

# Open Face Image Quality

Approach and implementation  
status

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

# Agenda

- 1 Goal
- 2 Approach
- 3 The past – shortlisted measures and implementations
- 4 The presence – which implementations have been integrated?
- 5 The future – roadmap to an ISO/IEC 29794-5 reference implementation

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- 1**      **Goal**
- 2**      Approach
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- 4**      The presence – which implementations have been integrated?
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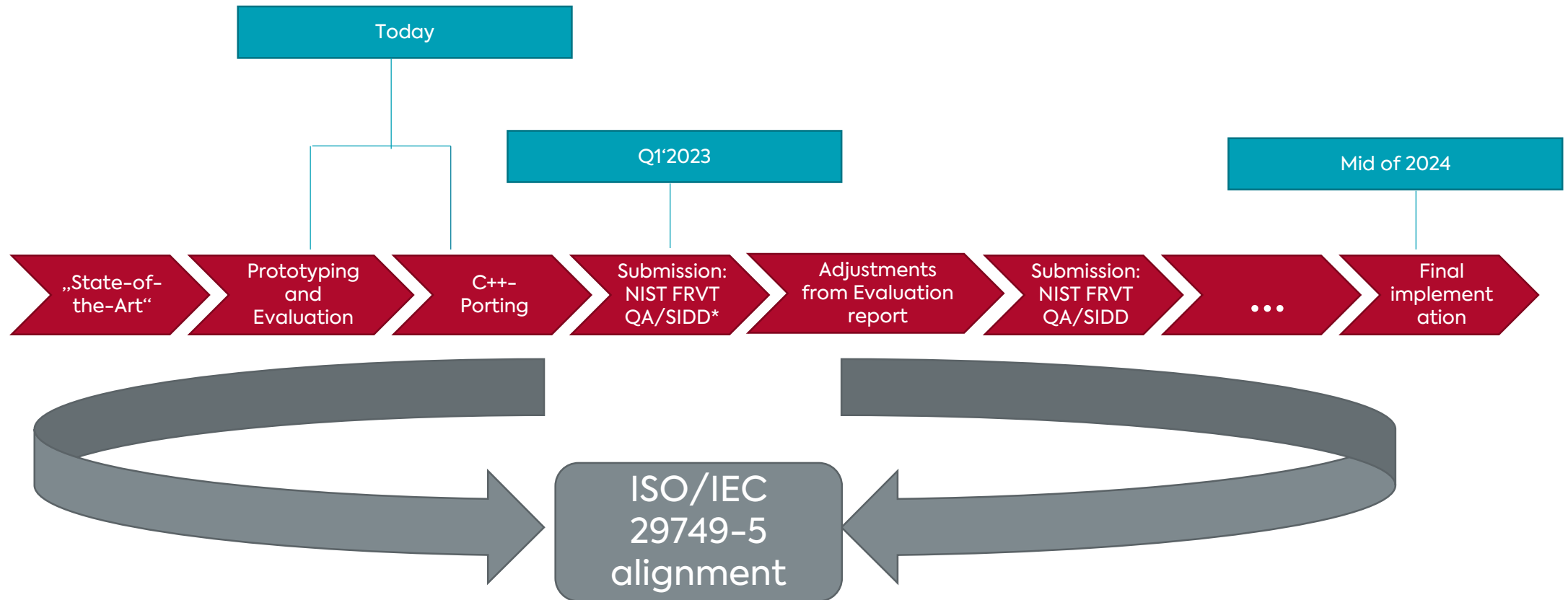
# Goal

- Open Face Image Quality (OFIQ) implementation
- C/C++
- Open source
- Allows commercial use
- In alignment with the ISO/IEC 29794-5 standard (work in progress)
- Reference implementation

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# Approach



\*SIDD = Specific Image Defection Detection ([https://pages.nist.gov/frvt/api/FRVT\\_ongoing\\_quality\\_sidd\\_api.pdf](https://pages.nist.gov/frvt/api/FRVT_ongoing_quality_sidd_api.pdf))

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# The past - shortlisted measures and implementations 1/2

measure/quality-score/component	shortlisted algorithms/implementations
Unified Quality Score	MagFace, SDD-FIQA, Fusion of OFIQ's factors
Face Detection, Segmentation, Landmark Localization and Alignment	TinaFace, Mediapipe, dlib, PFLD, CelebAMask-HQ, Face-parsing.PyTorch
Illumination	Image-checker, face-quality-metrics (dynamic range), face-image-quality-29794-5-2010, FIIQA, method from WD4 29794-4:2020
De-Focus, Sharpness, Motion blur, and Edge	Maximum Local Variation, Face Region in Focus Measure, method from WD4 29794-5:2022 (eigenvalue-based)
Compression	QGCN, JPEG compression detection, compression ratio
Unnatural Colour & Colour Balance	Method from WD4 29794-5:2022 (analysis of colour histogram)
Camera Subject Distance	Object detection and distance measurement, EXIF data
Camera Lens Focal Length	<b>Suggestion not to use in OFIQ</b>
No occlusion of the face	<b>Own implementation</b>
...	...



# The past - shortlisted measures and implementations 2/2

measure/quality-score/component	shortlisted algorithms/implementations
...	...
Inter-eye distance	Simple Euclidean distance by facial landmarks
Head pose	SynergyNet, 3DDFA-V2, MOS
Expression Neutrality	FacePose_pytorch, DMUE, DAN
Mouth closed	Mouth-open, Mouth-open-js, HippoYD
Eyes open	Eye-state-detection, Method suggested in WD4 29794-5:2022 (eye openness ratio), EAR-based method
No reflections on eye-glasses	Wangxiangxue, JHL-HUST
Location and Coverage of the head	Assessment of vertical/horizontal position of the face (WD4 29794-5:2022 suggestion)
Background uniformity & no other faces in the background	Face-parsing.PyTorch, subject segmentation + uniformity assessment

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# Current status– what has been ported?

measure/quality-score/component	algorithm/implementations	Status
Face Detection / Facial Landmarks	Google Mediapipe	integrated
Over and Underexposure	WD4 29794-5:2022 suggestion	integrated
Dynamic range	WD4 29794-5:2022 suggestion	integrated
Eyes open	Landmark-based (WD4 29794-5:2022 suggestion)	integrated
Mouth open	Landmark-based (WD4 29794-5:2022 suggestion)	Integrated
Camera to subject distance	EXIF data	Integrated
...	...	...

# Current status– what has been ported?

measure/quality-score/component	algorithm/implementations	Status
...	...	...
Image resolution	WD4 29794-5:2022 suggestion	Integration
Total face count	By face detection	integrated
Unnatural colour and colour balance	WD5 29794-5:2022 suggestion	integrated
Location of the head	WD5 29794-5:2022 suggestion	integrated
Background uniformity	CNN based on BiSeNet + entropy of luminance histogram	integrated
No head coverings	<ul style="list-style-type: none"><li>• CNN based on BiSeNet</li><li>• CNN based on CelebAMask-HQ</li></ul>	<ul style="list-style-type: none"><li>• Integrated</li><li>• In analysis</li></ul>

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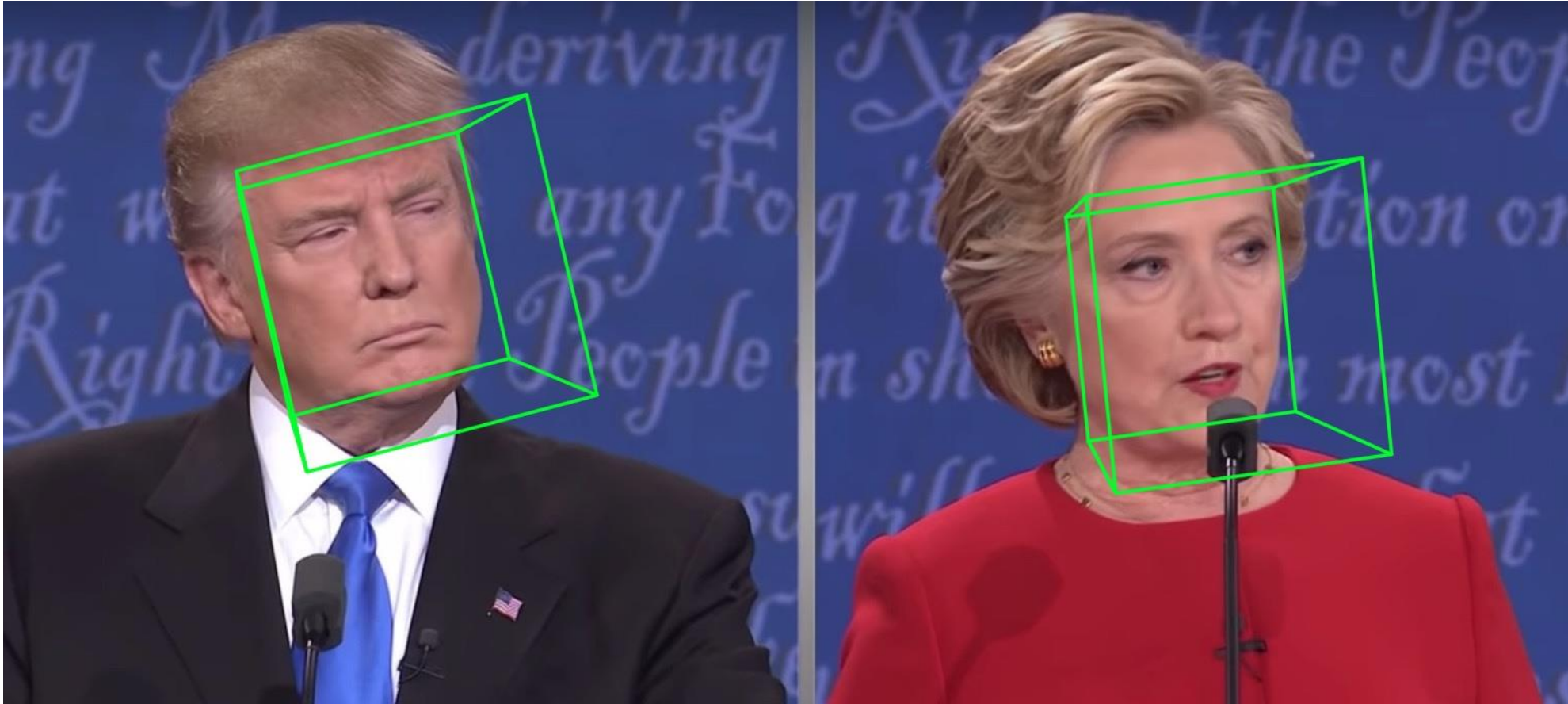
# Current status – Todos

measure/quality-score/component	algorithm/implementations	status
Head pose	<ul style="list-style-type: none"> <li>• CNN from 3DDFA-V2</li> <li>• CNN from Dense-Head-Pose-Estimation</li> </ul>	<ul style="list-style-type: none"> <li>• In evaluation</li> <li>• Ready to port</li> </ul>
Expression neutrality	<ul style="list-style-type: none"> <li>• CNN from DMUE</li> <li>• CNN from DAN</li> <li>• CNN from FacePose_pytorch</li> </ul>	<ul style="list-style-type: none"> <li>• In preparation</li> </ul>
No reflections on eye-glasses	<ul style="list-style-type: none"> <li>• Pixel variance on segmented eyeglasses</li> </ul>	<ul style="list-style-type: none"> <li>• In analysis</li> </ul>
No occlusion of the face	<ul style="list-style-type: none"> <li>• CNN trained by MSc thesis at secunet</li> <li>• AIZOOTech Face mask detection</li> <li>• De-occlusion approach</li> </ul>	<ul style="list-style-type: none"> <li>• Waiting for CNN</li> <li>• Paused</li> <li>• In analysis</li> </ul>
De-Focus	<ul style="list-style-type: none"> <li>• Edge density estimation with Sobel + Laplace operator (WD4 29794-5:2022 suggestion)</li> <li>• Difference with blurred image (WD4 29794-5:2022 suggestion)</li> </ul>	<ul style="list-style-type: none"> <li>• Ready to port</li> <li>• Ready to port</li> </ul>
...	...	...

# Current status – Todos

measure/quality-score/component	algorithm/implementations	status
...	...	...
Motion blur	<ul style="list-style-type: none"> <li>• Cepstrum analysis (WD4 29794-5:2022 suggestion)</li> <li>• Own SVM</li> </ul>	<ul style="list-style-type: none"> <li>• In analysis</li> <li>• Waiting for dataset</li> </ul>
Compression	<ul style="list-style-type: none"> <li>• Compression ratio (WD4 29794-5:2022 suggestion)</li> <li>• CNN from QGCN</li> </ul>	<ul style="list-style-type: none"> <li>• Ready to port</li> <li>• In evaluation</li> </ul>
Moments of the luminance distribution + Illumination uniformity	<ul style="list-style-type: none"> <li>• Algorithms suggested by WD5 29794-5:2022</li> </ul>	<ul style="list-style-type: none"> <li>• Not ready to port</li> </ul>
Shoulder presentation	<ul style="list-style-type: none"> <li>• Subject segmentation + algorithm suggested by WD5 29794-5:2022</li> </ul>	<ul style="list-style-type: none"> <li>• Open</li> </ul>
Agregation of quality component to a unified quality score		<ul style="list-style-type: none"> <li>• Idle (synchronisation with ISO/IEC 29794-5)</li> </ul>
Alternative implementations	<ul style="list-style-type: none"> <li>• Over- and Underexposure: open alternative</li> <li>• Dynamic range: Length of range between 0.05 and 0.95 quantiles</li> <li>• Eyes-open: EAR-based</li> </ul>	

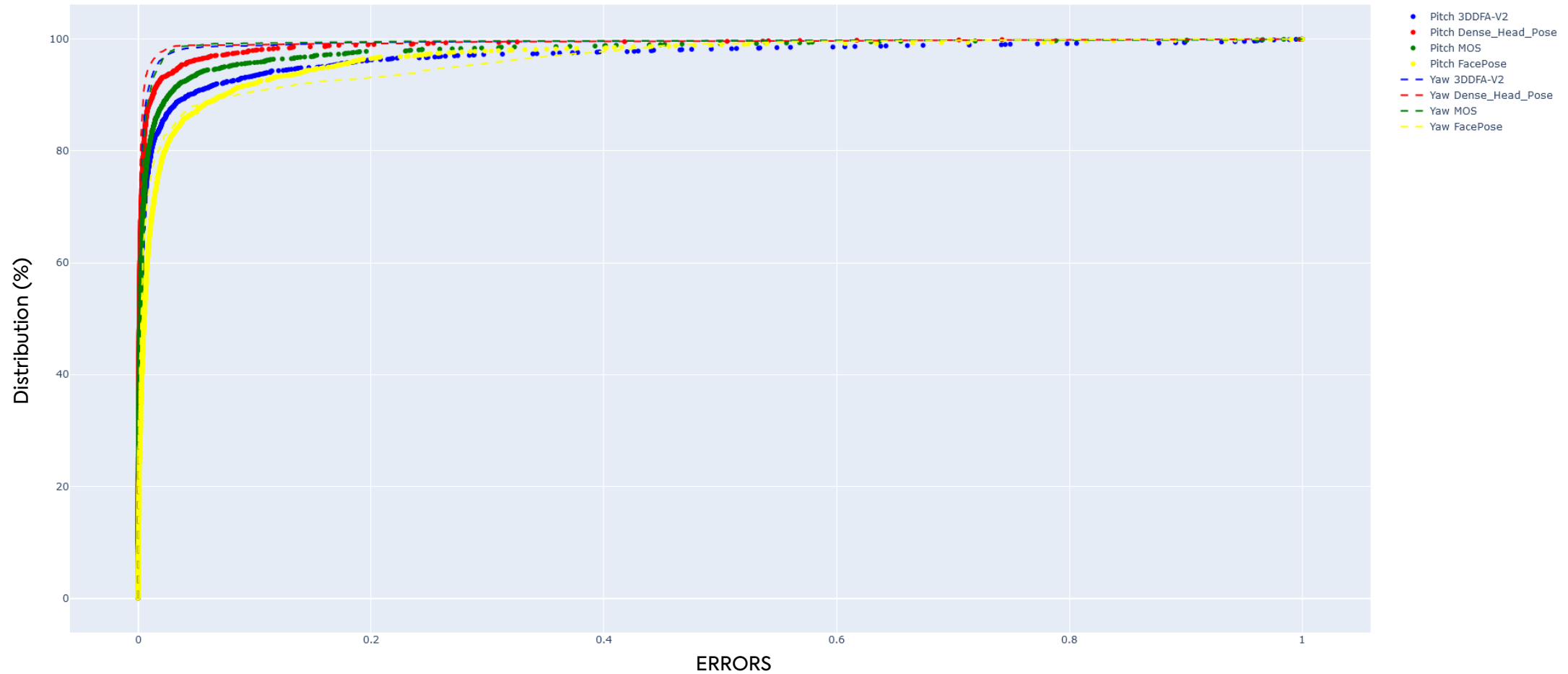
# Current status– Insight in our head pose pre-evaluation



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



# Current status – Example: Insight in our head pose pre-evaluation



ECDF on AFWL2000

# The future – roadmap to a reference implementation

- Submission to NIST FRVT QA/SIDD
- Covering all factors predicted to be required by final ISO/IEC 29794-5 standard
- Multiple parallel submissions with alternative quality factor implementations
- Choice of final scope by NIST FRVT QA/SIDD evaluation report
- Synchronisation with ISO/IEC 29794-5 working group
- Repeat NIST FRVT QA/SIDD submission, if necessary

**secunet**