TechCheck Slide

- Live-Demonstrations Running?
- Audio Sharing activated? *
- Microphone checked?
- Camera checked?
- Light Conditions checked?

* essential for virtual conferences

TNG TECHNOLOGY CONSULTING

AS SEEN ON TV

Pushing Deepfakes to the Limit

Fake Video Calls with AI

TNG TECHNOLOGY CONSULTING

AS SEEN ON TV

When a new technology like this comes along, the most dangerous period is when the technology is out there but the public isn't aware of it. That's when it can be used most effectively.

Carl Bergstrom
University of Washington

Speakers

Thomas Endres

Partner

Oracle® JavaOne Rockstar
Intel® Black Belt Software Developer
Intel® Software Innovator
Intel® Top Innovator 2014 - 2019

Martin Förtsch

Principal Consultant

Oracle® JavaOne Rockstar
Intel® Black Belt Software Developer
Intel® Software Innovator
Intel® Top Innovator 2014 - 2019

Jonas Mayer

Senior Consultant

Bedroom DJ
Teakwondo Black Belt
GameStar Certified Hacker
Intel® Software Innovator

Our Story

The Evolution of Deepfakes

Evolution of Deepfakes

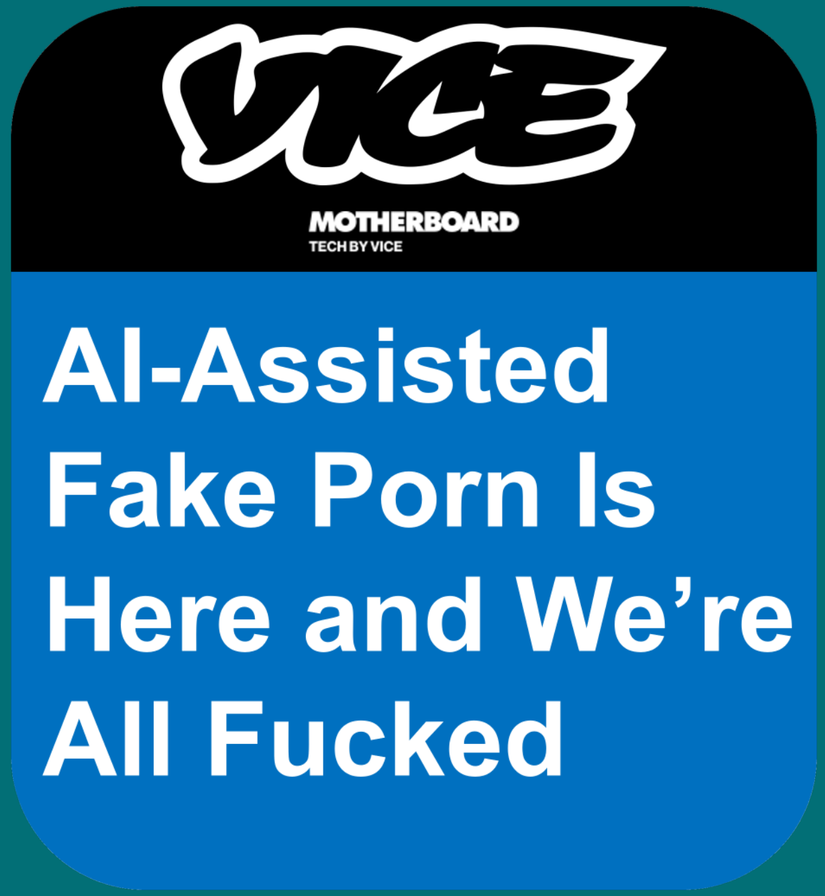
First Deepfake Videos Were Published on Reddit in Autumn 2017

Evolution of Deepfakes

First Deepfake Videos Were Used for NSFW-Videos

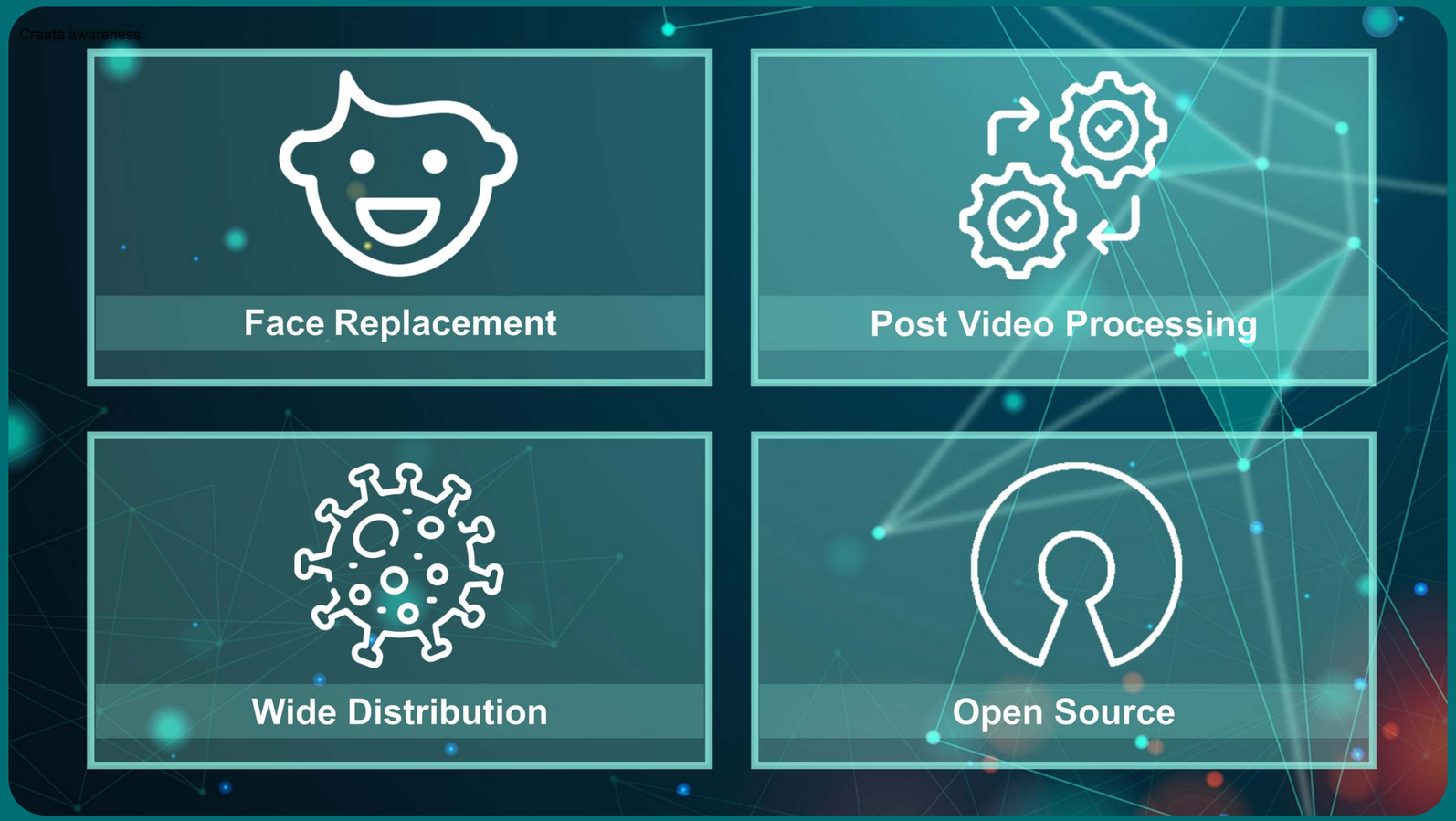
Evolution of Deepfakes

First News Article on Deepfakes at VICE Motherboard in Spring 2018



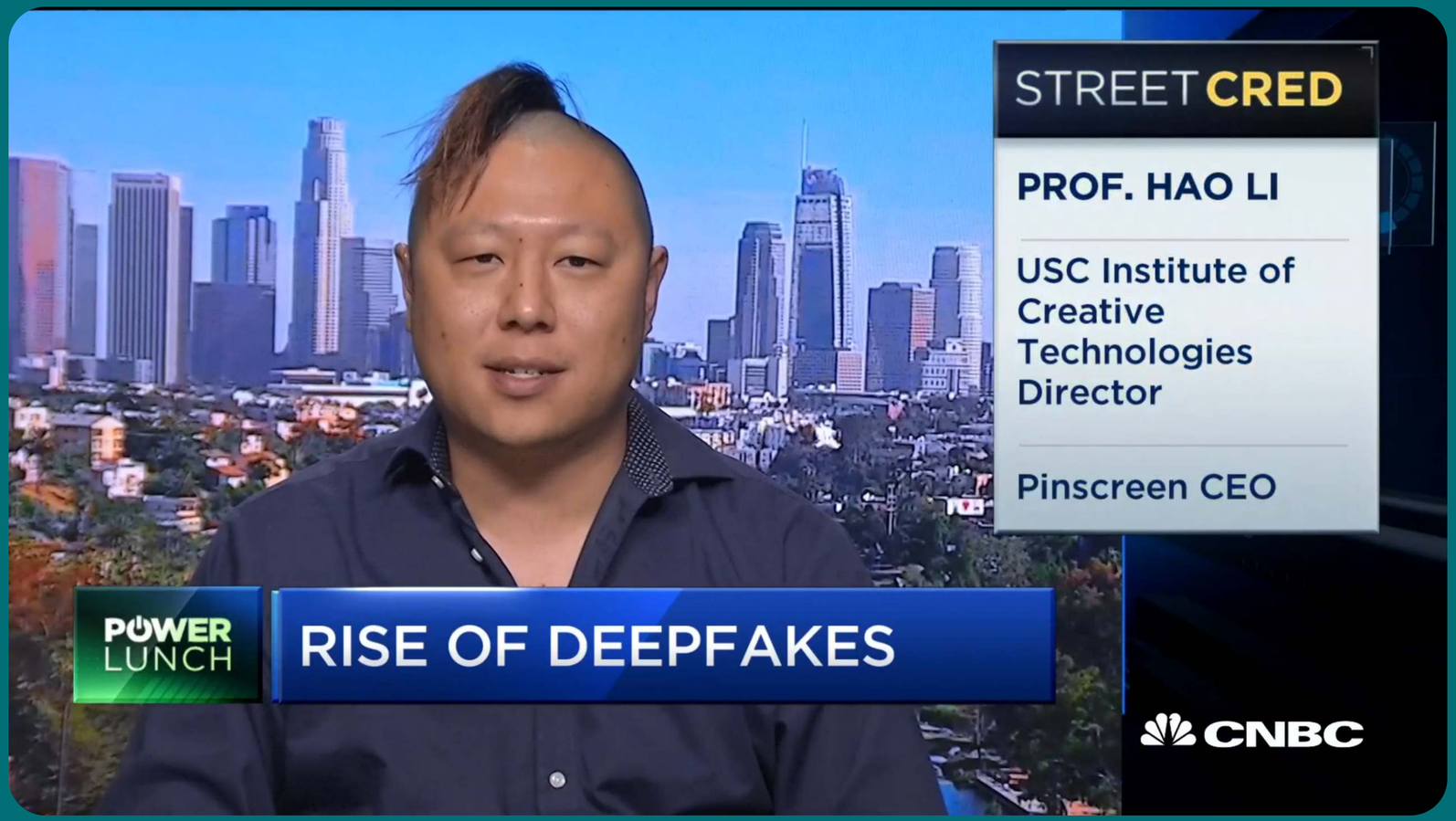
Evolution of Deepfakes

DeepFaceLab Published on GitHub (2018)



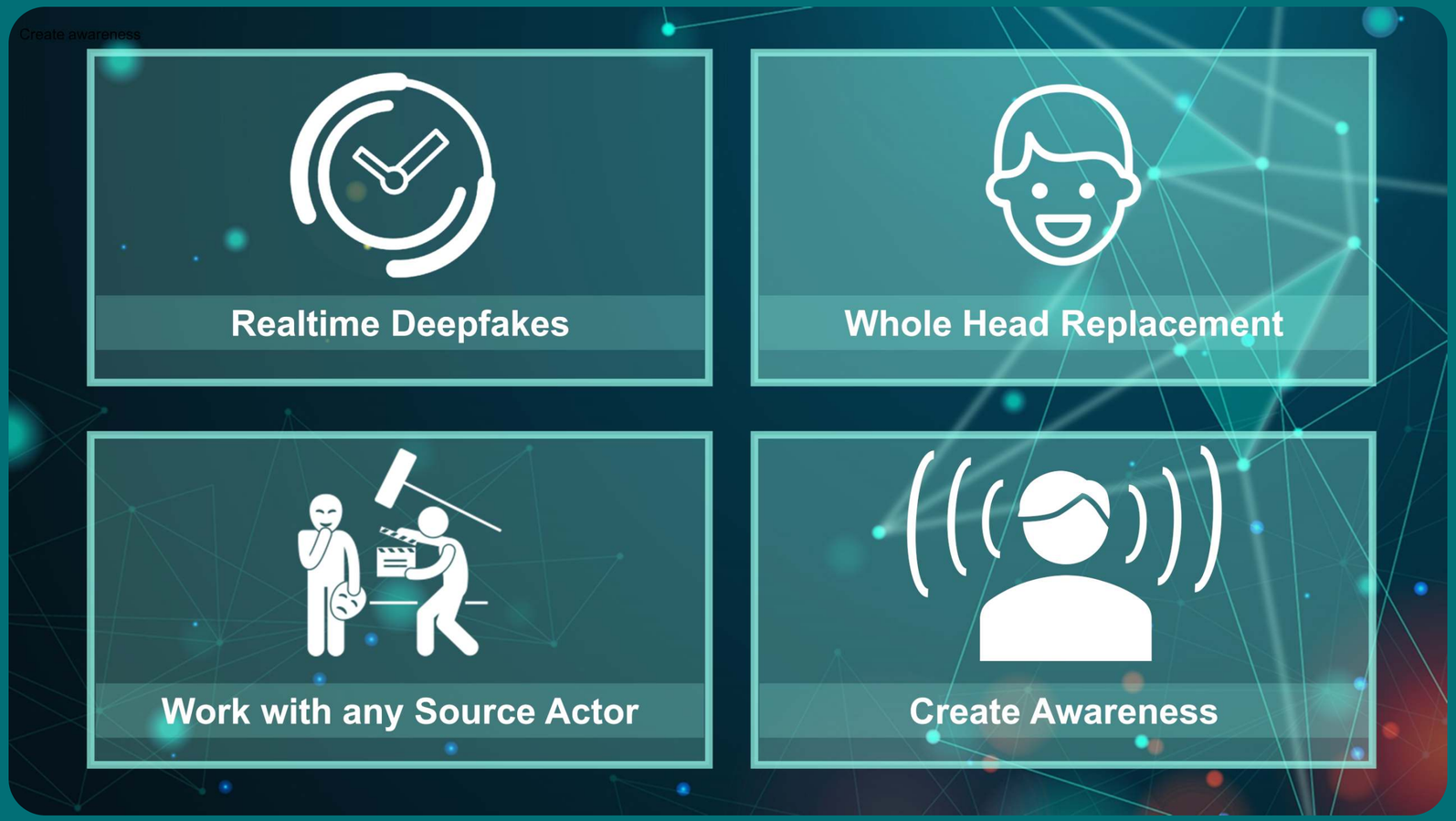
Evolution of Deepfakes

"Perfectly Real" Deepfakes Will Arrive in 6 Months to a Year (2019)



Realtime Deepfakes

The Motivation behind Deepfakes 2.0 (2019)

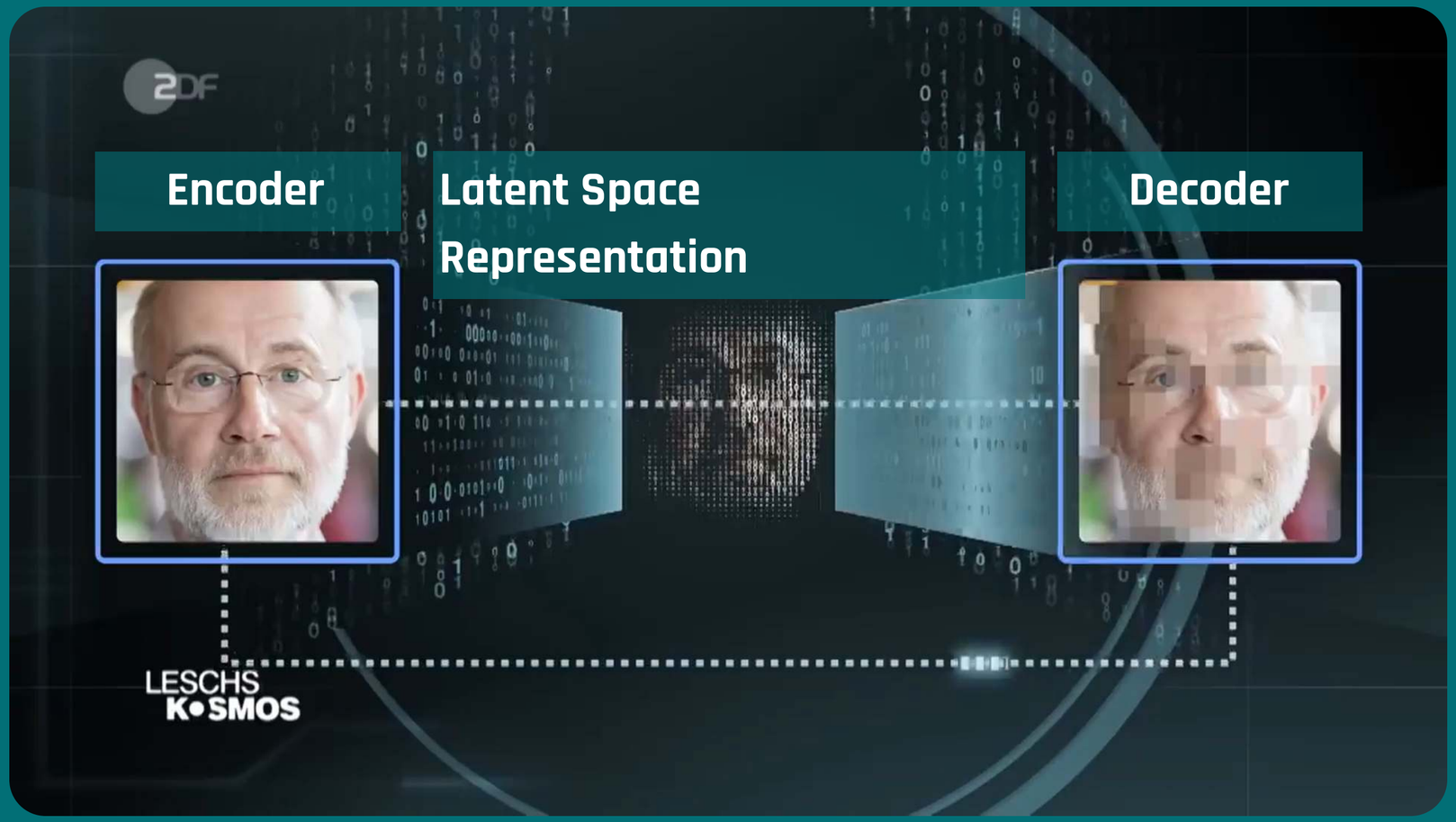


Agenda

- ▶ Deepfakes in a Nutshell
- ▸ Realtime Deepfakes
- ▸ Pushing Deepfakes to the Limit
- ▸ Videocalls with Deepfakes
- ▸ Conclusion

Deepfakes in a Nutshell

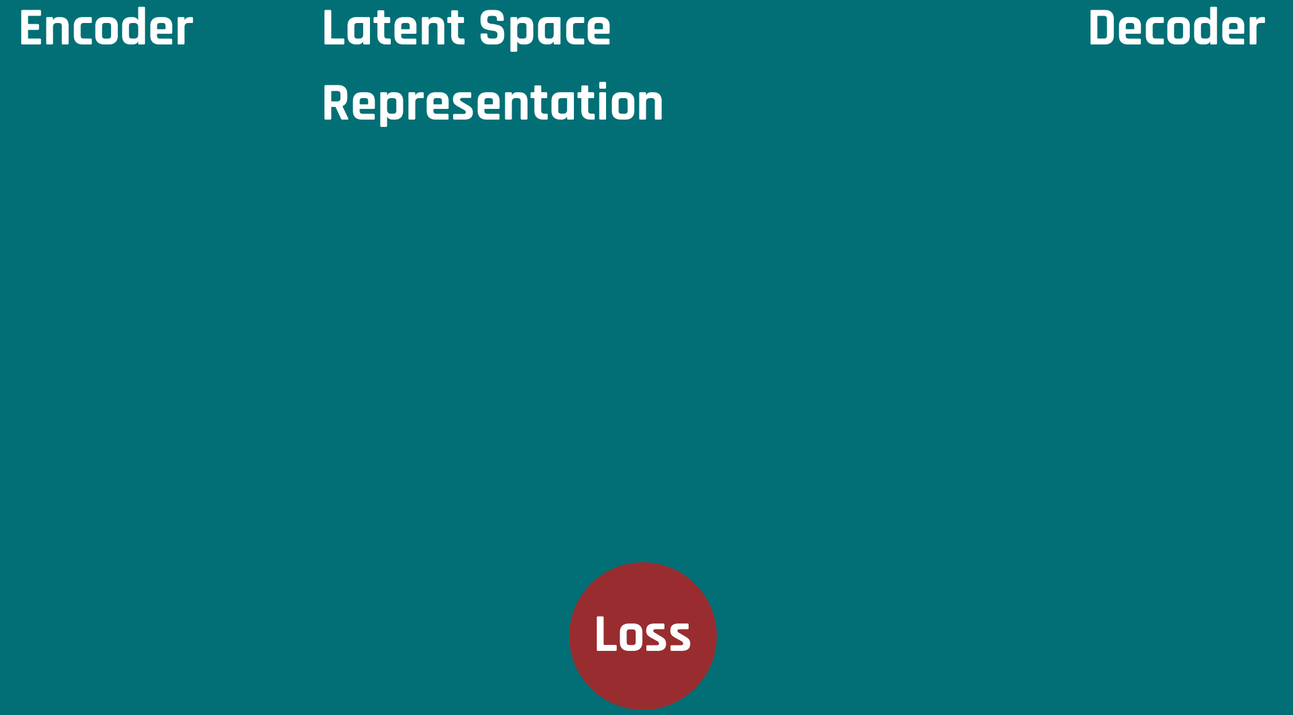
Training Encoder and Decoder on Harald Lesch



https://www.youtube.com/watch?v=ItTvXIM4cjE

Deepfakes in a Nutshell

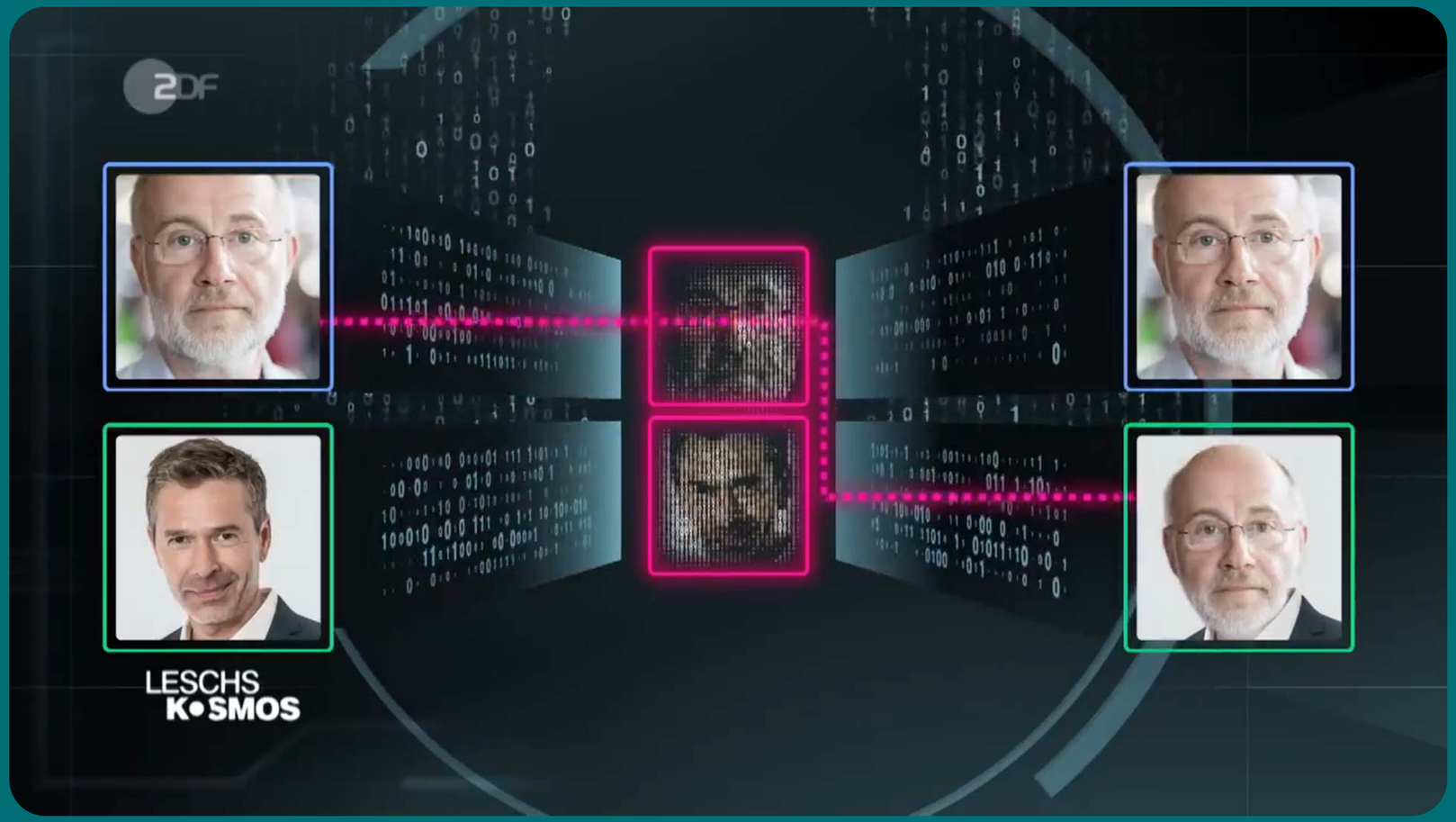
Loss Function Helps to Improve Generated Decoder Results



https://www.youtube.com/watch?v=ItTvXIM4cjE

Deepfakes in a Nutshell

Use Face Encoder but Different Face Decoder



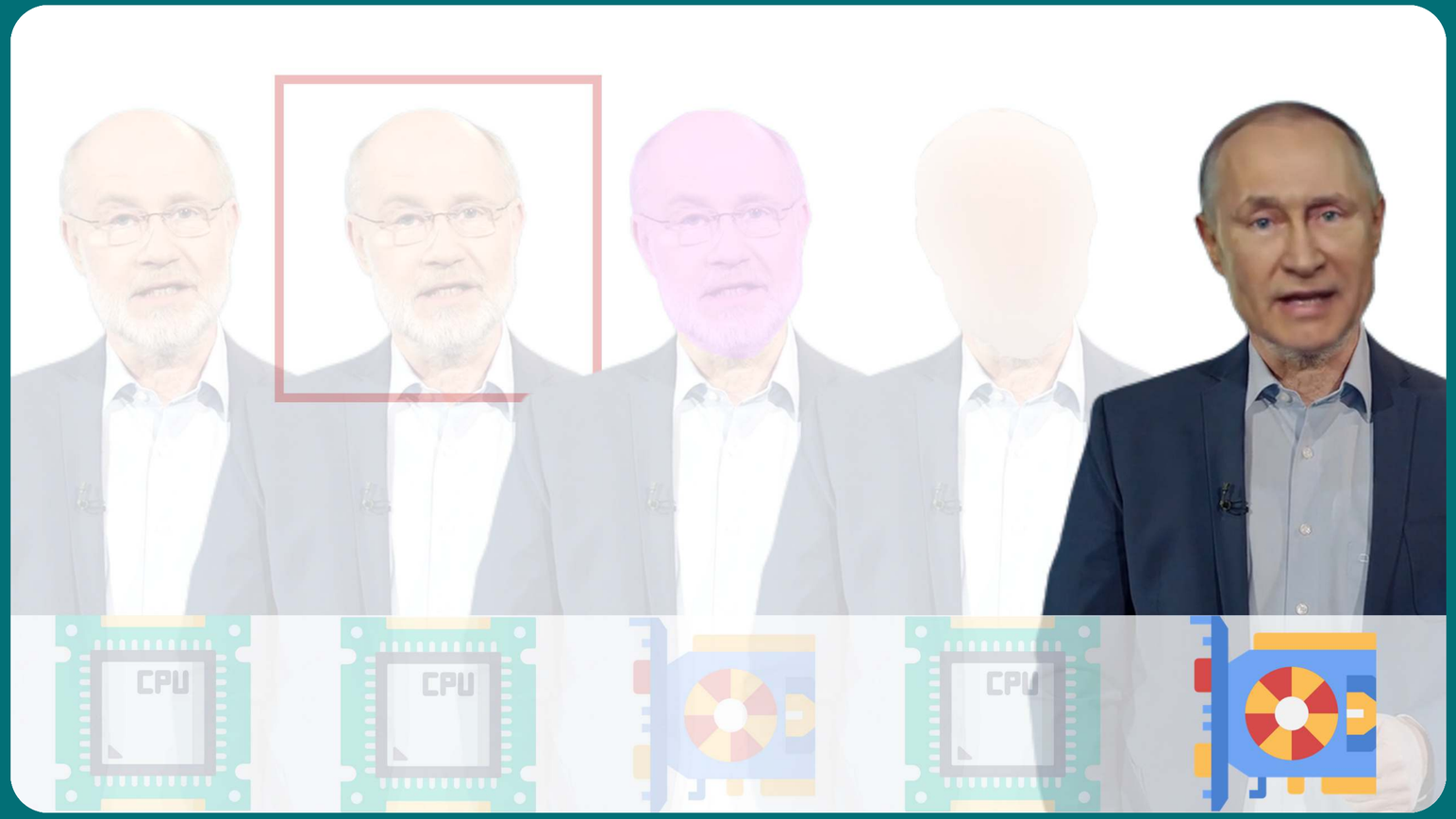
https://www.youtube.com/watch?v=ItTvXIM4cjE

Agenda

- Deepfakes in a Nutshell
- **Realtime Deepfakes**
- Pushing Deepfakes to the Limit
- Videocalls with Deepfakes
- Conclusion

Realtime Deepfakes

Inference Workflow with TNG Realtime Deepfakes 2.0

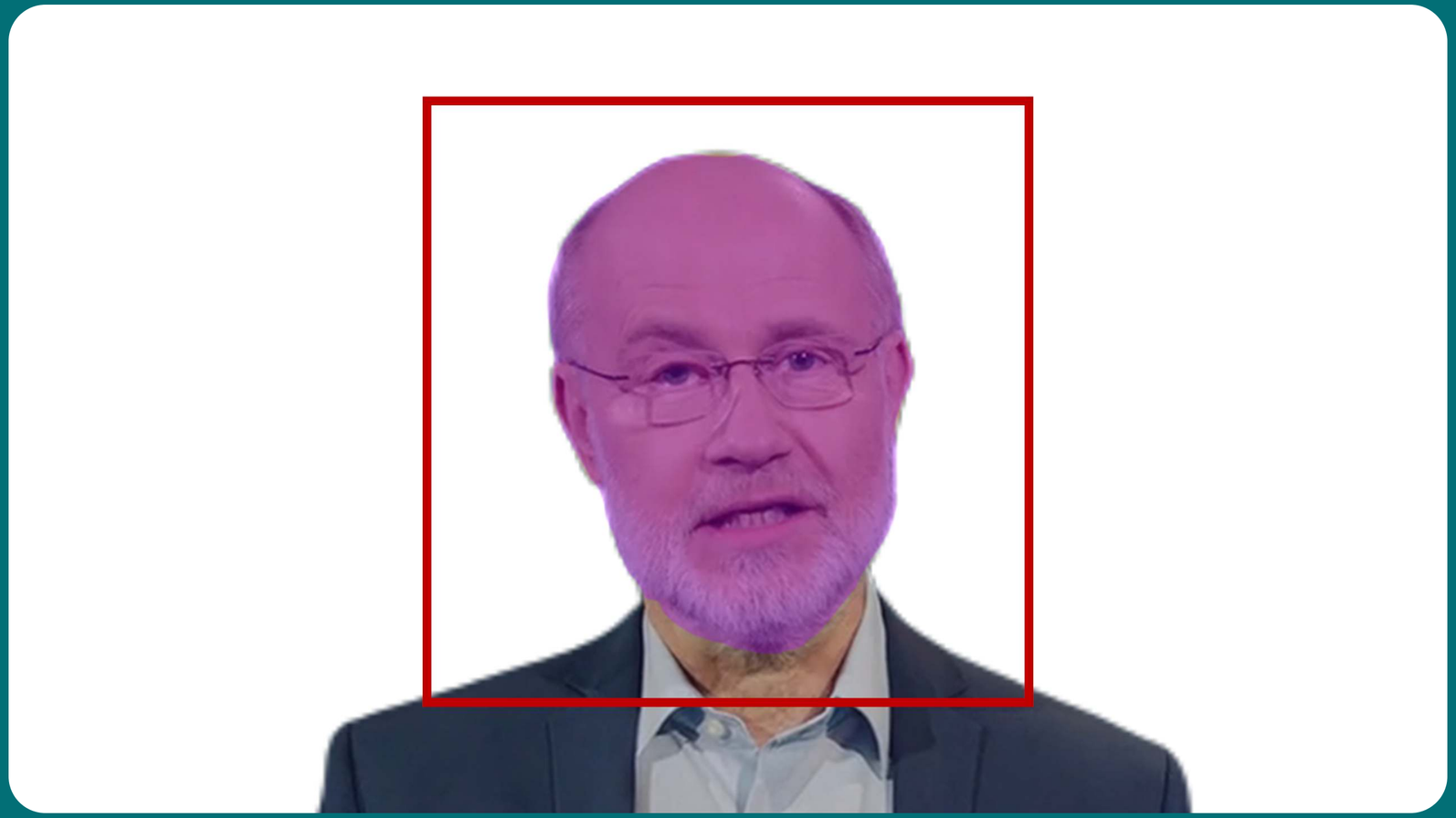


Realtime Deepfakes

Fast Face Detection Demo

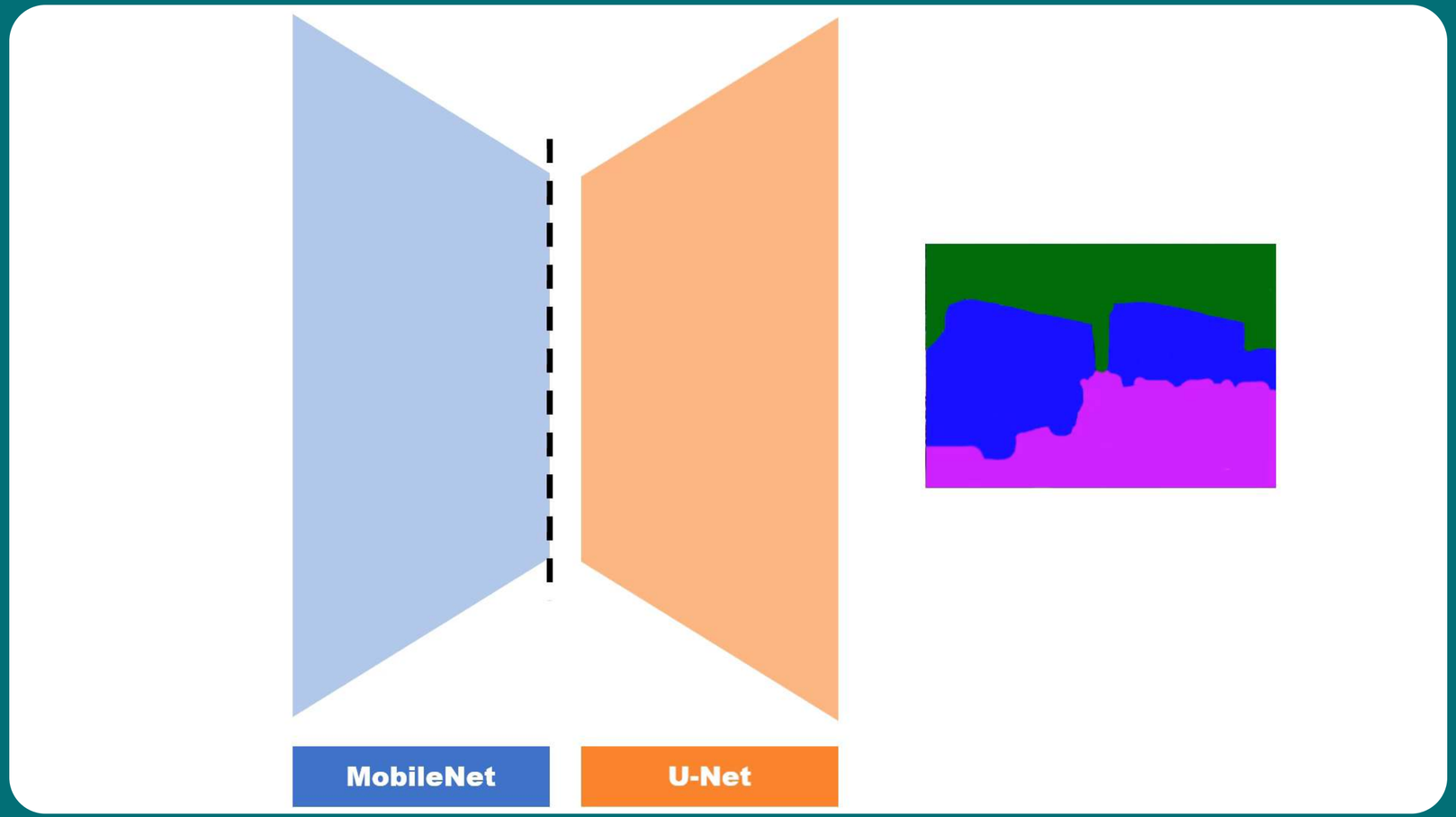
Realtime Deepfakes

Face Segmentation Demo



Realtime Deepfakes

Transfer Learning for Face Segmentation



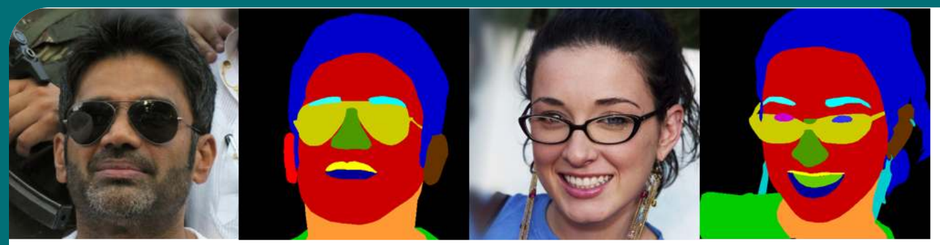
Realtime Deepfakes

Segmentation Dataset: CelebAMaskHQ

https://github.com/switchablenorms/CelebAMask-HQ

Realtime Deepfakes

Segmentation Dataset: CelebAMaskHQ



Eyeglasses

Earring

Cloth

Hat

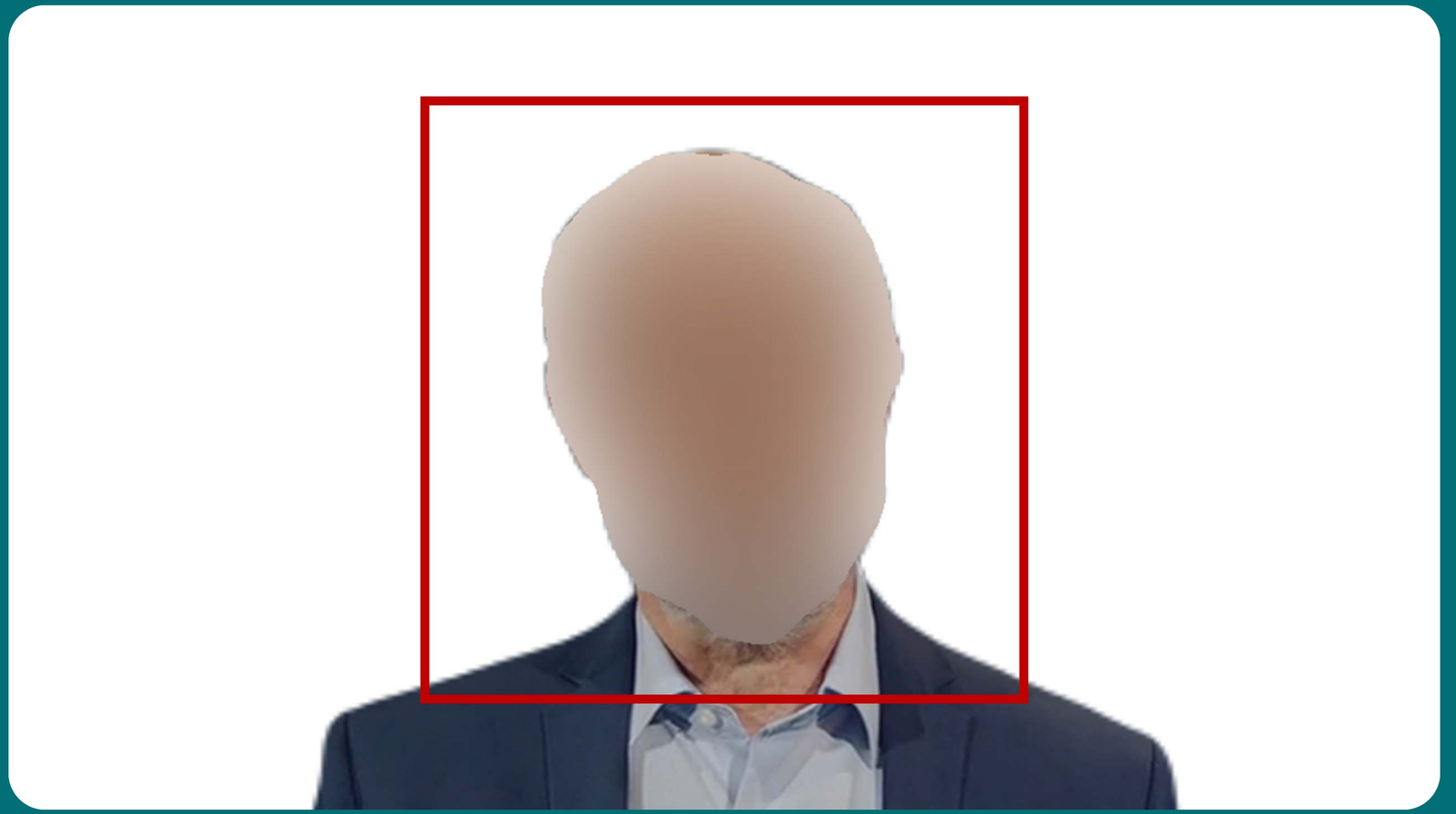
Necklace

Hair

https://github.com/switchablenorms/CelebAMask-HQ

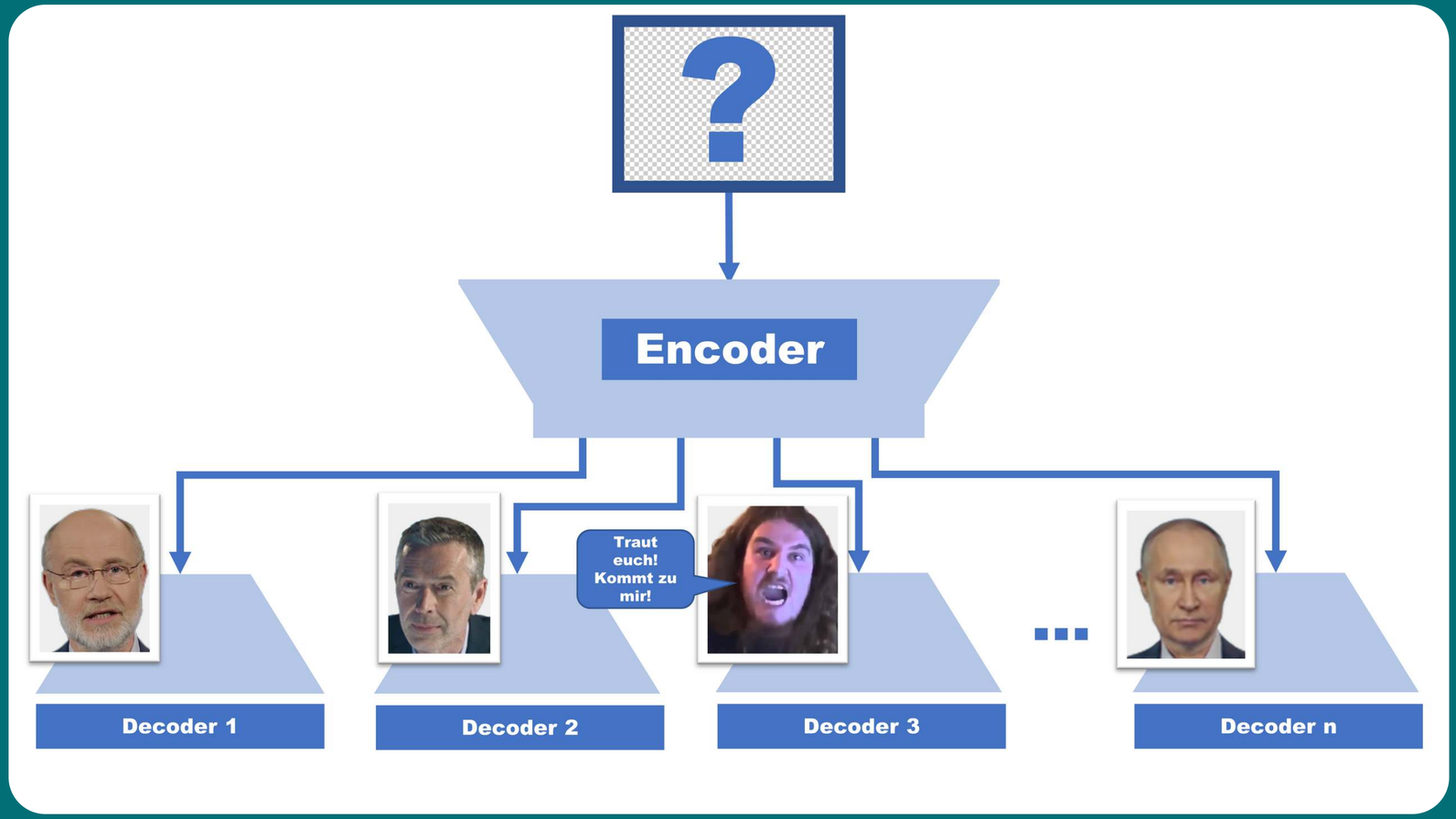
Realtime Deepfakes

OpenCV Inpainting Demo



Realtime Deepfakes

Multi-Decoder

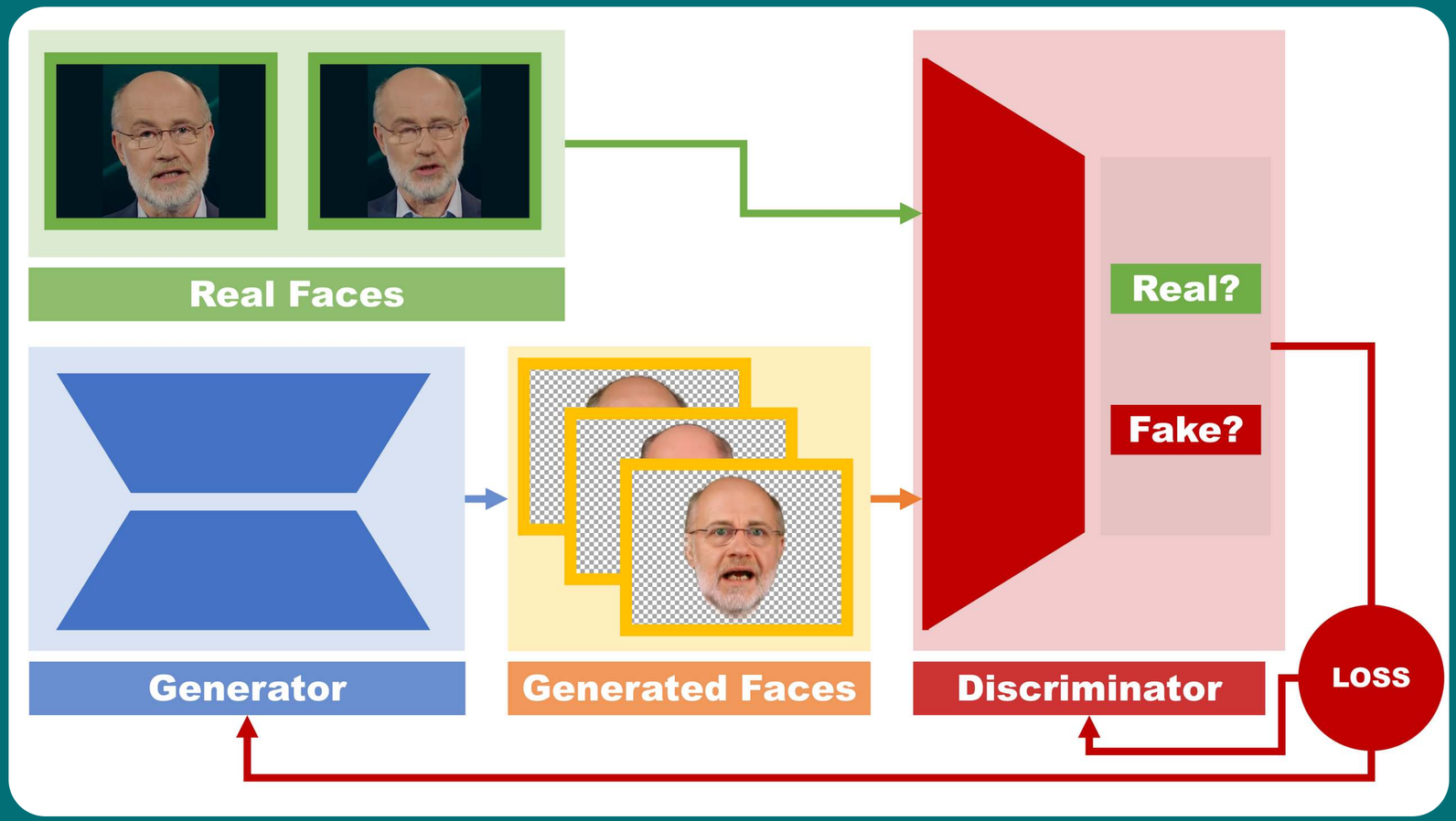


Realtime Deepfakes

First Results

Realtime Deepfakes

GAN (Generative Adversarial Networks) Training



Realtime Deepfakes

Full Demo

Realtime Deepfakes

Breaking News

Realtime Deepfakes

Talks! Talks! Talks!

Realtime Deepfakes

Leschs Kosmos (ZDF) Wants to Report on Realtime Deepfakes

Realtime Deepfakes

Challenges: Blurry Details

Realtime Deepfakes

Challenges: Disappearing Hair

Realtime Deepfakes

The "Hair Trick"

Agenda

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Deepfakes 2.1

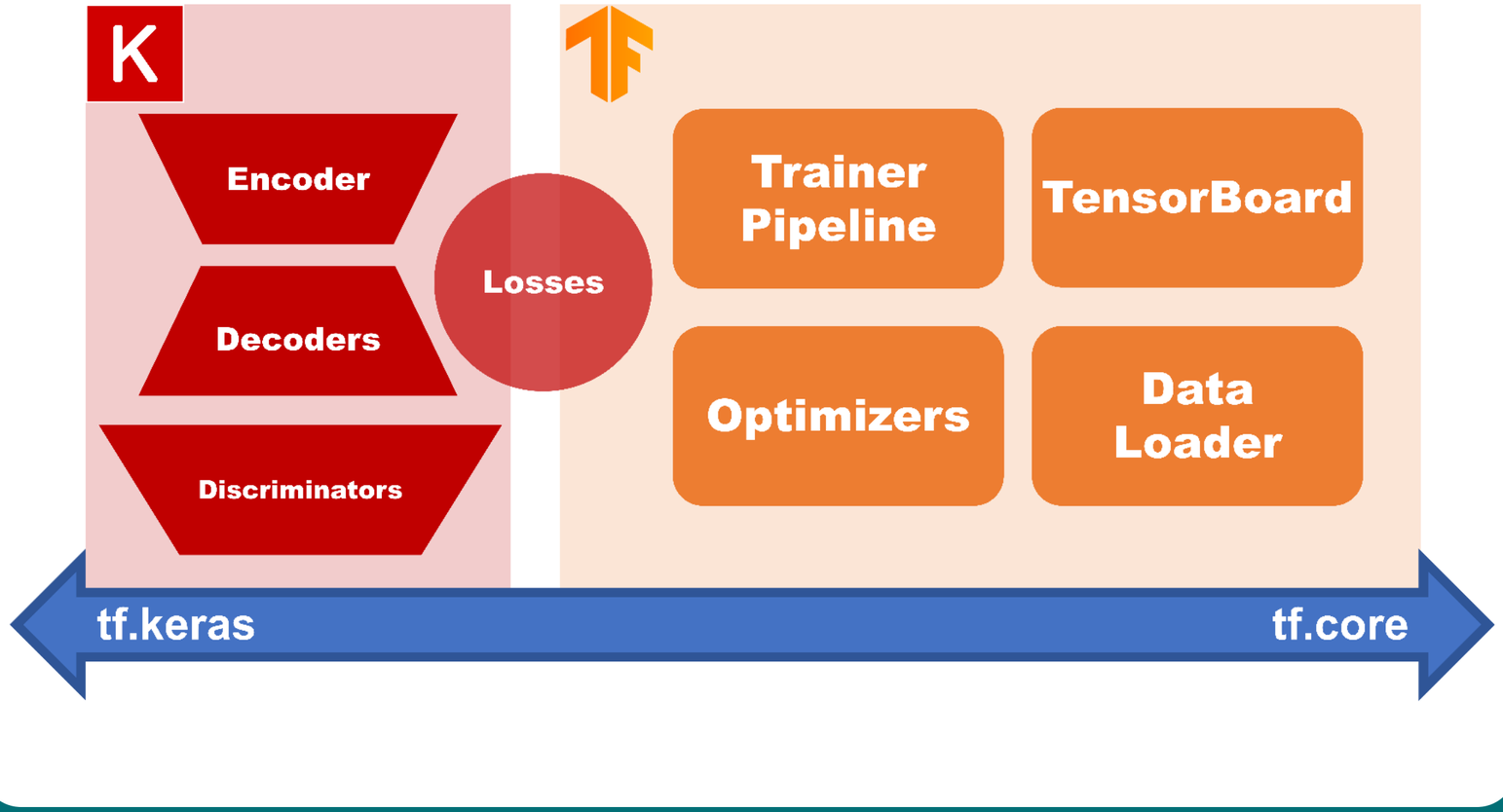
Introducing Tensorflow 2

Deepfakes 2.1

Tensorflow 💕 Keras

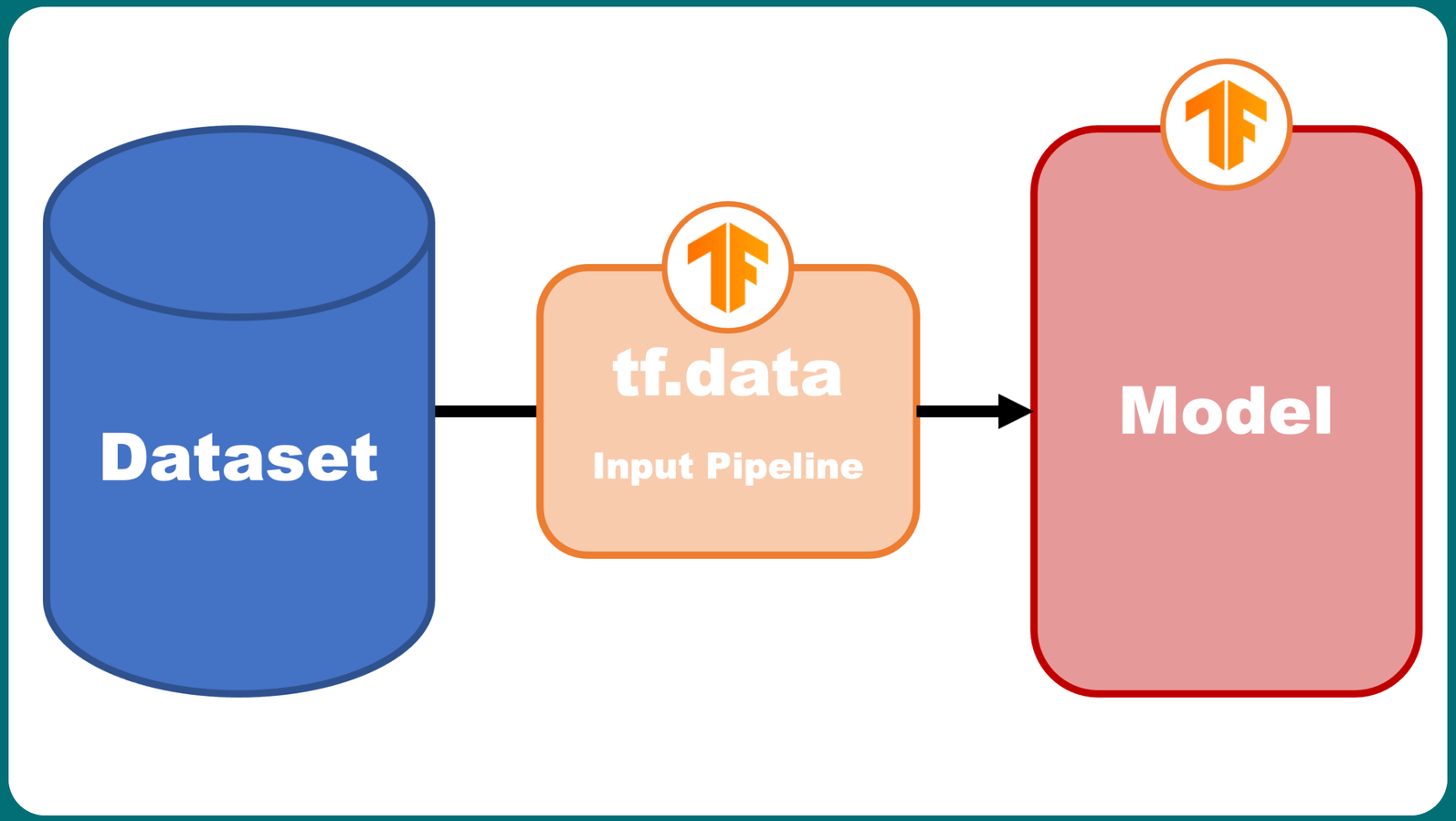
Deepfakes 2.1

Rewrite Trainer in Tensorflow 2



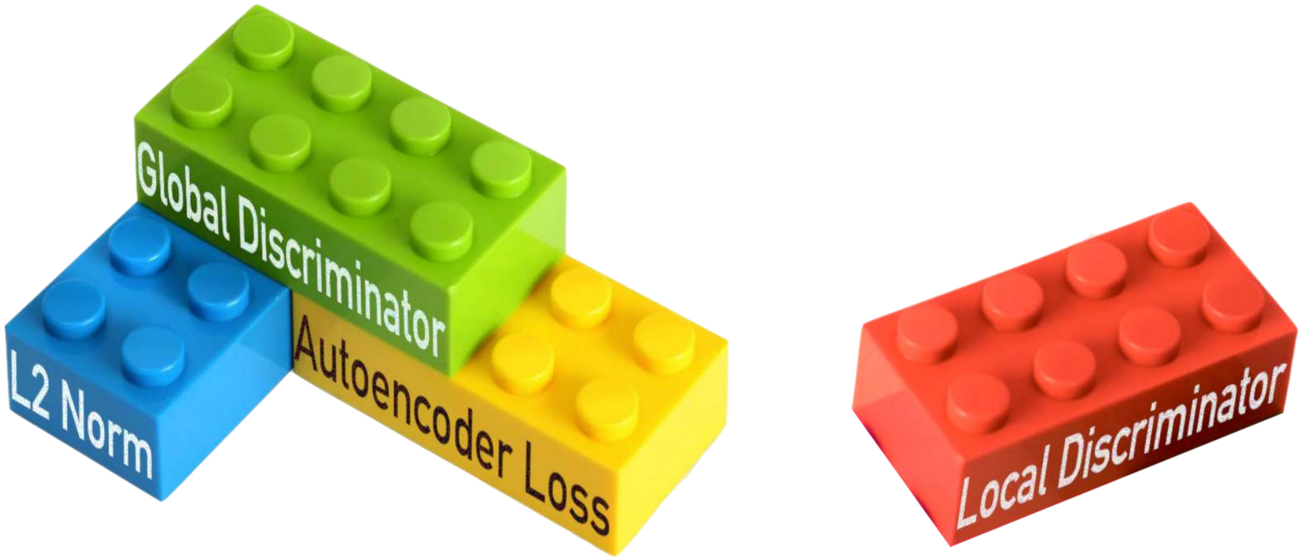
Deepfakes 2.1

tf.data: Faster loading of larger Datasets



Deepfakes 2.1

Modular Training Pipeline



Deepfakes 2.1

Remaining Issues

Realtime Deepfakes 2.0 - Challenges

1. Distortions
2. Alignment Problems
3. Centering Issues
4. Improvable Performance

Deepfakes 2.1

Remaining Issues: Speed

Deepfakes 2.1

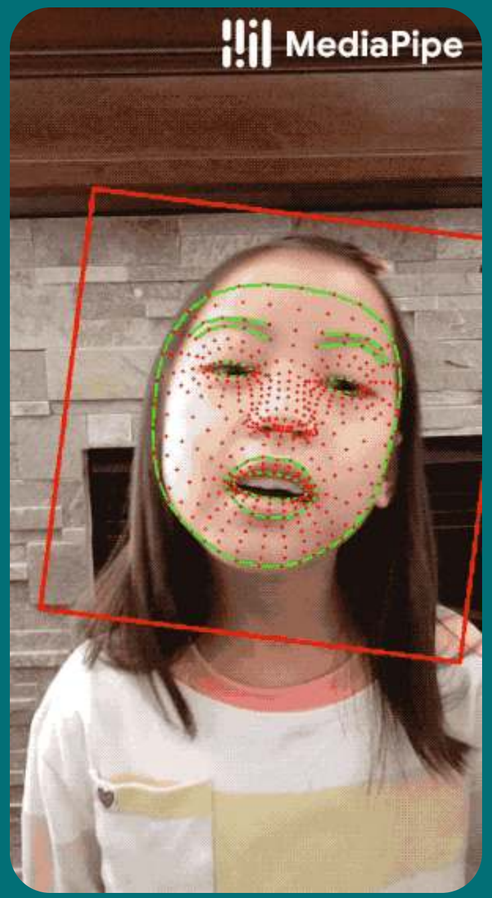
Introducing MediaPipe (2021)

Deepfakes 2.1

Introducing MediaPipe (2021)

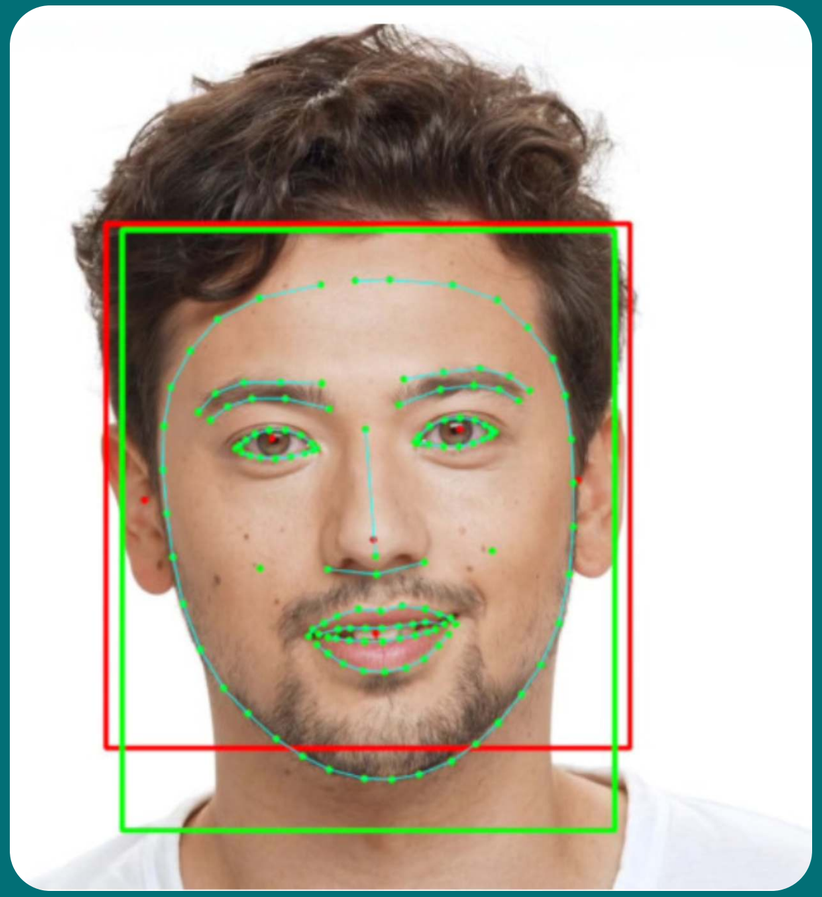
Deepfakes 2.1

Face Mesh for Fast Face Landmark Detection



Deepfakes 2.1

FaceMesh Is Based on BlazeFace Face Detection



SCAN ME

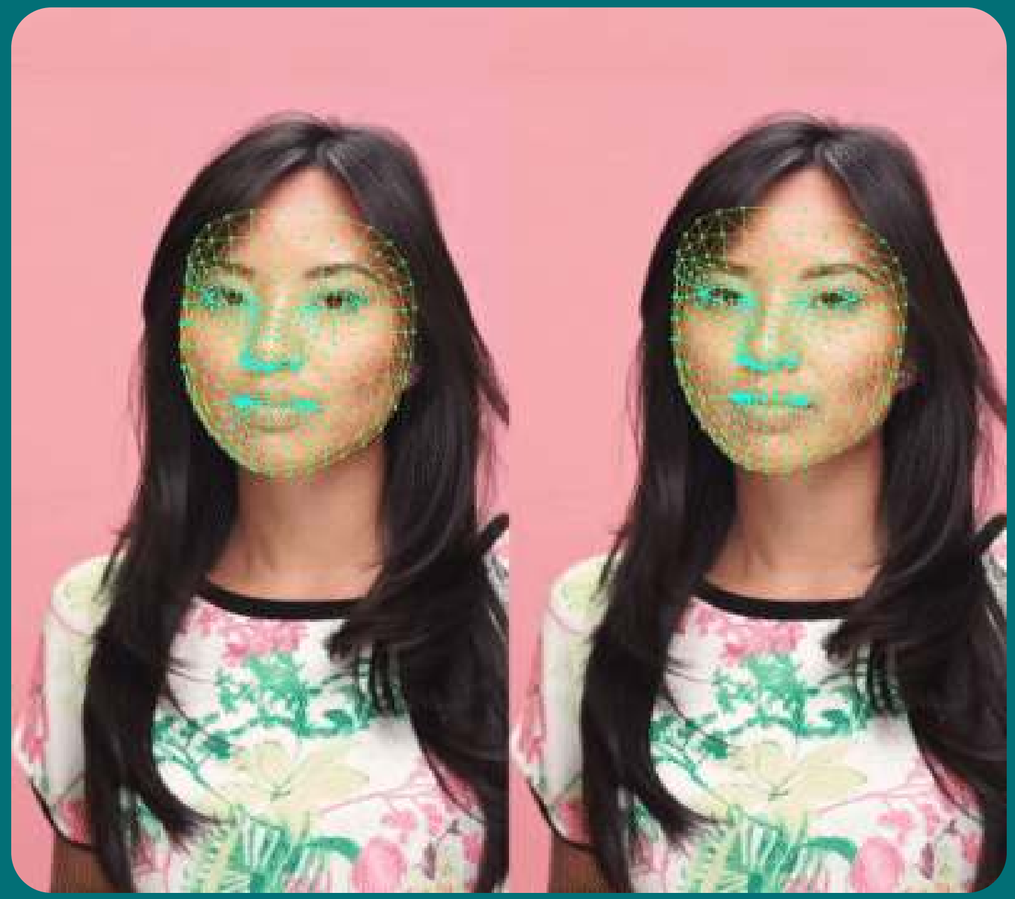
Deepfakes 2.1

From Face Mesh with 468 Landmark Points to Facial Surface

SCAN ME

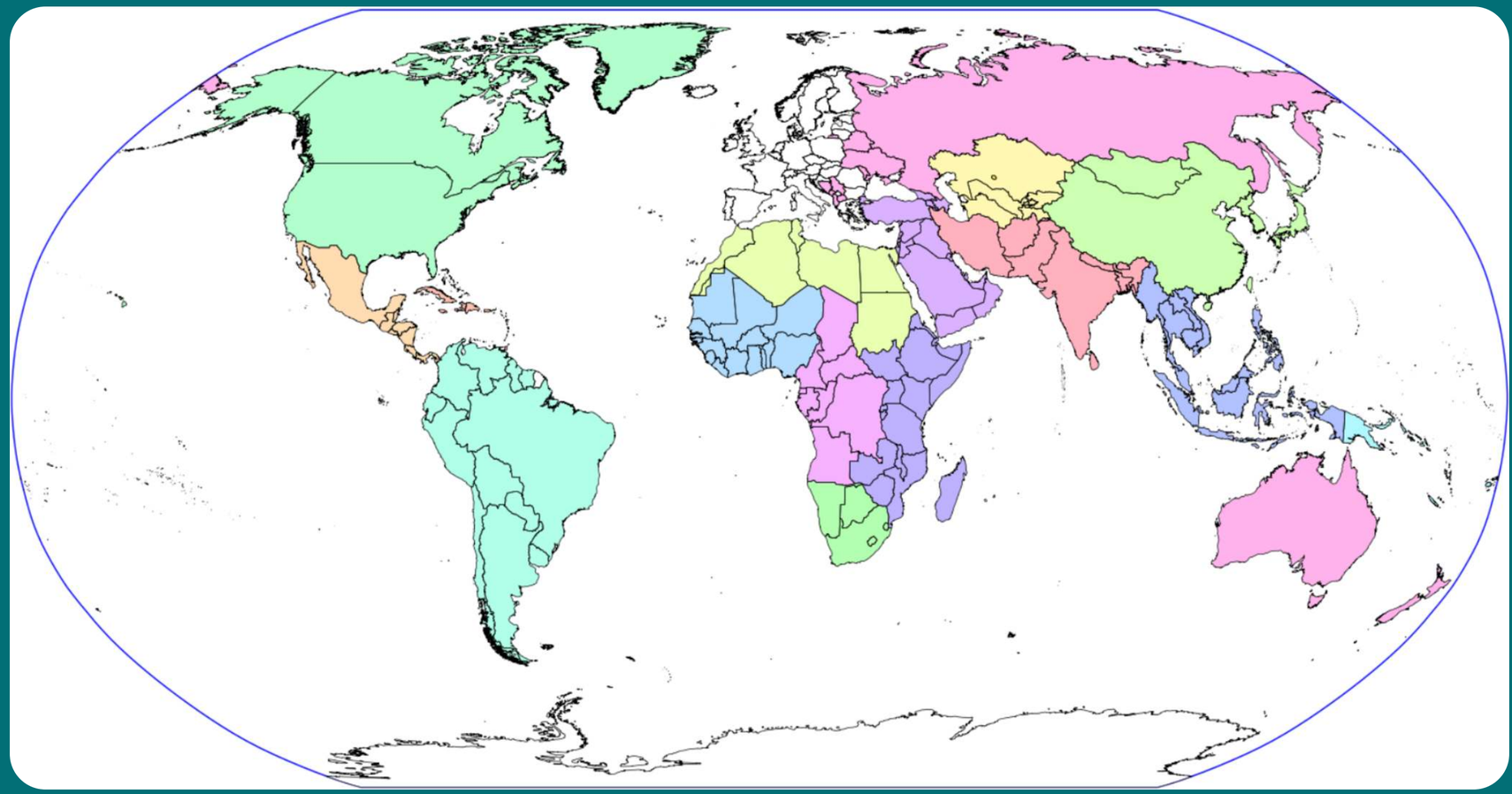
Deepfakes 2.1

Temporal Consistency



Deepfakes 2.1

FaceMesh Fairness Evaluation

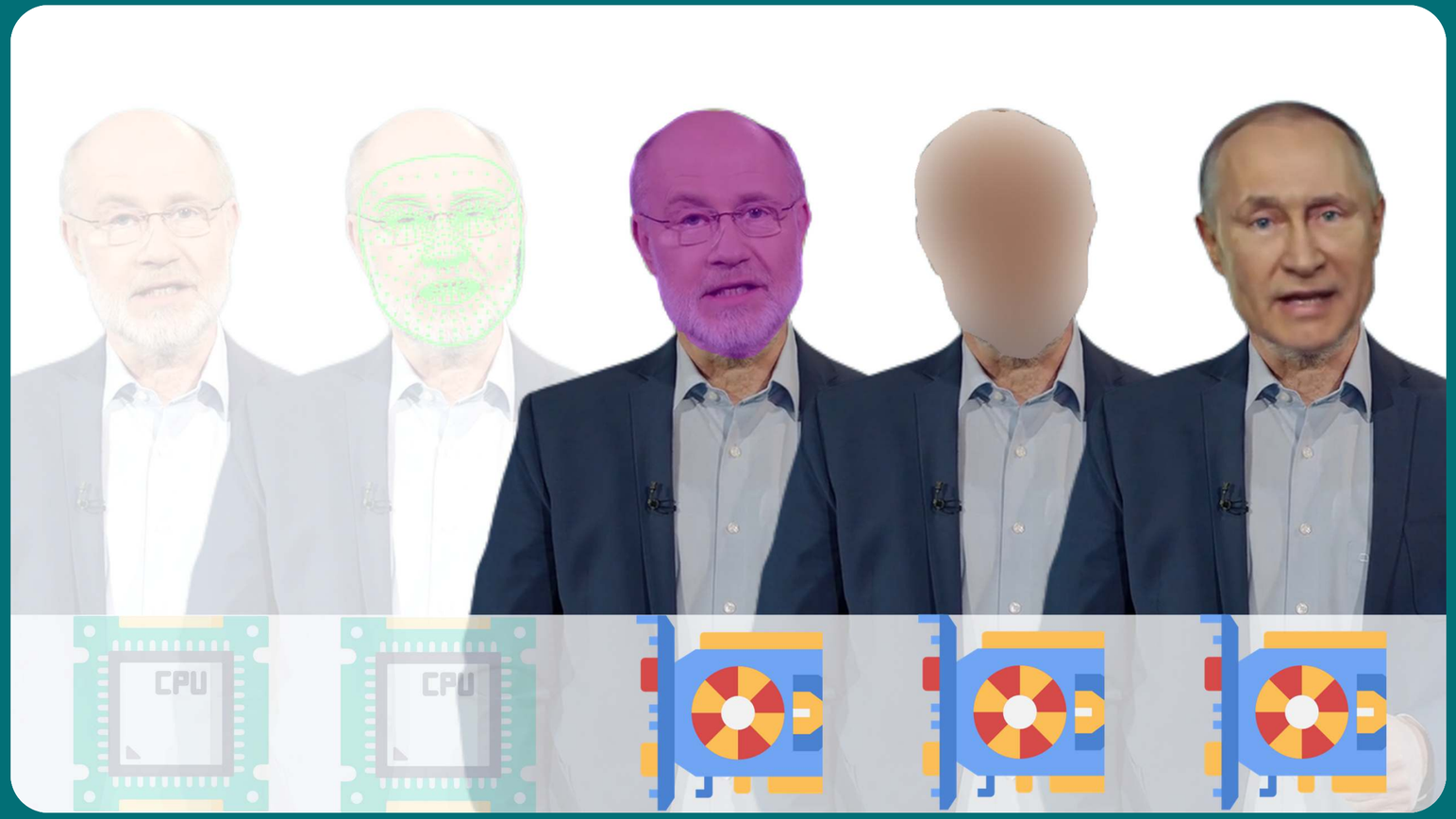


MediaPipe Demo

FaceMesh Demo

Realtime Deepfakes 2.1

Inference Workflow



Deepfakes 2.1

Full Demo

Agenda

- Deepfakes in a Nutshell
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Pro7 Galileo

Can You Cheat People on Video Calls?

Pro7 Galileo

Can You Cheat People on Video Calls?

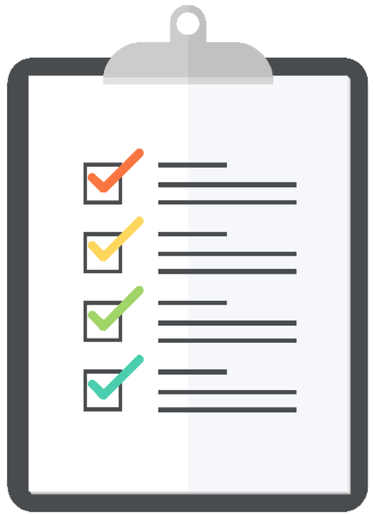
Pro7 Galileo

Can You Cheat People on Video Calls?

Realtime Deepfakes as Attack Vector

They Are Real and You Should Know about That!

Checklist: Attack Vectors #1

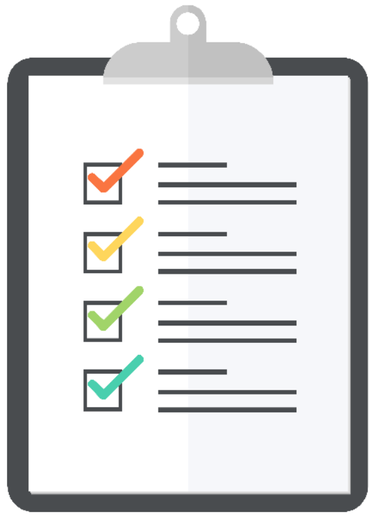


1. Phishing Scams
2. Data Breaches
3. Hoaxes
4. Celebrity Pron
5. Reputation Smearing

Realtime Deepfakes as Attack Vector

They Are Real and You Should Know about That!

Checklist: Attack Vectors #2



6. Election Manipulation
7. Social Engineering
8. Identity Theft
9. Financial Fraud
10. Blackmail

Scam Alert!

Woman Thought Vin Diesel Loved Her - Sent £5,000 in Online Scam

https://www.ladbible.com/news/news-woman-thought-vin-diesel-loved-her-sends-him-5000-20200819

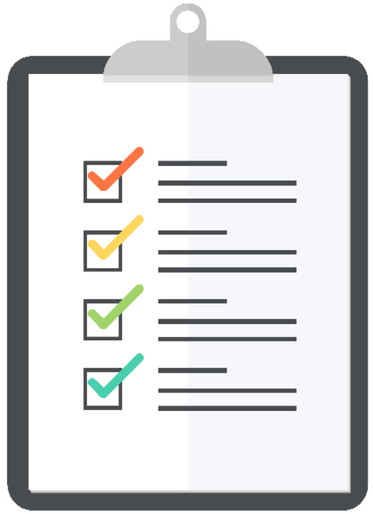
Pro7 Galileo

Part 2 - Fooling Parents

Realtime Deepfakes As Attack Vector

They Are Real and You Should Know about That!

Checklist: Signs to spot deepfakes #1



1. Suspicious Behaviour
2. Low Level Of Skin Details
3. Unusual Distortions In Face
4. Lack of Emotion
5. Artifacts Around the Headedges

Realtime Deepfakes As Attack Vector

They Are Real and You Should Know about That!

Agenda

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Evolution of Deepfakes ...

... is much faster than we predicted in 2019

Year	Name	Replacing	Realtime	Open Source	Technology
2017	DeepFaceLab				FaceNet
2019	TNG Deepfakes 2.0				
2020	DeepFaceLab				FaceNet
2021	TNG Deepfakes 2.1				
2021	DeepFaceLive				FaceNet

In 2019 we predicted ...

... that Deepfakes will be used in the Movie Industry

CGI

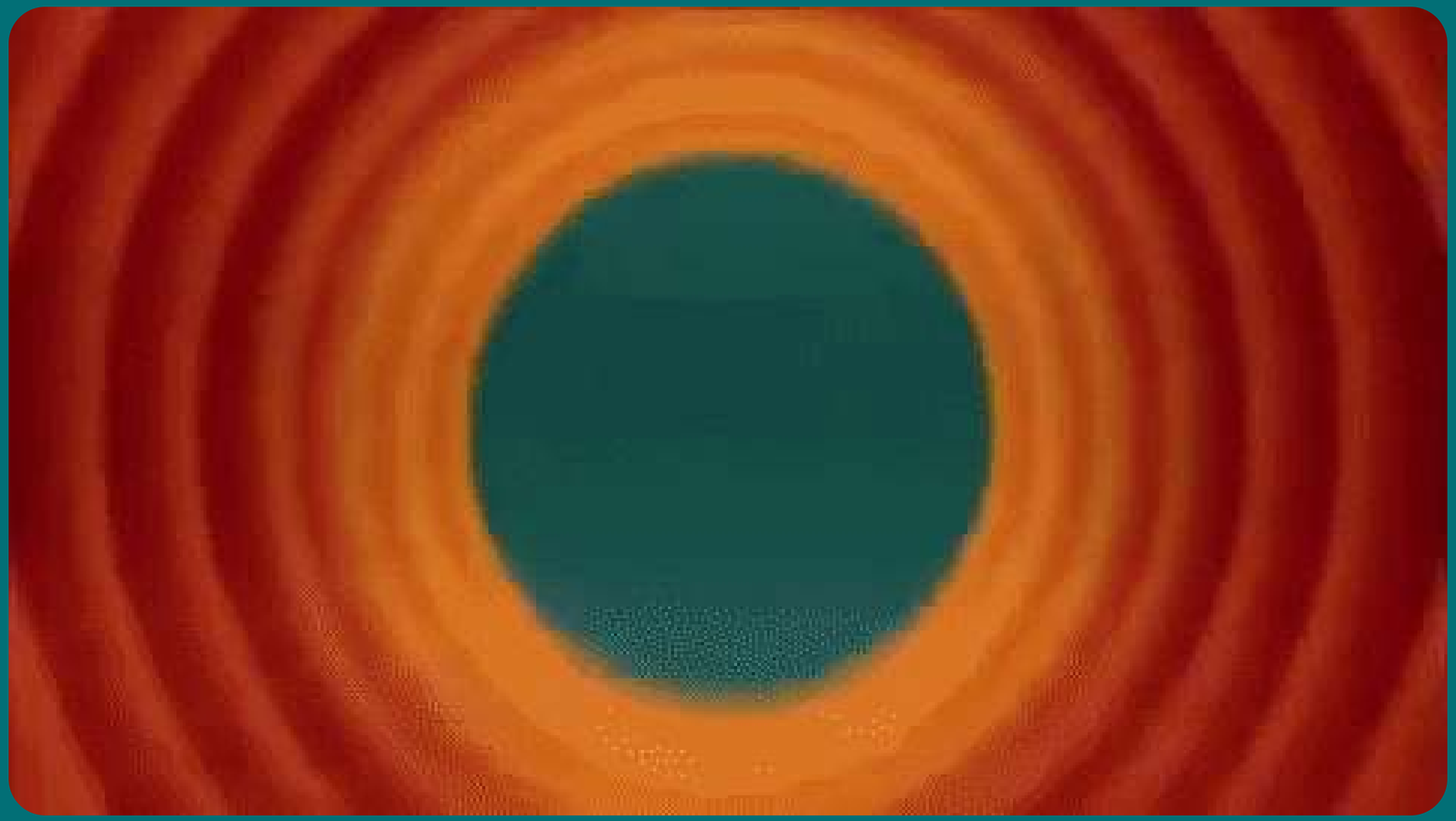
Deepfake

Movie Industry

Our Predictions came true!

Finish. Final. Fin. Ende.

Fine. конец. Einde. Pää. Lõpp. Pabaiga.



Other AI related talks

SCAN ME

Style Transfer AI

This talk introduces you
into deep neural networks,
how they work internally and
how they process images.

Artificial Neurons, Gradient Descent,
Deep Neural Networks, Cost Function

SCAN ME

Realtime Deepfakes

This talk introduces you
into how deep fakes can be created
and what it took to realize deep fakes
in realtime.

Deep Neural Networks, Autoencoder,
Transfer Learning,
Generative Adversarial Networks

Speakers

Thomas Endres

Partner

Oracle® JavaOne Rockstar
Intel® Black Belt Software Developer
Intel® Software Innovator
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Intel® Software Innovator

Audio Deepfakes

Tacotron 2 (2017)

SCAN ME

Audio Deepfakes

Tacotron 2 (2017)

Audio Deepfakes

Tacotron 2 (2017)

SCAN ME

Audio Deepfakes

First Documented Audio Deepfake Fraud