



# IFPC 2022

## Compressed Face Image Quality

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How does lossy compression affect comparison & quality scores for frontal face images?

Talk structure:

1. Introduction
2. Effect on comparison scores
3. Effect on quality scores (with respect to comparison scores)
4. Conclusions

Experiment setup:

- ▶ Used dataset: ColorFERET, frontal color image subset.
- ▶ Compression types: PNG-resized, JPEG, JPEG 2000, JPEG XL.
- ▶ Images were compressed as closely as possible to certain target sizes.
- ▶ ArcFace model for comparison scores.
- ▶ Various FIQA methods, mostly utility-centric deep learning models.



## Compression types

- ▶ PNG: ISO/IEC 15948:2004
  - ▶ PNG itself is lossless, “**PNG-resized**” refers to downscaled PNG images.
- ▶ **JPEG**: ISO/IEC 10918-1:1994
- ▶ **JPEG 2000**: ISO/IEC 15444-1:2019
- ▶ PNG, JPEG and JPEG 2000 are allowed in ISO/IEC 39794-5:2019.
- ▶ **JPEG XL**: ISO/IEC 18181-1:2022
  - ▶ “L” stands for long-term.
  - ▶ Lossy & lossless mode.
  - ▶ Lossless but smaller JPEG transcoding.
  - ▶ Variable DCT block sizes. (JPEG uses  $8 \times 8$ .)
  - ▶ Adaptive quantization & prediction.
  - ▶ Animations.
  - ▶ Alpha and other extra channels.
  - ▶ ...

## Process overview - Part 1

### 1. ColorFERET



Original image  
(512x768)



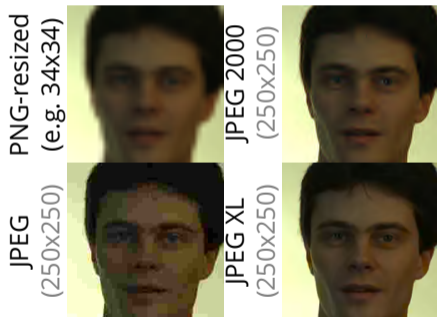
### 2. Preprocessing



Lossless  
ROI image  
(250x250)



### 3. Lossy compression



(e.g. for target size 2.2kB)



## Process overview - Part 2

### 4.A. Face recognition



Image  
pair



0.71

Comparison  
score

### 4.B. Quality assessment



Single  
image



0.34

Quality  
score



## Compression error example (at target size 2.2kB)

JPEG



JPEG 2000



JPEG XL



PNG-resized



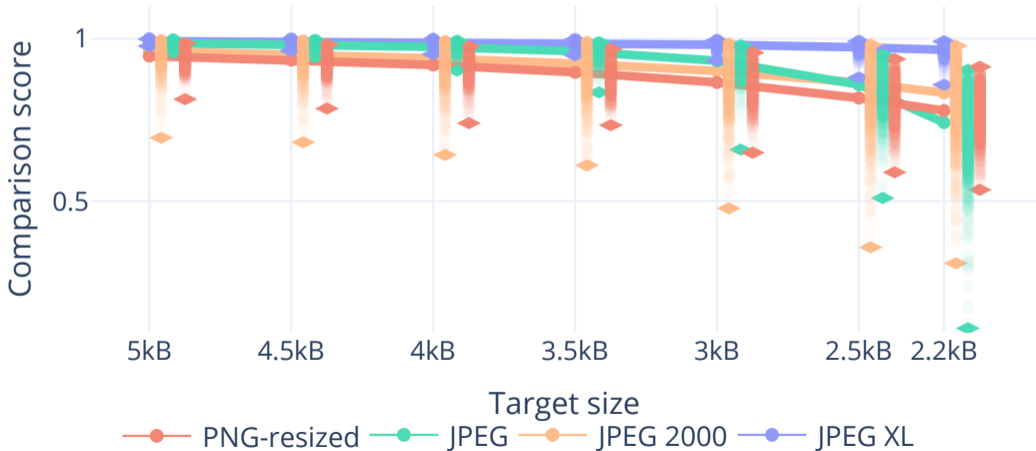


Mated-other: Different samples from the same subject at the same target size



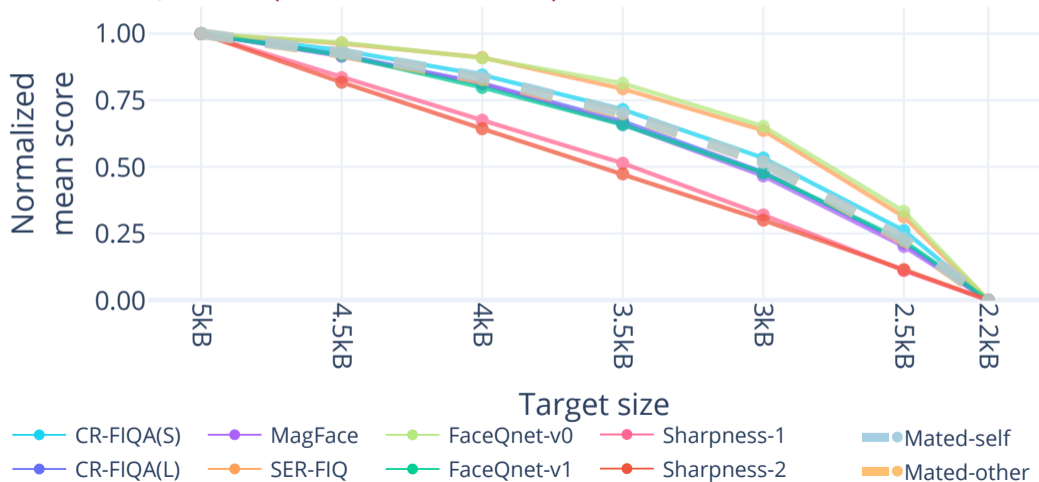


## Mated-self: Lossless vs lossy sample comparisons

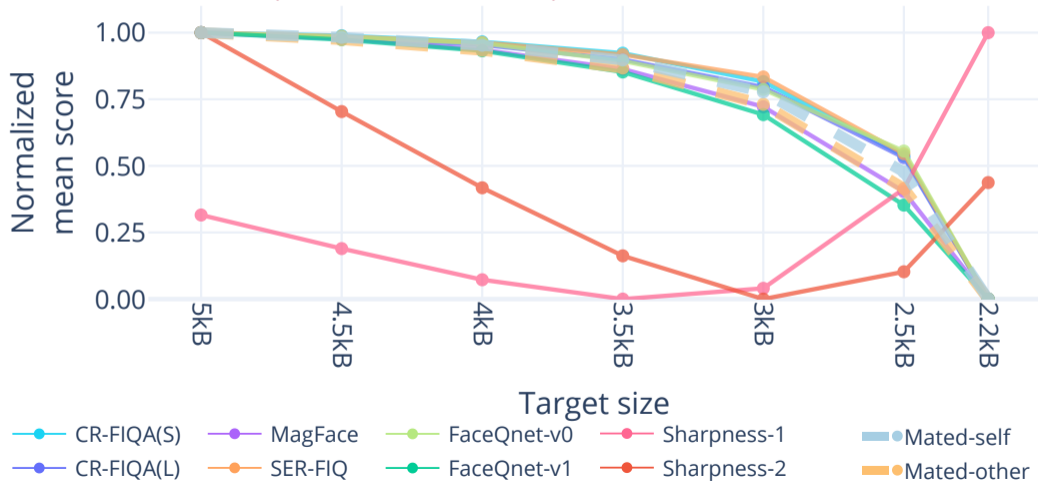




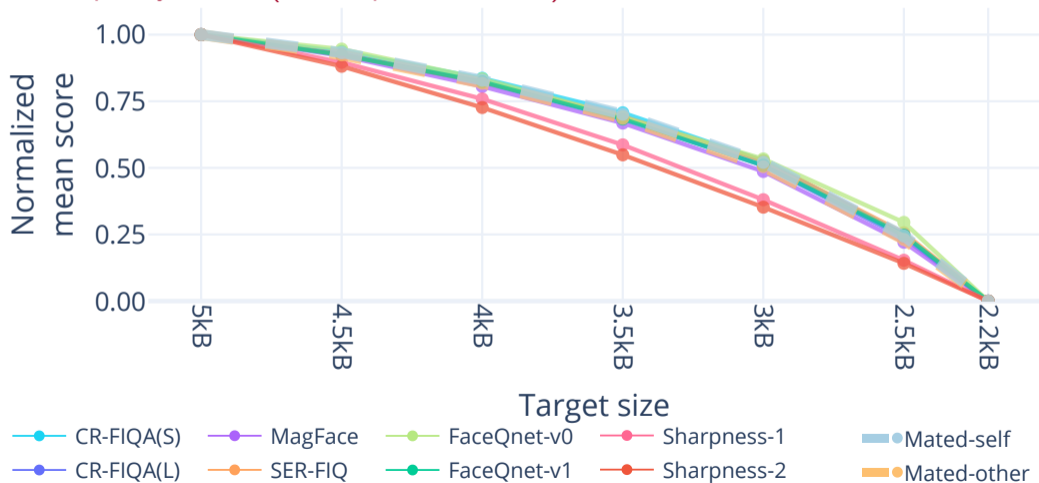
## Normalized quality scores (vs comparison scores) - PNG-resized



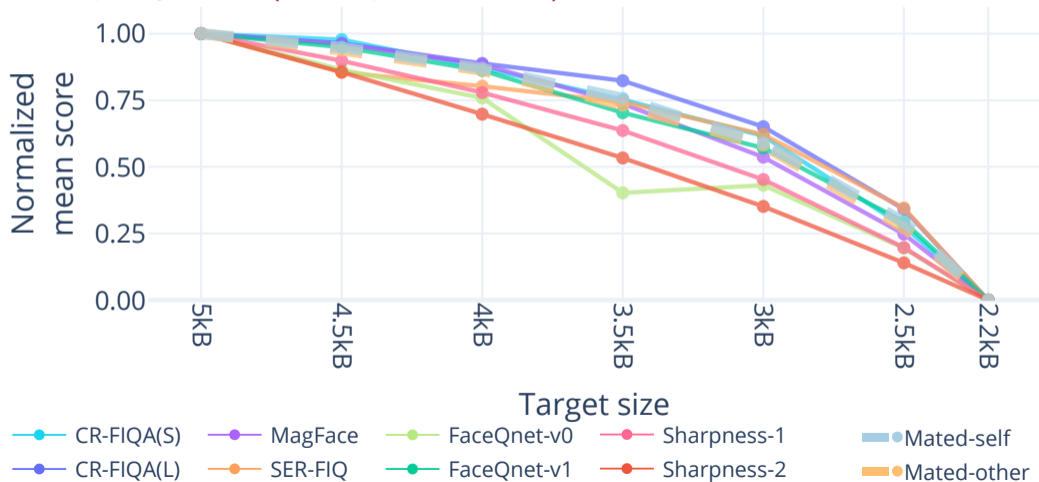
## Normalized quality scores (vs comparison scores) - JPEG



## Normalized quality scores (vs comparison scores) - JPEG 2000

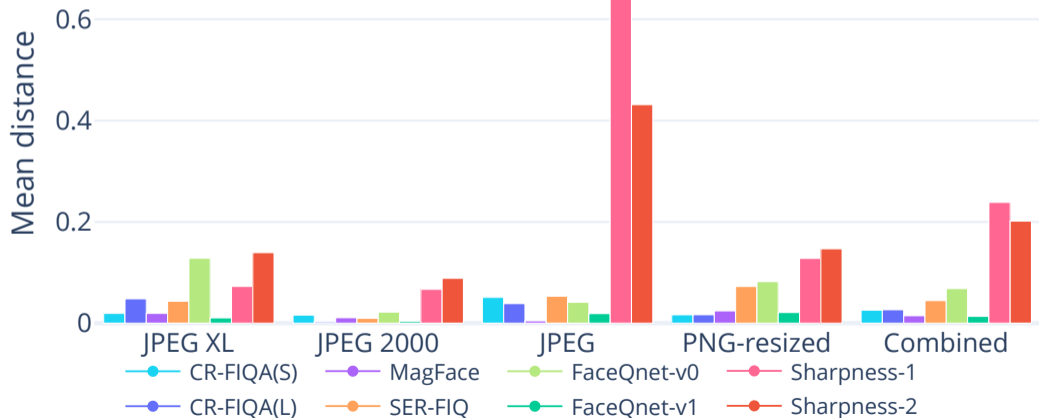


## Normalized quality scores (vs comparison scores) - JPEG XL



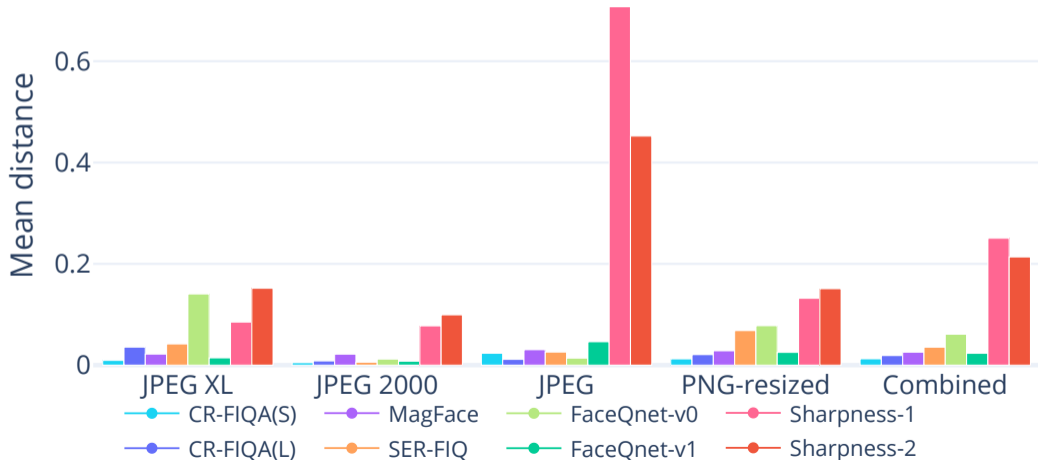


## Distance between quality and comparison score curves - Mated-other





## Distance between quality and comparison score curves - Mated-self





## Compression type conclusions for face recognition:

- ▶ JPEG XL was generally superior to or competitive with the other compression types, in terms of both mean and worst-case impact on comparison scores.
- ▶ Clearer differences were observed for ROI images at target sizes under 5kB, but higher sizes had only minor differences between the compression types.  
→No critical need for JPEG XL, but it would be an improvement.

## FIQA method comparison score correlation:

- ▶ Sharpness measures were confused by JPEG, presumably due to the block artifacts.
- ▶ Modern FIQA models however correlated well.
- ▶ Best for JPEG XL: FaceQnet-v1, CR-FIQA(S), MagFace.
- ▶ Note that this does not imply good FIQA performance in more general terms.



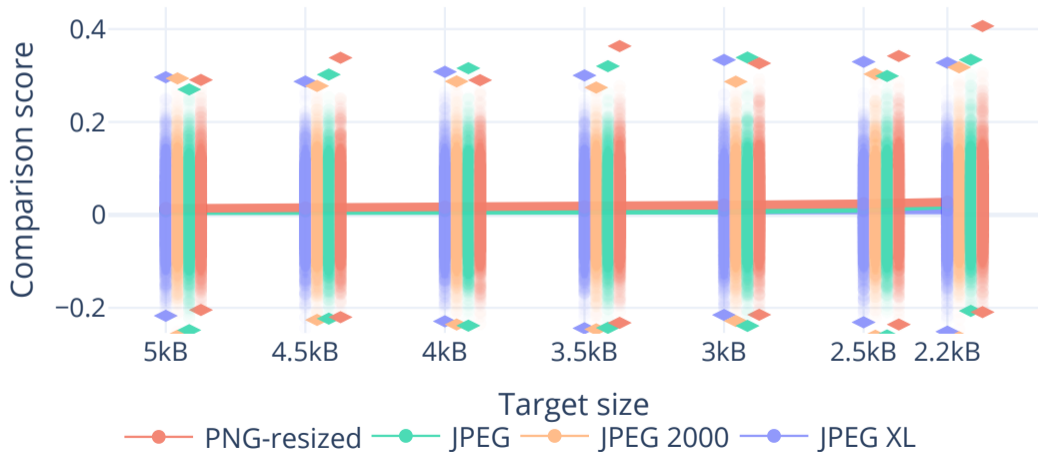
Thank you!

Questions?





## Non-mated: Randomly selected non-mated comparison trials





## Portrait image variant

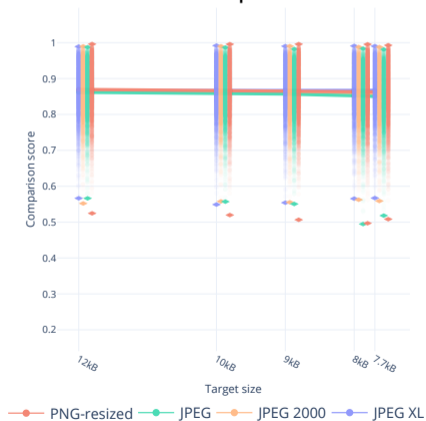
Original



Portrait variant



## Mated-other comparison scores



Portions of the research in this paper use the FERET database of facial images collected under the FERET program, sponsored by the DOD Counterdrug Technology Development Program Office.

- ▶ P.J. Phillips, H. Wechsler, J. Huang, P. Rauss, “The FERET database and evaluation procedure for face recognition algorithms”, Image and Vision Computing Journal, Vol. 16, No. 5, pp. 295-306, 1998.
- ▶ P.J. Phillips, H. Moon, S.A. Rizvi, P.J. Rauss, “The FERET Evaluation Methodology for Face Recognition Algorithms”, IEEE Trans. Pattern Analysis and Machine Intelligence, Vol. 22, pp. 1090-1104, 2000.