OWASP™

DEEPFAKES: A GROWING CYBERSECURITY CONCERN

What Are Deepfakes?

A combination of "deep learning" and "fake", deepfakes are hyper-realistic videos digitally manipulated to depict people saying and doing things that never actually happened.

Deepfakes rely on neural networks that analyze large sets of data samples to learn to mimic a person's facial expressions, mannerisms, voice, and inflections.

The process involves feeding footage of two people into a deep learning algorithm to train it to swap faces. In other words, deepfakes use facial mapping technology and AI that swaps the face of a person on a video into the face of another person.

What Are Deepfakes?

Deepfakes are difficult to detect, as they use real footage, can have authentic-sounding audio, and are optimized to spread on social media quickly. Thus, many viewers assume that the video they are looking at is genuine.

Deepfakes target social media platforms, where conspiracies, rumors, and misinformation spread easily, as users tend to go with the crowd.

At the same time, an ongoing ‘infopocalypse’ pushes people to think they cannot trust any information unless it comes from their social networks, including family members, close friends or relatives, and supports the opinions they already hold.

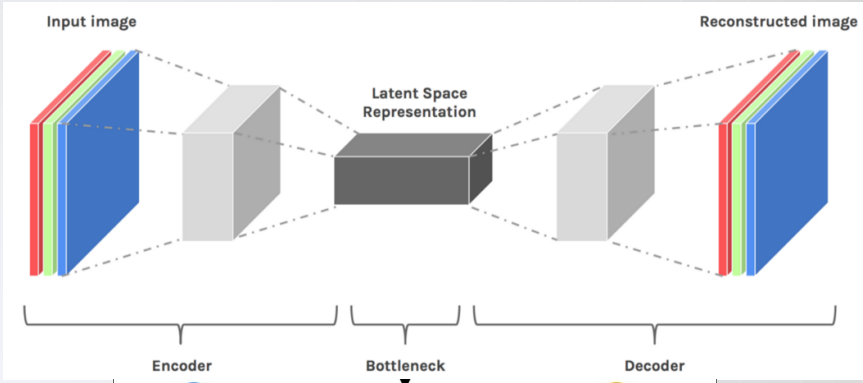
In fact, many people are open to anything that confirms their existing views even if they suspect it may be fake.

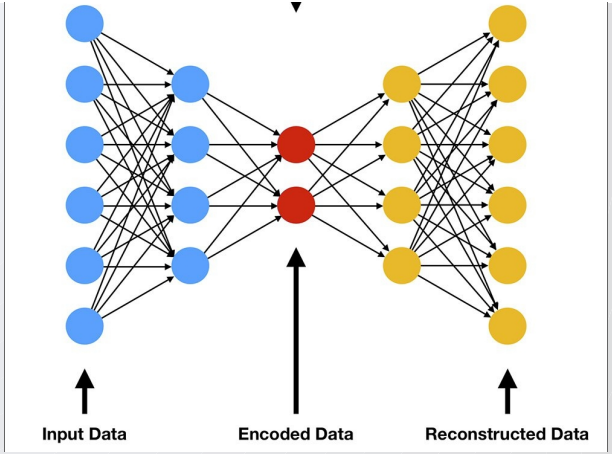
How Do Deepfakes Work?

An Autoencoder is a special type of neural network that is trained to copy its input to its output.

For example, given an image of a handwritten digit, an autoencoder first encodes the image into a lower dimensional latent representation, then decodes the latent representation back to an image.

An autoencoder learns to compress the data while minimizing the reconstruction error.





How Do Deepfakes Work?

The result is that the two autoencoders have a shared encoder that can "read" either a Mark Zuckerberg face or a Mr. Data face.

The goal is for the encoder to use the same representation for things like head angle or eyebrow position whether it's given a photo of Mark Zuckerberg or a photo of Mr. Data.

And that, in turn, means that once you've compressed a face with the encoder, you can expand it using either decoder.

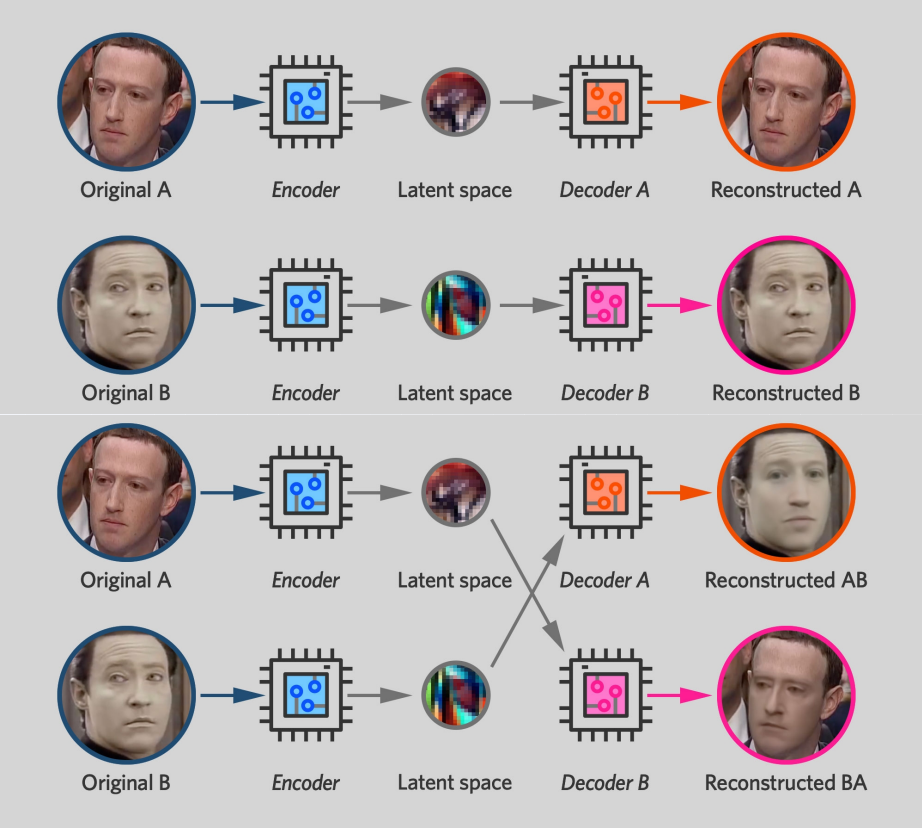
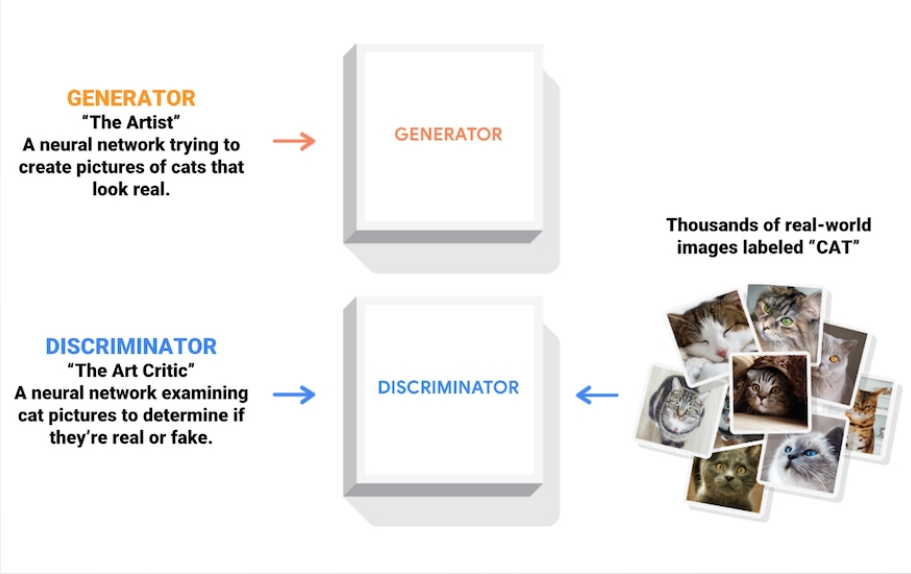


Photo Credit: Aurich Lawson - https://arstechnica.com/science/2019/12/how-i-created-a-deepfake-of-mark-zuckerberg-and-star-treks-data/

How Do Deepfakes Work?

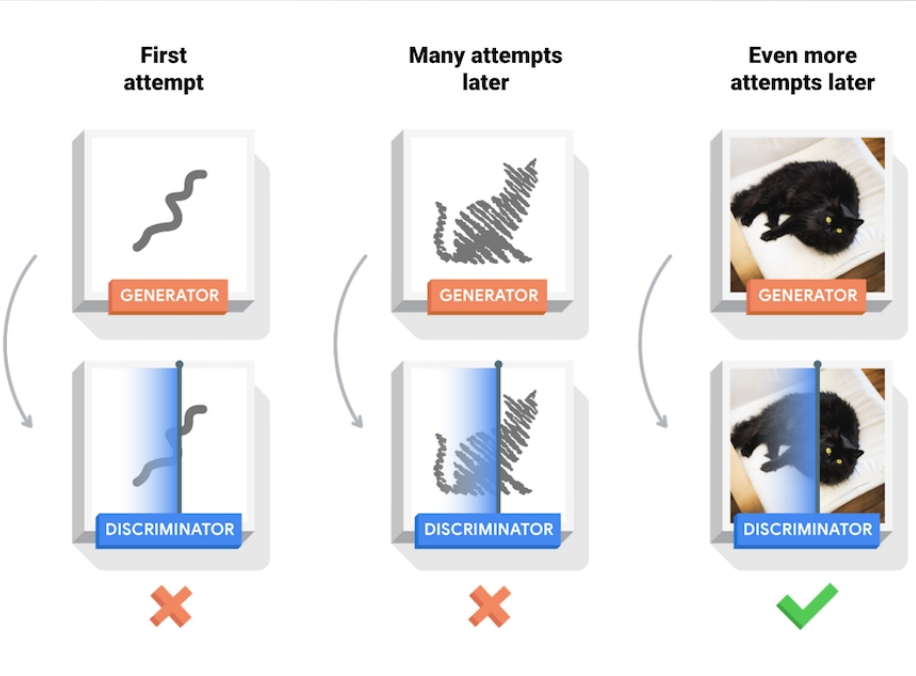
Generative Adversarial Networks (GANs) are one of the most interesting ideas in computer science today. Two models are trained simultaneously by an adversarial process. A generator ("the artist") learns to create images that look real, while a discriminator ("the art critic") learns to tell real images apart from fakes.



How Do Deepfakes Work?

During training, the generator progressively becomes better at creating images that look real, while the discriminator becomes better at telling them apart.

The process reaches equilibrium when the discriminator can no longer distinguish real images from fakes.



Deepfake Examples

+ Tech Timeline

DEEPFAKE TIMELINE

2016 NOV

Highlights:

- Adobe #VoCo is an audio manipulator that allows you to change words in a voiceover simply by typing new words. Presented live during the Adobe MAX 2016

https://www.youtube.com/watch?v=I3l4XLZ59iw

2018 FEB

Platforms Banning Deepfakes:

- Several websites, including Discord, Gfycat, and Twitter, ban deepfakes with varying degrees of success.

2018 APR

Obama Deepfake Video:

- Deepfake video of former US president Barack Obama raises mainstream awareness.

https://www.youtube.com/watch?v=cQ54GDm1eL0

2018 MAY

US Senator Voices His Concern About Deepfakes:

- US Senator Marco Rubio voices his concerns aboutdeepfakes at the Senate Intelligence Committee nomination hearing

“#VoCo. Adobe’s Audio Manipulator” Demo

https://www.youtube.com/watch?v=I3l4XLZ59iw

Obama Deepfake Video

https://www.youtube.com/watch?v=cQ54GDm1eL0

DEEPFAKE TIMELINE

2019 APR

Highlights:

David Beckham Deepfake Video:

- The recent global campaign showing Malaria survivors speaking through David Beckham to help raise awareness around the Malaria Must Die initiative spooked a lot of people

2019 JUN

House holds hearing on "deepfakes" and artificial intelligence amid national security concerns:

- The House Intelligence Committee heard from experts on the threats that so-called "deep fake" videos and other types of artificial intelligence-generated synthetic data pose to the U.S. election system and national security at large.

2019 JUL

FaceApp:

- AI photo editor FaceApp goes viral after adding AI-based age filter.

2019 AUG

DARPA Is Taking On the Deepfake Problem:

- The Defense Department is looking to build tools that can quickly detect deepfakes and other manipulated media amid the growing threat of “large-scale, automated disinformation attacks.”

David Beckham Deepfake Video

https://www.youtube.com/watch?v=QiiSAvKJIHo

DEEPFAKE TIMELINE

Highlights:

2019 SEP

CEO Deepfake Scam:

- Criminals used artificial intelligence-based software to impersonate a chief executive's voice and demand a fraudulent transfer of €220,000 ($243,000) in what cybercrime experts described as an unusual case of artificial intelligence being used in hacking.

2019 OCT

California and Texas ban political deepfake videos:

- California and Texas have passed a law meant to prevent altered "deepfake" videos from influencing elections in a plan that has raised free speech concerns..

2020 DEC

Deepfake Queen: 2020 Alternative Christmas Message:

- An alternative Christmas message for a very alternative year.

https://www.youtube.com/watch?v=IvY-Abd2FfM

2021 JUL

DeepFaceLive:

- Real-time face swap for PC streaming or video calls.

https://github.com/iperov/DeepFaceLive

“Deepfake Queen: 2020” Video

https://www.youtube.com/watch?v=IvY-Abd2FfM

“This is not Morgan Freeman” Video

https://www.youtube.com/watch?v=oxXpB9pSETo

Making A Deepfake With DeepFaceLab

DeepFaceLab is the leading software for creating deepfakes.

https://github.com/iperov/DeepFaceLab

Data Set


Downloads › DeepFaceLab › DeepFaceLab_NVIDIA_RTX3000_series › workspace › data_src
Search data_src
aligned
00001.png 00002.png 00003.png 00004.png 00005.png 00006.png 00007.png 00008.png 00009.png 00010.png 00011.png 00012.png 00013.png 00014.png 00015.png 00016.png 00017.png 00018.png 00019.png 00020.png 00021.png
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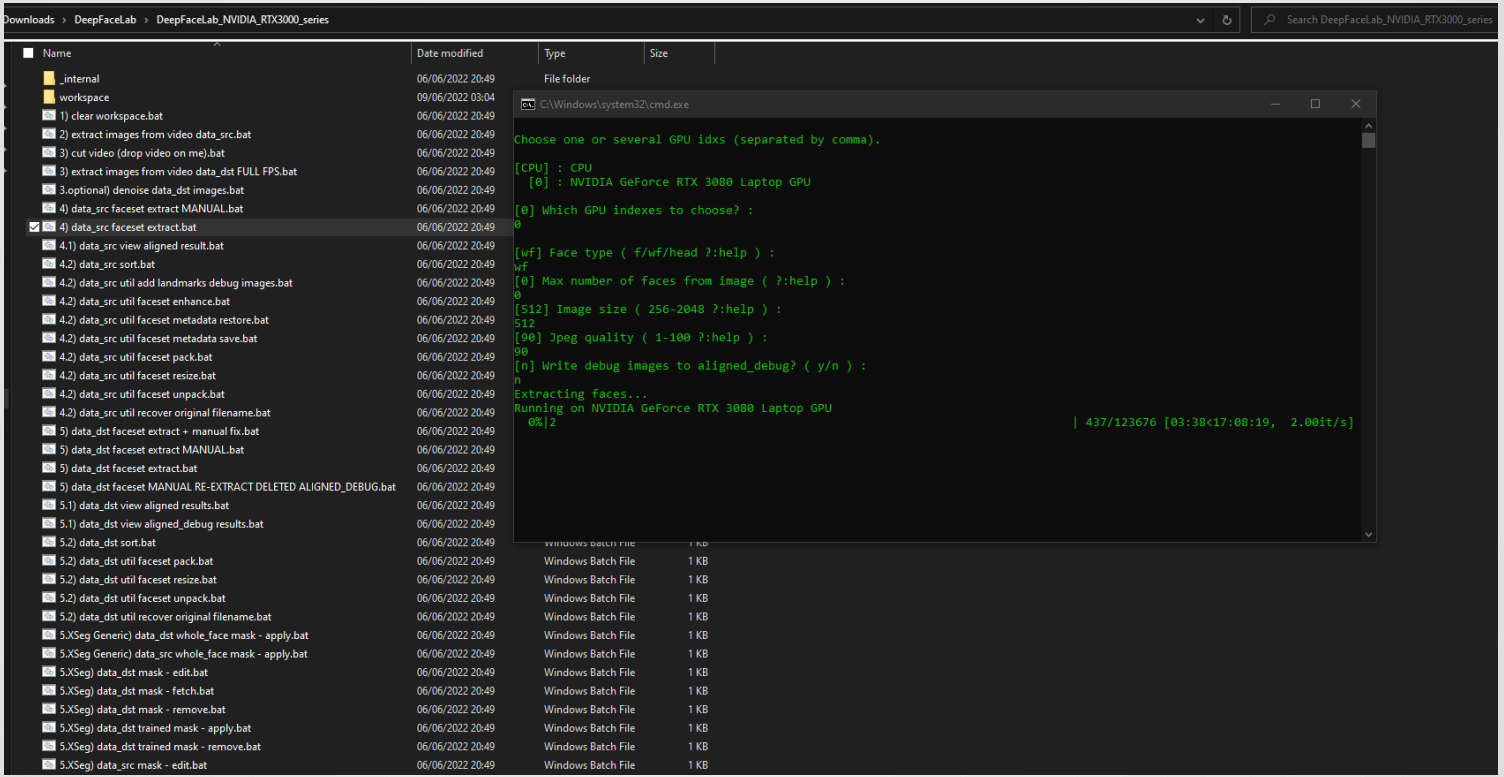
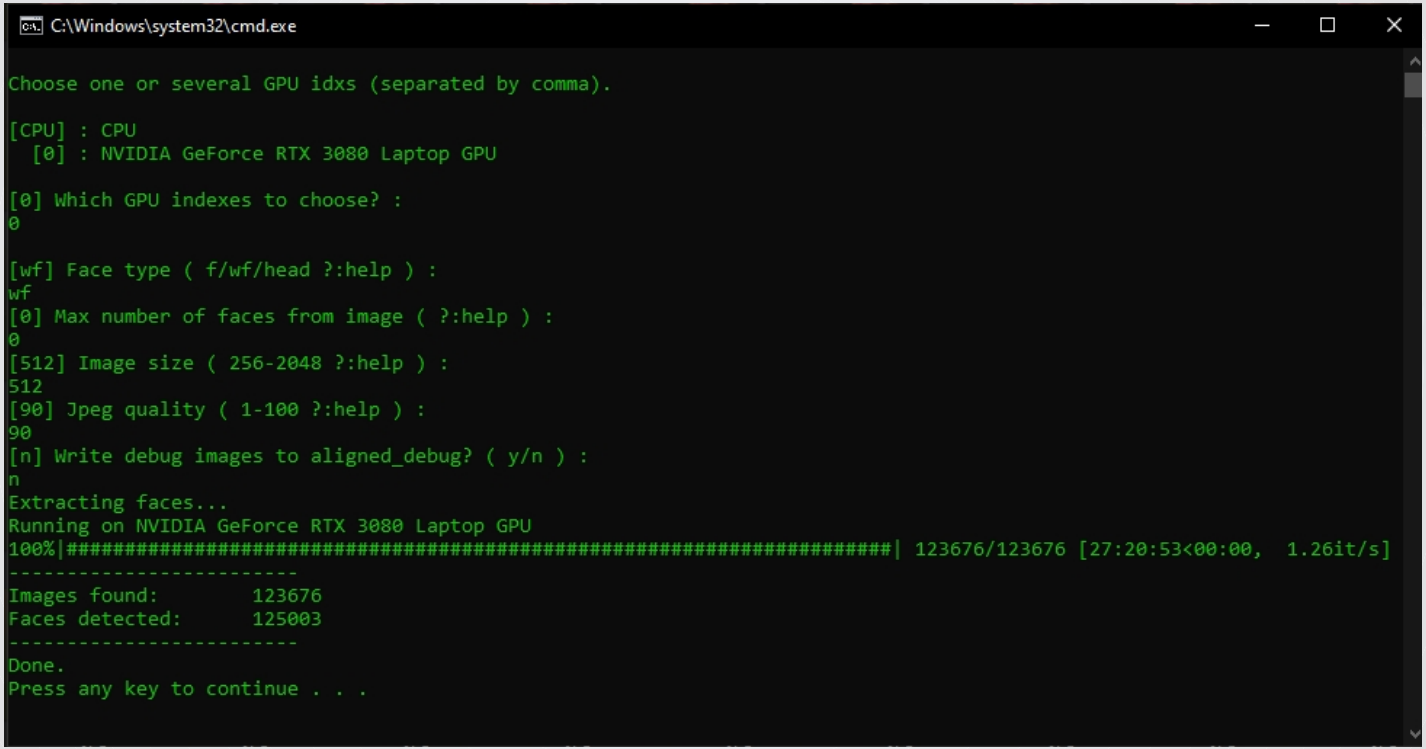
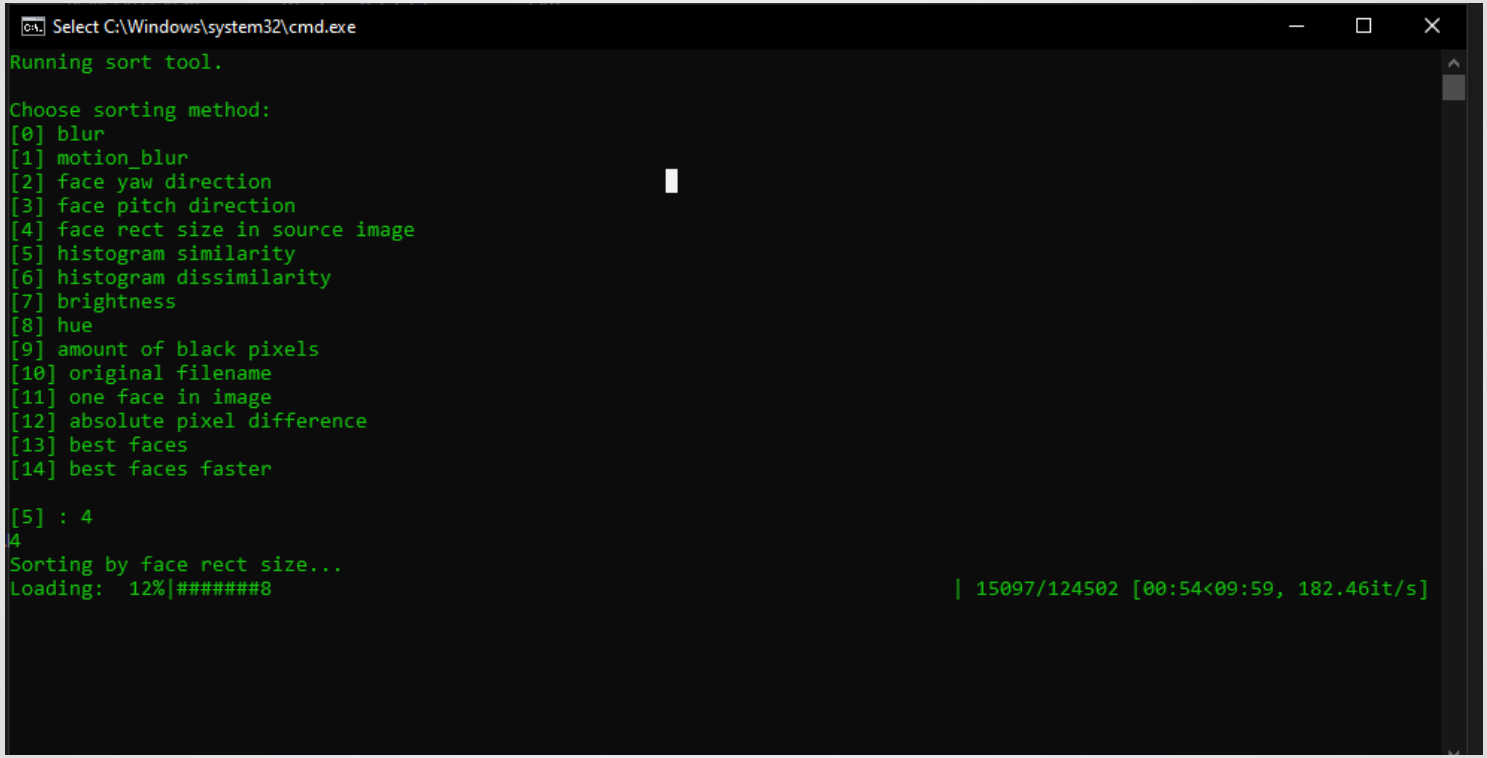
DeepFaceLab | Extract Faces from SRC



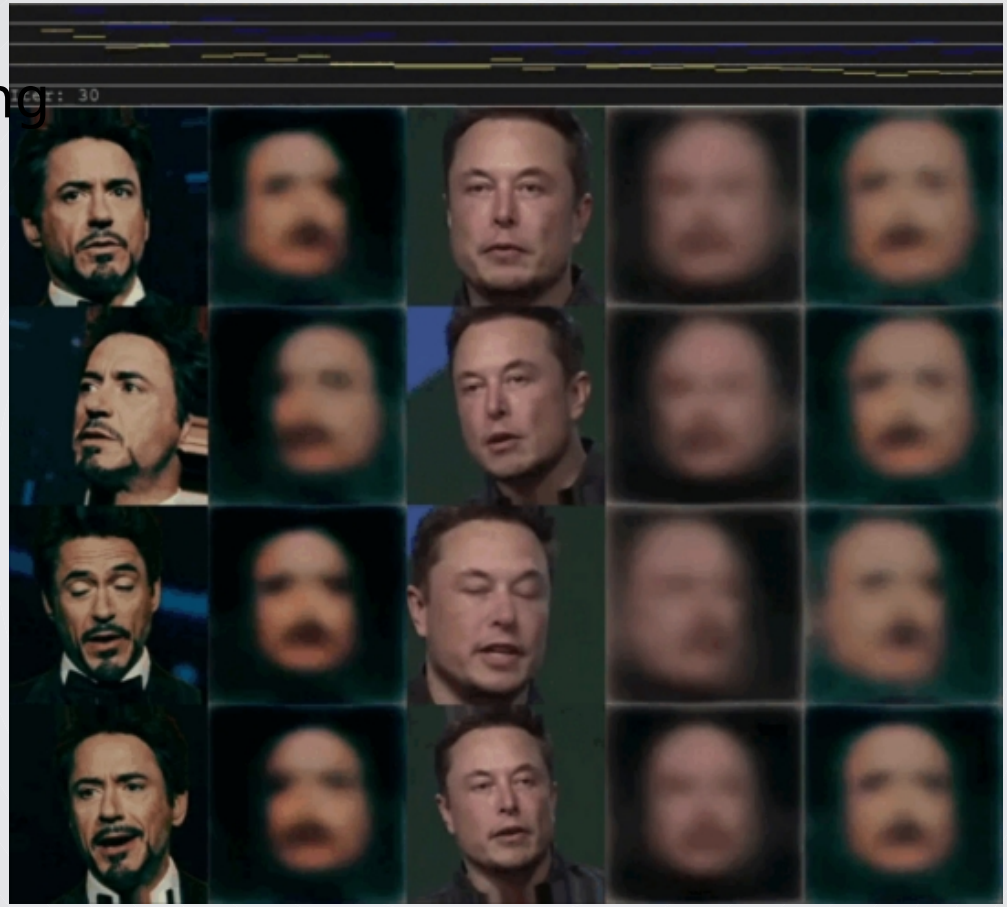
DeepFaceLab | Extract Faces... 27 hours later...



DeepFaceLab | Sorting Faces



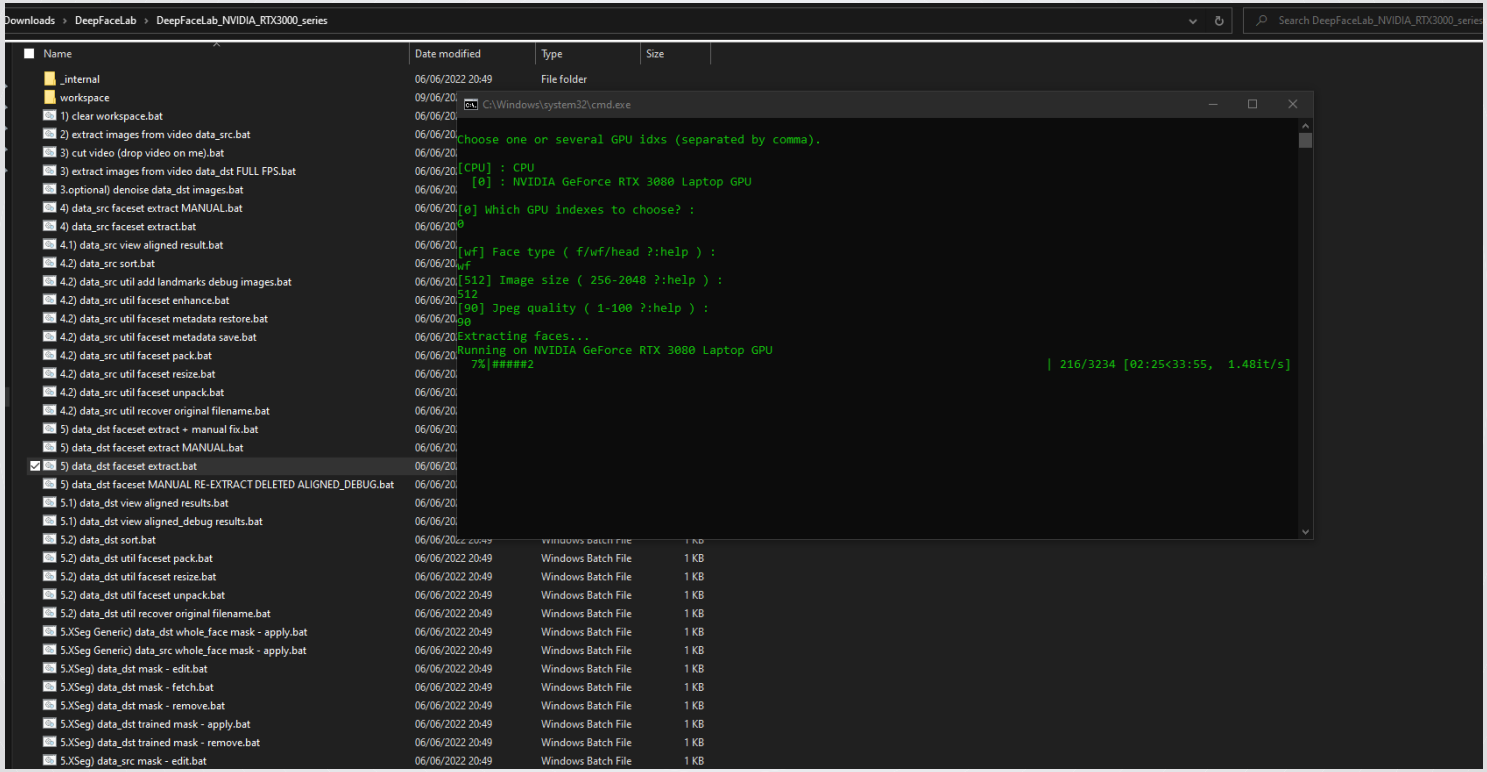
Model Training



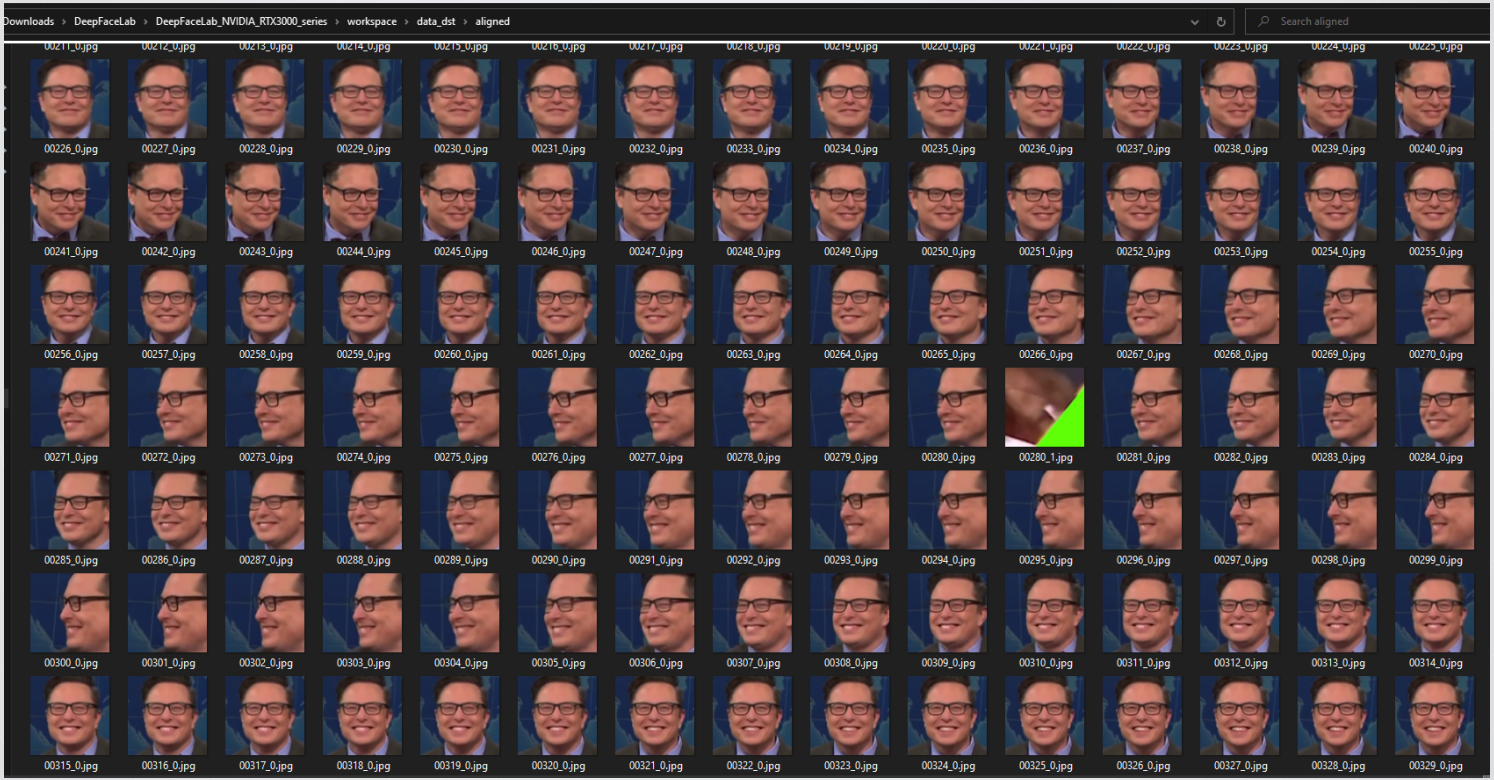
SRC Real SRC Gen DST Real DST Gen SRC + DST Mix

DeepFaceLab | Preprocessing Target Video

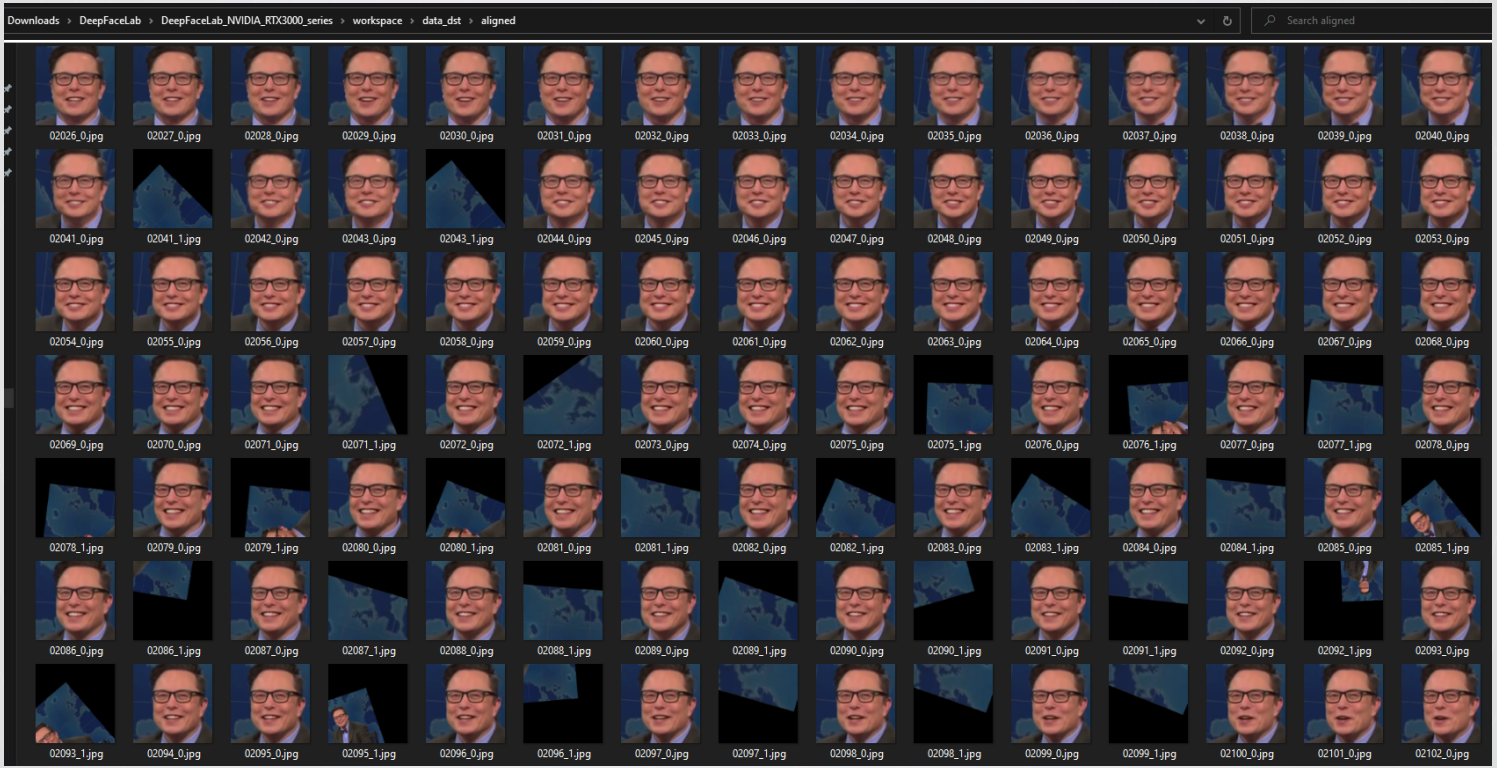
DeepFaceLab | Extracting Faces from DEST



DeepFaceLab | Preprocessing DEST



DeepFaceLab | Preprocessing DEST



Detection

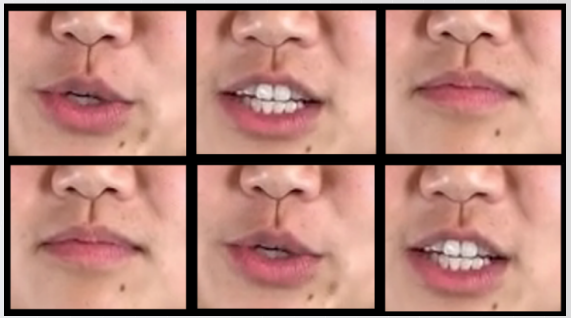
Deepfake Detection

The basic idea is to look for inconsistencies between “visemes,” or mouth formations, and “phonemes,” the phonetic sounds.

Specifically, the researchers looked at the person’s mouth when making the sounds of a “B,” “M,” or “P,” because it’s almost impossible to make those sounds without firmly closing the lips.

Researchers at Stanford have said that their approach is merely part of a “cat-and-mouse” game. As deep-fake techniques improve, they will leave even fewer clues behind.

In the long run, the real challenge is less about fighting deep-fake videos than about fighting disinformation. To reduce disinformation, we need to increase media literacy and develop systems of accountability. For example laws against deliberately producing disinformation and consequences for breaking them, as well as mechanisms to repair the harms caused as a result.



Positive Benefits

Benefits of Deepfakes?

Deepfake technology also has positive uses in many industries, including movies, educational media and digital communications, games and entertainment, social media and healthcare, material science, and various business fields, such as fashion and e-commerce.

The film industry can benefit from deepfake technology in multiple ways. For example, it can help in making digital voices for actors who lost theirs due to disease, or for updating film footage instead of reshooting it.

Deepfakes For Good

(31:00, 33:43)

https://www.youtube.com/watch?v=V5aZjsWM2wo

Questions?