdf/1905.01388.pdf

013 (2019-04-9) Decorrelated Adversarial Learning for Age-Invariant Face Recognition
https://arxiv.xilesou.top/pdf/1904.04972.pdf

014 (2019-03-30) UVA A Universal Variational Framework for Continuous Age Analysis
https://arxiv.xilesou.top/pdf/1904.00158.pdf

015 (2019-10-6) Age Progression and Regression with Spatial Attention Modules
https://arxiv.xilesou.top/pdf/1903.02133.pdf

016 (2019-02-26) BoostGAN for Occlusive Profile Face Frontalization and Recognition
https://arxiv.xilesou.top/pdf/1902.09782.pdf

017 (2019-01-10) Learning Continuous Face Age Progression A Pyramid of GANs
https://arxiv.xilesou.top/pdf/1901.07528.pdf

018 (2018-11-27) Intra-class Variation Isolation in Conditional GANs
https://arxiv.xilesou.top/pdf/1811.11296.pdf

019 (2019-03-31) Global and Local Consistent Wavelet-domain Age Synthesis
https://arxiv.xilesou.top/pdf/1809.07764.pdf

020 (2019-04-15) Attribute-aware Face Aging with Wavelet-based Generative Adversarial Networks
https://arxiv.xilesou.top/pdf/1809.06647.pdf

021 (2018-09-28) Anonymizing k-Facial Attributes via Adversarial Perturbations
https://arxiv.xilesou.top/pdf/1805.09380.pdf

022 (2018-04-8) Facial Aging and Rejuvenation by Conditional Multi-Adversarial Autoencoder with Ordinal Regression
https://arxiv.xilesou.top/pdf/1804.02740.pdf

023 (2018-08-6) Recursive Chaining of Reversible Image-to-image Translators For Face Aging
https://arxiv.xilesou.top/pdf/1802.05023.pdf

024 (2018-02-1) Face Aging with Contextual Generative Adversarial Nets
https://arxiv.xilesou.top/pdf/1802.00237.pdf

025 (2018-01-25) Global and Local Consistent Age Generative Adversarial Networks
https://arxiv.xilesou.top/pdf/1801.08390.pdf

026 (2019-01-10) Learning Face Age Progression A Pyramid Architecture of GANs
https://arxiv.xilesou.top/pdf/1711.10352.pdf

027 (2017-12-1) Personalized and Occupational-aware Age Progression by Generative Adversarial Networks
https://arxiv.xilesou.top/pdf/1711.09368.pdf

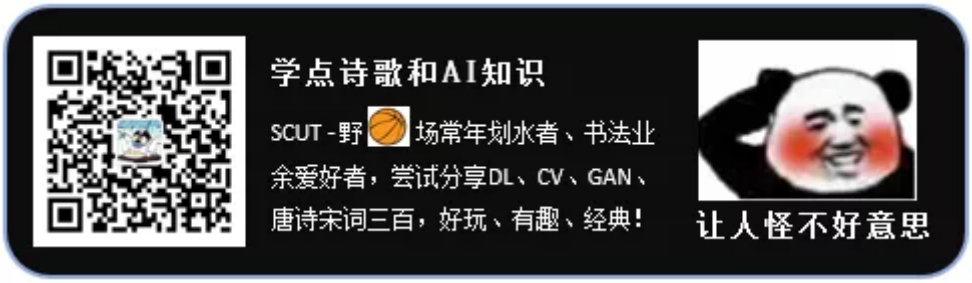
028 (2017-03-24) Temporal Non-Volume Preserving Approach to Facial Age-Progression and Age-Invariant Face Recognition
https://arxiv.xilesou.top/pdf/1703.08617.pdf

029 (2017-03-28) Age Progression/Regression by Conditional Adversarial Autoencoder
https://arxiv.xilesou.top/pdf/1702.08423.pdf

030 (2017-05-30) Face Aging With Conditional Generative Adversarial Networks
https://arxiv.xilesou.top/pdf/1702.01983.pdf

031 (2018-12-6) Deep Identity-aware Transfer of Facial Attributes
https://arxiv.xilesou.top/pdf/1610.05586.pdf

欢迎关注公众号哦，来看看不才整理的最新、更丰富的分享！



也欢迎备注“**GAN进群**”加入微信群：“**GAN爱好者交流群**”。与大家一起畅所欲言、互相分享交流！！！