

# Open Source Face Image Quality (OFIQ)

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<https://de.wikipedia.org/wiki/StyleGAN>

# Agenda

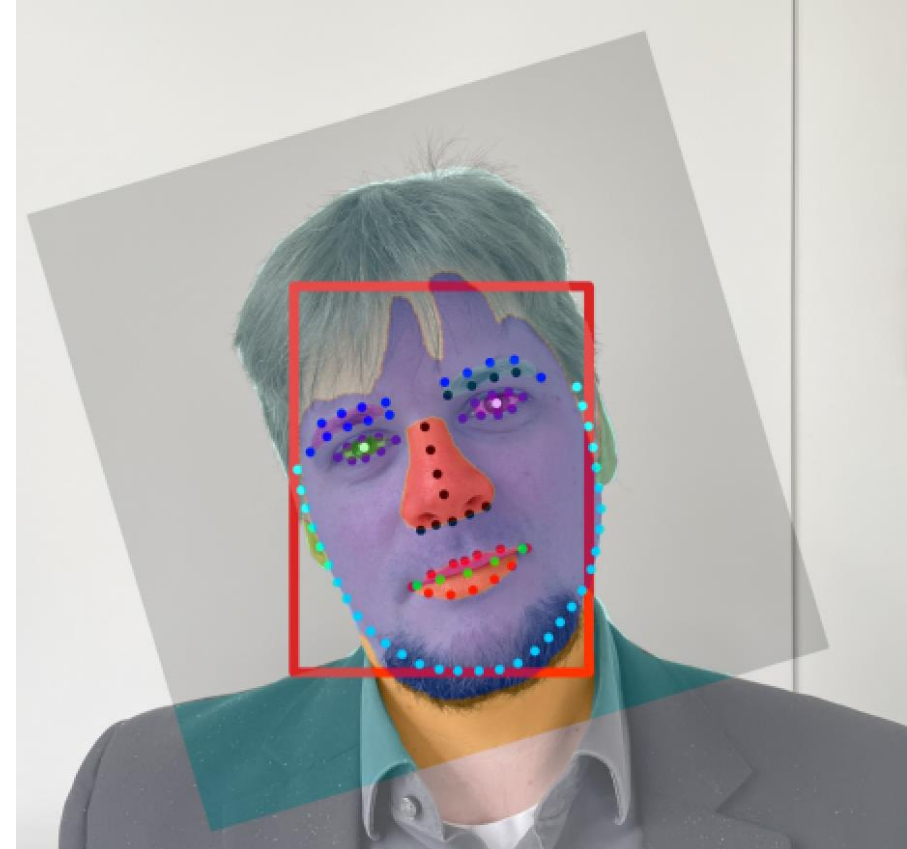
- Objectives
- Algorithms
- Release
- Way Forward

# Objectives

- C++ software library for facial image quality assessment (FIQA)
- Checks quality requirements from ISO/IEC 39794-5:2019
- Open source published under liberal licences
  - Commercial use possible, no copy-left
- Support of many platforms (incl. mobile devices)
- Evaluation through NIST FATE Quality SIDD and internal test
- Reference implementation of upcoming revision of ISO/IEC 29794-5
- Development funded by BSI

# Pre-Processing Algorithms

- Face Detection
- Face Landmark Estimation
- Alignment
- Segmentations:
  - Landmarked Region
  - Occlusion Segmentation
  - Face Parsing

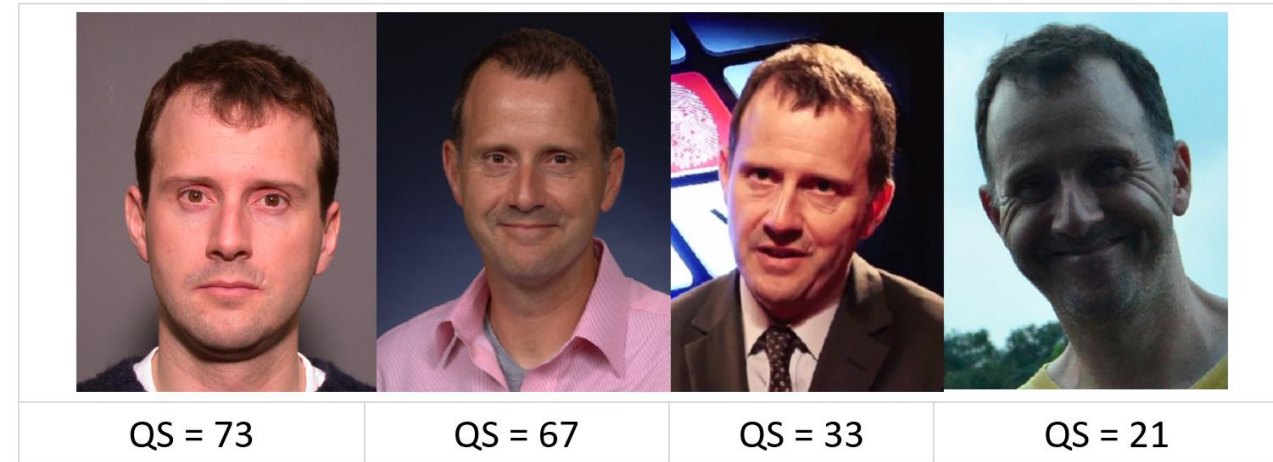


# Algorithms

- Unified Quality Score
- Background Uniformity
- Illumination Uniformity
- Moments of the Luminance Distribution
- Under-Exposure / Over-Exposure
- Dynamic Range
- Sharpness
- No Compression Artifacts
- Natural Colour
- Single Face Present
- Eyes Open
- Mouth Closed
- Eyes Visible
- Mouth Occlusion Prevention
- Face Occlusion Prevention
- Inter-Eye Distance
- Head Size
- Crop of the Face
- Head Pose
- Expression Neutrality
- No Head Coverings

# Algorithms – Unified Quality Score

- Not limited to certain quality defects
- CNN MagFace (iResNet 50 model)
- Excellent results in FATE Quality
  - 1st out of 52 algorithms<sup>1</sup>
- Good prediction of face recognition scores



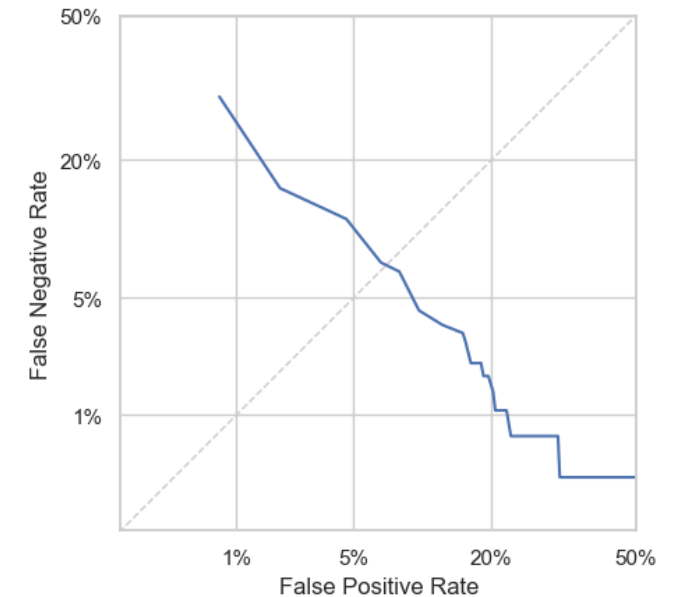
# Algorithms – Sharpness

- Random Forest classifier
- Several features:
  - Sobel-Filter
  - Laplace filter
  - Difference of image from mean-filtered image
- Restricted to landmarked region
- Trained on synthetic and real blur



# Algorithms – Sharpness

- Good results in FATE Quality
  - 5th out of 34
  - Only synthetic blur
- Internal evaluation on FRGCv2 (real blur)
  - Accuracy high but not very high
  - Challenging





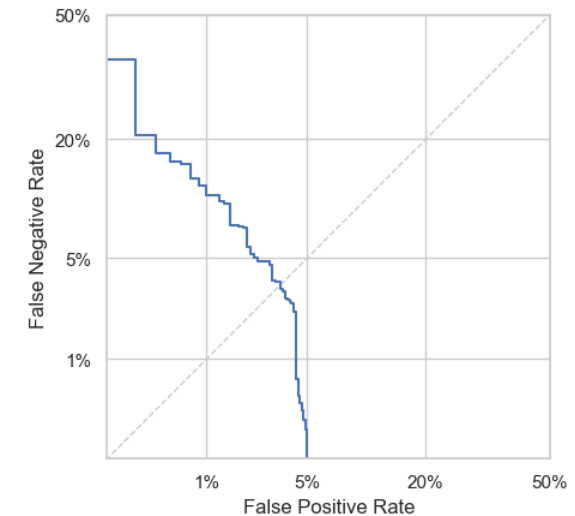
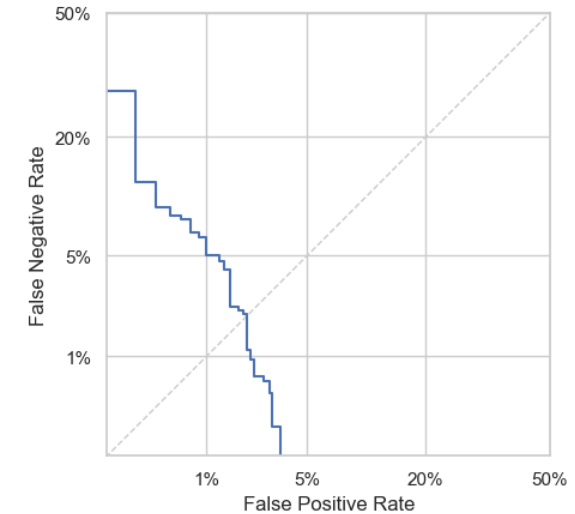
# Algorithms – No Compression Artifacts

- CNN trained by secunet
  - Trained to predict the PSNR between compressed and uncompressed image
  - Trained on JPEG and JPEG2000 artifacts
  - Also trained on scaled and rotated artifacts



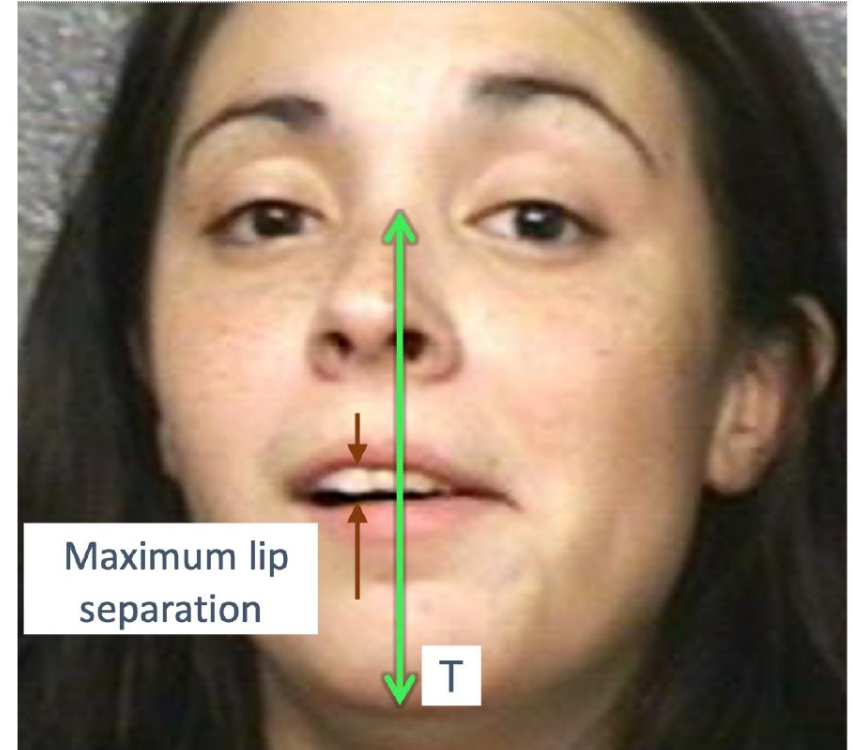
# Algorithms – No Compression Artifacts

- Results in FATE Quality not bad
  - 10th out of 20
  - Only JPEG tested
  - No scaling or rotation after compression
- Internal evaluation of test sets based on FFHQ
  - Test set 1: Only scaling after compression
  - Test set2: Scaling and rotation after compression



# Algorithms - Eyes Open and Mouth Closed

- Algorithms based on landmarks
- Maximum distance between lids / lips
- Normalized by distance T between eye's midpoint and chin



# Algorithms - Eyes Open and Mouth Closed

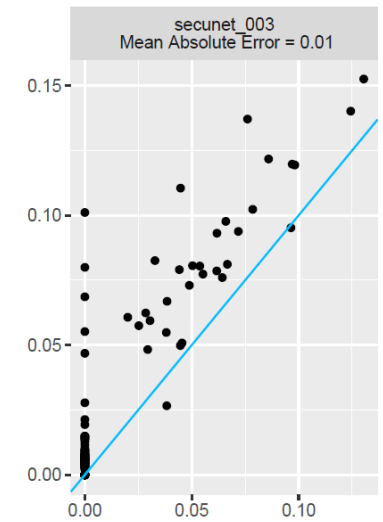
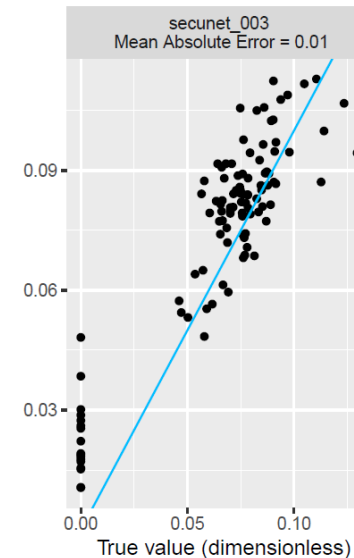
- Very good results in FATE Quality

- 1st out of 22 (Eyes Open 2)
- 2nd out of 19 (Mouth Open 2)

- Very good results in internal evaluation

- No ethnic bias found for Eyes Open

- No errors on CAS-PEAL-R1



# Algorithms – Face Occlusion Prevention

- Based on face occlusion segmentation
- CNN from repository FaceExtraction<sup>1</sup>
- Fraction of un-occluded landmarked region
- Similar approach used for Mouth Occlusion Prevention and Eyes Visible



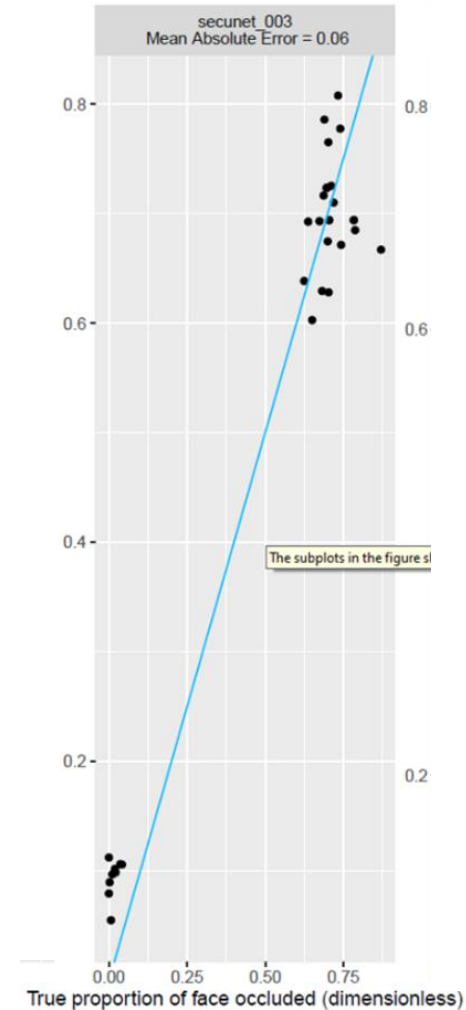
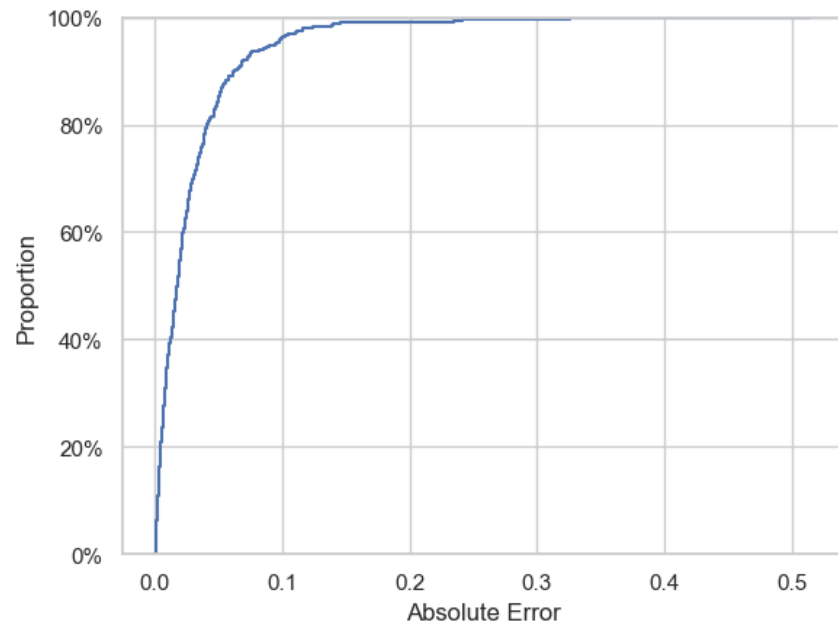
<sup>1</sup> <https://github.com/face3d0725/FaceExtraction>

# Algorithms – No Face Occlusion

- Excellent performance in FATE Quality

  - 1st of 20

- High accuracy on COFW test set



# Algorithms – Head Pose

- CNN from repository 3DDFA\_V2<sup>1</sup>
- Results in FATE Quality vary strongly among test sets
  - Yaw: 19th / 4th / 15th
  - Pitch: 4th / 34th / 16th
  - Roll: 10th

out of 36 algorithms
- Results heavily tainted by errors of face detection

<sup>1</sup>[https://github.com/cleardusk/3DDFA\\_V2](https://github.com/cleardusk/3DDFA_V2)

# Release of OFIQ

- Release 1.0.0 published in November 2024  
<https://github.com/BSI-OFIQ/OFIQ-Project>
- Implementation & Evaluation Report published <sup>1</sup>
- Regular maintenance
- Current release is 1.0.1

<sup>1</sup> [https://github.com/BSI-OFIQ/OFIQ-Project/blob/main/doc/reports/Public Report V1.2 2024 11 06.pdf](https://github.com/BSI-OFIQ/OFIQ-Project/blob/main/doc/reports/Public%20Report%20V1.2%202024%2011%2006.pdf)



# Way Forward

- Development of OFIQ 2.0 has begun
  - Objectives remain unchanged
- Planned to be completed by end of 2027
- Close alignment with revision of ISO/IEC 29794-5
- Input from community is very welcome
- OFIQ user group virtual meeting: <https://eab.org/events/program/374>

# Way Forward – Potential Improvements

- Computational performance
  - E.g. Landmark Estimation, Face Parsing
- Accuracy
  - E.g. Background Uniformity
- Reduction of demographic bias
  - Under Exposure Prevention
- Additional quality checks
  - Motion Blur, Eyes Looking to the Camera

# More information:

<https://github.com/BSI-OFIQ/OFIQ-Project>

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