AI for the Media

Week 9, DeepFakes

11.3.2022 / UAL-CCI

~ Vít Růžička

Overview

Deepfakes (*pre-recorded lecture*):

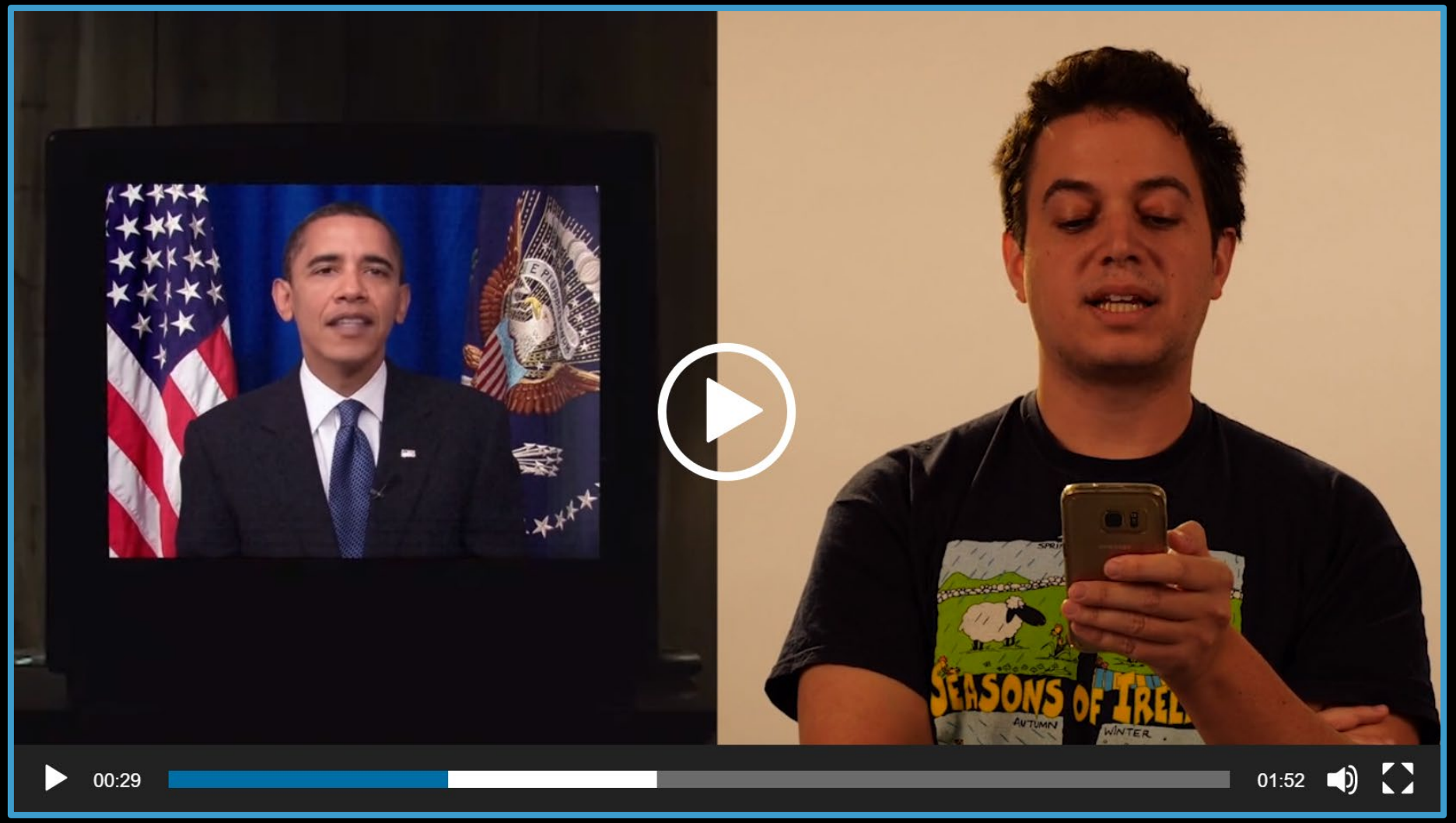
- **History of fake images**
- Generating fake faces **as images** and **as videos**
- **Detection**
- **Artworks**

Practical session (*during the live session*):

- **Code**: *"First Order Motion Model for Image Animation"* model

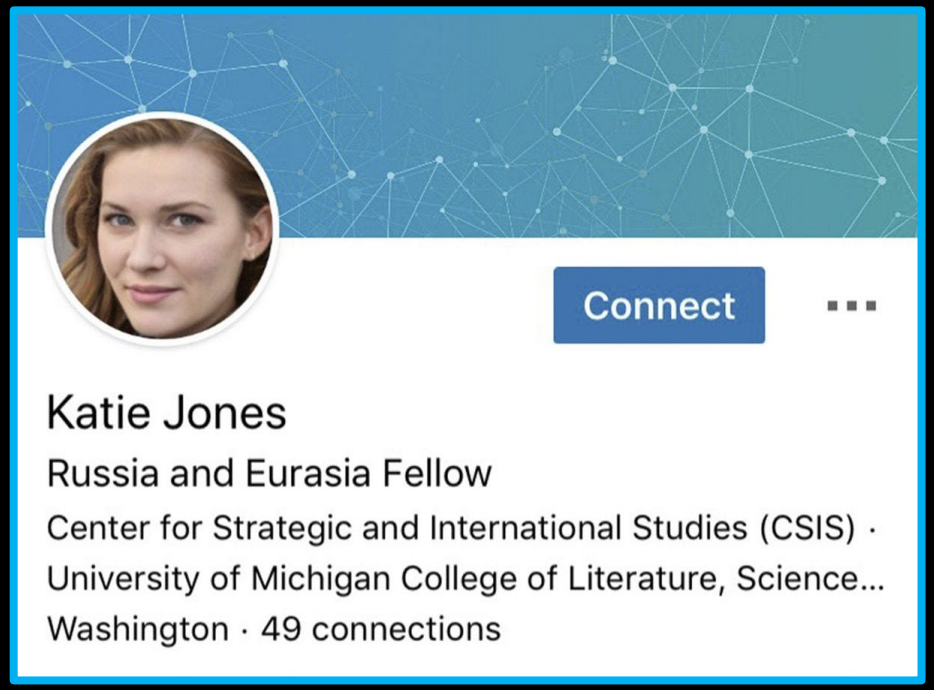
Motivation

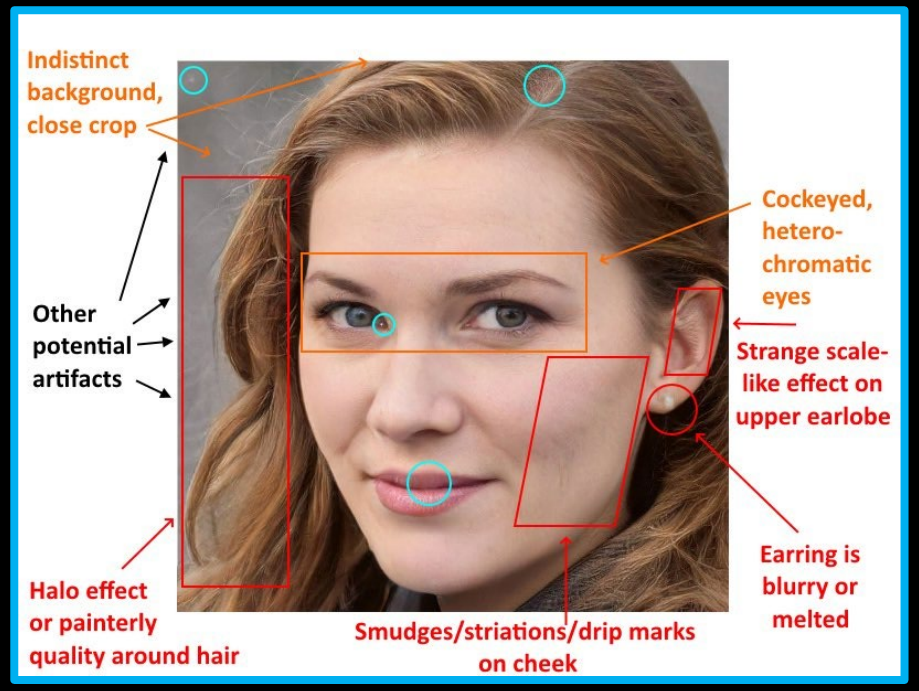
pix2pix / deep fakes – **Canny AI**, Imagine (2020)



Watch: youtube.com/watch?v=KHMNPjkd5-0

Fake identity for spying (article, 2019)





by Raphael Satter, journalist at Reuters, @razhael

"…The **fake profile**, given the name Katie Jones, **connected with a number of policy experts in Washington**. These included a scattering of government figures such as a senator's aide, a deputy assistant secretary of state, and Paul Winfree, an economist currently being considered for a seat on the Federal Reserve."

History of Fake images

“**Louis Daguerre, honoured** for his invention of the daguerreotype photographic process **by the French Academy of Sciences and the Académie des Beaux Arts in 1839**. But what about Daguerre’s contemporary Hippolyte Bayard, who had also been developing and refining his own form of photography?”

Self portrait as a drowned man, by Hippolyte Bayard (1840)

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"**The Government** which has been only **too generous to Monsieur Daguerre, has said it can do nothing for Monsieur Bayard**, and the poor wretch has drowned himself," reads the note on the back of the photograph. "Oh the vagaries of human life….!"

source

Self portrait as a drowned man, by Hippolyte Bayard (1840)

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- Photograph as **proof of reality**
- Manipulation as a **statement**

source

Generating fake images

This ____ doesn’t exist

thispersondoesnotexist.com

This ____ doesn’t exist

thispersondoesnotexist.com

thisjellyfishdoesnotexist.com

This ____ doesn't exist

thispersondoesnotexist.com

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This ____ doesn't exist

thishorsedoesnotexist.com

thispersondoesnotexist.com

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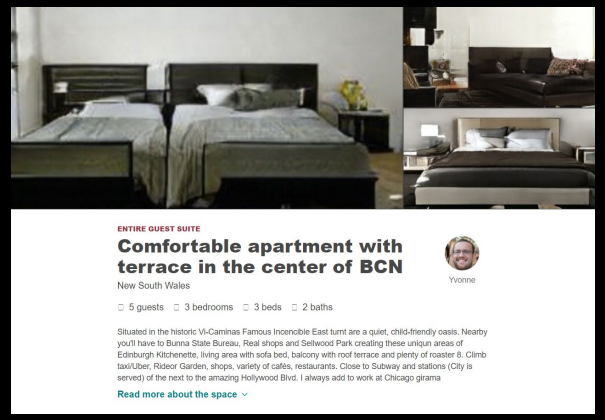
This ____ doesn't exist



thisrentaldoesnotexist.com

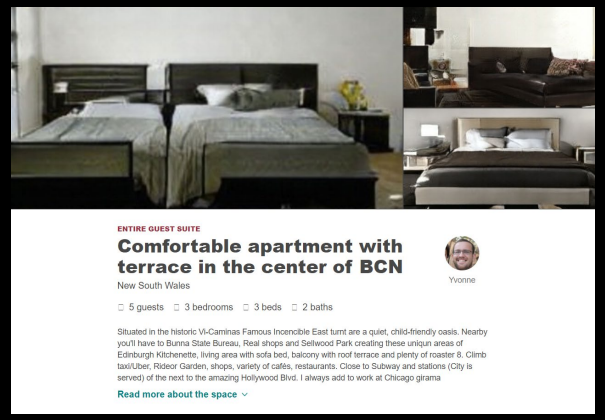
thishorsedoesnotexist.com

thispersondoesnotexist.com

thisjellyfishdoesnotexist.com

thischairdoesnotexist.com

This ____ doesn't exist



thisrentaldoesnotexist.com

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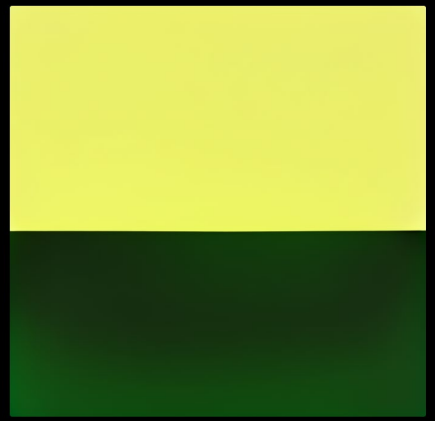
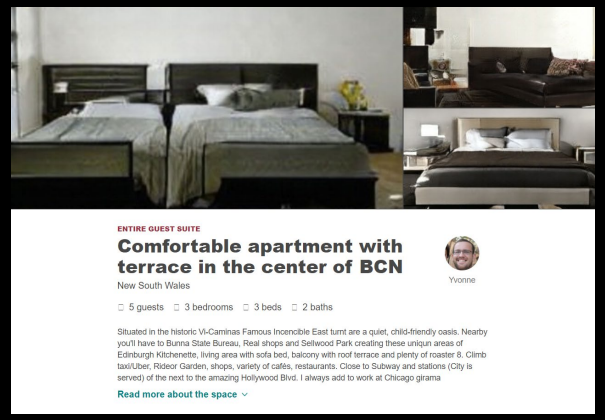
This ____ doesn't exist

thisflagdoesnotexist.com



The Flag of Lego



thisrentaldoesnotexist.com

thishorsedoesnotexist.com

This ____ doesn't exist

> thisxdoesnotexist.com <

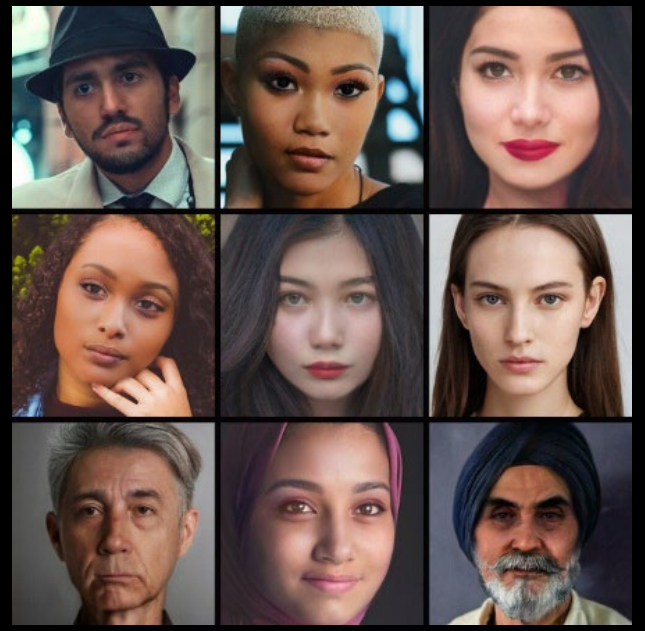
A list of all similar projects

What you do with it afterwards also matters …

Uncanny Valleys: Generative landscape
online gallery, 2019
postcards, generated videos, 3D printed

This ____ doesn’t exist

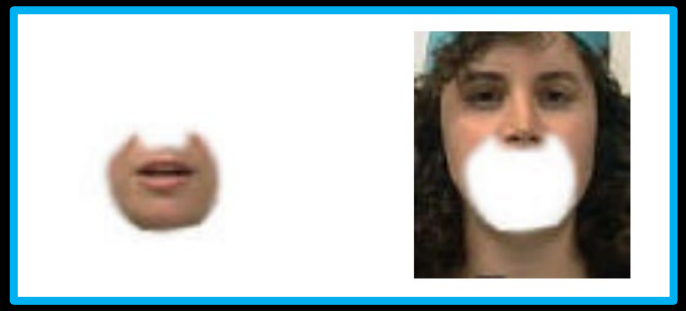
- This person doesn’t exist!
- This person does exist!



Humans of AI (2020)

- Generating more than just the face
- project

Realism over years

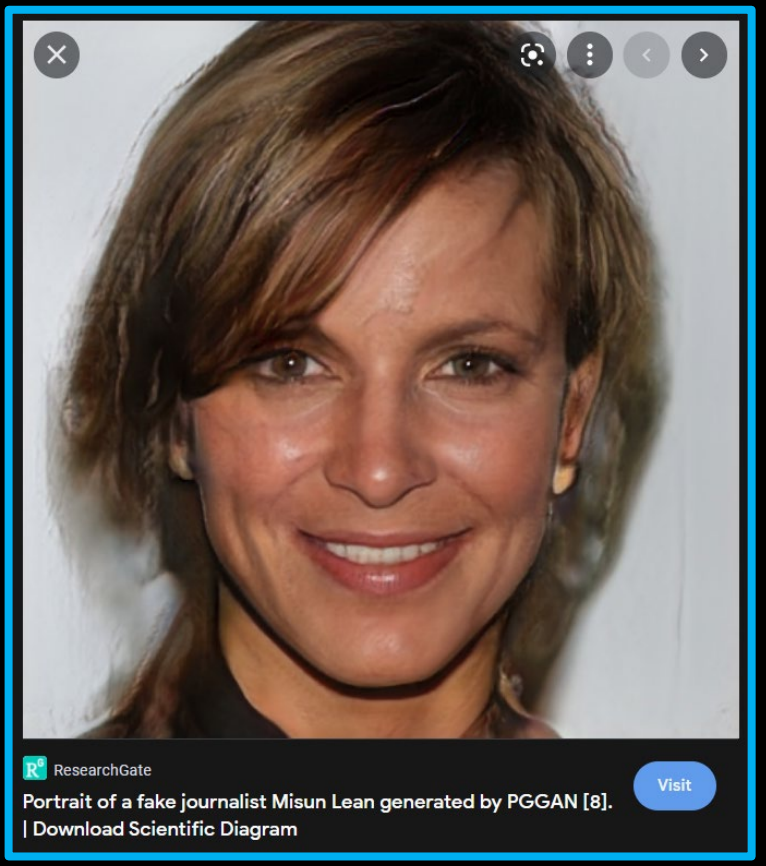


Early work from 1997!
The Video Rewrite program
(tracking points of mouth)

- Deep leaning models getting **more and more realistic**
  - DCGAN, Progressively Growing GAN, StyleGAN v1, v2, v3, …
  - *(In contrast: Generating the whole face)*

Fake identities

- These models have been used to **generate fake identities:**
  - Fake journalists
  - Fake attractive photos
  - Fake professional photo



[Fake News, Myths of out Time Generated journalist]

part of an art project (2018), openly described as a potential thread *(+ also generated imagery as a reflection to the society)*

Account from 2019, covered by Raphael Satter, journalist at Reuters, [@razhael]

Ben Collins
@oneunderscore_

Quick thread:

I want you all to meet Vladimir Bondarenko.

He's a blogger from Kiev who really hates the Ukrainian government.

He also doesn't exist, according to Facebook.

He's an invention of a Russian troll farm targeting Ukraine. His face was made by AI.

Ben Collins @oneunderscore_ · Feb 28
"Vladimir" has a whole backstory on the Ukraine Today website. He was an aviation engineer, until he was forced into blogging when Ukraine's aviation infrastructure "collapsed."

He also has weird ears, which is what happens when you make a face on ThisPersonDoesNotExist.com

The websites featured articles pushing Russian talking points like "Zelensky is building a neo-Nazi dictatorship in Ukraine" and "Why Ukraine will only get worse." As of Sunday night, the sites still featured the biographies and computer-generated faces of the columnists and linked out to their accounts on VKontakte, Russia's Facebook competitor.

Account from 2021, covered By Ben Collins, reporter for NBCNews, [@oneunderscore]

Control via attributes

- **Generative models which can be controlled via attributes** available in the dataset (conditional GANs)
  - One can take these attributes as a slider and change these for the generated face – for example: change age, change *gender**
  - **) But this is mostly what has been labeled in the dataset*

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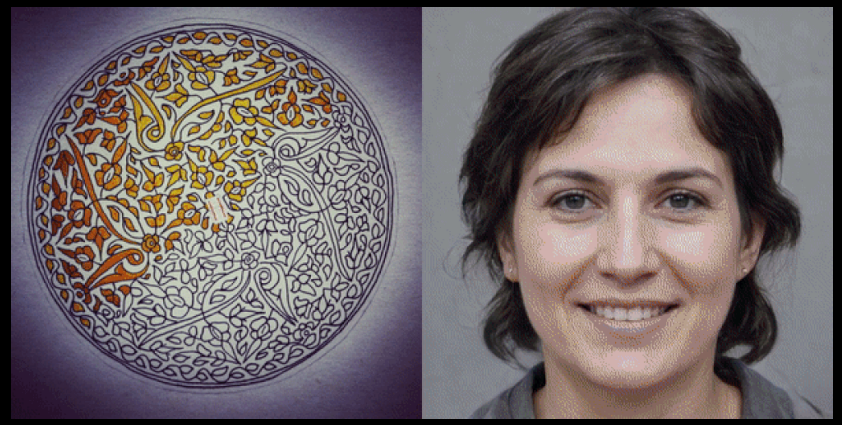
- With **projection**, one can embed a target (or your own) face into the model's space and edit it using these models



source

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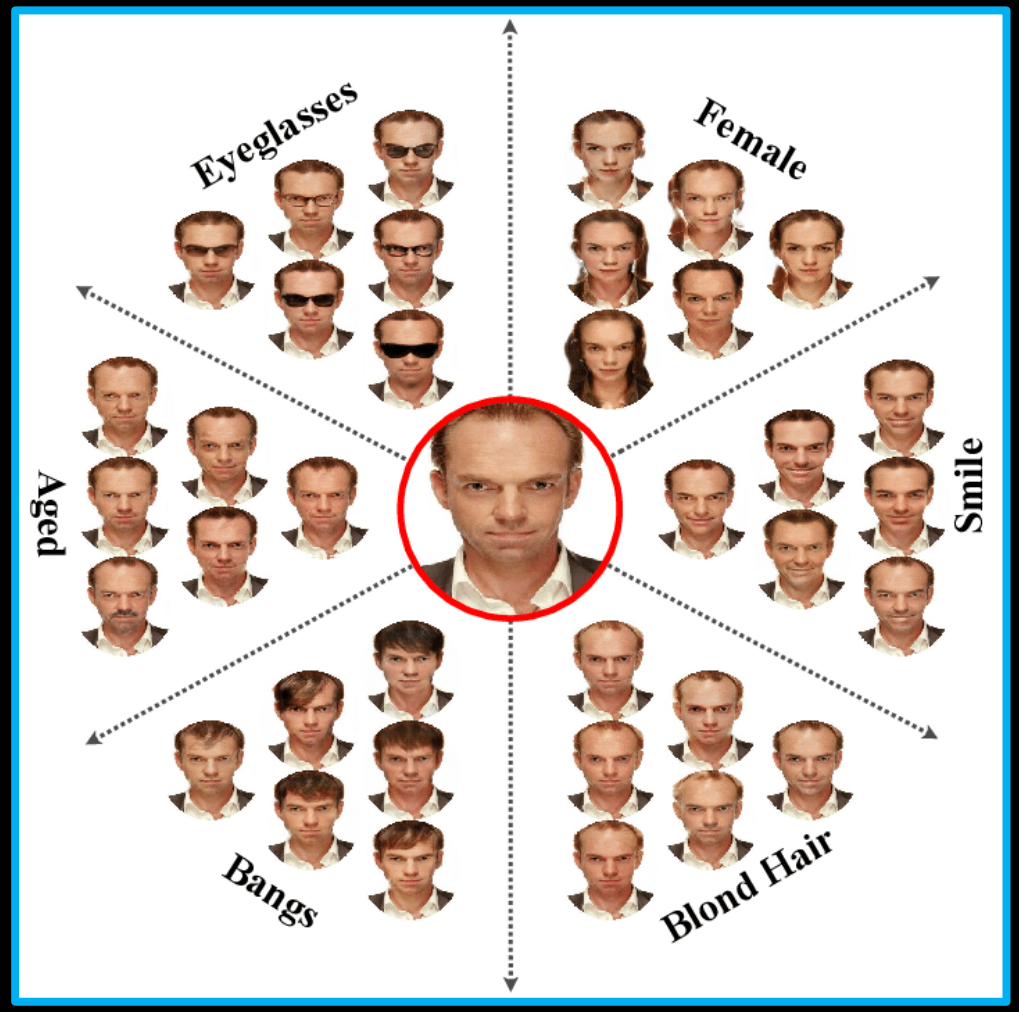
- With **projection**, one can embed a target (or your own) face into the model's space and edit it using these models
- *Note, there are applications which can do this, but there's always a **concern with sending one's likeness** with these*
  - *I'd recommend trying some online Colabs instead!*

Visual attribute vectors

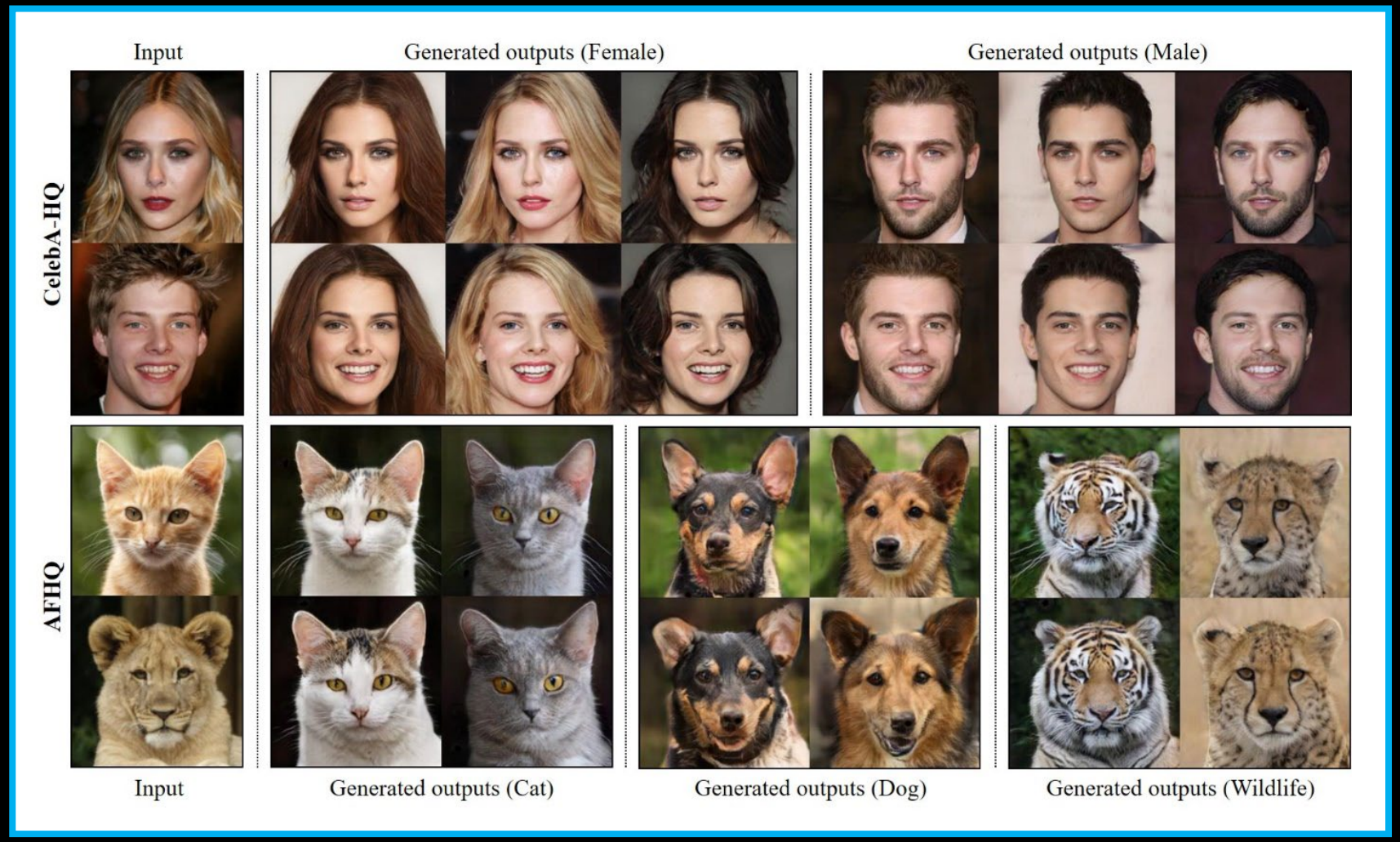


- **Visual attribute vectors:**
  - Eyeglasses vector
  - Smile vector
  - Blond hair vector
  - Bangs vector
  - Age vector
  - "Female" vector

- *PS: Heavily depends on what we labelled "smile", "blond" … or "female" …*

[2018] SMIT: Stochastic Multi-Label Image-to-Image Translation

StarGAN v2



[2020] StarGAN v2: Diverse Image Synthesis for Multiple Domains, code

Art project: Madam president

Madam President 2020 (pre-election) reimagines all of the US Presidents as females.

- project

DNA 2 Face

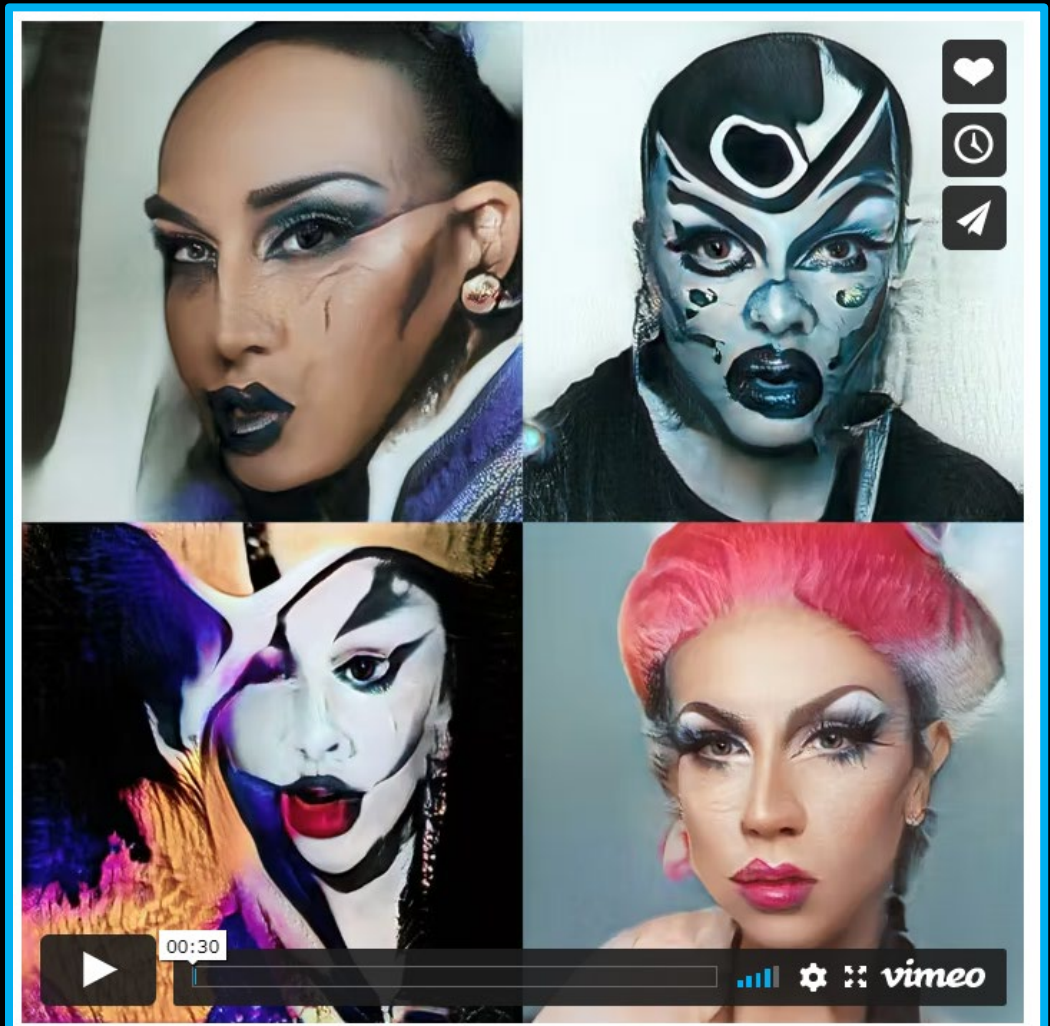
Chelsea Manning's face created by artist Heather Dewey-Hagborg

- DNA 2 Face as a forensics analysis software
- From randomly found (and also targeted) DNA samples recreated corresponding faces
- Press: the Guardian, NY Times

"Feeding in those different parameters, I could generate random variations of Chelsea's face within a prescribed typology," Dewey-Hagborg told the Guardian.

The technique is the same controversial process of "forensic DNA phenotyping" that is increasingly being used by police departments to produce likenesses of suspects. The artist's work is conceived partly as a **critique of the phenotyping itself as a form of policing**.

Zizi - Queering the Dataset



Zizi: Queering the Dataset 2019, 30 second extract of single channel

- Art project playing with gender of the faces
- Perhaps these models and datasets can be used for more than propagating bias…
  - *“Made by disrupting these systems* and re-training them with the addition of 1000 images of drag and gender fluid faces found online.”*
- Project: https://www.jakeelwes.com/project-zizi-2019.html

*) PS: now it’s a good time to take a pause

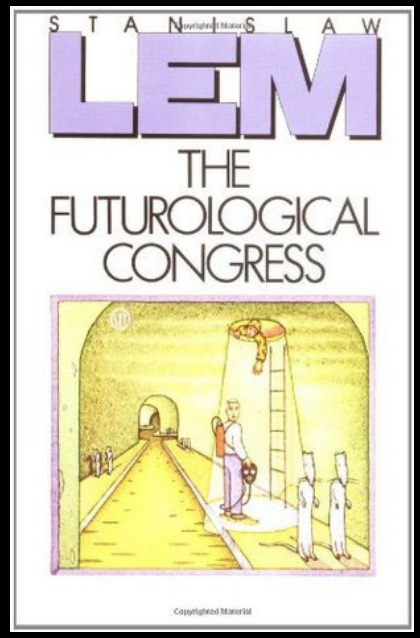
Generating fake videos

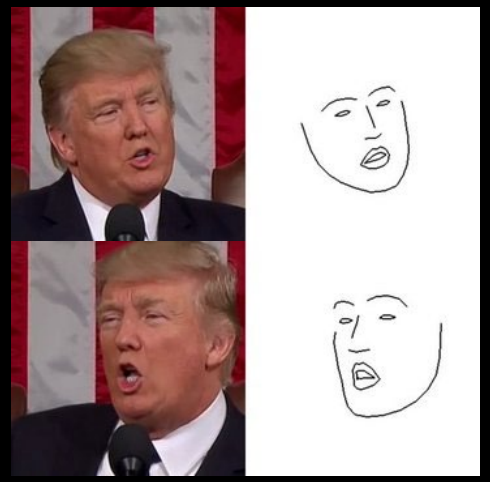
Video

- **Believability**: People are even more likely to believe a video, than a photograph
- Possible **usage in film industry**

“De-aged” examples:

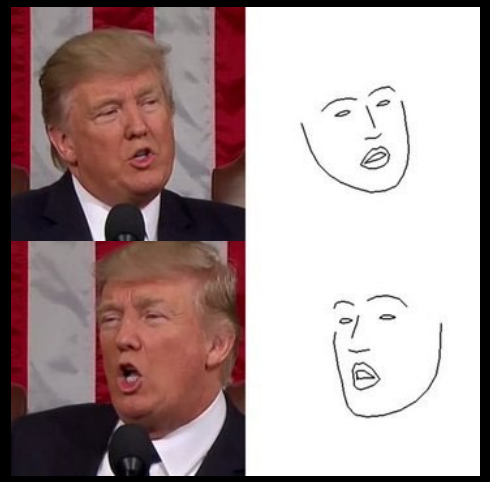
Film: **The Congress**
(2013)





First adapted models

Gene Kogan’s - Meat Puppets (2017), **pix2pix**
https://twitter.com/genekogan/status/857922705412239362



First adapted models

Gene Kogan's - Meat Puppets (2017), **pix2pix**
https://twitter.com/genekogan/status/857922705412239362

"**CycleGAN** Face-off (2017)" (Project)

- CycleGAN allows unpaired faces

Advanced models

First Order Motion Model for Image Animation (2019)
https://github.com/AliaksandrSiarohin/first-order-model

Needs:

- Driving video for **motion**
- Single image for the **face**

Follow-up research:
Motion Representations for Articulated Animation (2021)

Alongside an exhibition

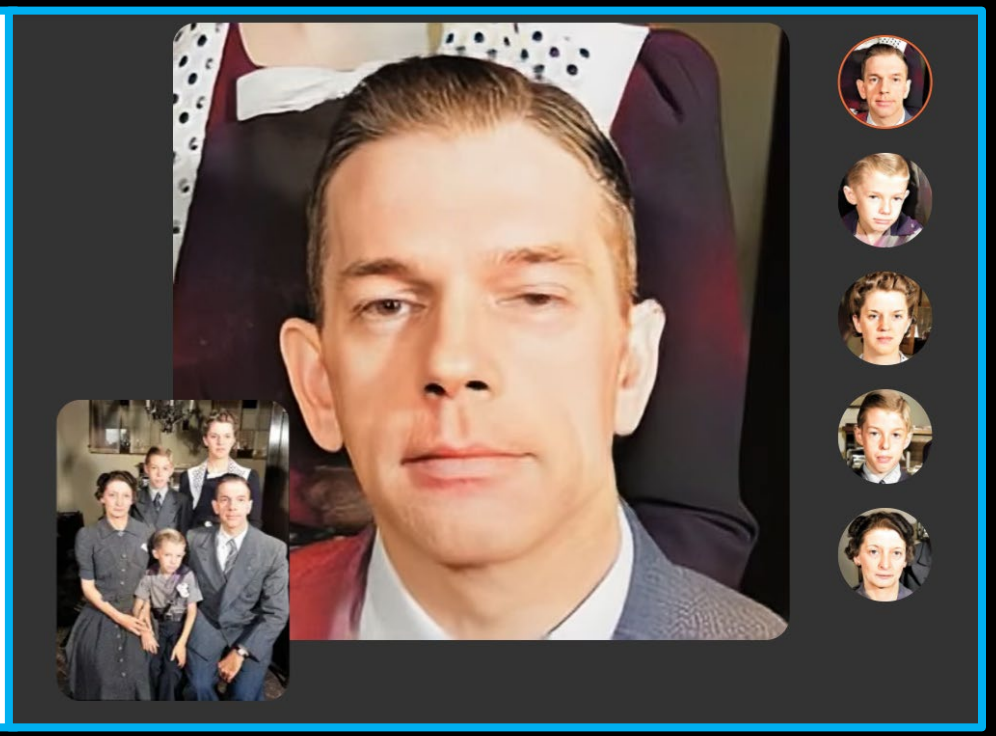
“Dalí once said: *“Si muero, no muero por todo,”* or *“If I die, I won’t completely die.”* Thirty years after his death, his words take on a new meaning at The Dalí Museum in St. Petersburg, Florida. "Dalí Lives" uses artificial intelligence to let visitors experience his bigger-than-life personality in an up close and personal way.”

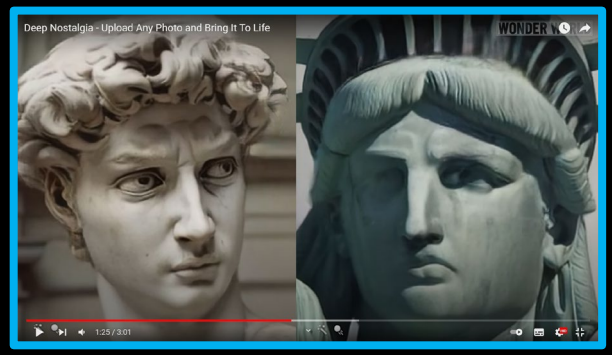
Dalí Lives – Art Meets Artificial Intelligence. (2019)

Likely process:

- *Actor performance*
- *With AI swapped faces*

Deep Nostalgia



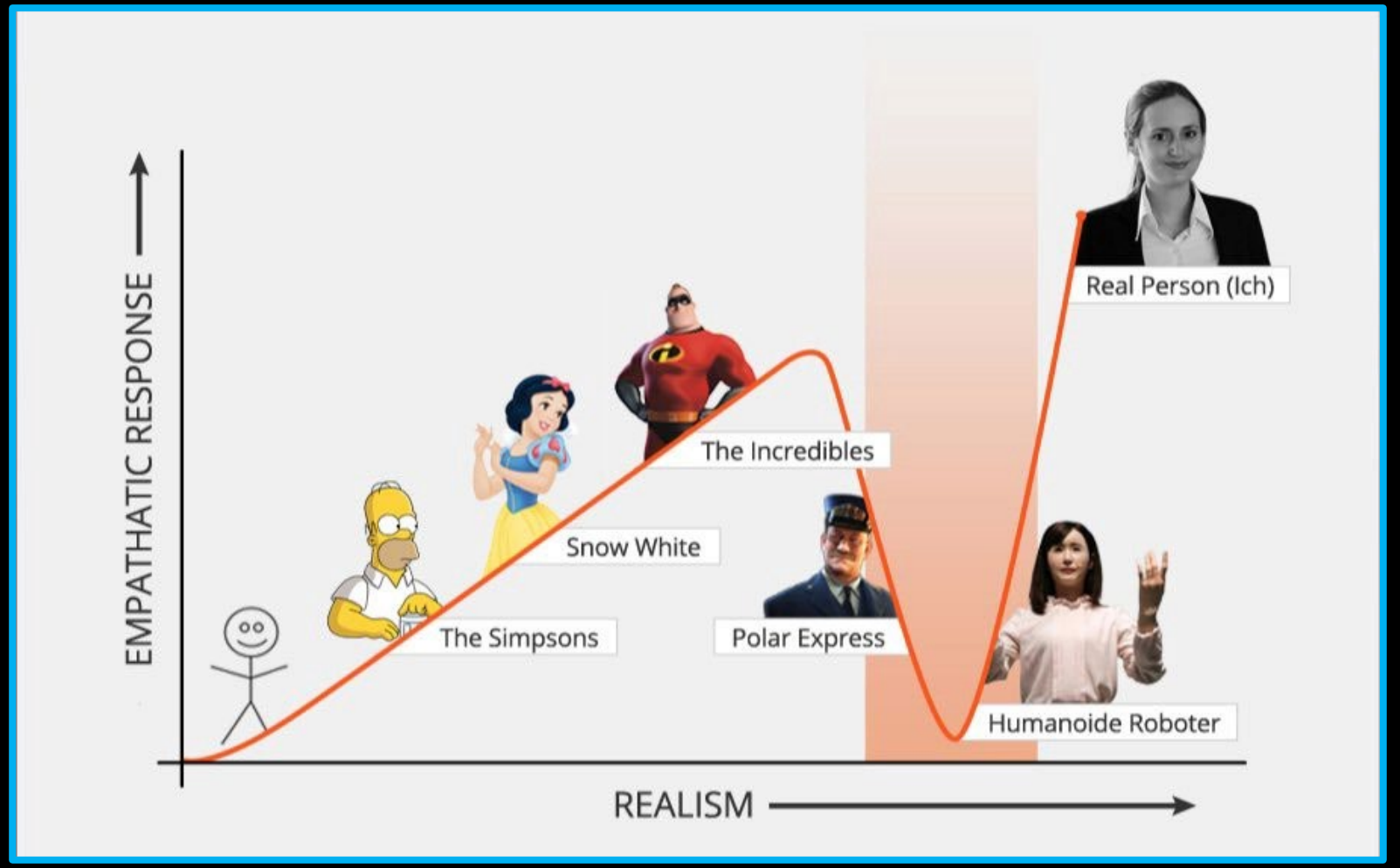


Company offering:

- Animating your relatives from old photographs
- Website: myheritage.com/deep-nostalgia

Likely process:

- *Actor performance*
- *With AI swapped faces*


EMPATHATIC RESPONSE
REALISM
The Simpsons
Snow White
The Incredibles
Polar Express
Real Person (Ich)
Humanoide Roboter

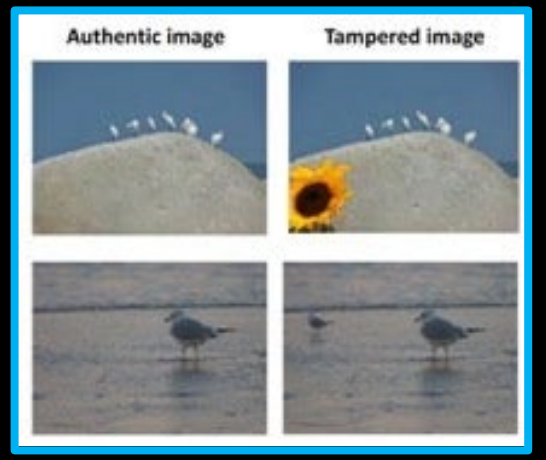
Detection

Intuition

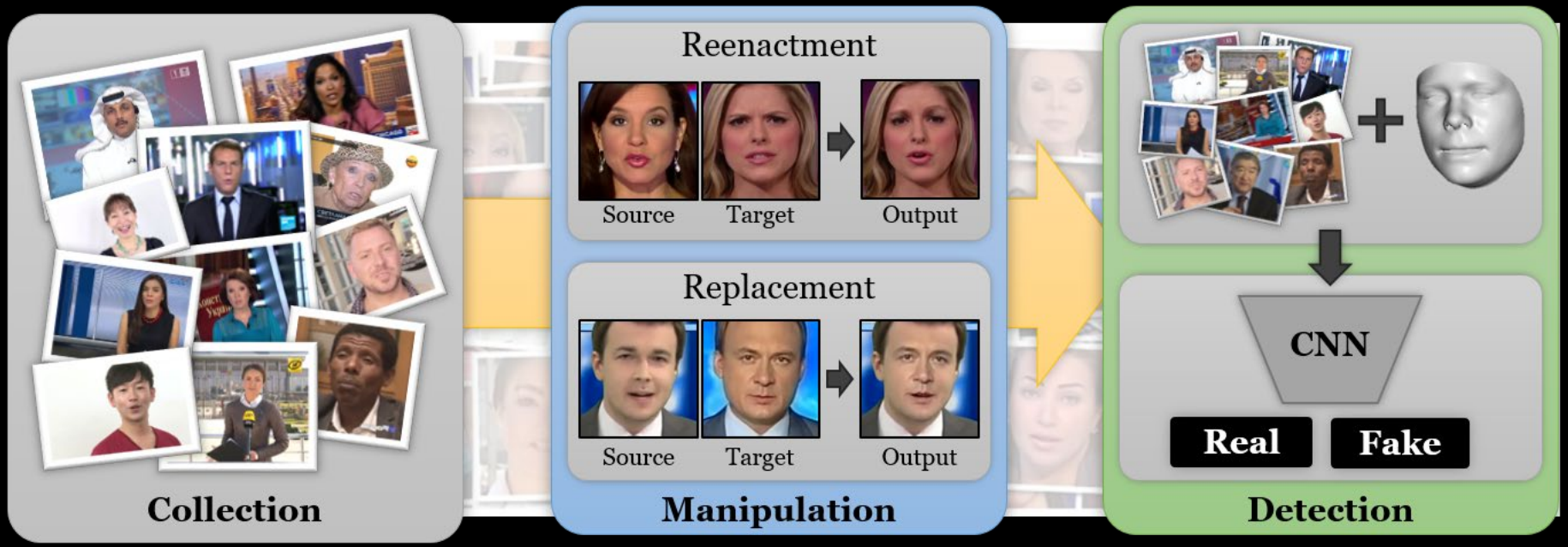
- Generated images tend to have **specific noise**, almost like **tell-tale glitches and patterns**
- After working with GANs for a while you will also begin to see these
  - Some linked to particular model versions
  - StyleGAN v1 had strange **blobs** for example:
  - Most of GANs have **ripples** due to the Convolutions in the models

Detection as a task

- Could this detection be done automatically?
- Train a **ML model to detect ML generated images**?
  - Theoretically it's a simple classification task
  - Theoretically even when training a GAN, we have a Discriminator determining real/fake labels
- Detecting wide array of **manipulations**

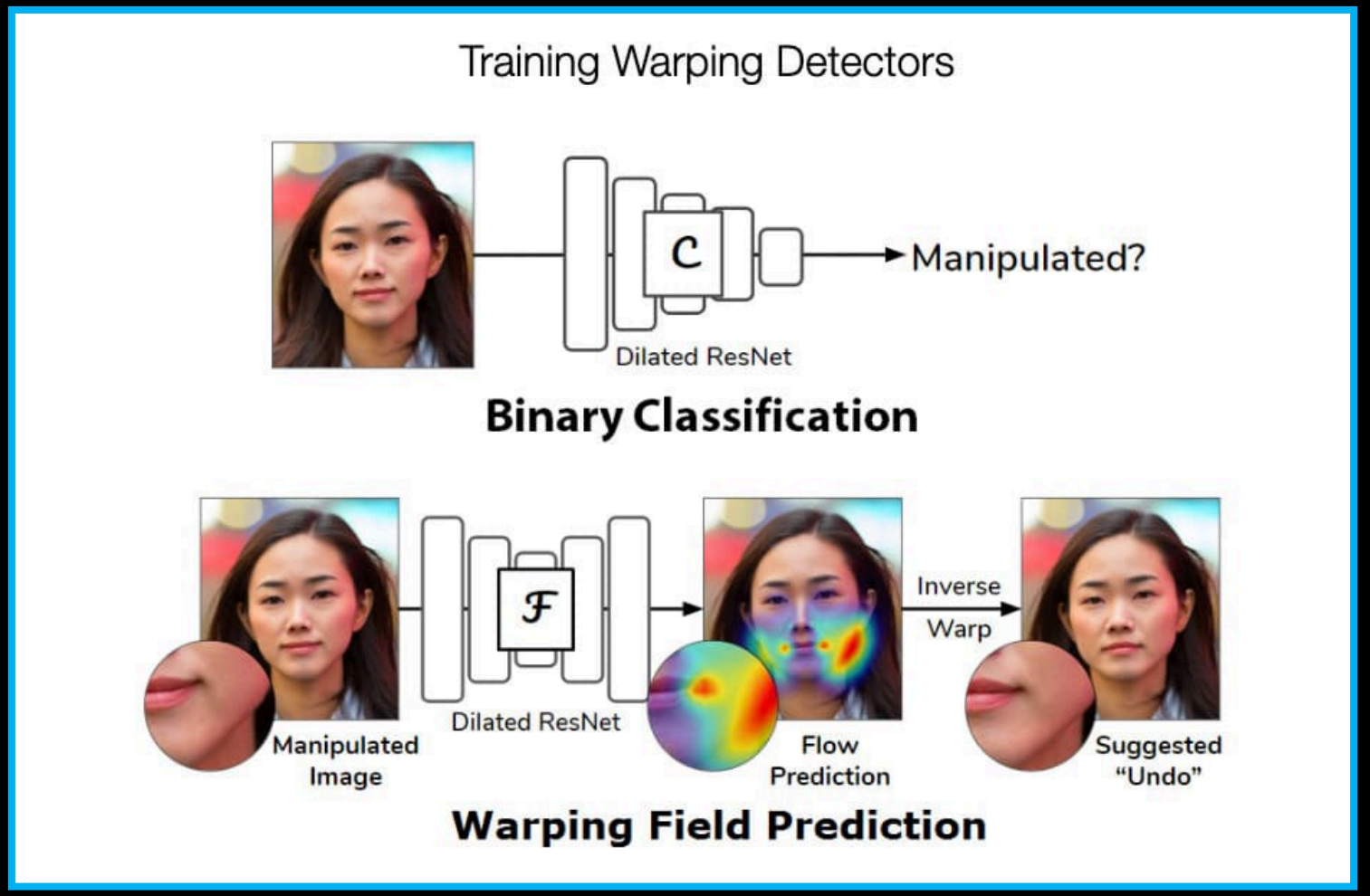


Research in the area



- There are datasets and active research in this area – because there's a real danger in not detecting fake identities
  - Dataset: github.com/ondyari/FaceForensics/tree/master/dataset

Software



- Proposed as a tool for Adobe Photoshop
  - Adobe Research article (2019), on fxguide
  - **Research** here and here

Examples

Generated identities

(we already talked about generated identities which were made to **give more credibility to social network accounts**)

Generated identities

- **Politicians**, a usual target for **mockery** with these models, but also a **dangerous** area
  - Can a video of a politician's statement be trusted?
  - How can it be verified in the media that someone's footage is real?

  - *{Are we living in post-real world?}*

The dark side of deepfakes

- Sadly, pornography, wide spread of this at the start. Very obviously very dangerous – regardless of the fidelity of the models, it can cause large amounts of harm!
  - These videos got later banned …

The dark side of deepfakes

- Same technology, but **safe for work examples:**
  - Actor replacement between movies (enough data online)
  - Slightly less malign examples of these methods…
  - **Use this as a lesson:** Notice what works and notice what doesn't on these videos

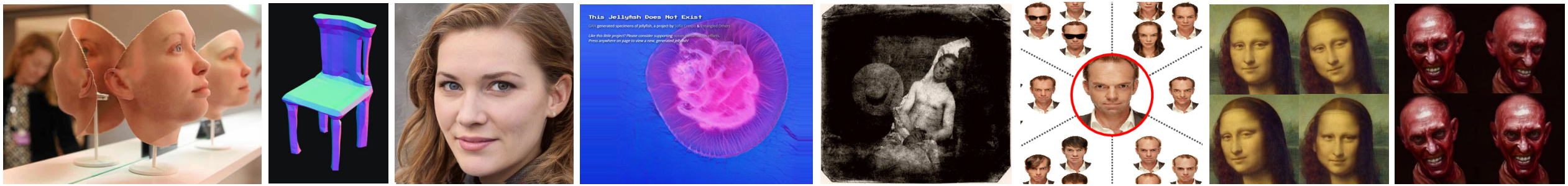
Links: video collage, r/deepcage/ community

Summary from the lecture

- **Deepfakes**:
  - Methods to **generate fake images (GANs)** and **fake videos**
  - Methods to **detect manipulated data (classification)**
  - **Examples in news (attempts of misinformation), artworks (both in revealing these problems and manipulation of face datasets)**

AI for the Media

Week 9, DeepFakes



Practical: Deep Nostalgia recreation

11.3.2022 / UAL-CCI

~ Vít Růžička

First Order Motion Model for Image Animation

Target **face**

Source **video** (motion)

First Order Motion Model for Image Animation

Needs:

- Get a **source data** of movements / expressions
  - source video – your own made!
- And a **single photo of the target face**
  - Hopefully not very harmful! (low fidelity) **but please keep this in mind when working one these projects**
- Can even be playful, ex: animating Mona Lisa

Possible suggestion, getting a generated face from **artbreeder**:

Example: artbreeder.com/i?k=65aeb101d7c882d81225

Target **face**

Result video

Source **video** (motion)

https://www.artbreeder.com/i?k=cc4903632bd13c1cc7fc7178408c

https://www.artbreeder.com/i?k=920ce5b3373a70bff383d60ed7a5

https://www.artbreeder.com/i?k=6201da4167cd151cfb8f9b22c5f9

https://www.artbreeder.com/i?k=922c26efd402d232a116956fc8c4

https://www.artbreeder.com/i?k=f0ea6fcb50bb0282ae37b895f8f8

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https://www.artbreeder.com/i?k=9564cfb30bf1d5a6341f0ea6a2cb

https://www.artbreeder.com/i?k=6ec5463f6e28941750a2

Links

Starter code:
w09_DeepNostalgieRecreation_with_first_order_model_(2019).ipynb

Interaction

Copy your results here:
https://docs.google.com/document/d/1tVVIJRtB9dRuBdIp3tY_xj3uK2H63vIrVay2mJ6jskA/edit?usp=sharing

The end