PROJECT REPORT

DeepFaceLab: Introduction to a state-of-the-art framework

TABLE OF CONTENTS

01 OVERVIEW

02 ARCHITECTURE

03 IMPLEMENTATION

01

Overview

DIEP
NEP.
THIS IS NOT MORGAN FREEMAN.

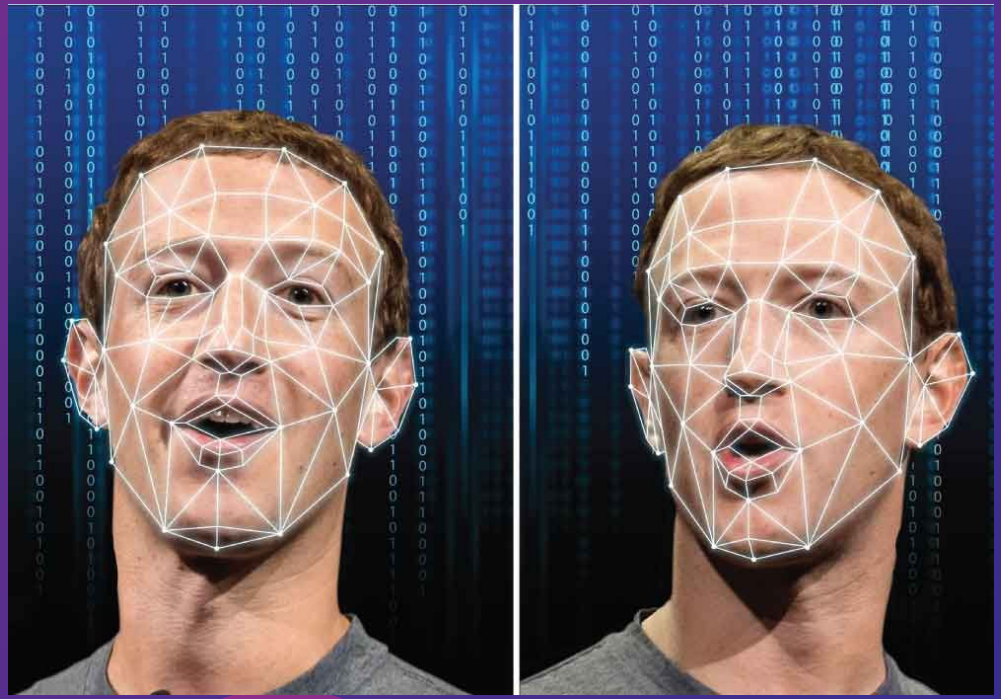
What is deepfake?

- A type of synthetic media that is created using deep learning algorithms, particularly artificial neural networks.
- Involves the use of algorithms to manipulate or superimpose images, videos, and audio recordings in a way that makes it difficult to distinguish the fake from the original.
- Involves training an artificial intelligence model on a large dataset of real images, videos, and audio recordings of a particular person.
  -> Model uses this data to generate a new video or audio clip that appears to be authentic.

Problem stating

Prior to DeepFaceLab and other similar tools, deepfaking methods were largely underdeveloped and inefficient.

-> DeepFaceLab is born to address these issues: provide a more effective and automated solution for creating high-quality face-swapping videos.



What is DeepFaceLab?

- Is a powerful deep learning software application used for face swapping and face restoration.
- Utilizes deep learning techniques, particularly the Generative Adversarial Network (GAN), to create high-quality face swaps that look realistic and seamless.

INPUT

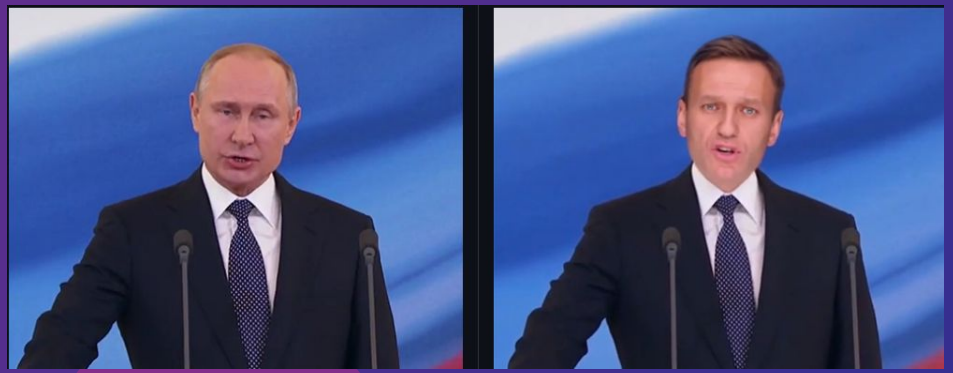
- Image / video that include human face

In detail:

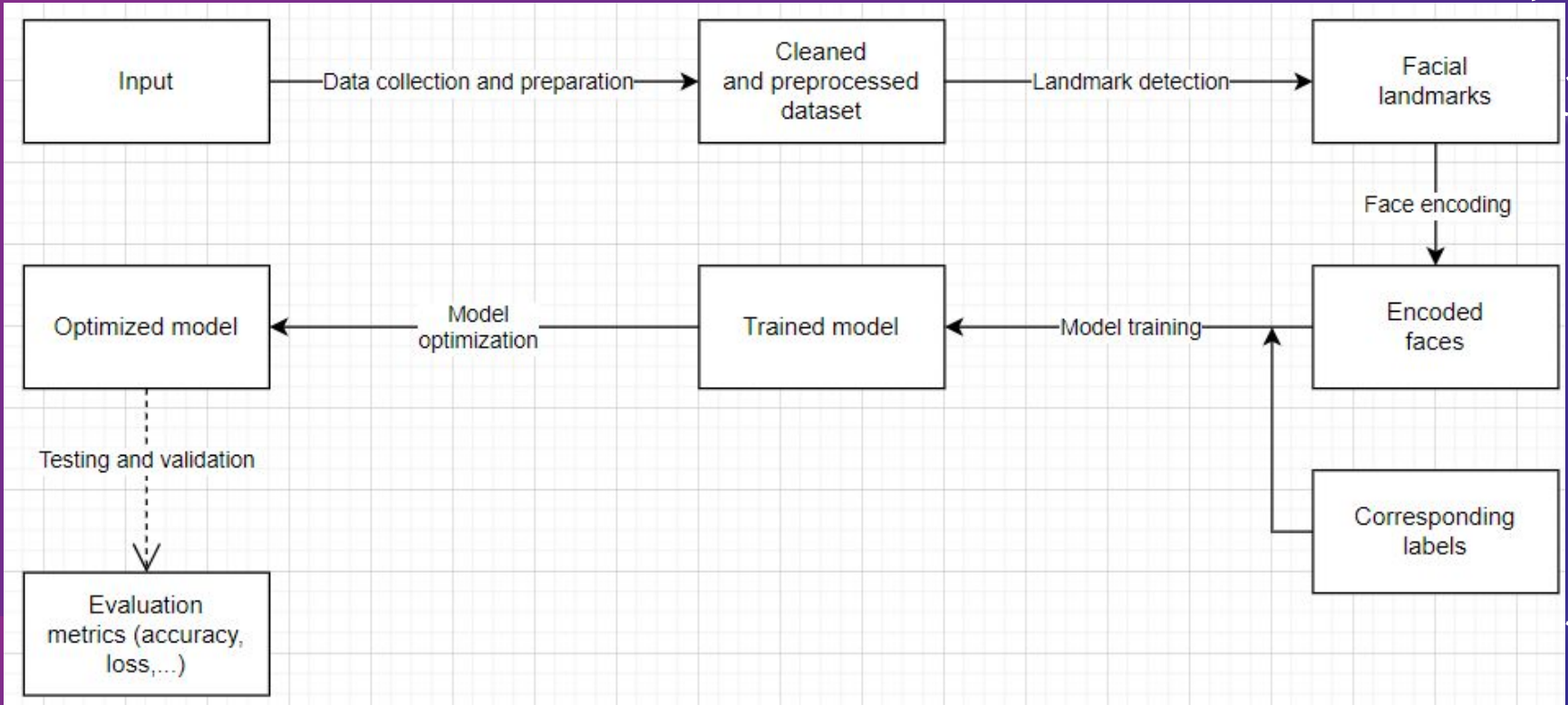
- A large dataset of images and videos that satisfy these conditions:
- Variety (angles, expressions,...)
- Consistent (quality, lighting)
- High quantity: Dataset should around 3000 to 8000 images (frame)

OUTPUT

A trained deep learning model that can be used for a specific face manipulation task.



MAIN WORKFLOW



02

Approach and architecture

DEEPFACE LAB

https://arxiv.org/abs/2005.05535

arXiv:2005.05535v5 [cs.CV] 29 Jun 2021

DeepFaceLab: Integrated, flexible and extensible face-swapping framework

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Abstract

Deepfake defense not only requires the research of detection but also requires the efforts of generation methods. However, current deepfake methods suffer the effects of obscure workflow and poor performance. To solve this problem, we present DeepFaceLab, the current dominant deepfake framework for face-swapping. It provides the necessary tools as well as an easy-to-use way to conduct high-quality face-swapping. It also offers a flexible and loose coupling structure for people who need to strengthen their pipeline with other features without writing complicated boilerplate code. We detail the principles that drive the implementation of DeepFaceLab and introduce its pipeline, through which every aspect of the pipeline can be modified painlessly by users to achieve their customization purpose. It is noteworthy that DeepFaceLab could achieve cinema-quality results with high fidelity. We demonstrate the advantage of our system by comparing our approach with other face-swapping methods.[1]

1. Introduction

Since deep learning has empowered the realm of computer vision in recent years, manipulating digital images, especially the manipulation of human portrait images, has improved rapidly and achieved photorealistic results in most cases. Face swapping is an eye-catching task in generating fake content by transferring a source face to the destination while maintaining the destination's facial movements and expression deformations.

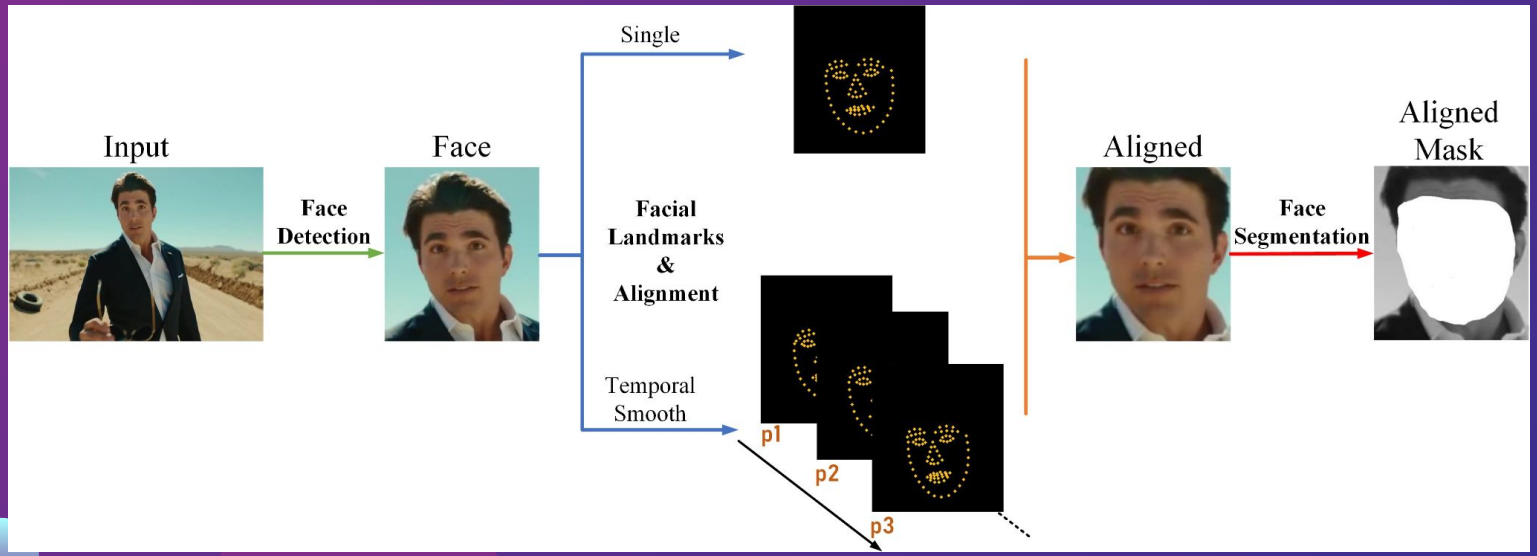
The fundamental motivation behind face manipulation techniques is Generative Adversarial Networks (GANs) [7]. More and more faces synthesized by StyleGAN [10], StyleGAN2 [11] are becoming more and more realistic and en-

[1]For more information, please visit: https://github.com/iperov/DeepFaceLab/. (Kunlin Liu is the corresponding author.)

Pipeline

Extraction → **Training** → **Conversion**

1. Extraction



Face Detection

S3FD

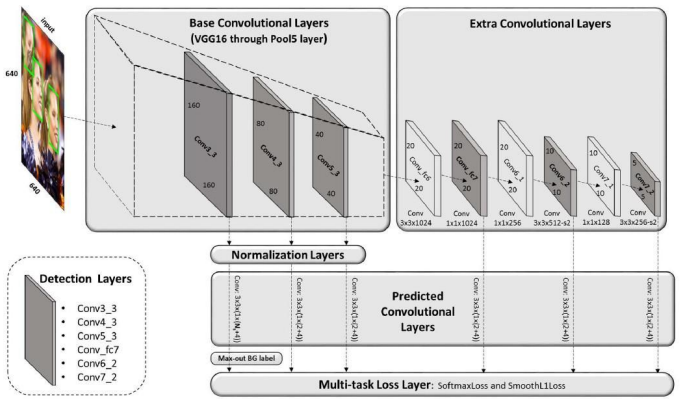
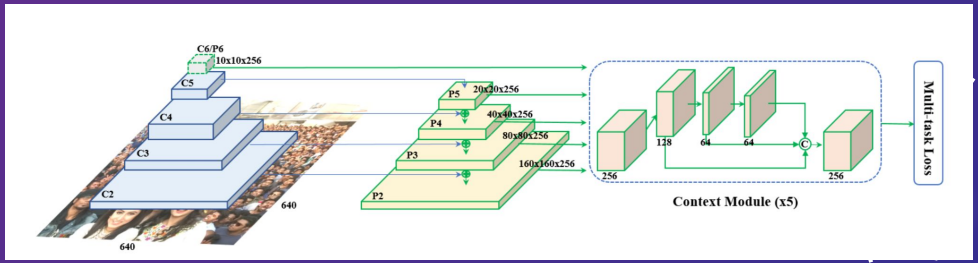


Figure 2. Architecture of Single Shot Scale-invariant Face Detector (S^3FD). It consists of **Base Convolutional Layers**, **Extra Convolutional Layers**, **Detection Convolutional Layers**, **Normalization Layers**, **Predicted Convolutional Layers** and **Multi-task Loss Layer**.

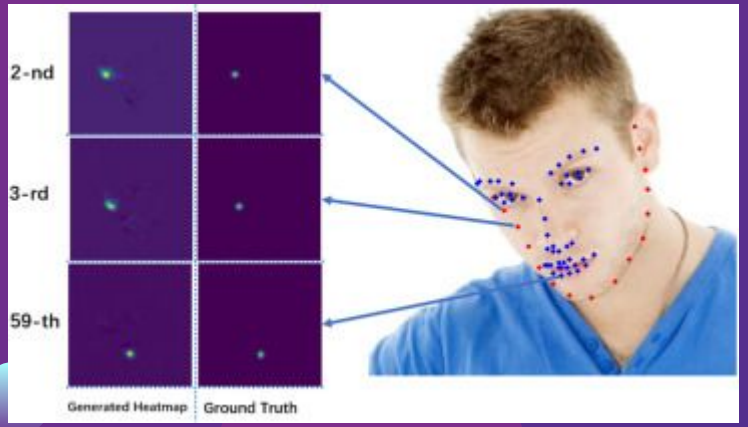
RetinaFace



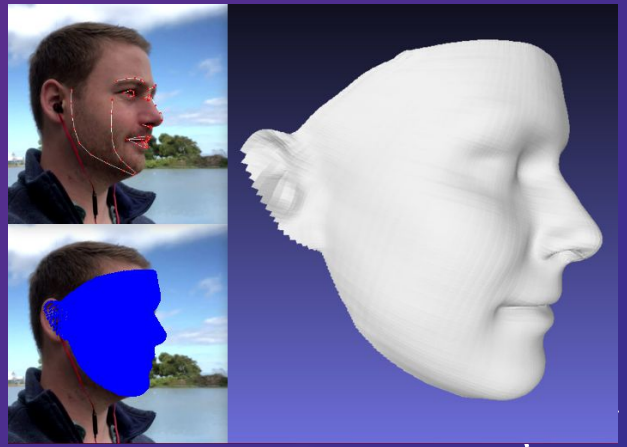
Face Alignment

- Facial landmarks are the key

Heatmap-base (2DFAN)



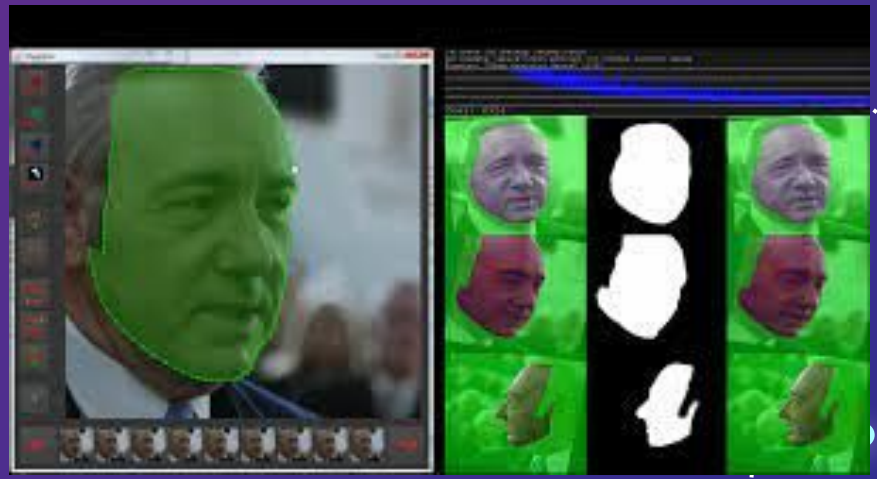
3D Face (PRNet)



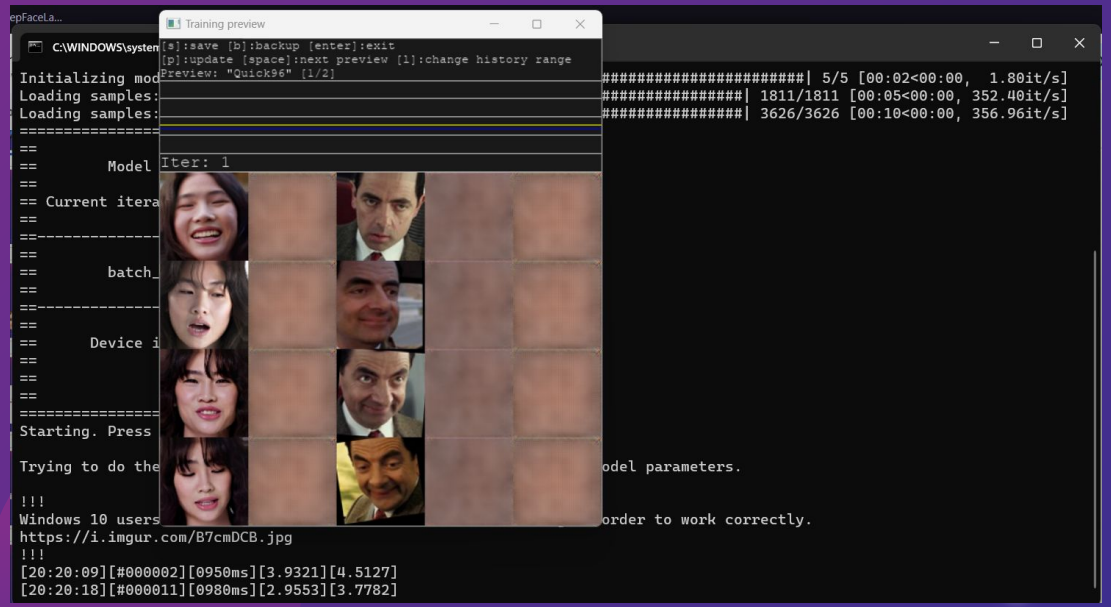
Face Segmentation

TernausNet

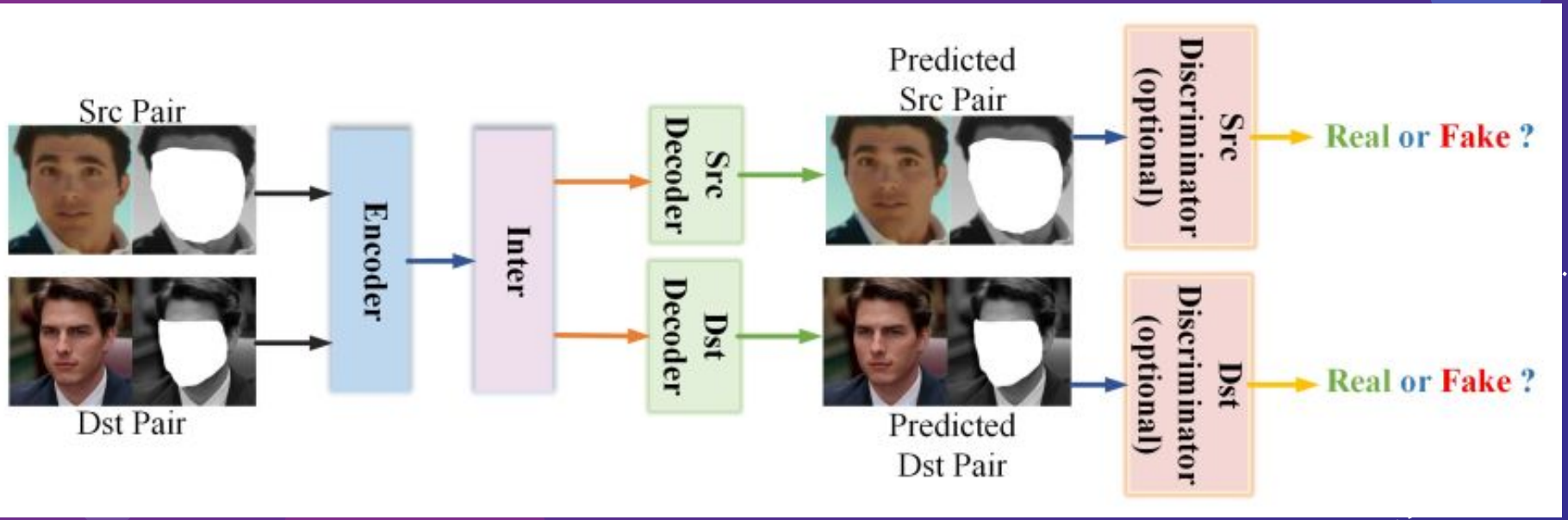
XSeg (DFL)



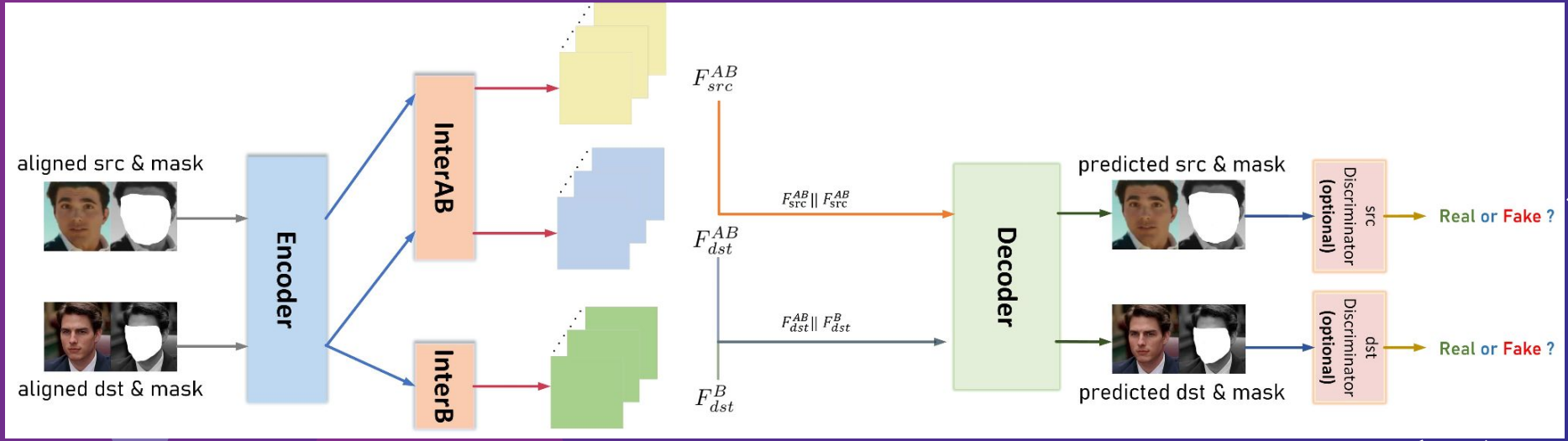
2. Training and Architecture



DF Structure



LIAE Structure

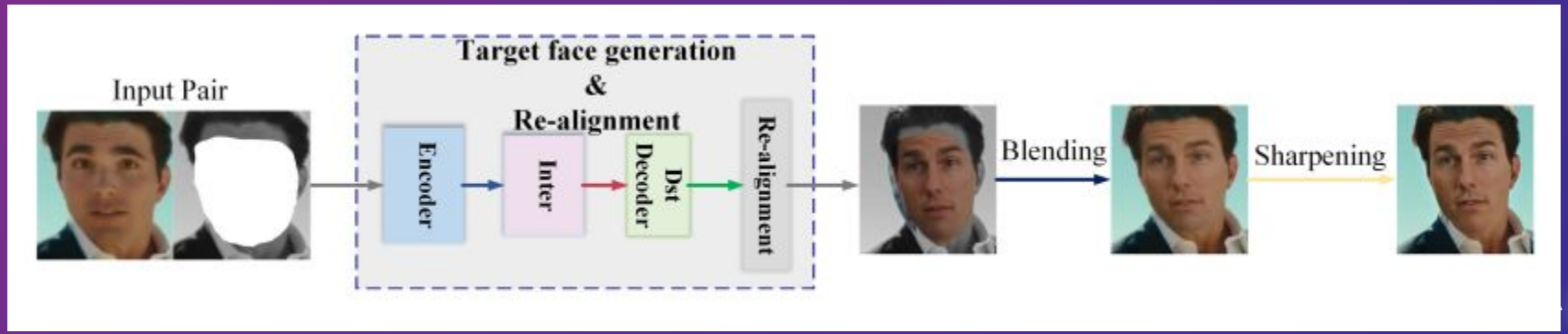


Additional

- Weighted sum mask

- DSSIM + MSE = Loss function
  General + Clarity

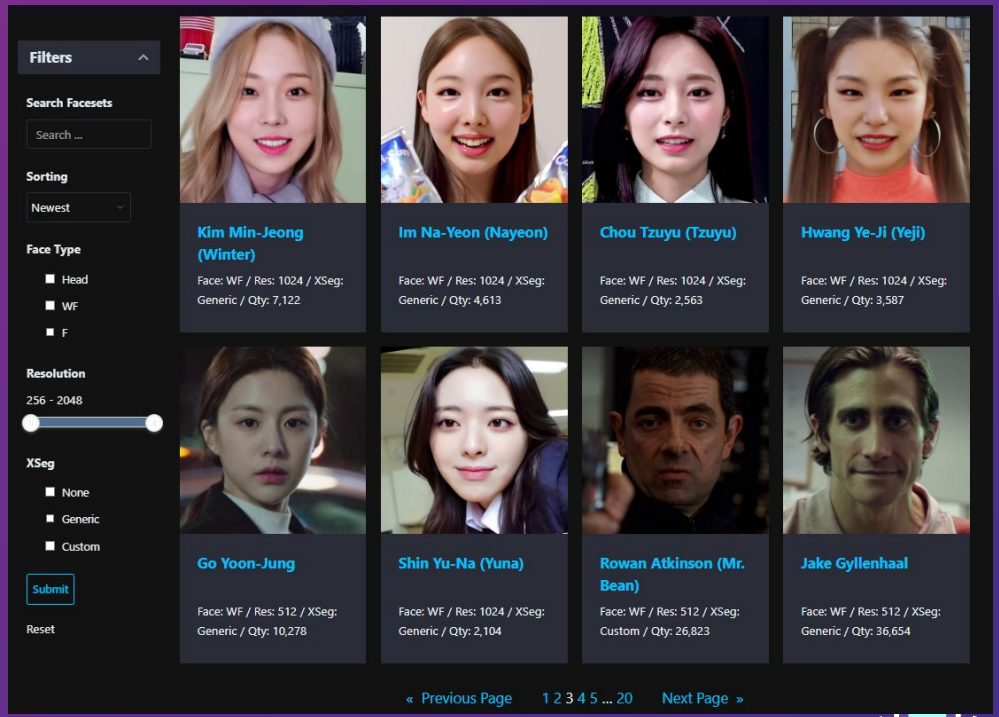
3. Conversion



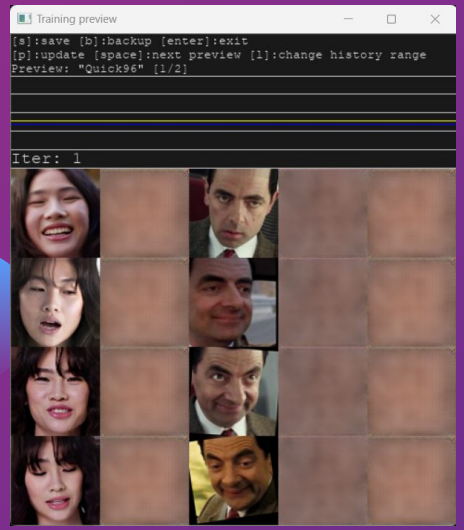
03

Implementation

Celebrity Facesets



https://www.deepfakevfx.com/celebrity-facesets/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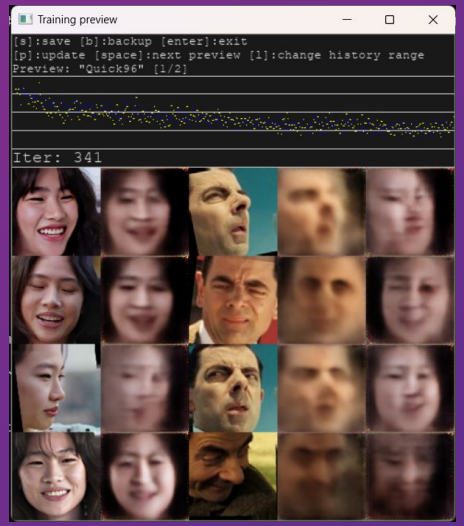
Iter: 1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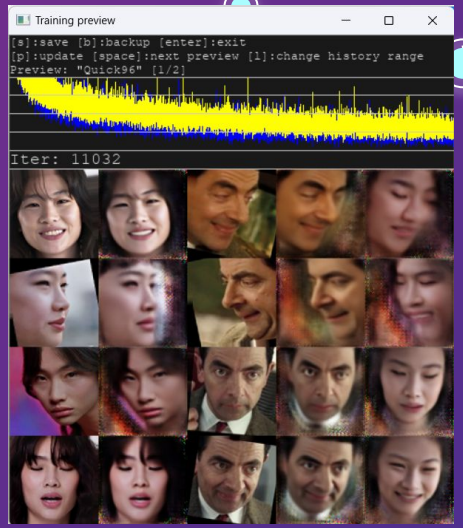
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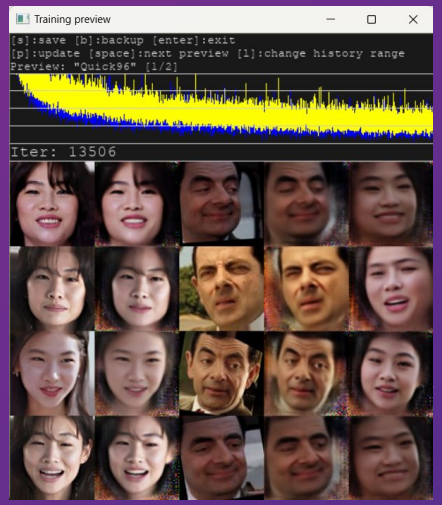
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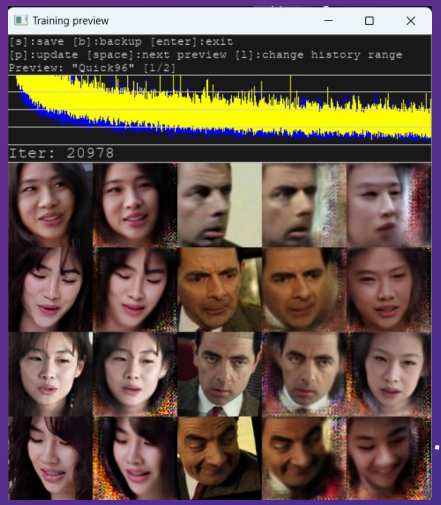
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Iter: 20978

Training preview
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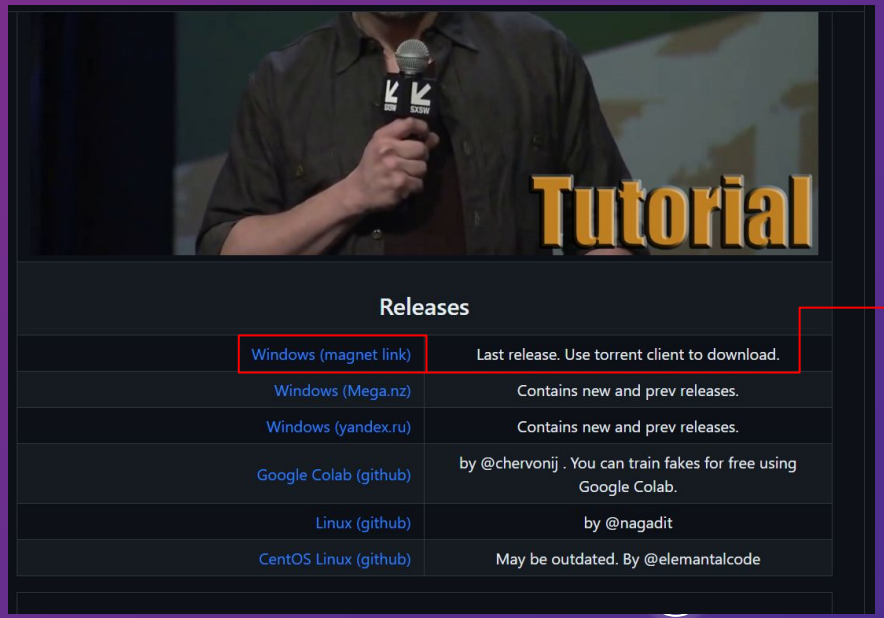
Iter: 23180

Quick tutorial use

- Download DeepFaceLab release from the official site (https://github.com/iperov/DeepFaceLab)



Use BitTorrent to access the link and download DeepFaceLab

Quick tutorial use

- Run and extract the files for the DeepFaceLab appropriate for your hardwares.

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DeepFaceLab_NVIDIA_up_to_RTX2080Ti	4/20/2023 7:33 PM	File folder	
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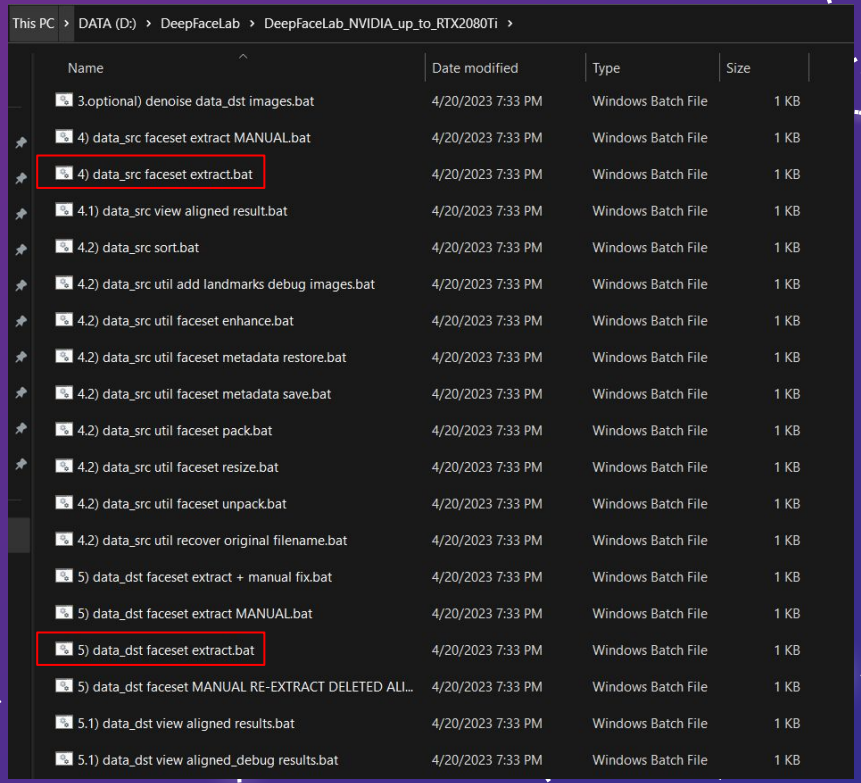
...DirectX12....exe: modern AMD cards
...RTX3000....exe: RTX30xx
...RTX2080Ti....exe: GTX900-1000 and RTX20xx

Quick tutorial use

- Download 2 facesets from the Celebrity Facesets site. Better choose ones that have the same resolution and face type.
- Put the facesets in the appropriate folders (workspace/data_src and workspace/data_dst).
- Run the extraction scripts to extract the face from the facesets.



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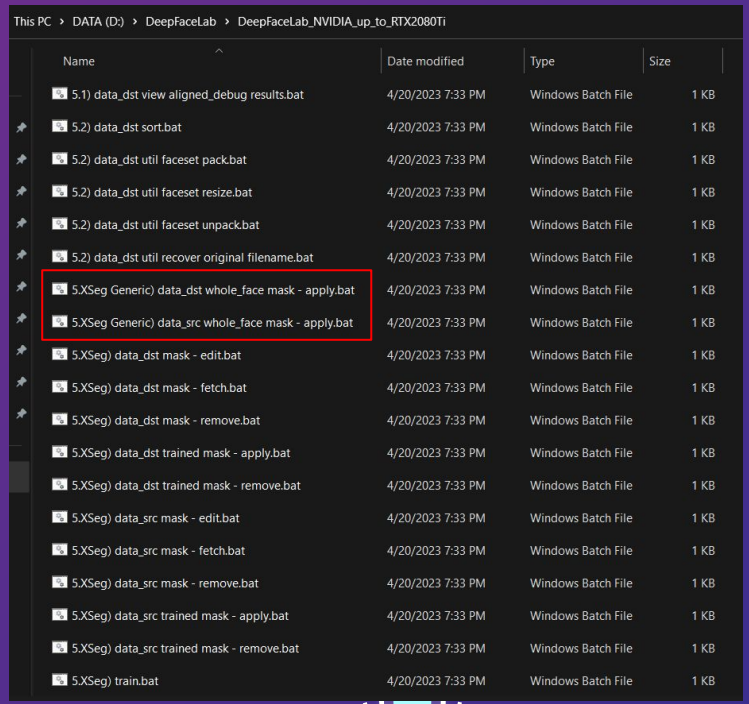
Quick tutorial use

- Apply XSeg masks on the extracted faces.
- XSeg allows you to define how you want your faces to be masked, which parts of the face will be trained on and which won't.
- XSeg can be used to exclude just about every obstruction.



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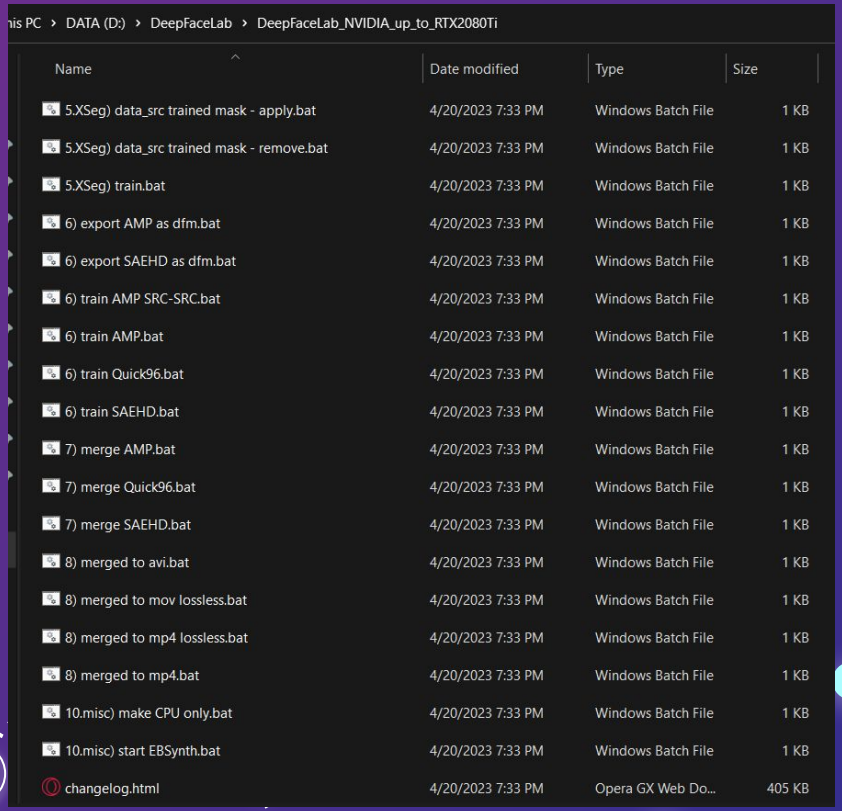
5.XSeg) train.bat	4/20/2023 7:33 PM	Windows Batch File	1 KB

Quick tutorial use

- Train the model with the processed source and destination materials.
- Recommend using Quick96 for quick and less resource-intensive train.



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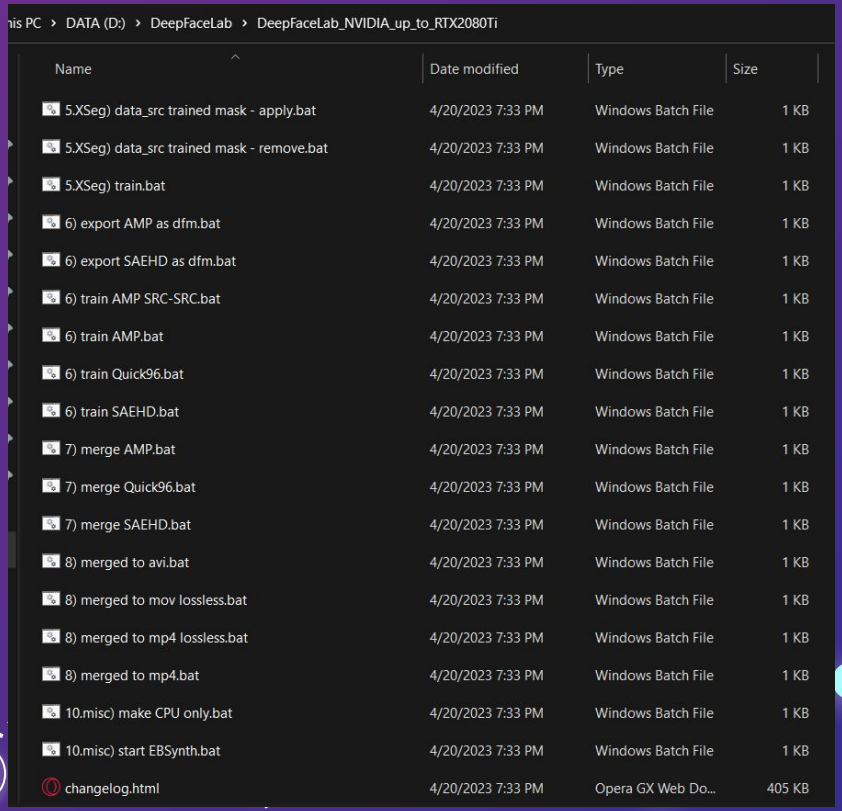
Quick tutorial use

- Train the model with the processed source and destination materials.
- Recommend using Quick96 for quick and less resource-intensive train.
-



his PC › DATA (D:) › DeepFaceLab › DeepFaceLab_NVIDIA_up_to_RTX2080Ti

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8) merged to mp4.bat	4/20/2023 7:33 PM	Windows Batch File	1 KB
10.misc) make CPU only.bat	4/20/2023 7:33 PM	Windows Batch File	1 KB
10.misc) start EBSynth.bat	4/20/2023 7:33 PM	Windows Batch File	1 KB
changelog.html	4/20/2023 7:33 PM	Opera GX Web Do...	405 KB