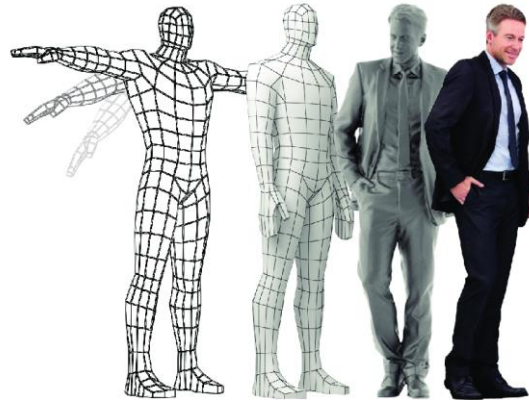


# INVICTUS

Innovative Volumetric Capture and Editing Tools for Ubiquitous Storytelling

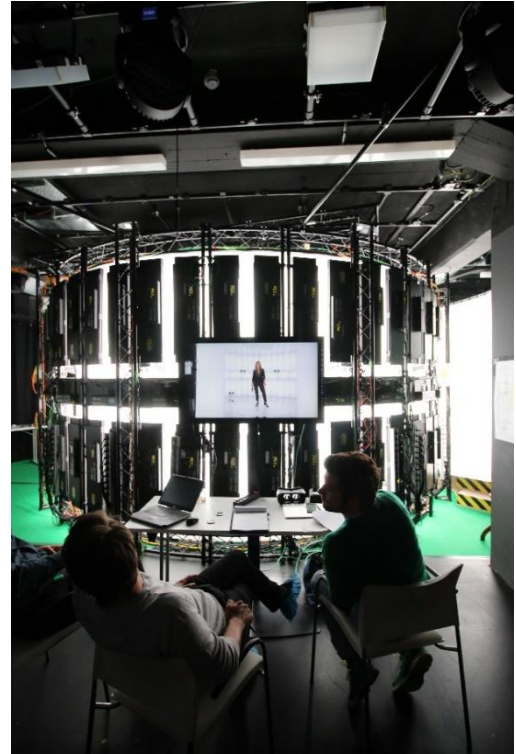
Peter Eisert



# INVICTUS



# Volumetric Video Capturing



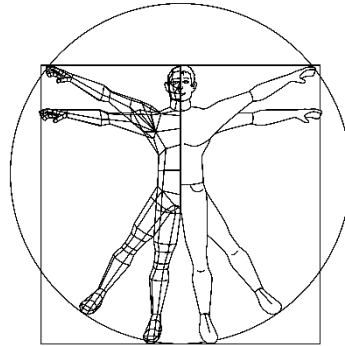
# Free Viewpoint / AR Visualization of Volumetric Video



VOLUCAP

# INVICTUS: Make Volumetric Video Interactive & Animatable

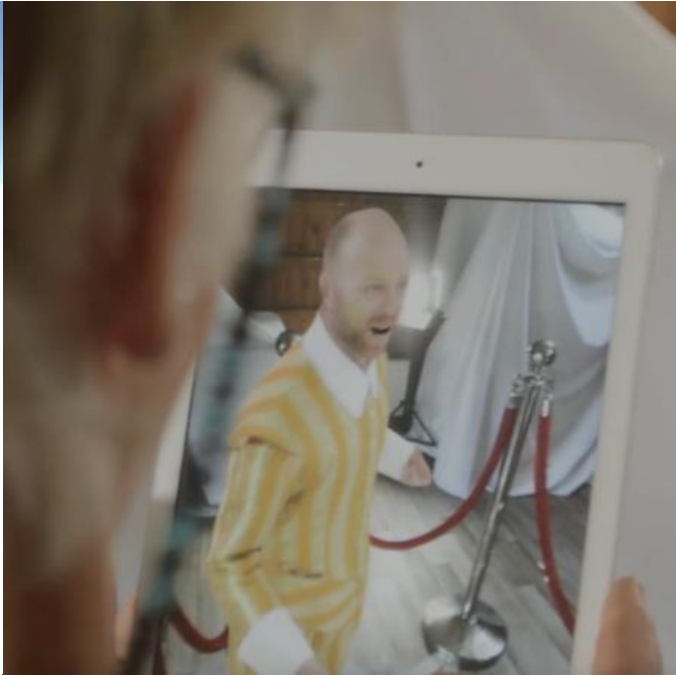
- H2020 Project (ICT-55)
- Duration: 09/2020 – 12/2022
- 5 Partners



INVICTUS



# INVICTUS Use Cases



Interactive AR Narratives



Interactive Museum Guides

# Volumetric Data Capturing @ Volucap



- Capturing of 2 actors and the curator of the Berlin Museum of Decorative Arts
- Full body + face close-ups (68 TB of data)
- Body motion, dialogs, presentations

# Reconstruction of Volumetric Video



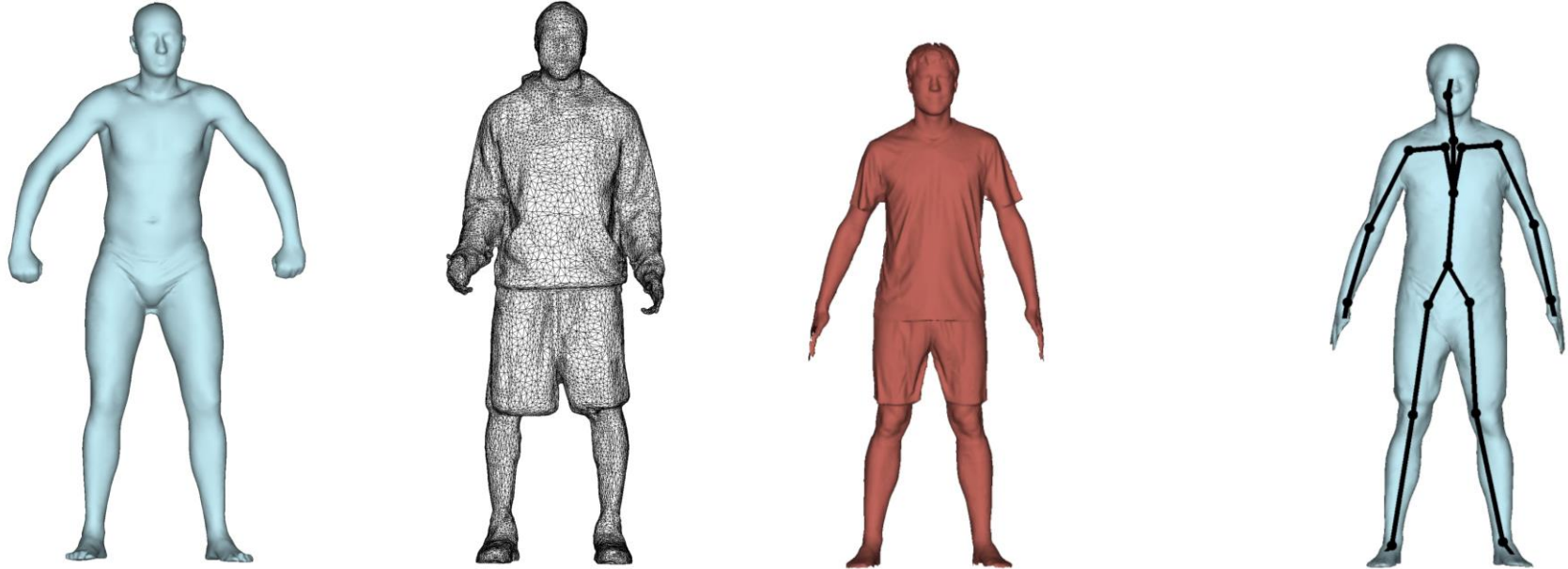
# Reconstruction of Volumetric Video Sequences





# Semantic Model Fitting and Tracking

[Fechteler, CGF 2019]



- CG template model (SMPL) fitted to volumetric video and tracked over time
- Provides semantic information, defines temporal correspondences
- Can be used for animation

# Interactive Gaze Correction

- CG template model can be animated
- Surface motion transferred to volumetric video meshes
- New poses can be generated that were not captured originally

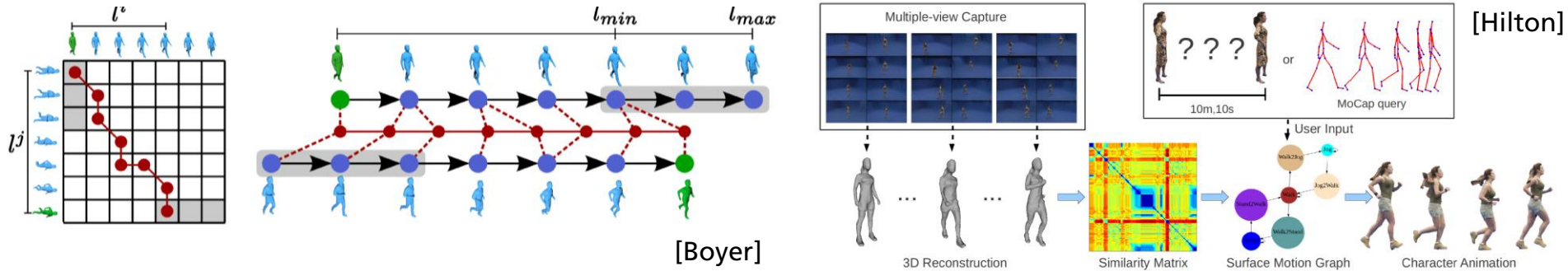


original



modified head pose

# Concatenation of Motion Sequences



- Capturing of a volumetric video database with motion samples
- Registration of template mesh with skeleton information
- Find transitions between sequences according to user input
- Compute smooth temporal blending

# Pose Compensated Blending of Volumetric Video



concatenated



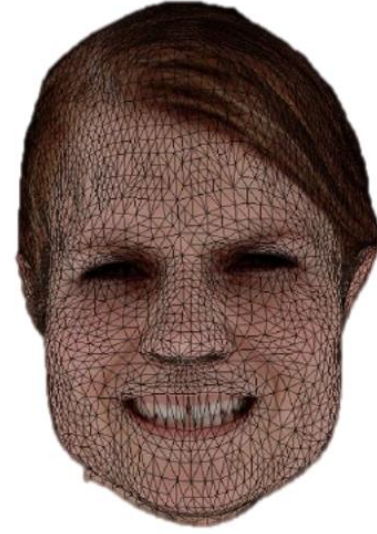
interpolated

# Learned Representations of Bodies and Faces



## Body

- SMPL template mesh
- Details: video texture/displacement maps
- Input: skeleton data



## Face

- Template mesh + blendshapes
- Details: video textures
- Input: text, speech, animation parameters

CG template mesh for animation, details / variations through video textures

# Hybrid Face Representation



texture

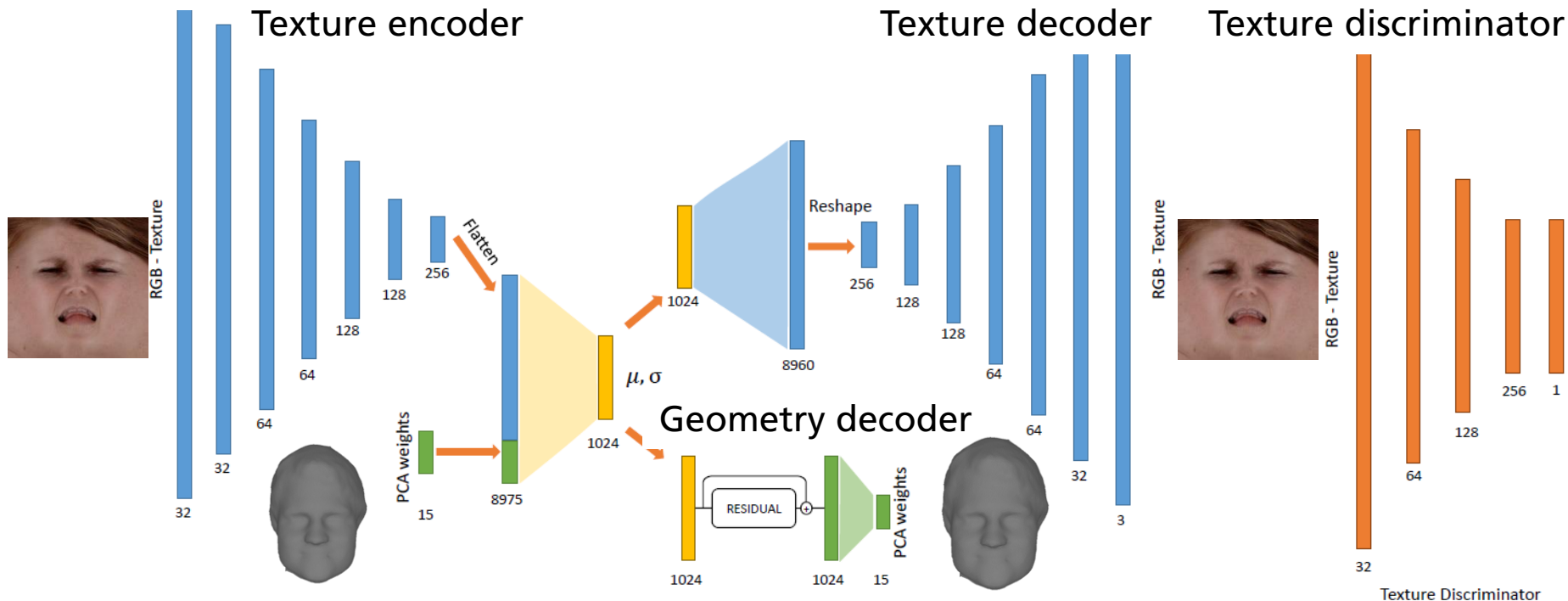


geometry



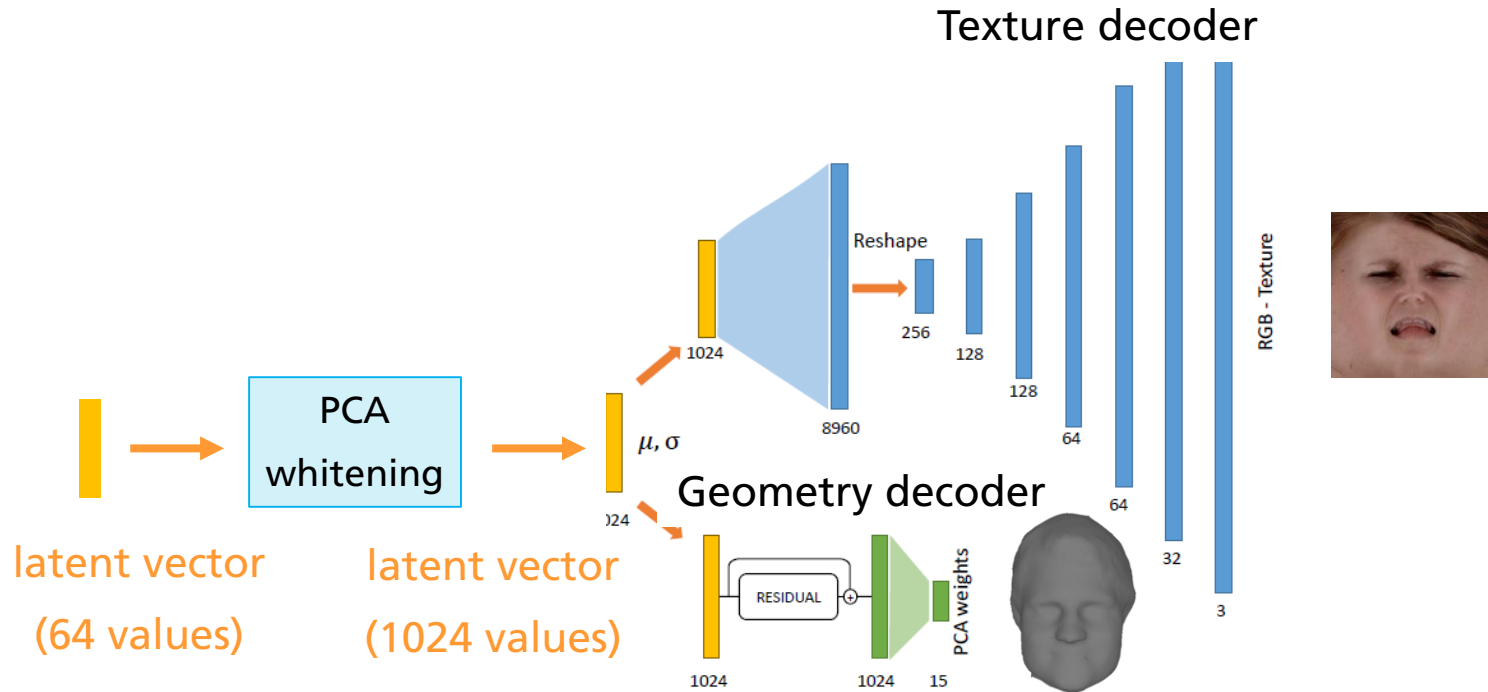
texture + geometry

# Neural Face Representation



[W. Paier et al., Neural Face Models for Example-Based Visual Speech Synthesis, CVMP 2020 (best paper)]

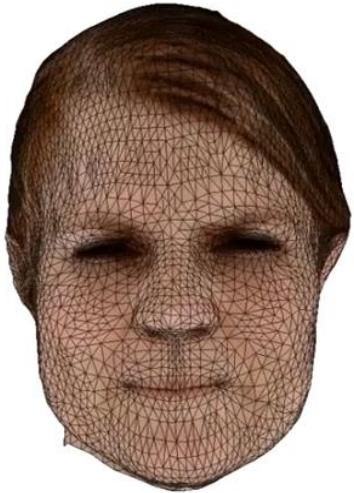
# Neural Face Representation



[W. Paier et al., Neural Face Models for Example-Based Visual Speech Synthesis, CVMP 2020 (best paper)]



# Face Synthesis from Latent Space



wire-frame



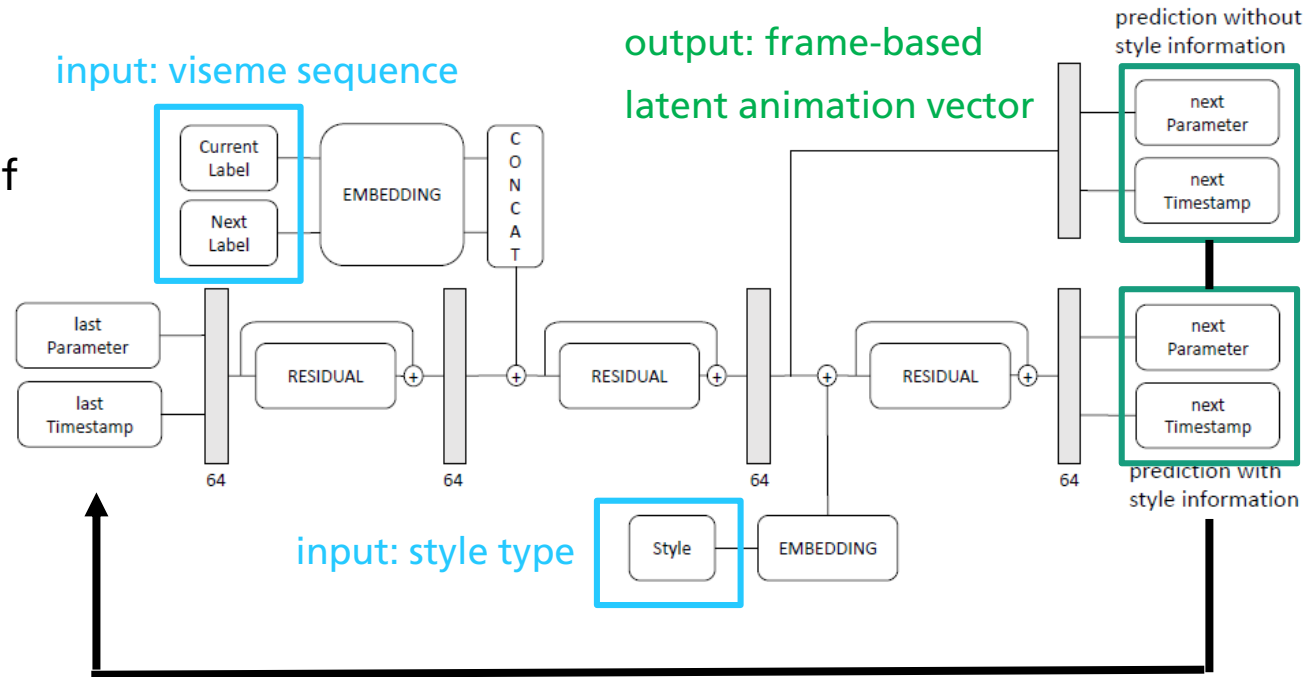
with directional light



original video

# Visual Speech Synthesis

- Autoregressive neural network
- Synthesize sequence of animation parameters from viseme labels
- Learns co-articulation effects
- Generates 'connected' sequences
- Style input for more output variation



W. Paier et al., Example-Based Facial Animation of Virtual Reality Avatars using Auto-Regressive Neural Networks, IEEE CGA, 2021

# Results for Visual Speech Synthesis



Willkommen bei SRF Meteo



Samstag, Quellwolken und Regen

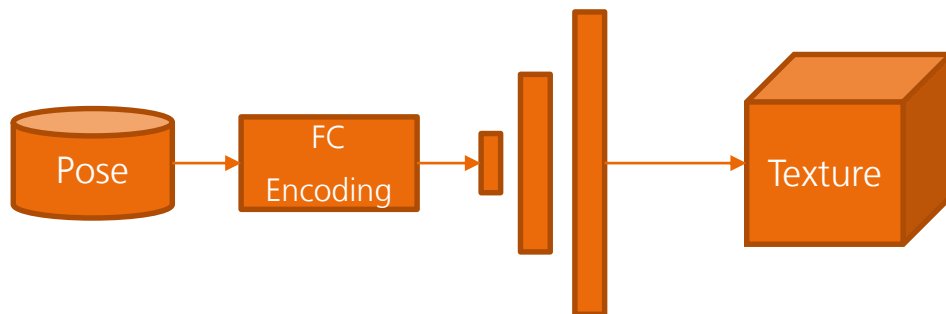
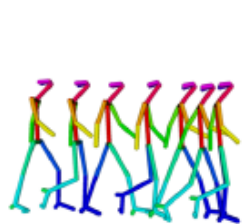
# Body Synthesis

- Template mesh with consistent topology
- Track sample sequences
- Learn pose dependent texture (and displacement map)



Texture

Confidence Map



# Learning Textures with a Decoder Network



volumetric  
video

model with  
synthesized texture

# Neural Re-Rendering



synthesized model



re-rendered model



original views

# Conclusion

- Volumetric video provides high realism for virtual human rendering
- Invictus adds interactivity and editing capabilities
- Hybrid approach
  - unstructured volumetric video data
  - template model with skeleton and facial blendshapes
  - neural synthesis and correction
- Efficient real-time rendering
- Novel applications for interactive films, games, e-learning,....

# Fraunhofer-Institut für Nachrichtentechnik, Heinrich-Hertz-Institut, HHI

## WE PUT SCIENCE INTO ACTION.

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