Face Ageing through c-GAN

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Introduction

Traditional face ageing techniques:

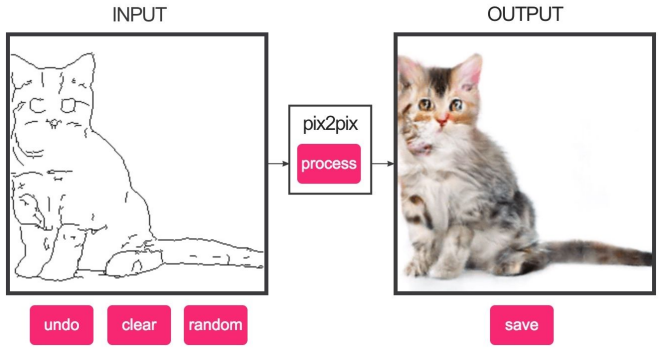
- **Prototyping:** Based on general rules, discards personalized information. Results in unrealistic images
- **Modelling:** Employs parametric models to simulate the aging mechanism. Requires face aging sequence across wide range of years which is costly.

Face ageing using Deep Learning!

- Based on Generative Adversarial Network aka GANs
- **Age-cGAN** (Age Conditional Generative Adversarial Network), the first GAN to generate high-quality synthetic images within required age categories.

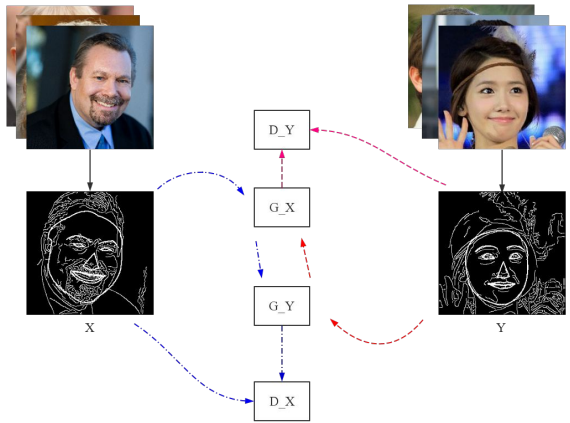
Literature Review

1. **pix2pix:** Takes conditional adversarial networks as a general-purpose solution to image-to-image translation issues



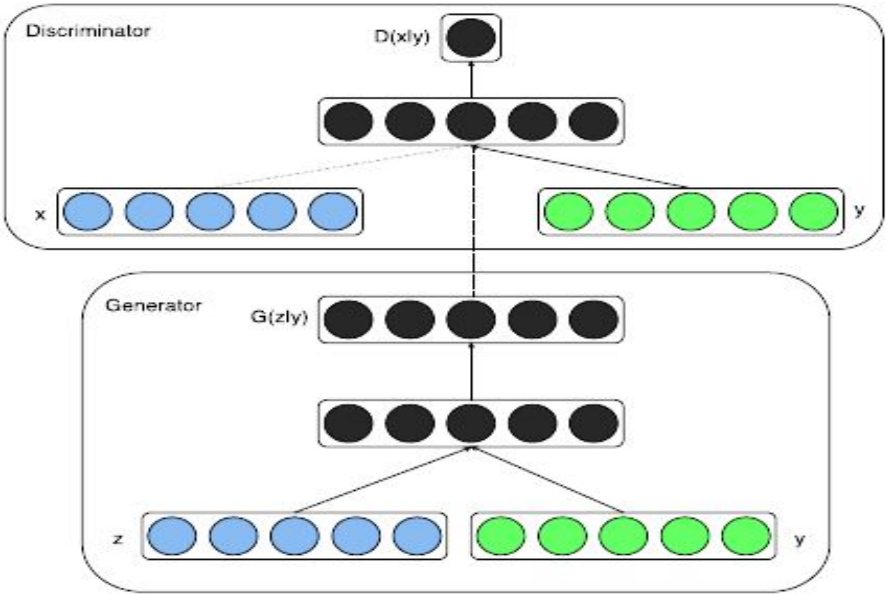
https://phillipi.github.io/pix2pix/

2. **E2E-CycleGAN:** Transfers face image's edge maps, and utilizes E2F-pix2pixHD to synthesize realistic faces with edge maps and identity information as the input



E2E-CycleGAN training procedure. From How Old Are You? Face Age Translation with Identity Preservation Using GANs Zipeng Wang et al.

Our Approach



Architecture of Cycle GAN

- Conditional GANs (cGANs) extends the idea of plain GANs, **allowing us to control the output of the generator network**.
- Age-cGANs consider attributes like facial expressions and superficial accessories, such as spectacles and facial hair, unlike normal GANs and hence are better

Advantages and disadvantages

1. GANs are an unsupervised learning method
2. Learn density distributions of data
3. Generate data
4. The trained discriminator is a classifier

VS

1. Mode collapse- the generator network generates samples that have little variety
2. Vanishing Gradient Problem
3. Slowing down of process due to an internal covariate shift

Design and Implementation

The Age-cGAN consists of 4 networks:

a) **Encoder** - Helps us learn the inverse mapping of input face images and the age condition with the latent vector z_o.

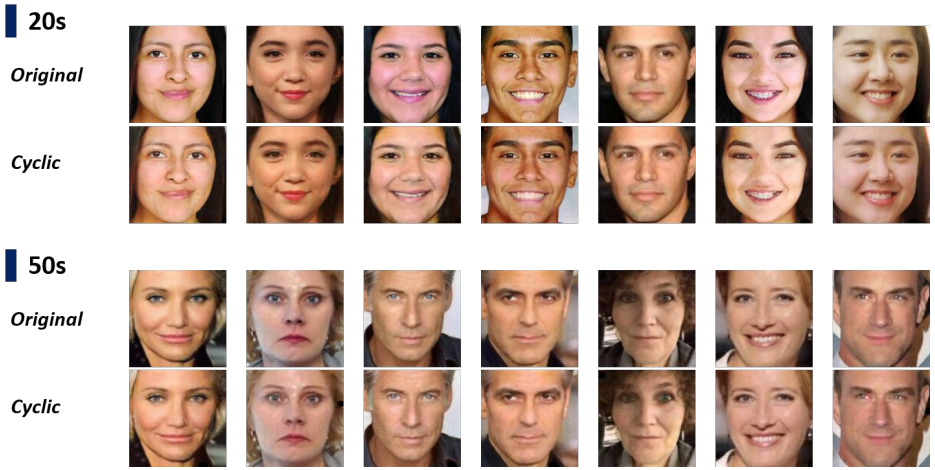
b) **FaceNet** - It is a face recognition network which learns the difference between an input image ***x*** and a reconstructed image $\bar{x}$

c) **Generator network** - Takes a hidden (latent) representation consisting of a face image and a condition vector, and generates an image.

d) **Discriminator network** - Discriminates between the real and fake images.

Result

We tried to replicate the results of a similar study of GroundAI. While we were able to begin training our model with the initial set of data (derived from **IMDB-WIKI – 500k+ face images with age and gender labels**), we were not able to finish the training.



Illustrative Expected Output

Challenges faced

1. Setting up failure and bad initialization
2. Mode collapse
3. Problem with counting

Next Steps

- Cross-age face recognition
- Finding lost children
- Entertainment
- Visual Effects in Movies

Codebase https://github.com/Shubhamsaboo/Face_Aging-through-Cycle_GAN

References

1. P. Isola, J. Zhu, T. Zhou, and A. A. Efros (2017) Image-to-image translation with conditional adversarial networks. In Proceedings of the IEEE conference on computer vision and pattern recognition, pp. 1125–1134.
2. Wang, Kohou. “How Old Are You? Face Age Translation with Identity Preservation Using GANs.” GroundAI, GroundAI, 11 Sept. 2019, www.groundai.com/project/how-old-are-you-face-age-translation-with-identity-preservation-using-gans/
3. IMDB-WIKI – 500k+ face images with age and gender labels https://data.vision.ee.ethz.ch/cvl/rrothe/imdb-wiki/
4. https://arxiv.org/pdf/1702.01983.pdf

Thank You.