

Quantifying the impact of image degradation on Deep Learning models in face recognition systems

Leandro Dias Carneiro¹, Flavio de Barros Vidal²

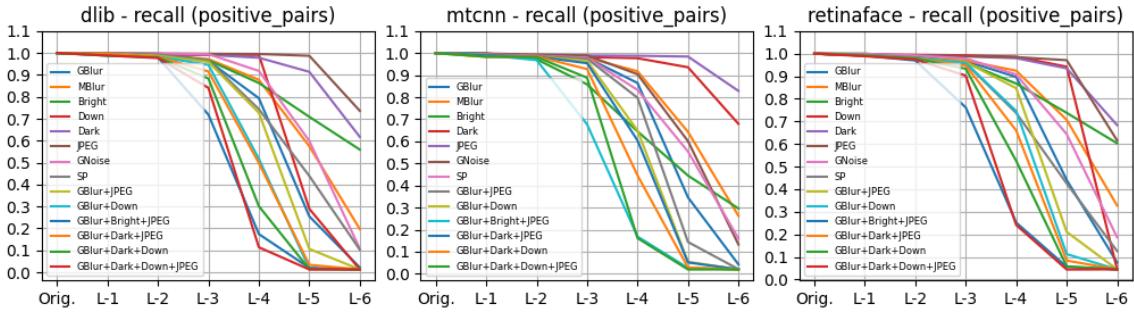
¹Criminalistics Institute of the Federal District Civil Police – Brasília – DF – Brazil

²Dep. of Computer Science – University of Brasília – Brasília – DF – Brazil

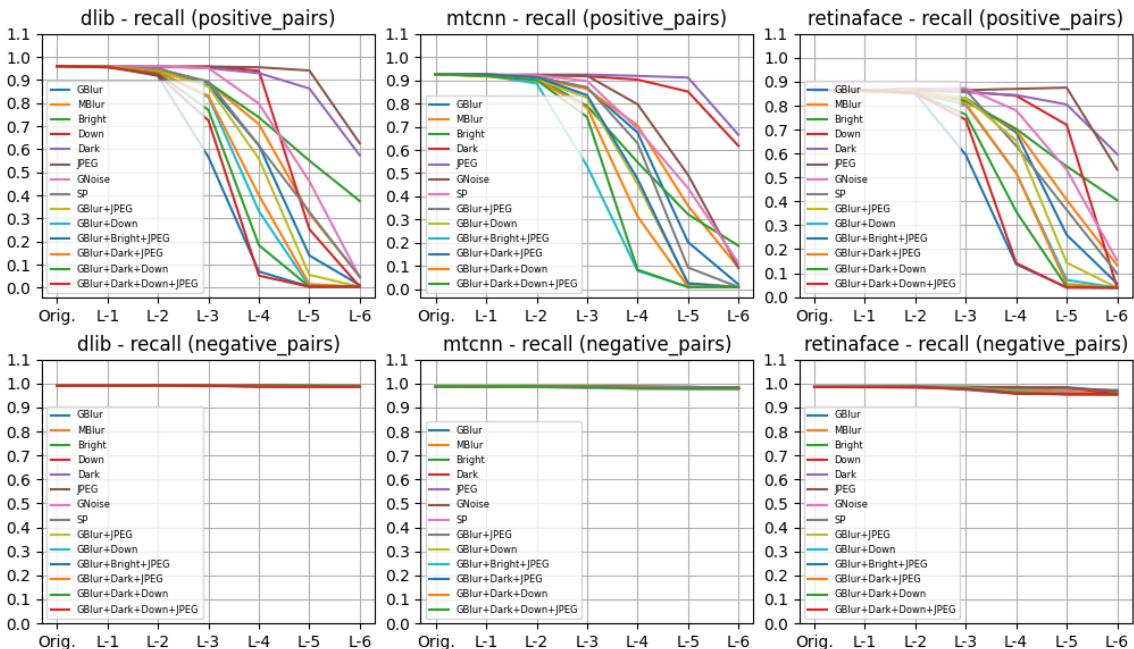
`leandro.carneiro@pcdf.df.gov.br, fbvidal@unb.br`

Supplementary Material

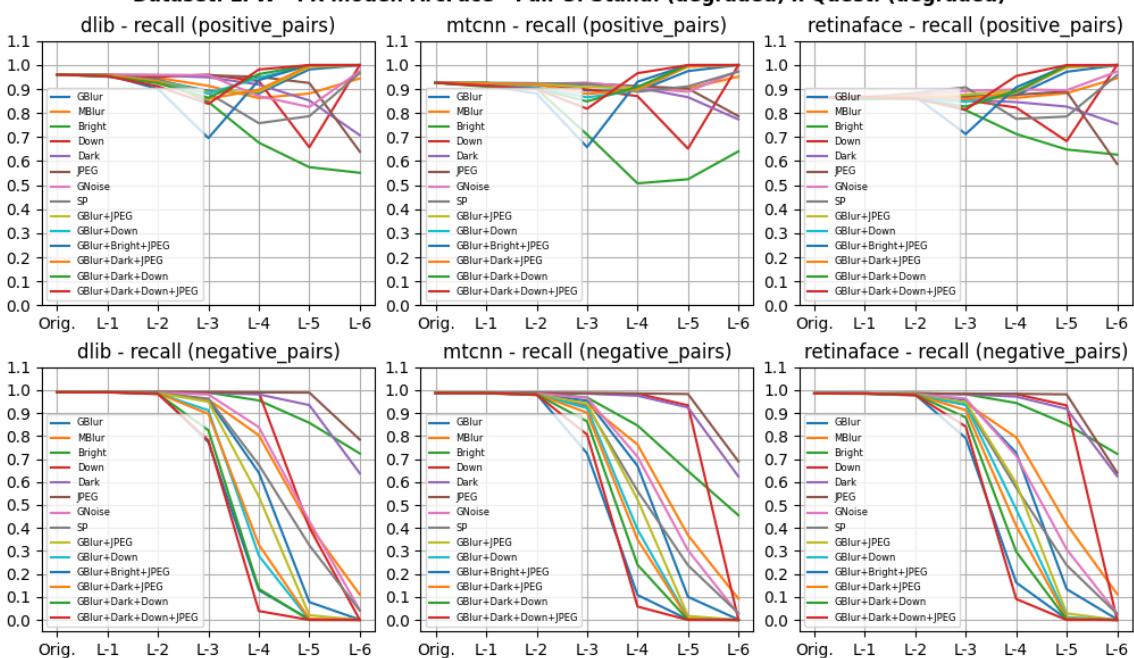
Dataset: LFW - FR model: ArcFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



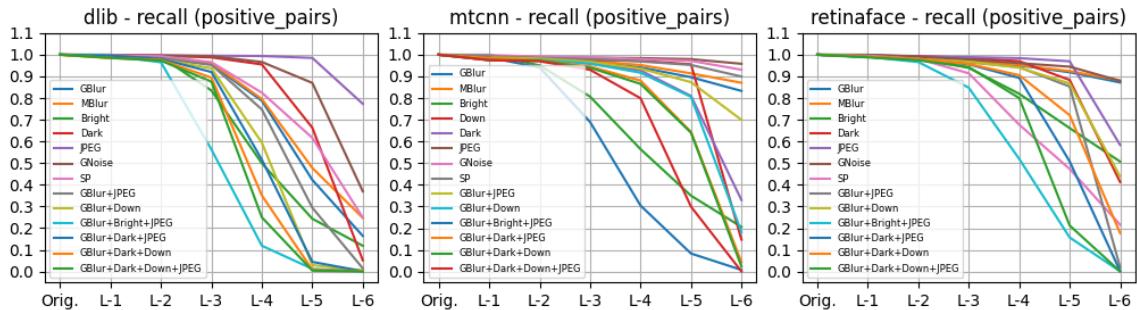
Dataset: LFW - FR model: ArcFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



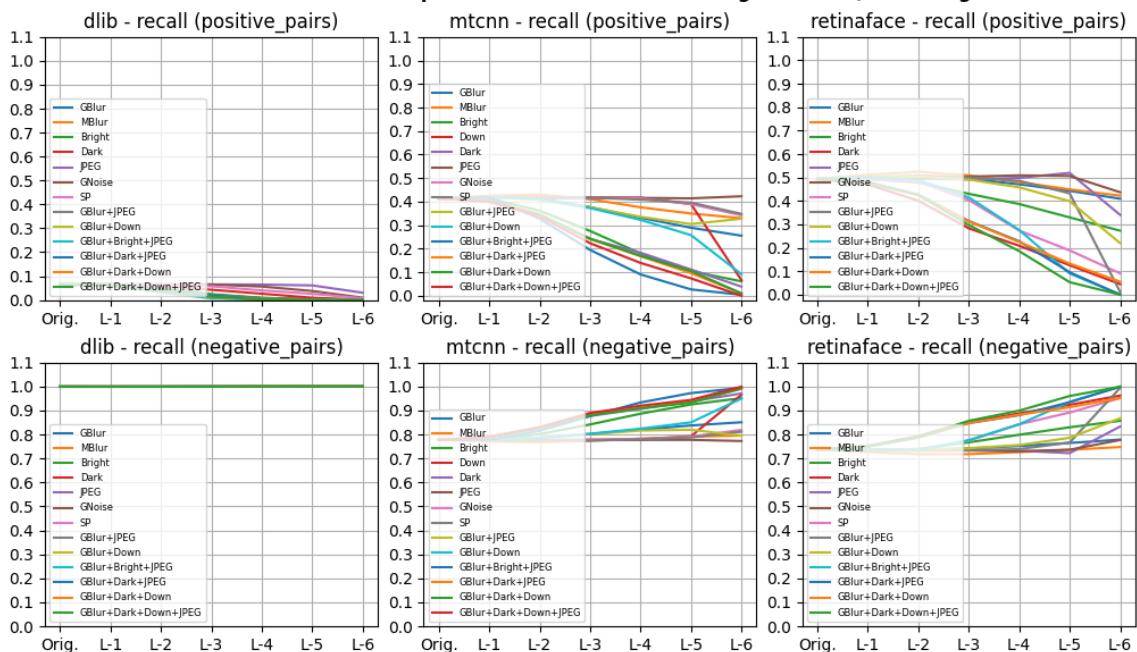
Dataset: LFW - FR model: ArcFace - Pair 3: Stand. (degraded) x Quest. (degraded)



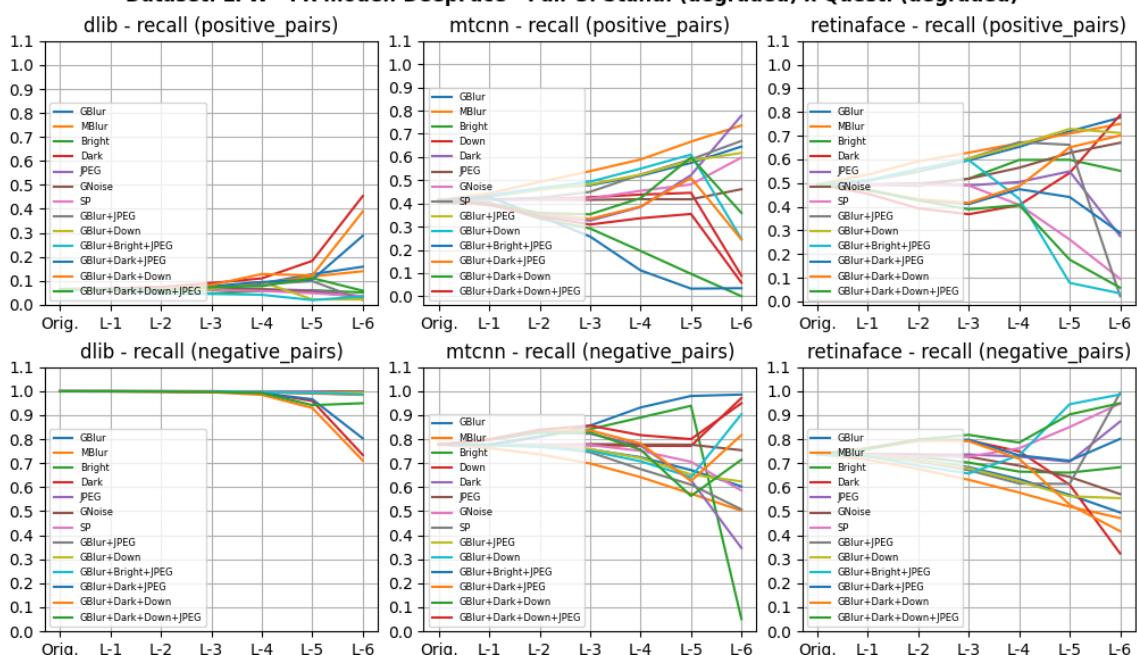
Dataset: LFW - FR model: DeepFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



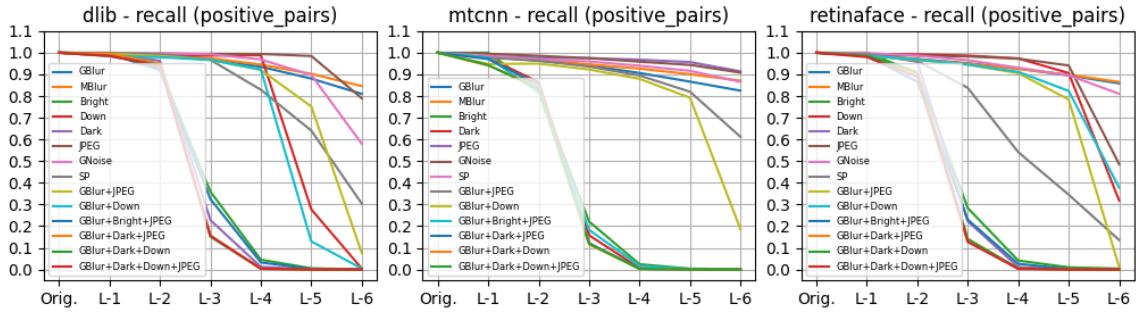
Dataset: LFW - FR model: DeepFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



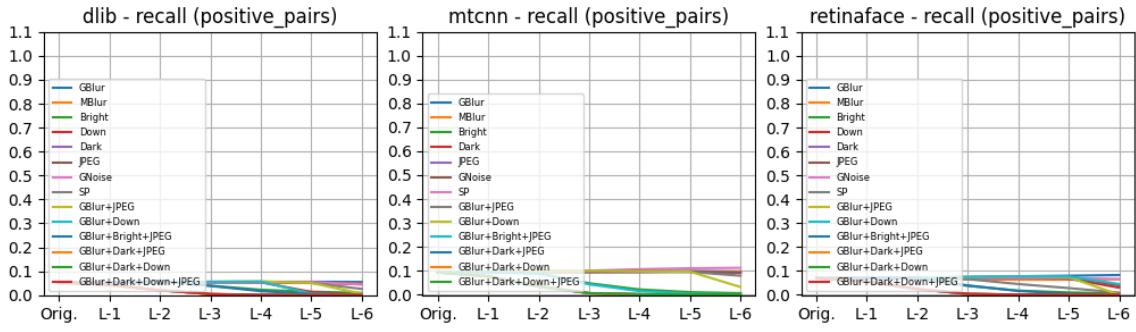
Dataset: LFW - FR model: DeepFace - Pair 3: Stand. (degraded) x Quest. (degraded)



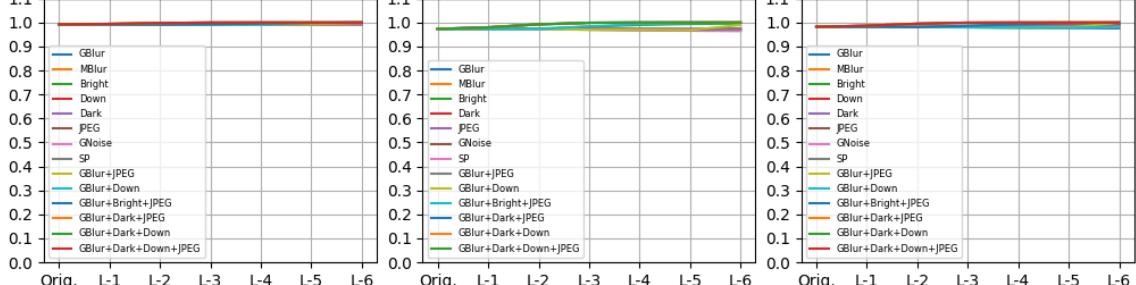
Dataset: LFW - FR model: DeepID - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



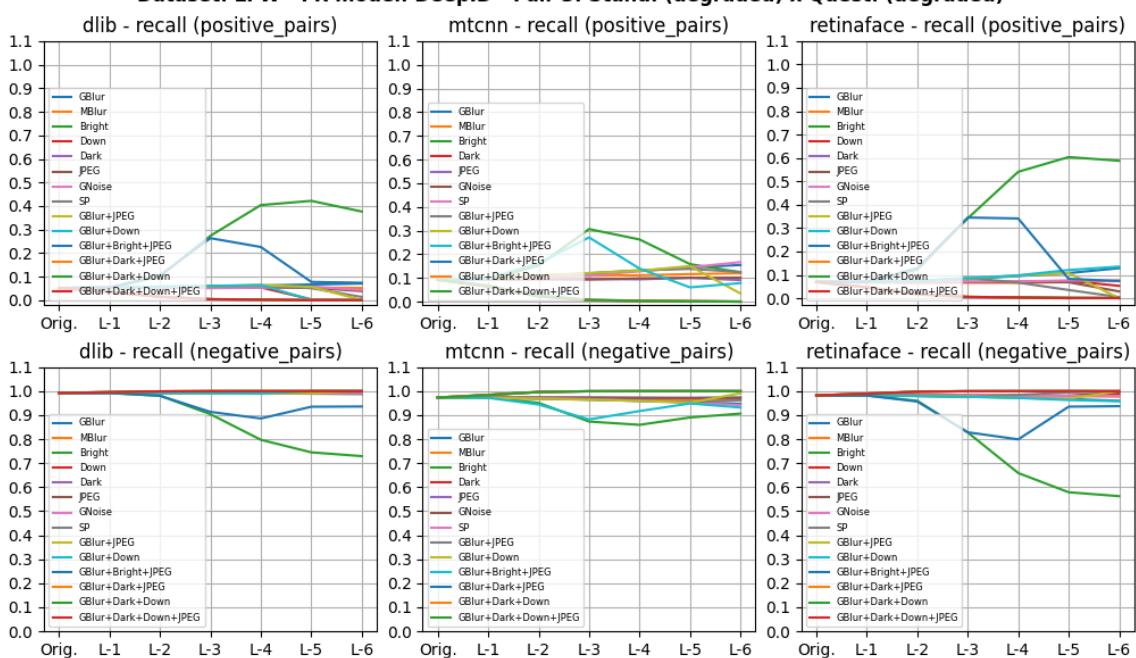
Dataset: LFW - FR model: DeepID - Pair 2: Stand. (non-degraded) x Quest. (degraded)



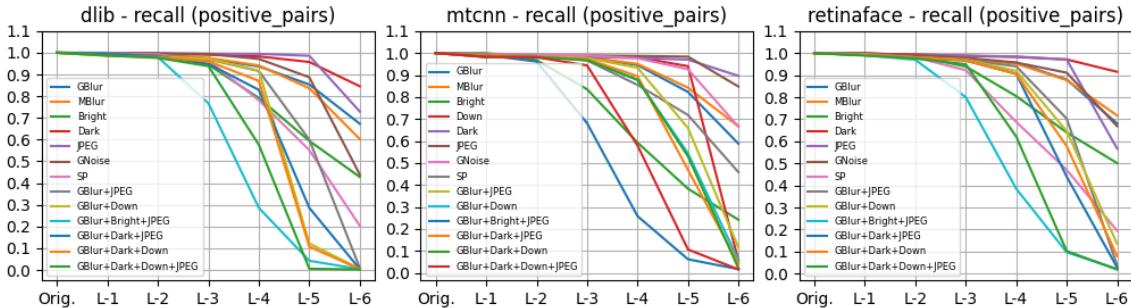
dlib - recall (negative_pairs)



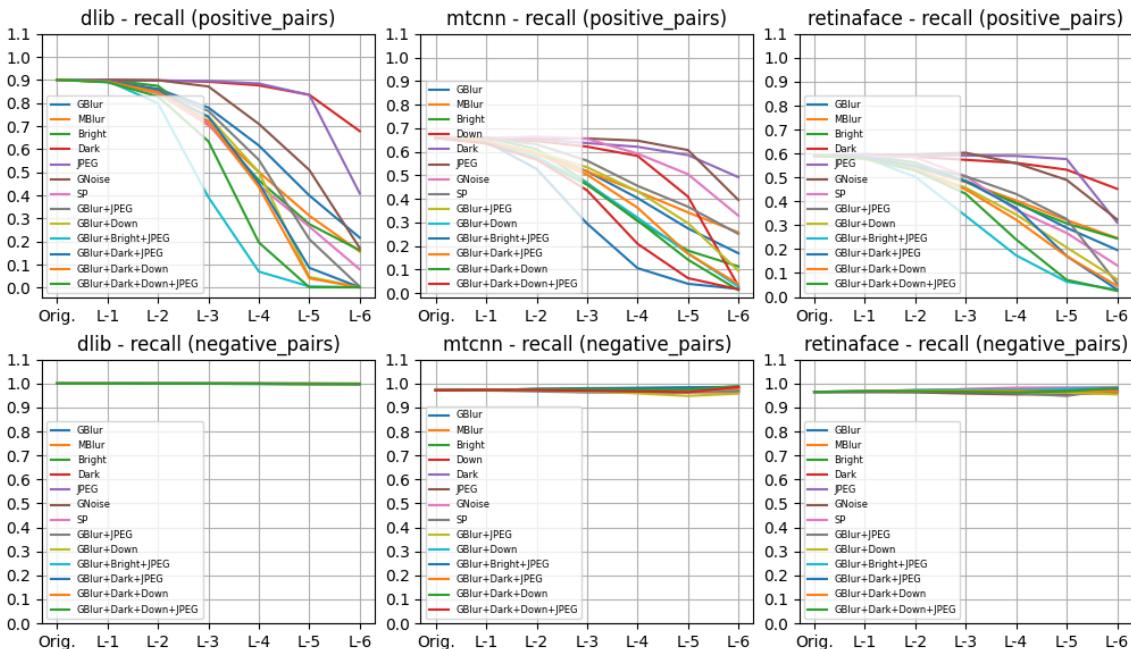
Dataset: LFW - FR model: DeepID - Pair 3: Stand. (degraded) x Quest. (degraded)



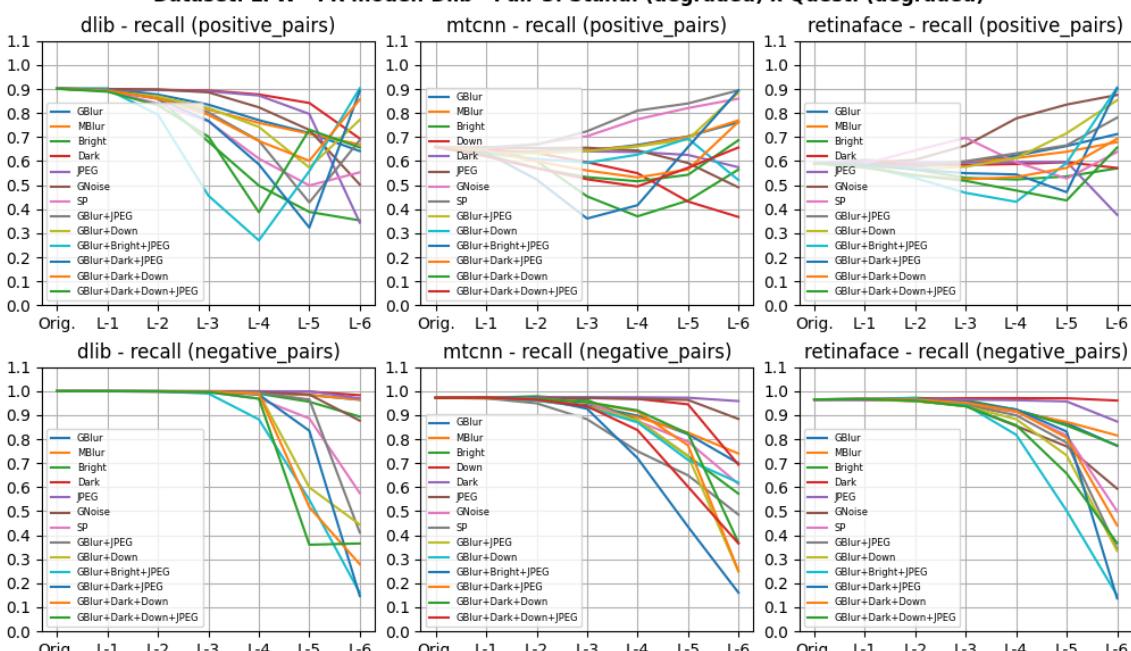
Dataset: LFW - FR model: Dlib - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



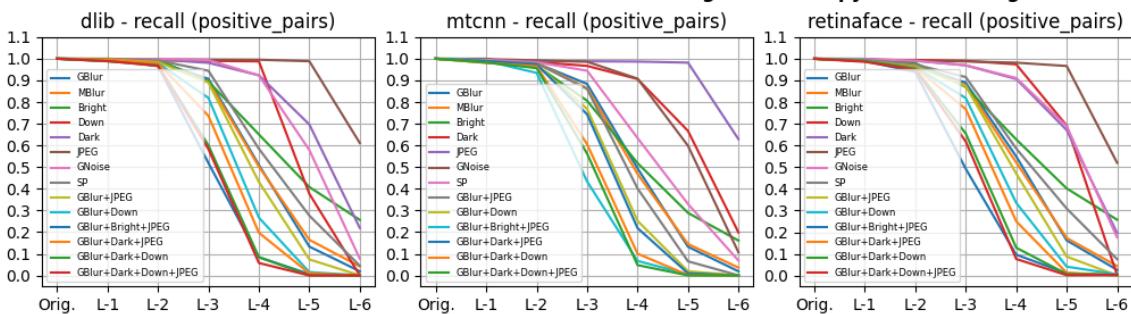
Dataset: LFW - FR model: Dlib - Pair 2: Stand. (non-degraded) x Quest. (degraded)



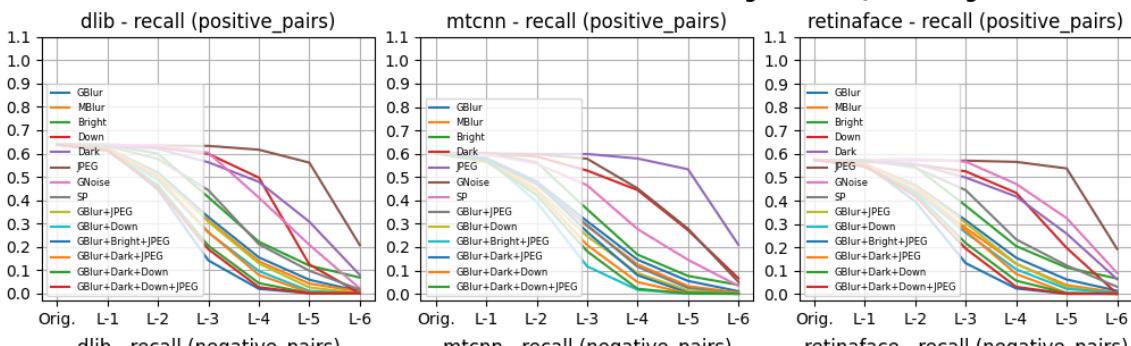
Dataset: LFW - FR model: Dlib - Pair 3: Stand. (degraded) x Quest. (degraded)



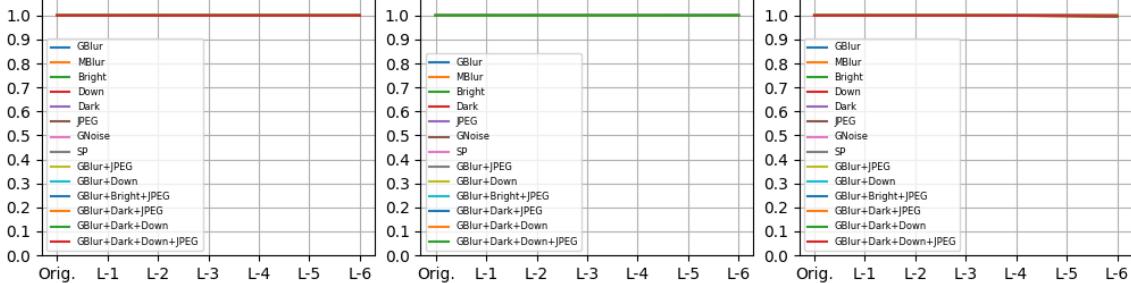
Dataset: LFW - FR model: Facenet512 - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



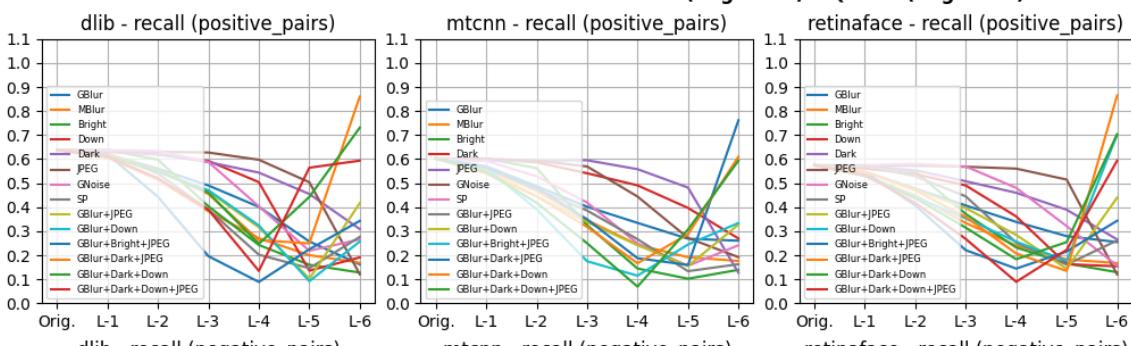
Dataset: LFW - FR model: Facenet512 - Pair 2: Stand. (non-degraded) x Quest. (degraded)



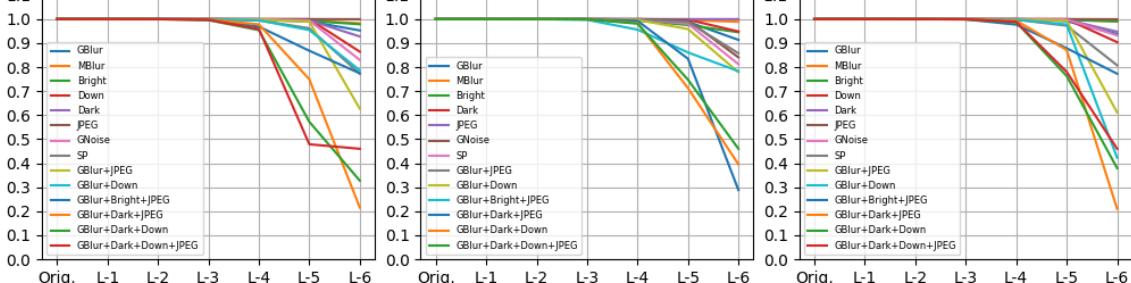
dlib - recall (negative_pairs)



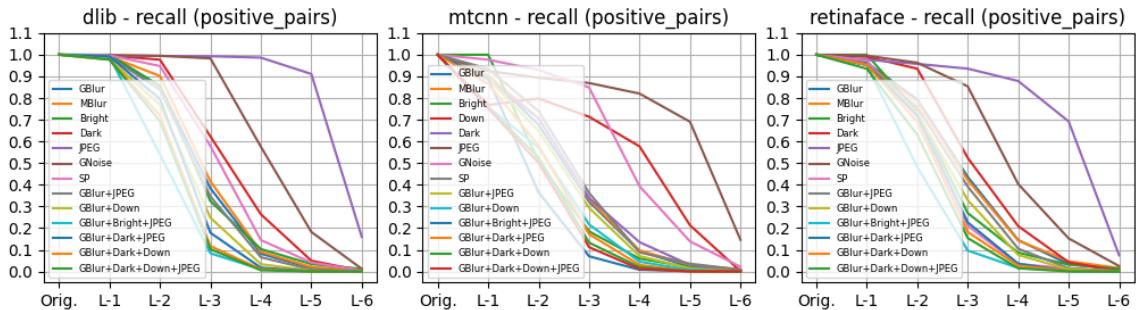
Dataset: LFW - FR model: Facenet512 - Pair 3: Stand. (degraded) x Quest. (degraded)



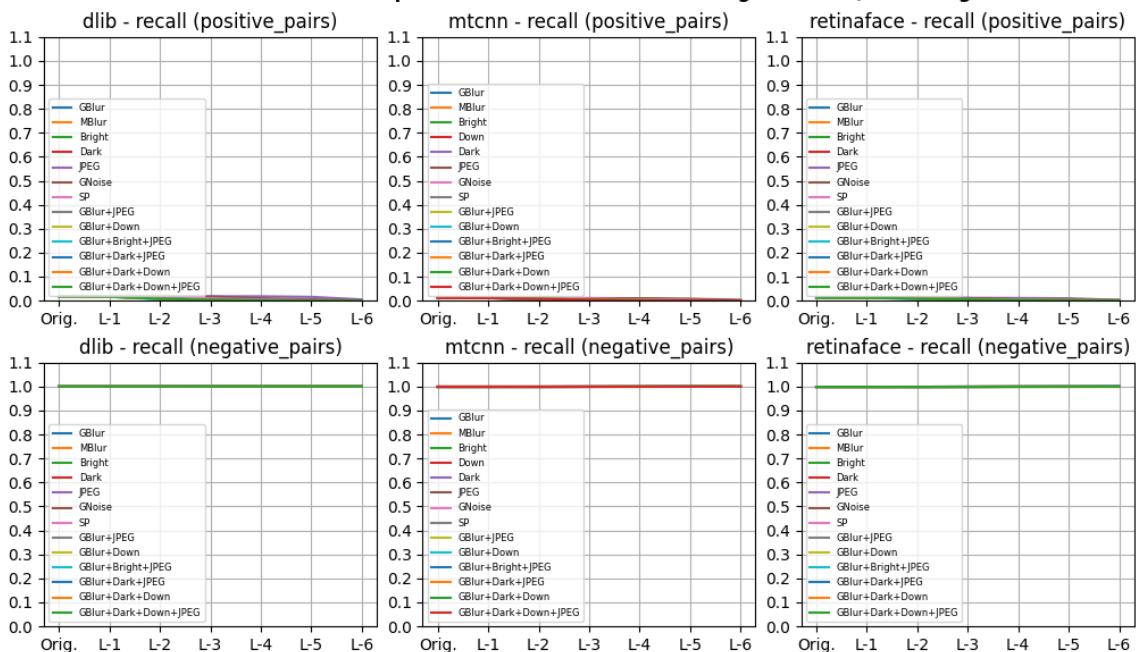
dlib - recall (negative_pairs)



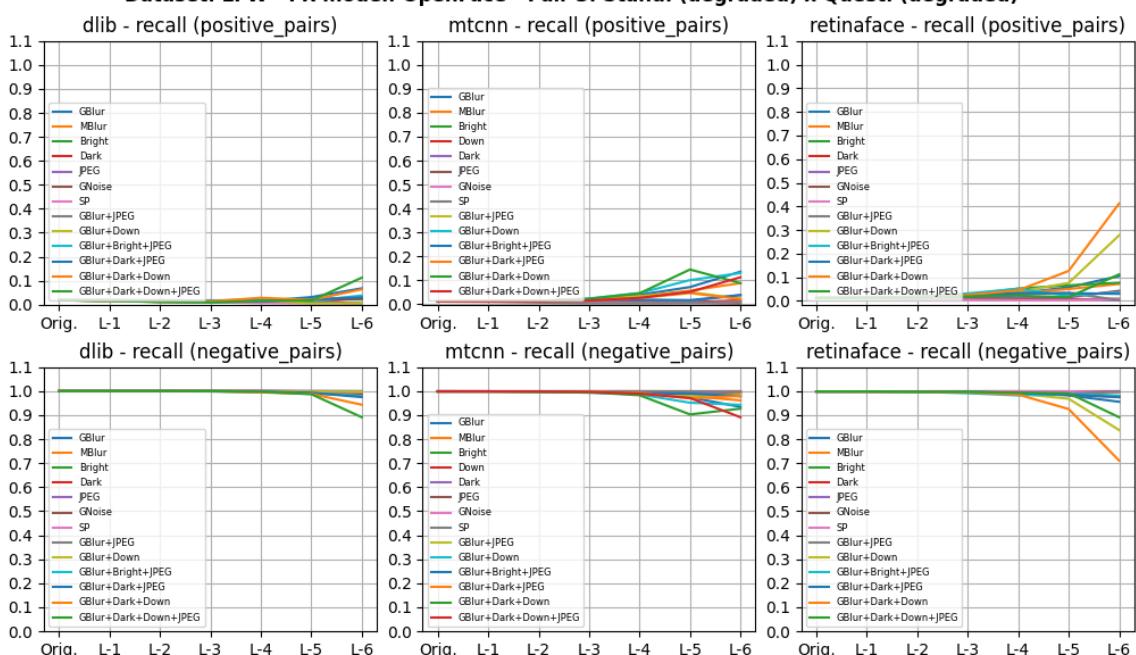
Dataset: LFW - FR model: OpenFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



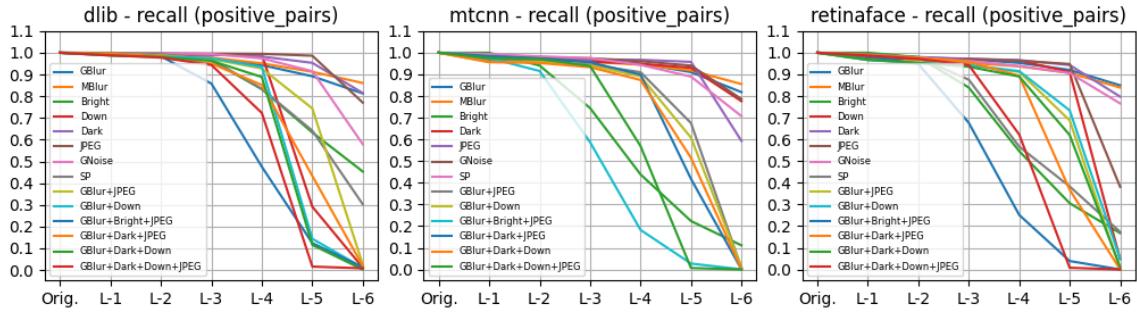
Dataset: LFW - FR model: OpenFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



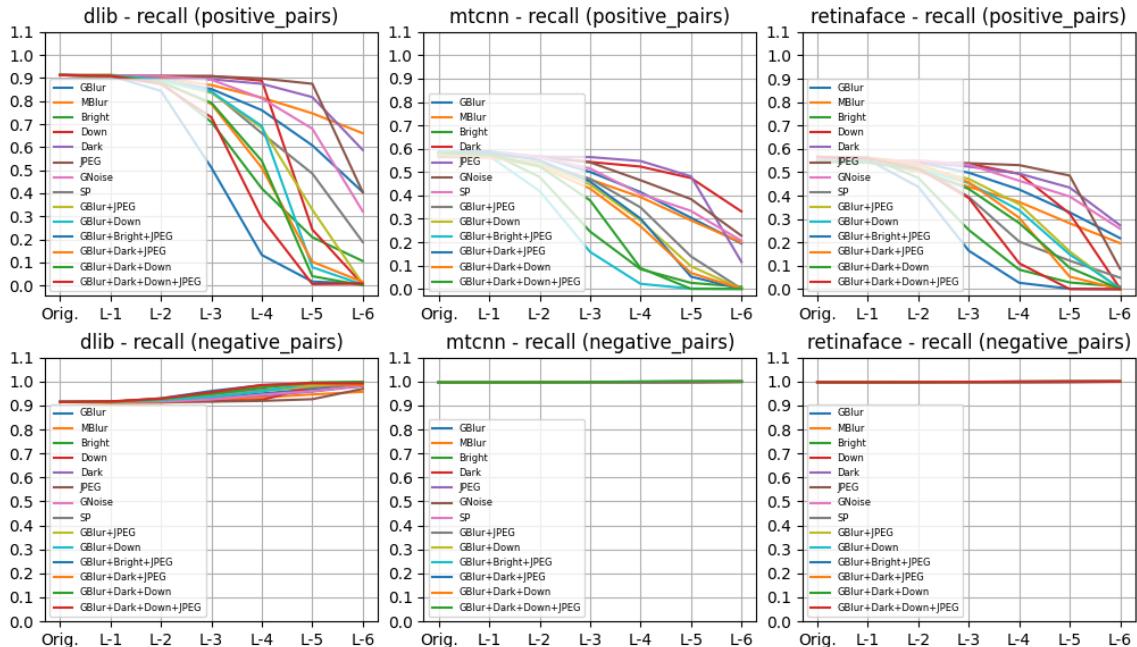
Dataset: LFW - FR model: OpenFace - Pair 3: Stand. (degraded) x Quest. (degraded)



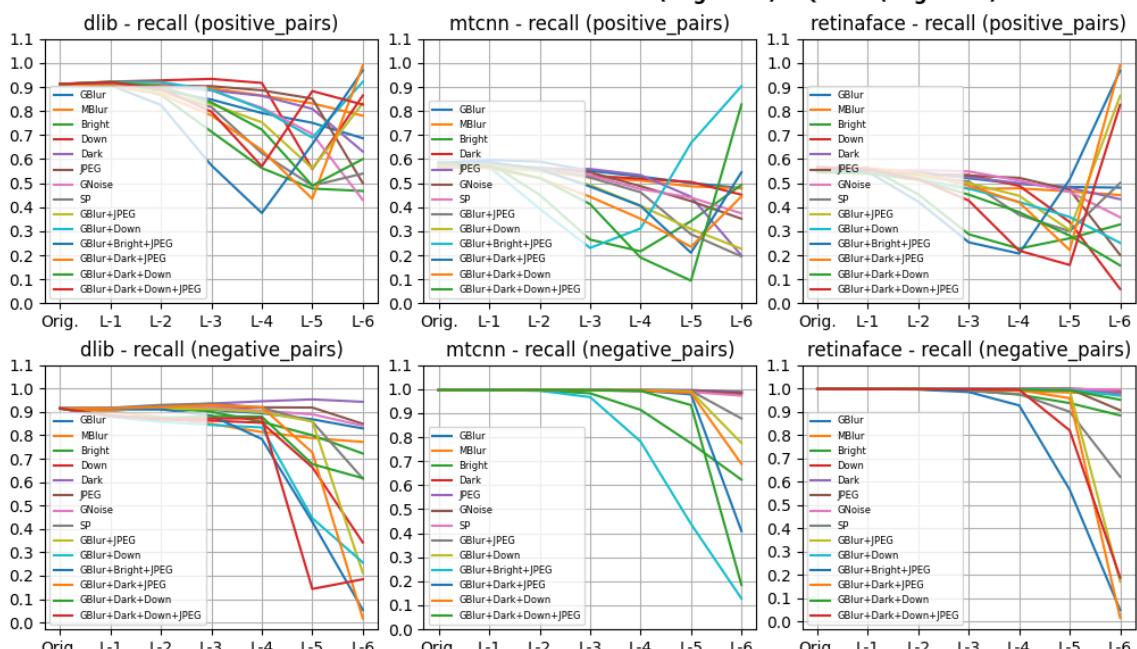
Dataset: LFW - FR model: SFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



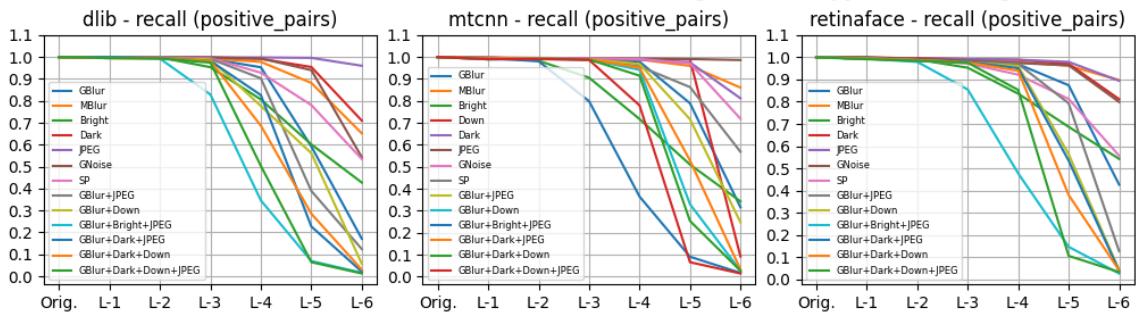
Dataset: LFW - FR model: SFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



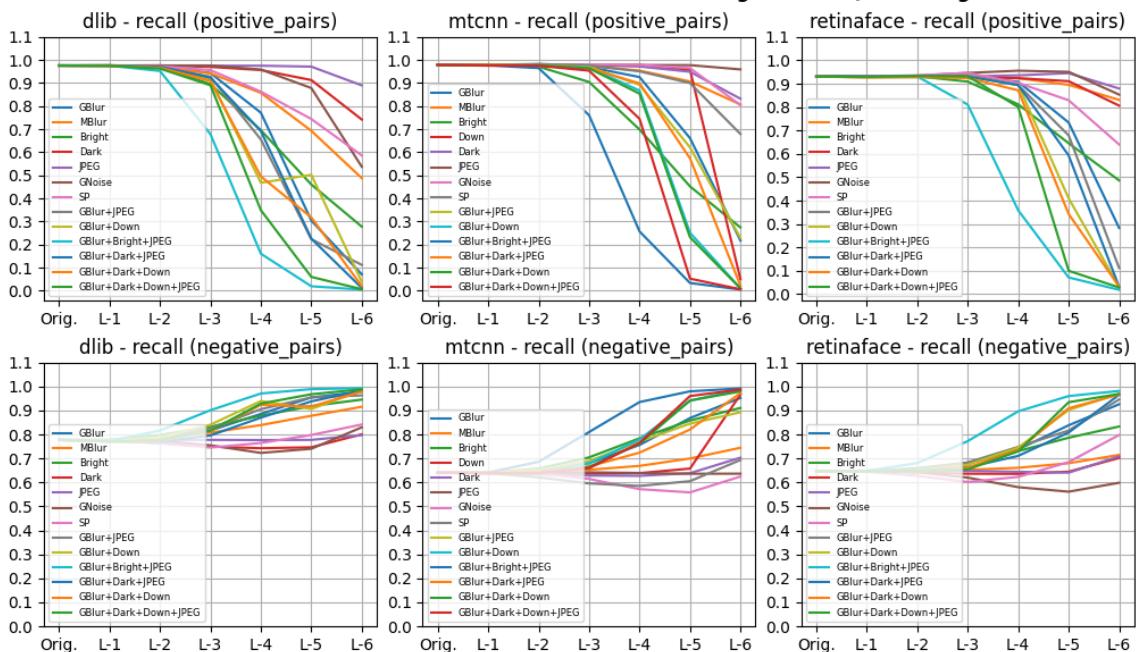
Dataset: LFW - FR model: SFace - Pair 3: Stand. (degraded) x Quest. (degraded)



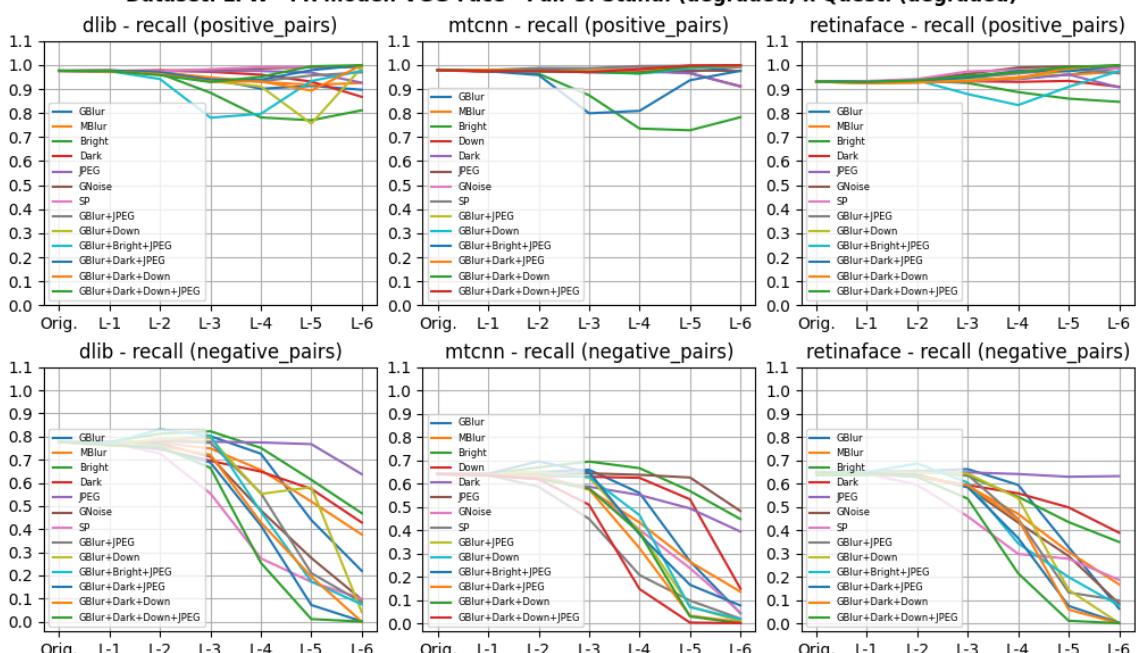
Dataset: LFW - FR model: VGG-Face - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)

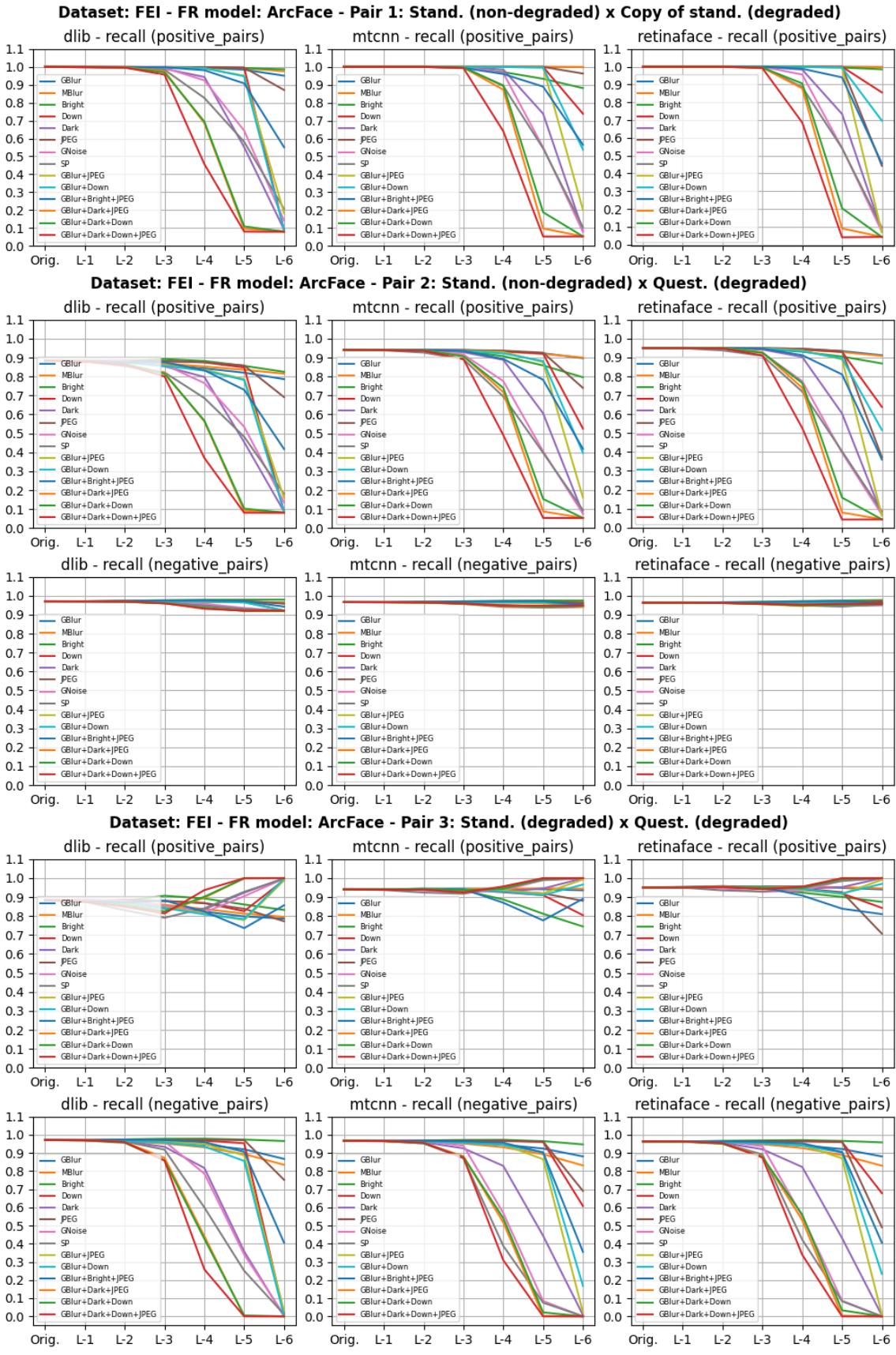


Dataset: LFW - FR model: VGG-Face - Pair 2: Stand. (non-degraded) x Quest. (degraded)

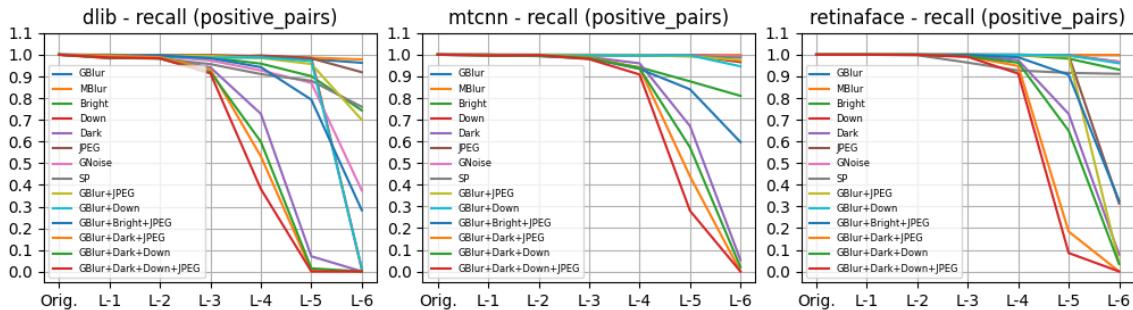


Dataset: LFW - FR model: VGG-Face - Pair 3: Stand. (degraded) x Quest. (degraded)

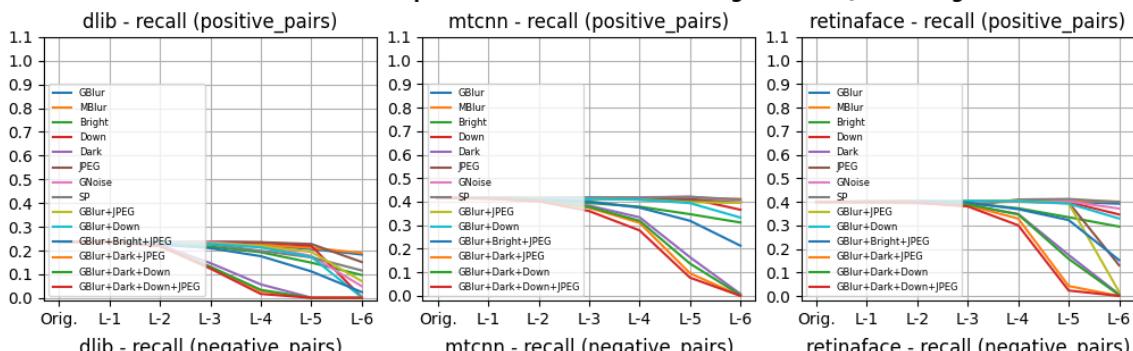




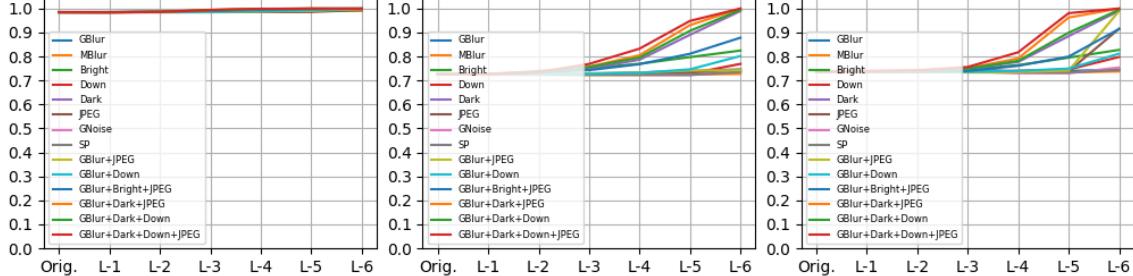
Dataset: FEI - FR model: DeepFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



Dataset: FEI - FR model: DeepFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



dlib - recall (negative_pairs) 1.1 interlin - recall (negative_pairs) 1.1 retinolace - recall (negative_pairs) 1.1



Dataset: FEI - FR model: DeepFace - Pair 3: Stand. (degraded) x Quest. (degraded)

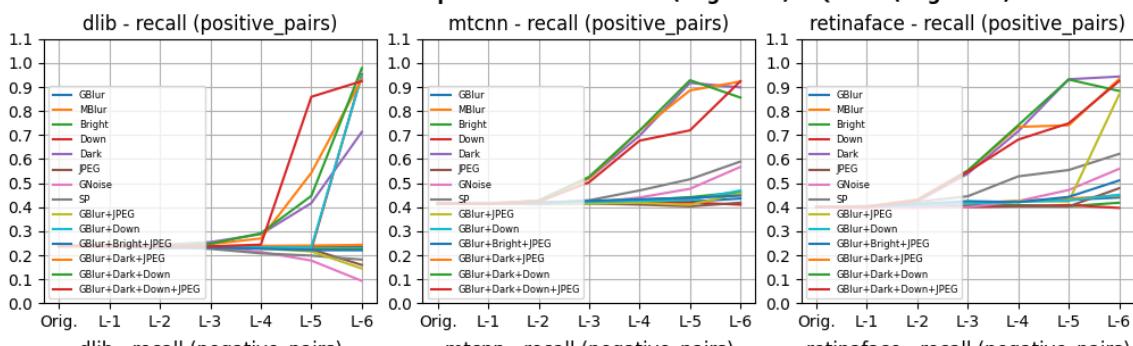
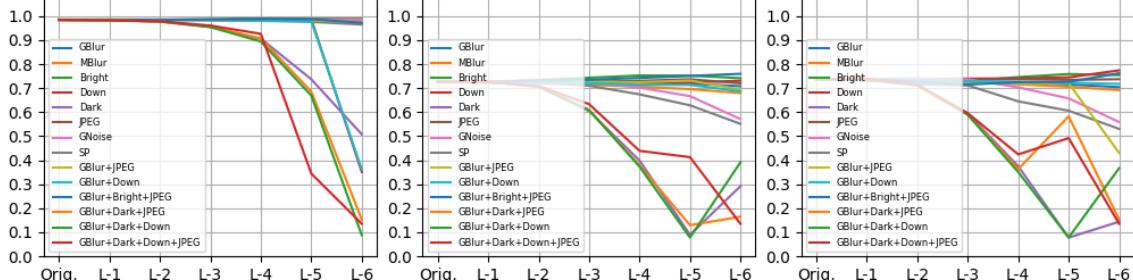
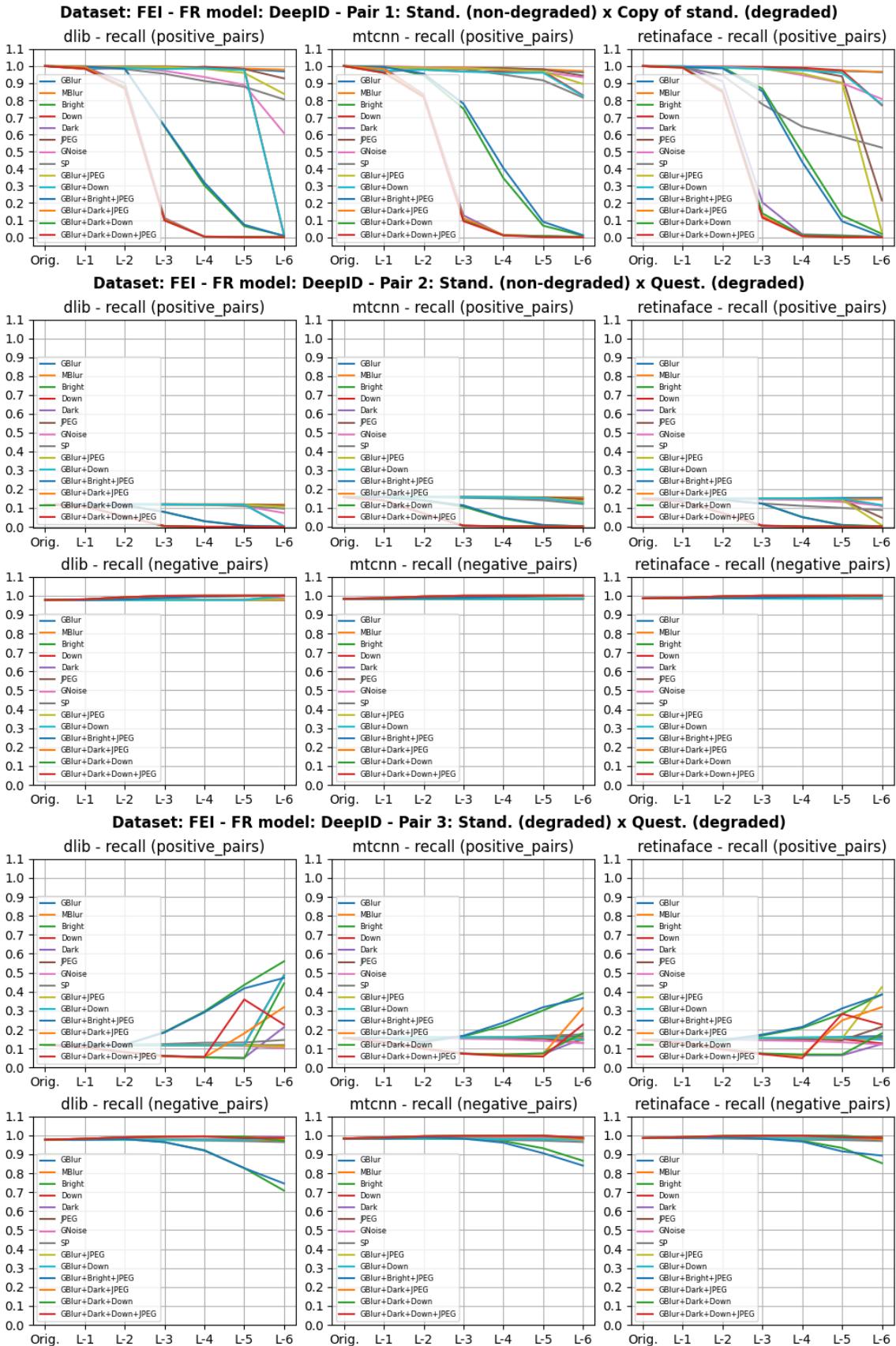
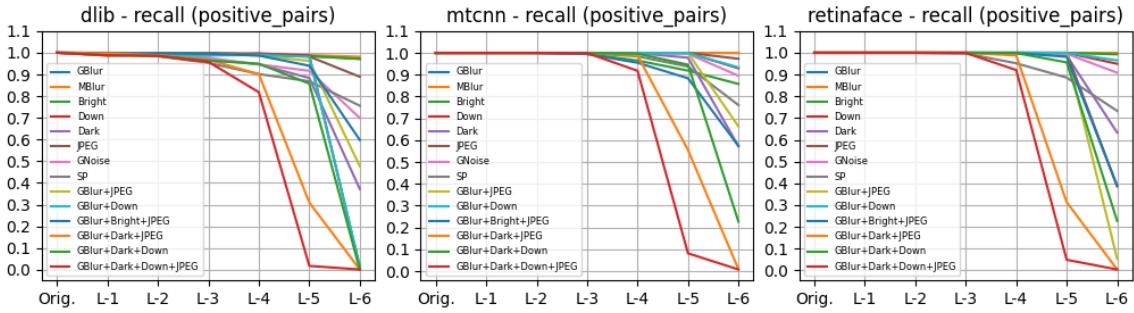


Figure 10: The recall of three detectors on negative pairs.

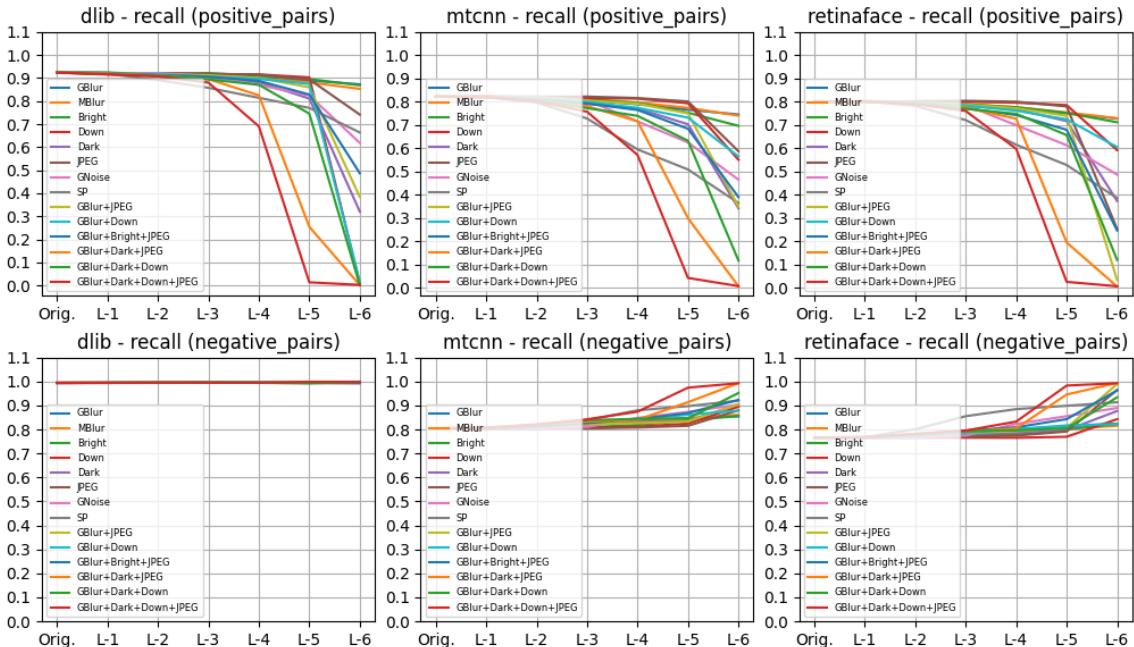




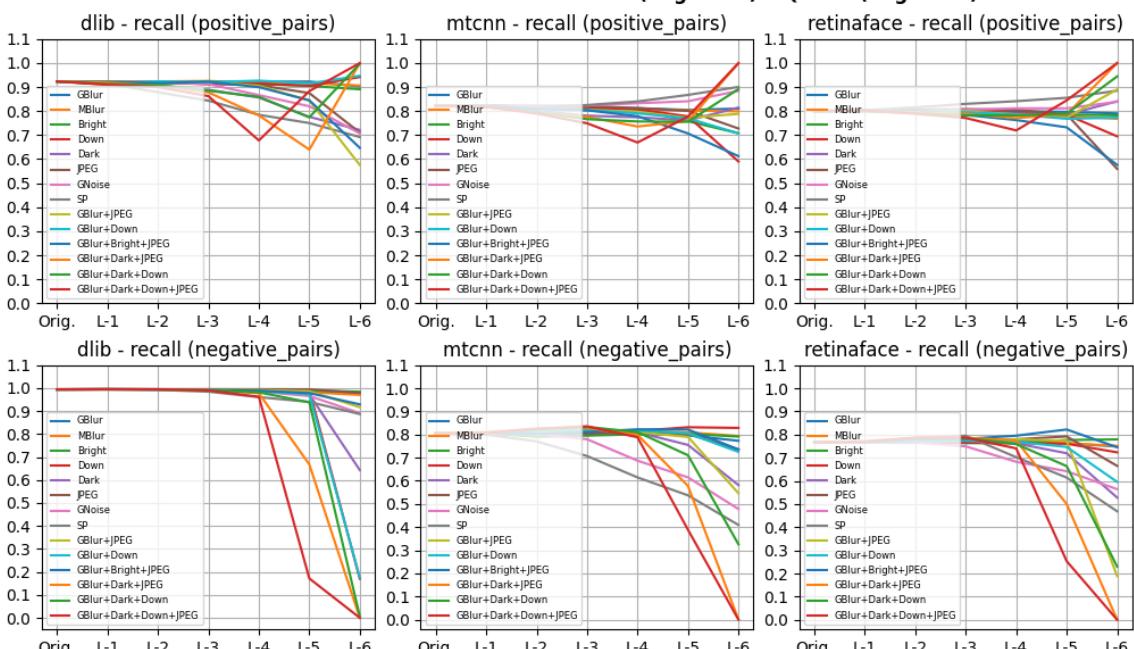
Dataset: FEI - FR model: Dlib - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



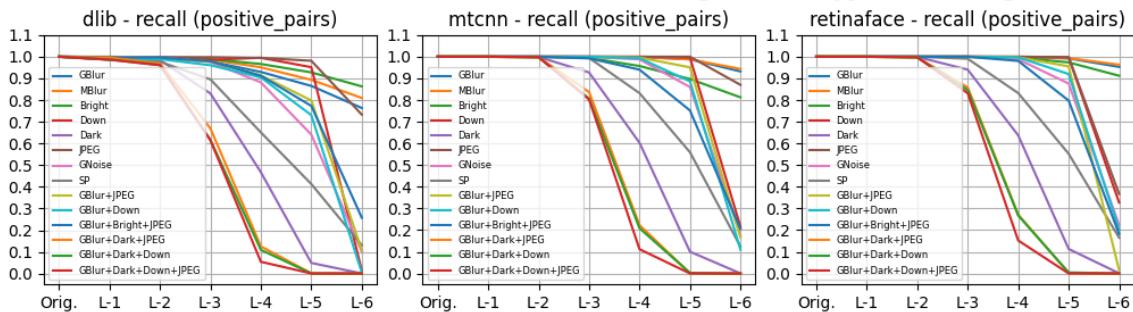
Dataset: FEI - FR model: Dlib - Pair 2: Stand. (non-degraded) x Quest. (degraded)



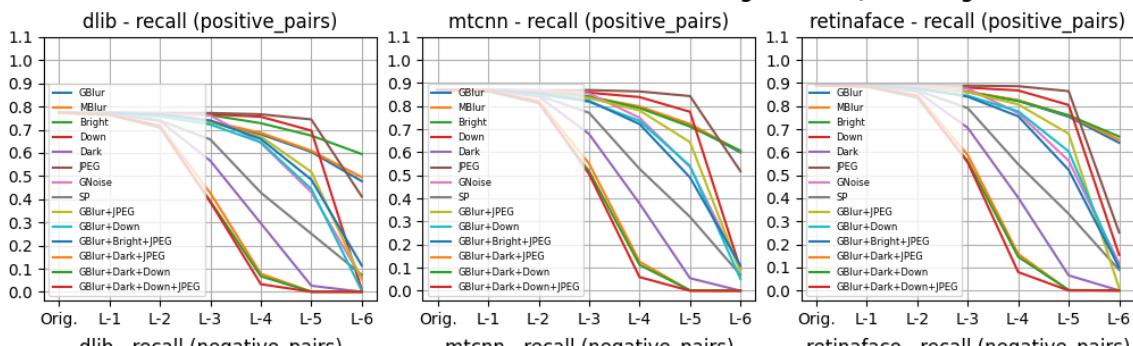
Dataset: FEI - FR model: Dlib - Pair 3: Stand. (degraded) x Quest. (degraded)



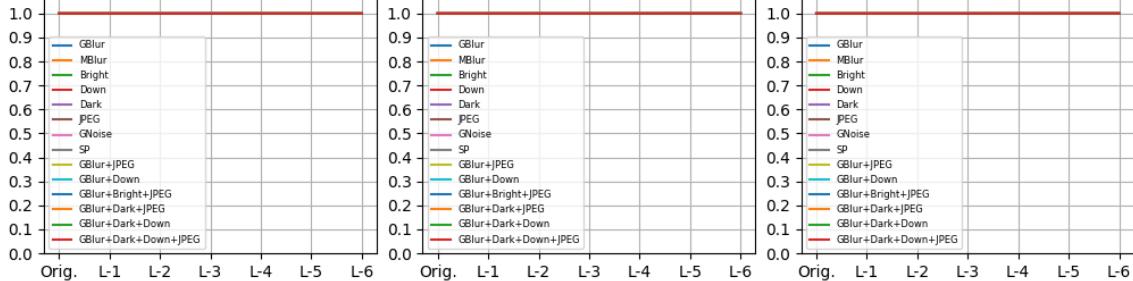
Dataset: FEI - FR model: Facenet512 - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



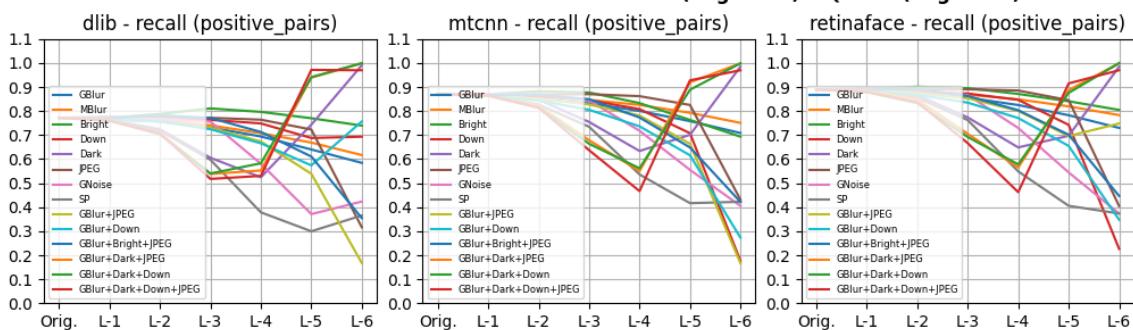
Dataset: FEI - FR model: Facenet512 - Pair 2: Stand. (non-degraded) x Quest. (degraded)



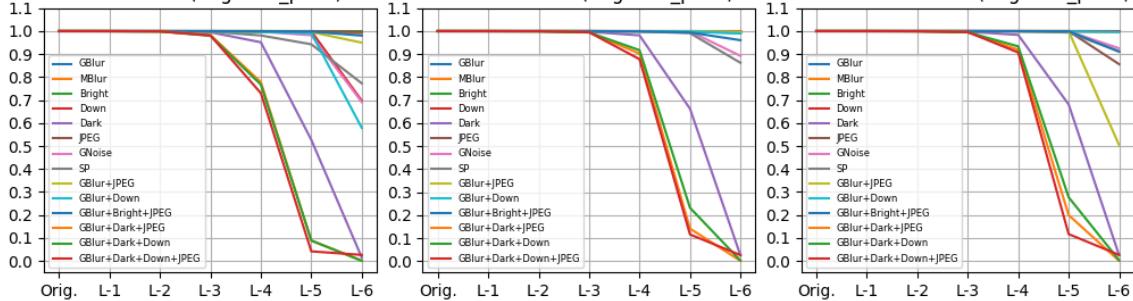
dlib - recall (negative_pairs) 1.1 mtcnn - recall (negative_pairs) 1.1 retinface - recall (negative_pairs)



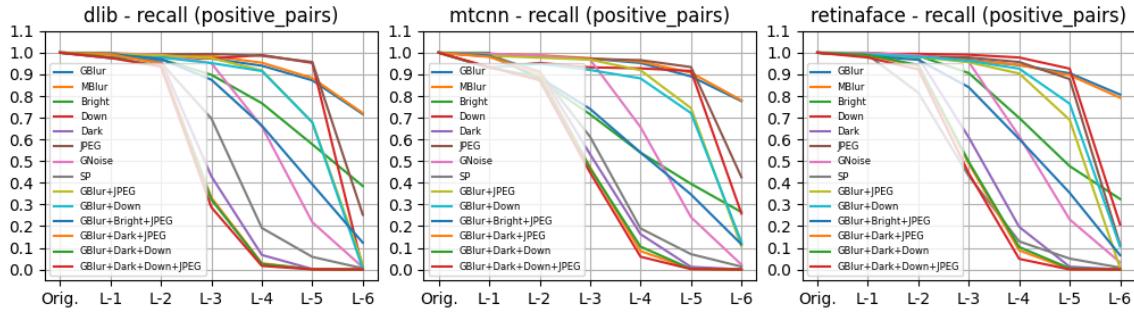
Dataset: FEI - FR model: Facenet512 - Pair 3: Stand. (degraded) x Quest. (degraded)



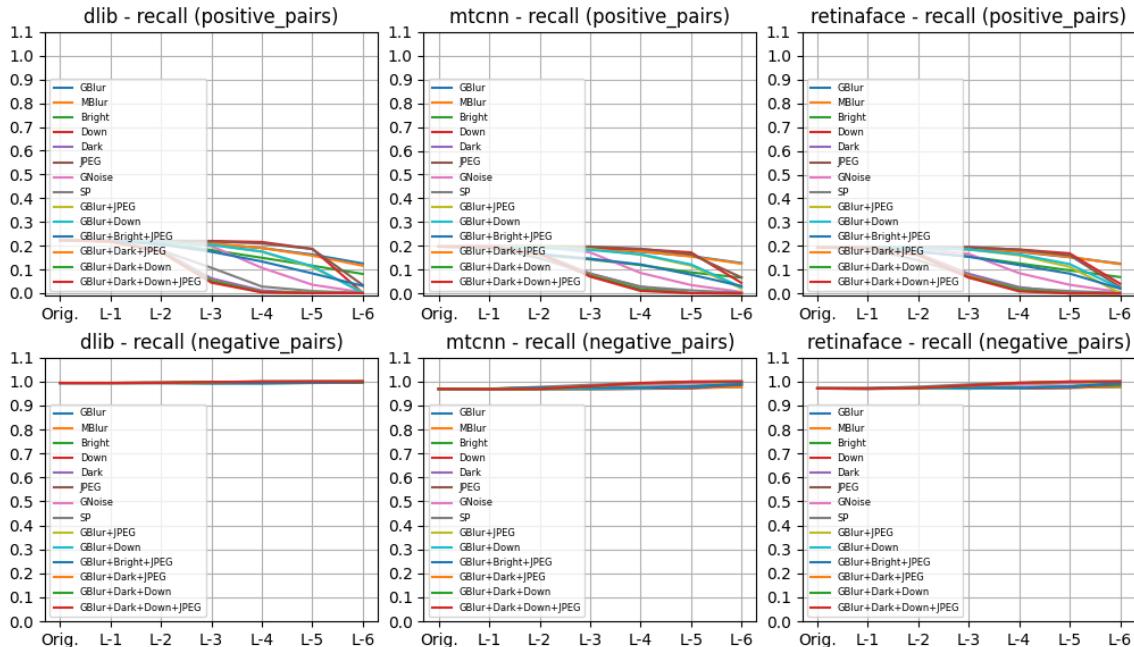
dlib - recall (negative pairs) mtcnn - recall (negative pairs) retinaface - recall (negative pairs)



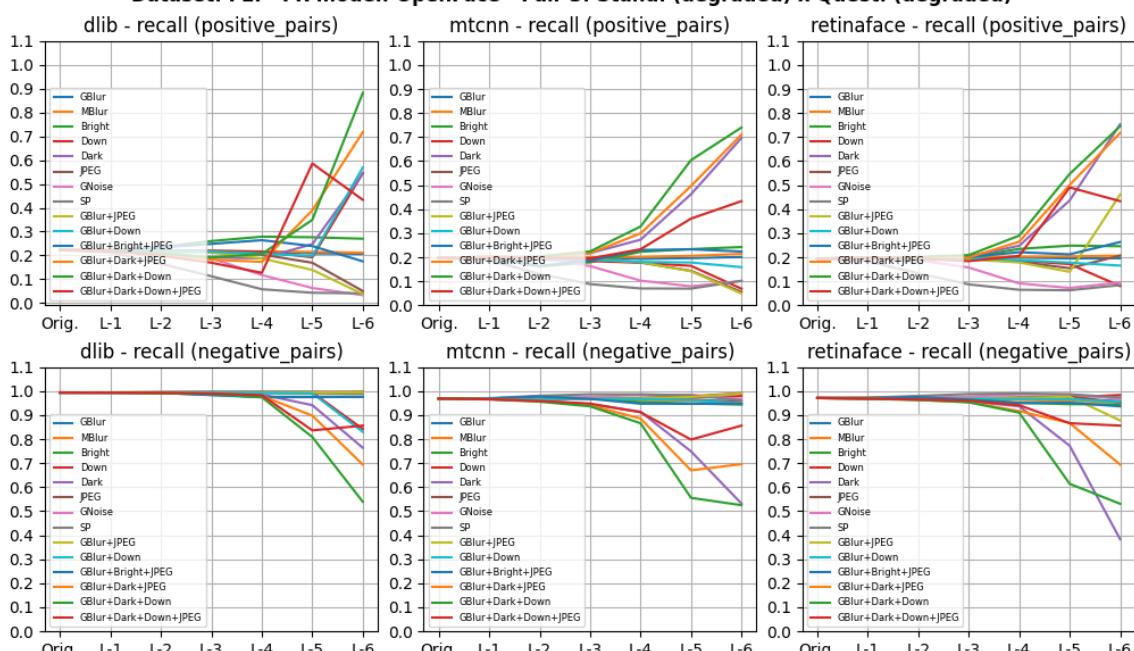
Dataset: FEI - FR model: OpenFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



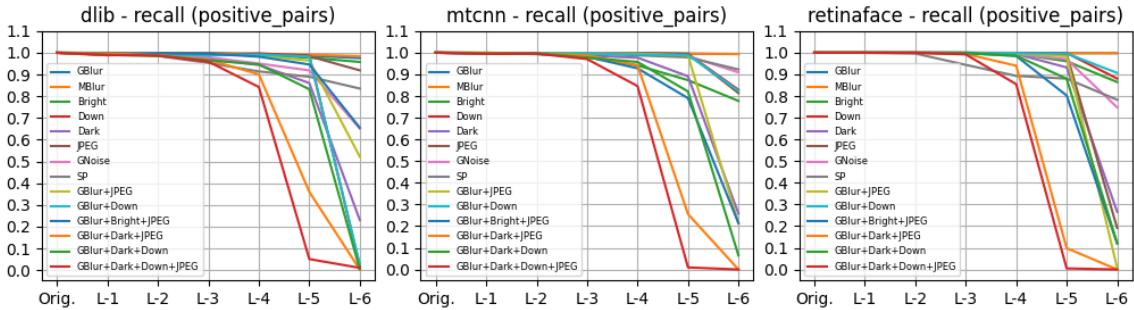
Dataset: FEI - FR model: OpenFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



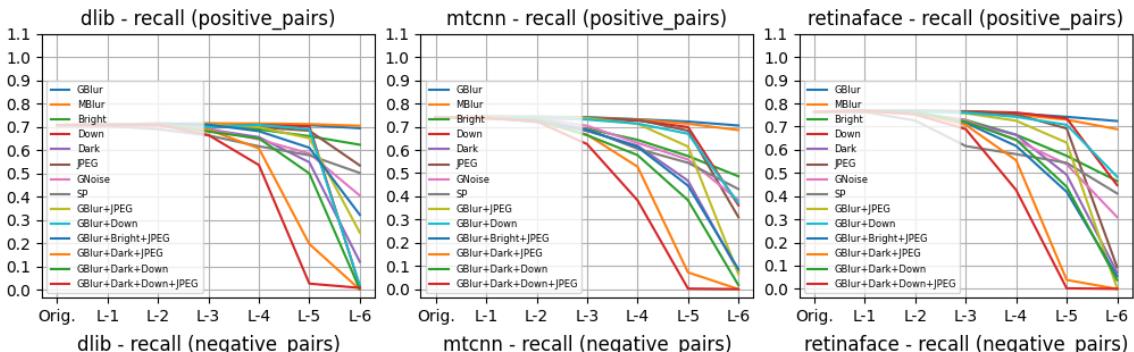
Dataset: FEI - FR model: OpenFace - Pair 3: Stand. (degraded) x Quest. (degraded)



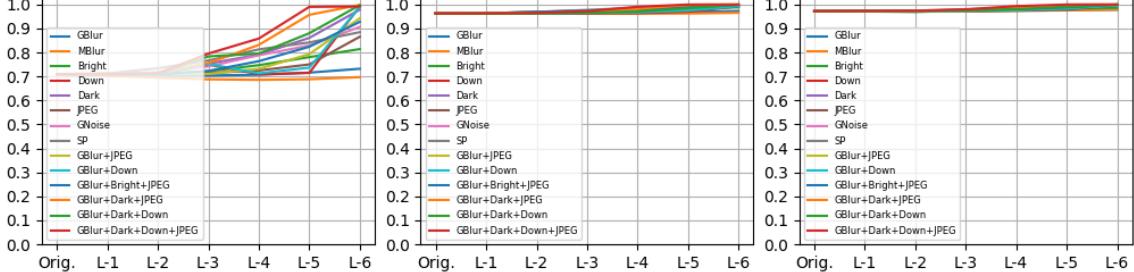
Dataset: FEI - FR model: SFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



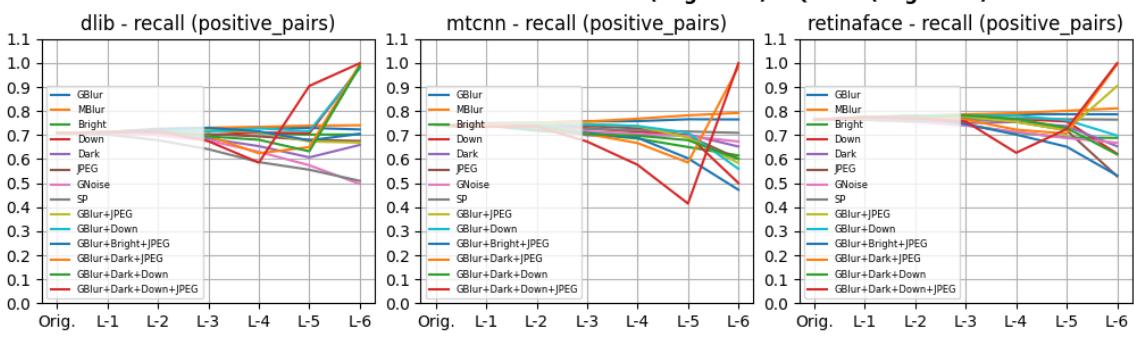
Dataset: FEI - FR model: SFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



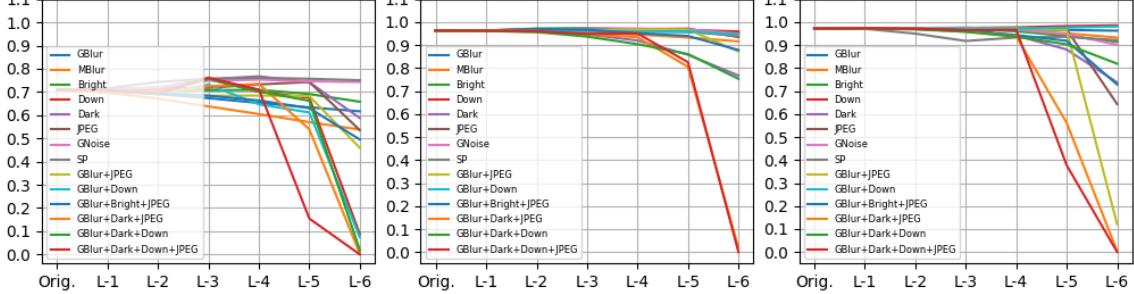
www.english-test.net



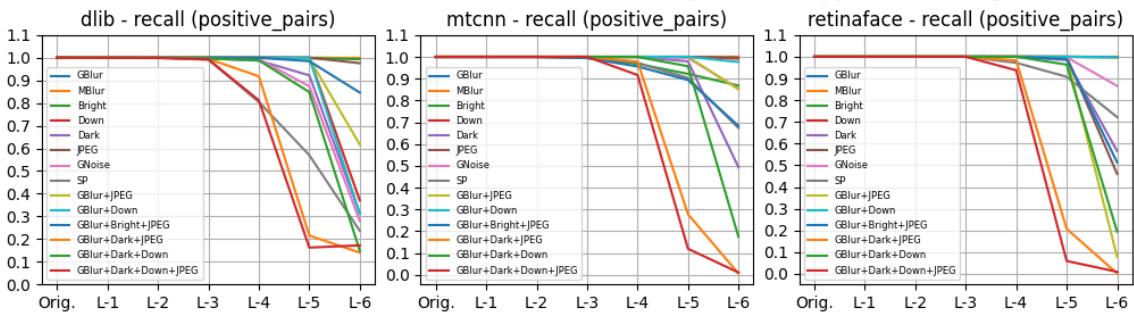
Dataset: FEI - FR model: SFace - Pair 3: Stand. (degraded) x Quest. (degraded)



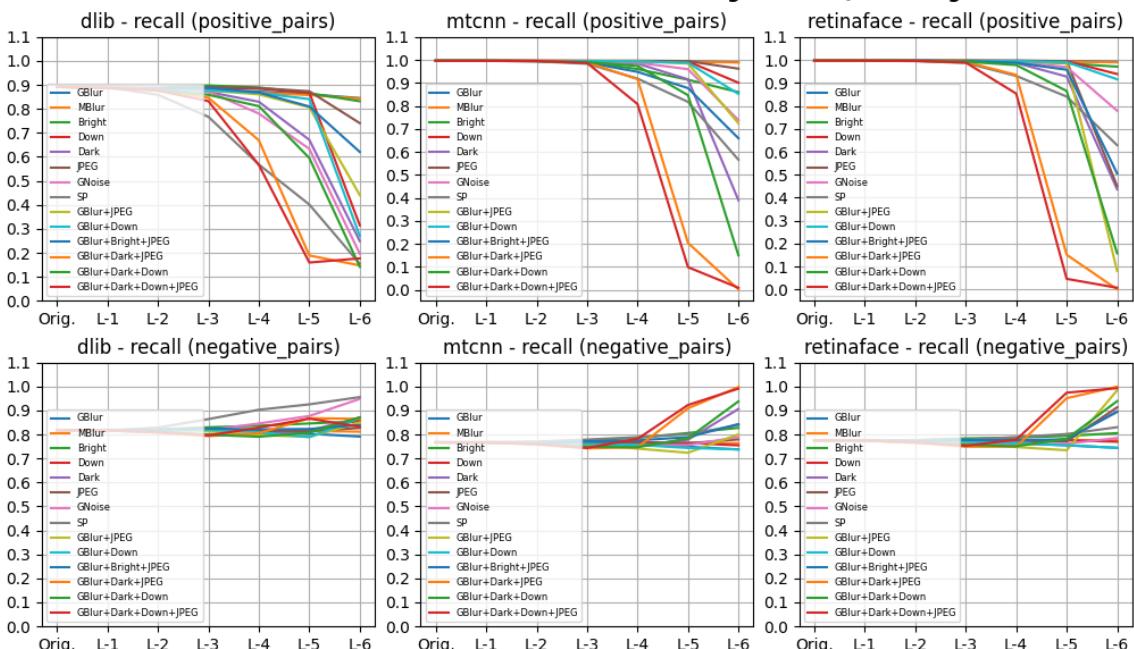
dlib - recall (negative_pairs)



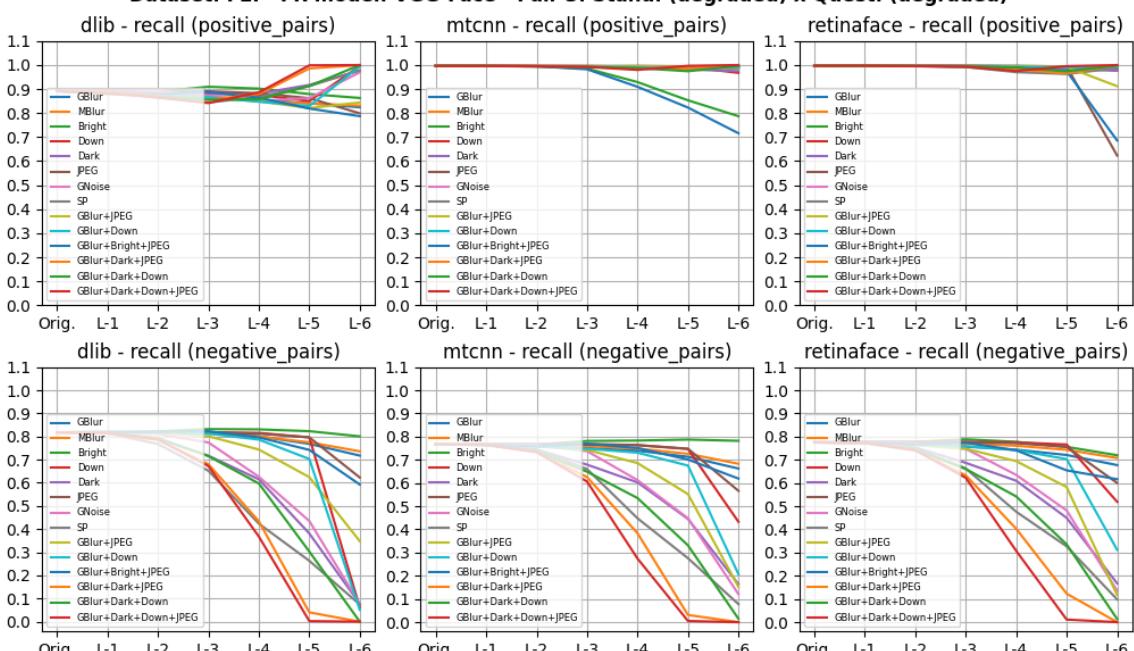
Dataset: FEI - FR model: VGG-Face - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



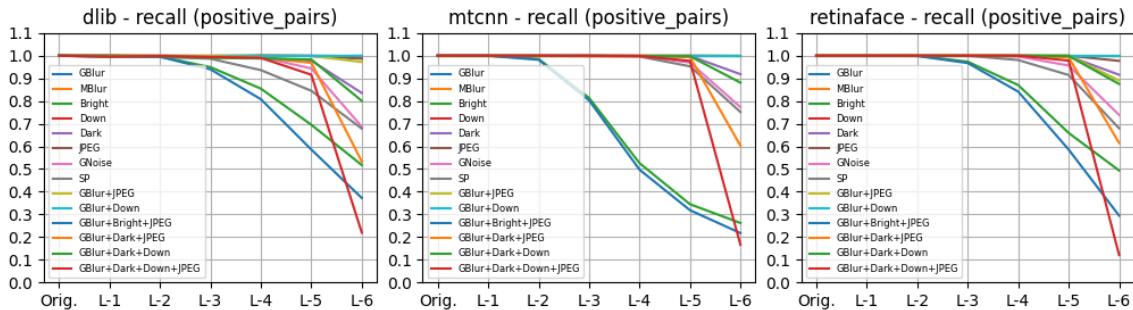
Dataset: FEI - FR model: VGG-Face - Pair 2: Stand. (non-degraded) x Quest. (degraded)



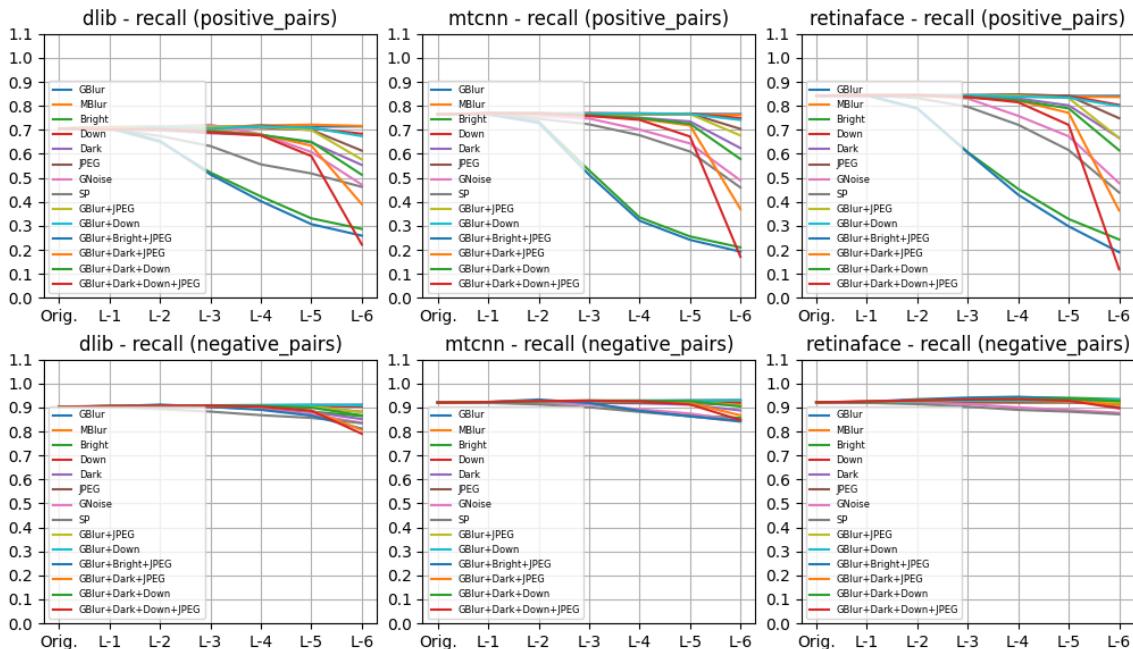
Dataset: FEI - FR model: VGG-Face - Pair 3: Stand. (degraded) x Quest. (degraded)



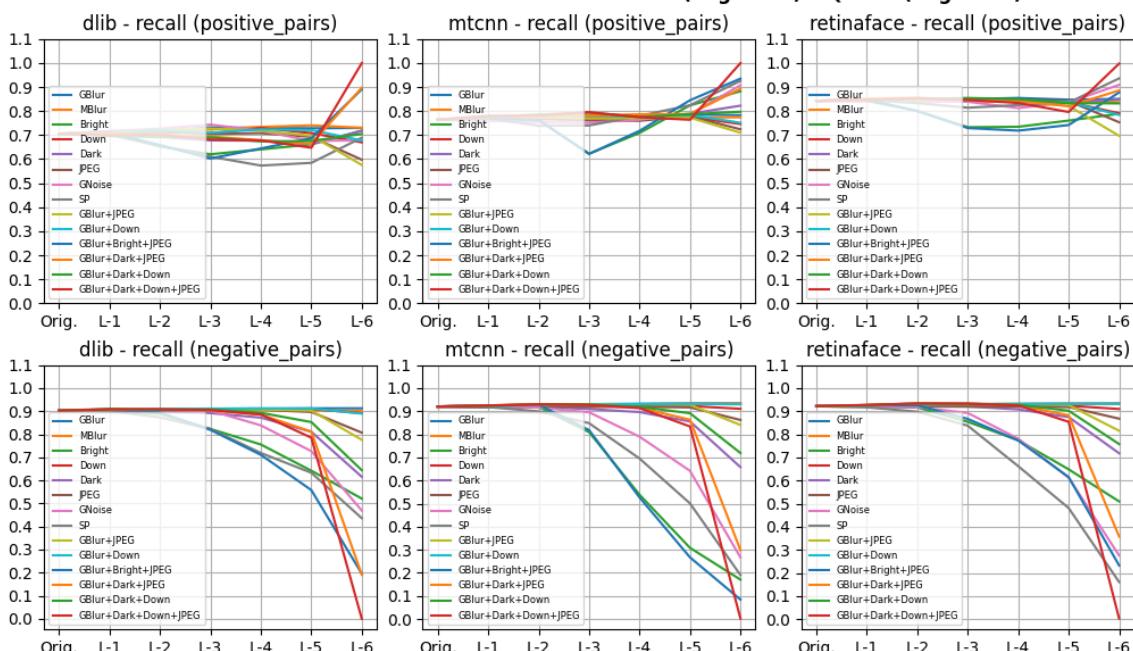
Dataset: SCFace - FR model: ArcFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



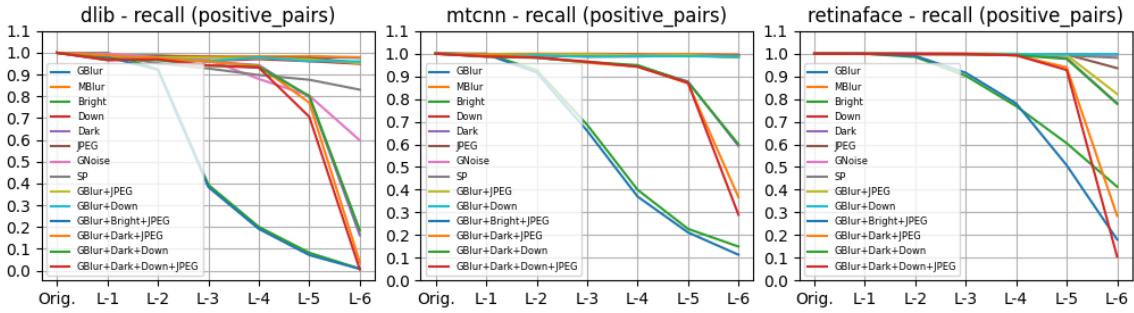
Dataset: SCFace - FR model: ArcFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



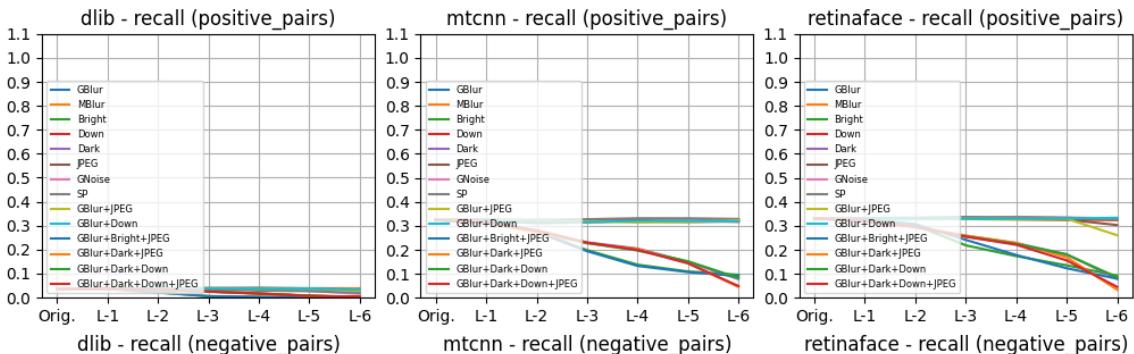
Dataset: SCFace - FR model: ArcFace - Pair 3: Stand. (degraded) x Quest. (degraded)



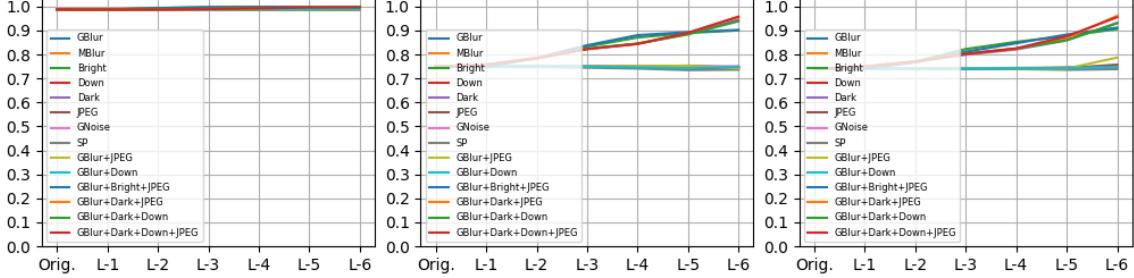
Dataset: SCFace - FR model: DeepFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



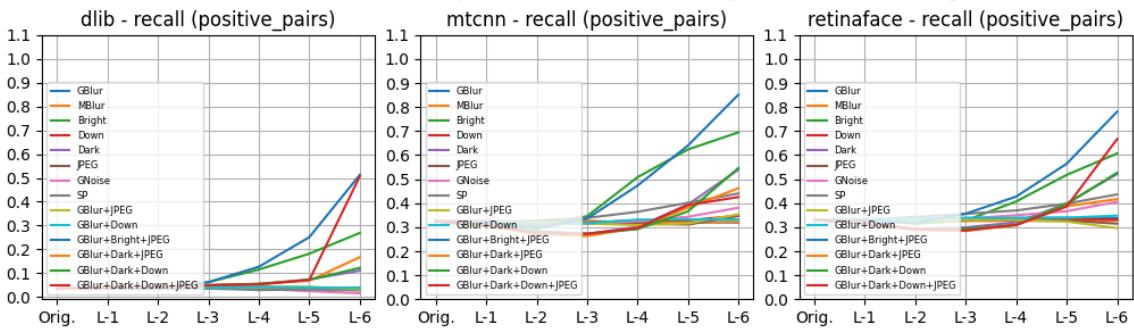
Dataset: SCFace - FR model: DeepFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



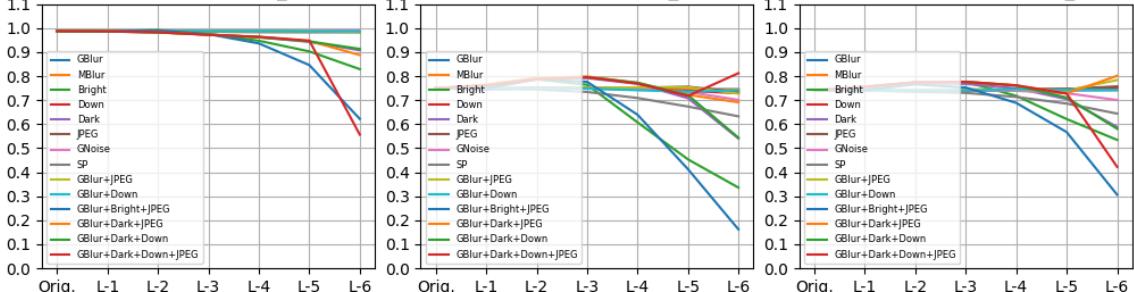
1.1 1.2



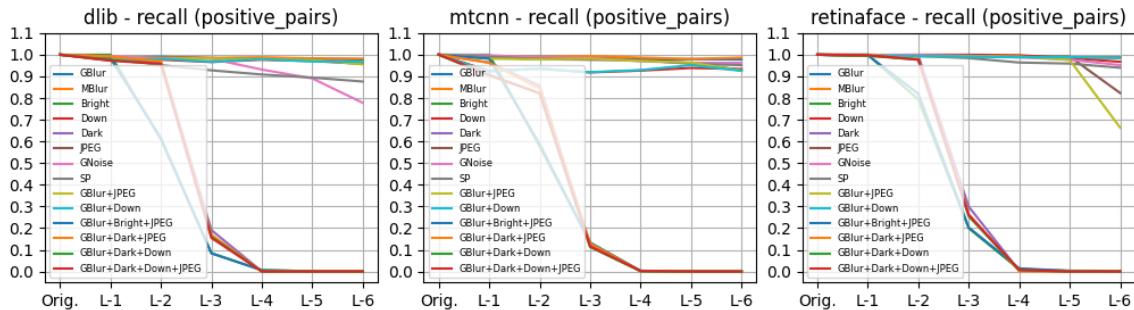
Dataset: SCFace - FR model: DeepFace - Pair 3: Stand. (degraded) x Quest. (degraded)



dlib - recall (negative_pairs)



Dataset: SCFace - FR model: DeepID - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



Dataset: SCFace - FR model: DeepID - Pair 2: Stand. (non-degraded) x Quest. (degraded)

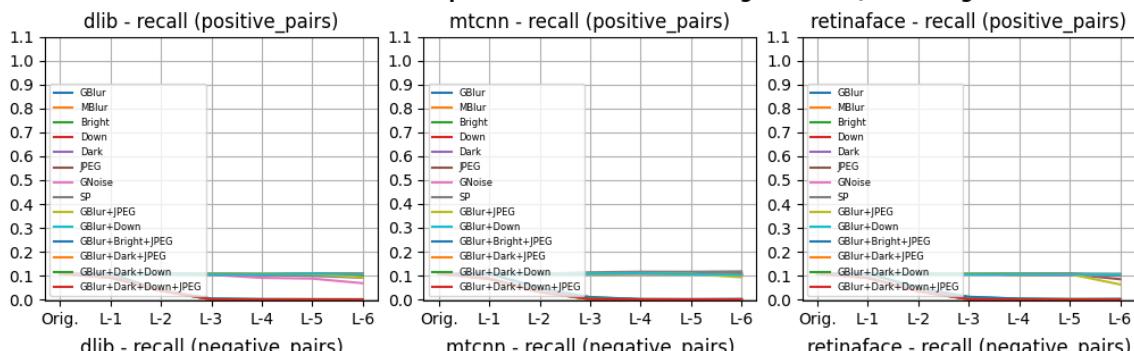
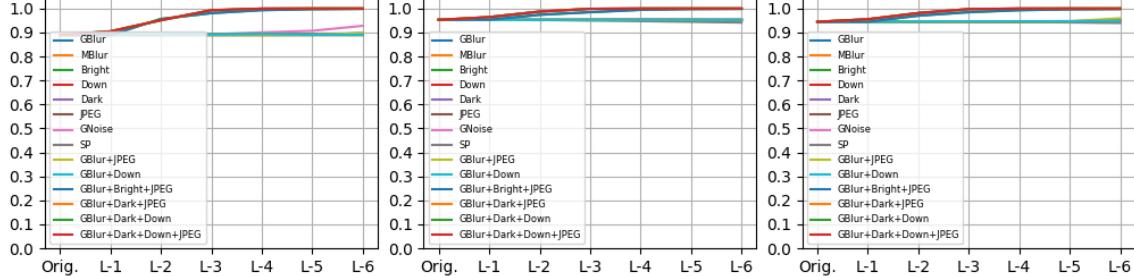
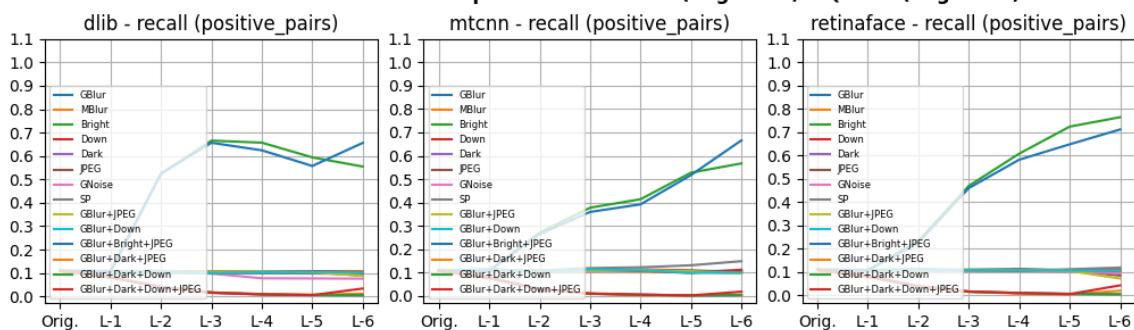


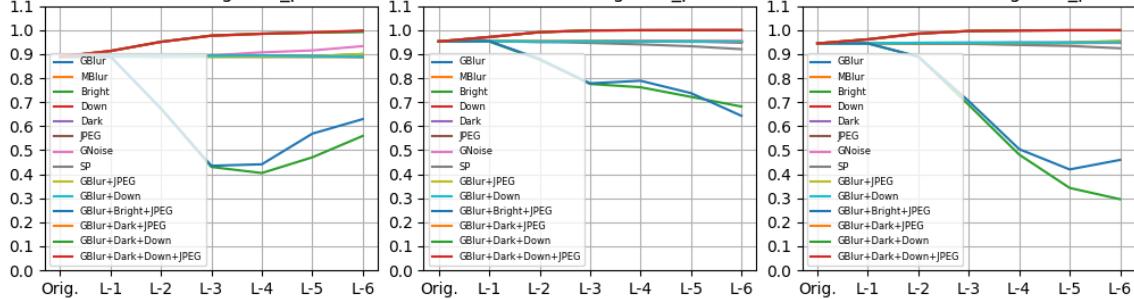
Figure 11. The effect of the number of negative pairs on the performance of the three models.



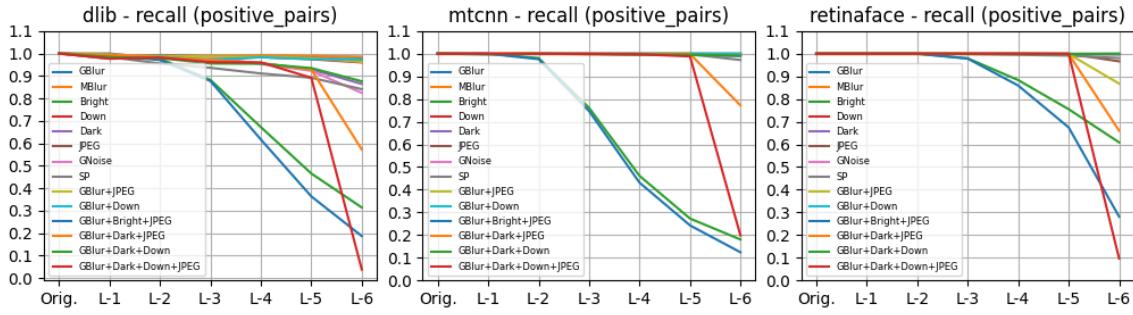
Dataset: SCFace - FR model: DeepID - Pair 3: Stand. (degraded) x Quest. (degraded)



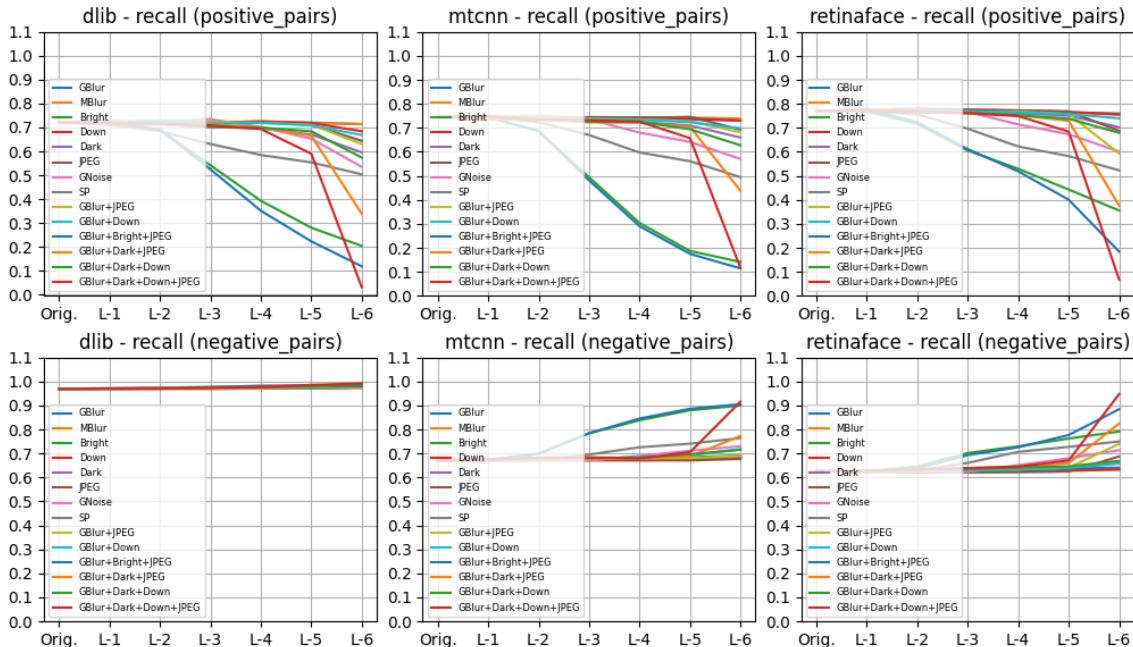
dlib - recall (negative_pairs) mtcnn - recall (negative_pairs) retinaface - recall (negative_pairs)



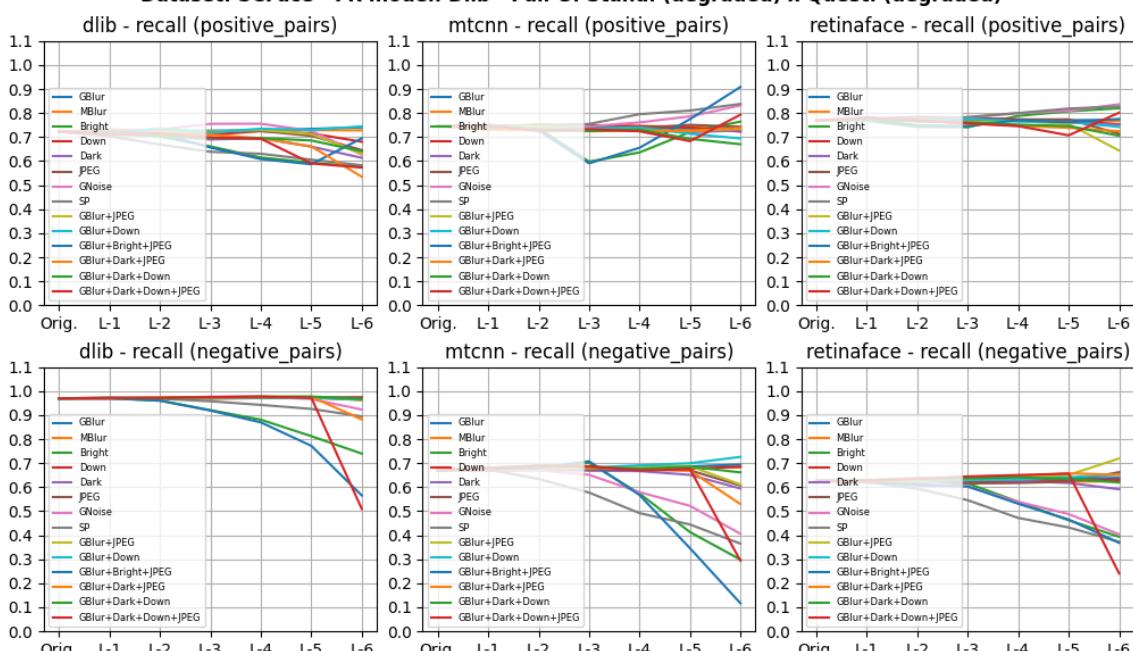
Dataset: SCFace - FR model: Dlib - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



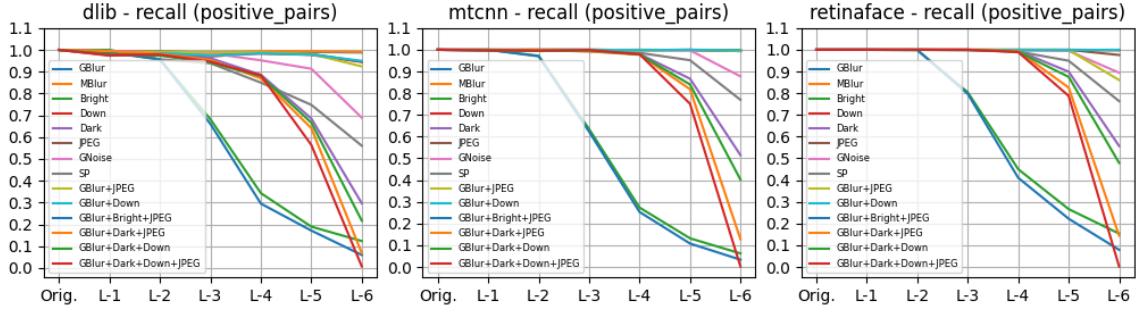
Dataset: SCFace - FR model: Dlib - Pair 2: Stand. (non-degraded) x Quest. (degraded)



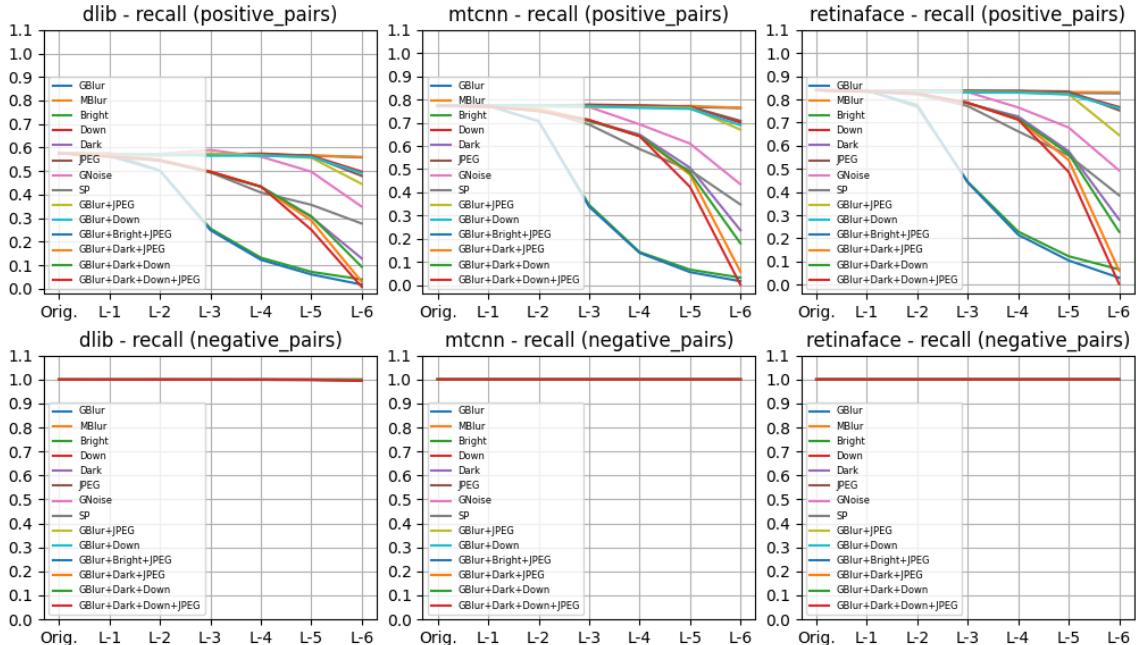
Dataset: SCFace - FR model: Dlib - Pair 3: Stand. (degraded) x Quest. (degraded)



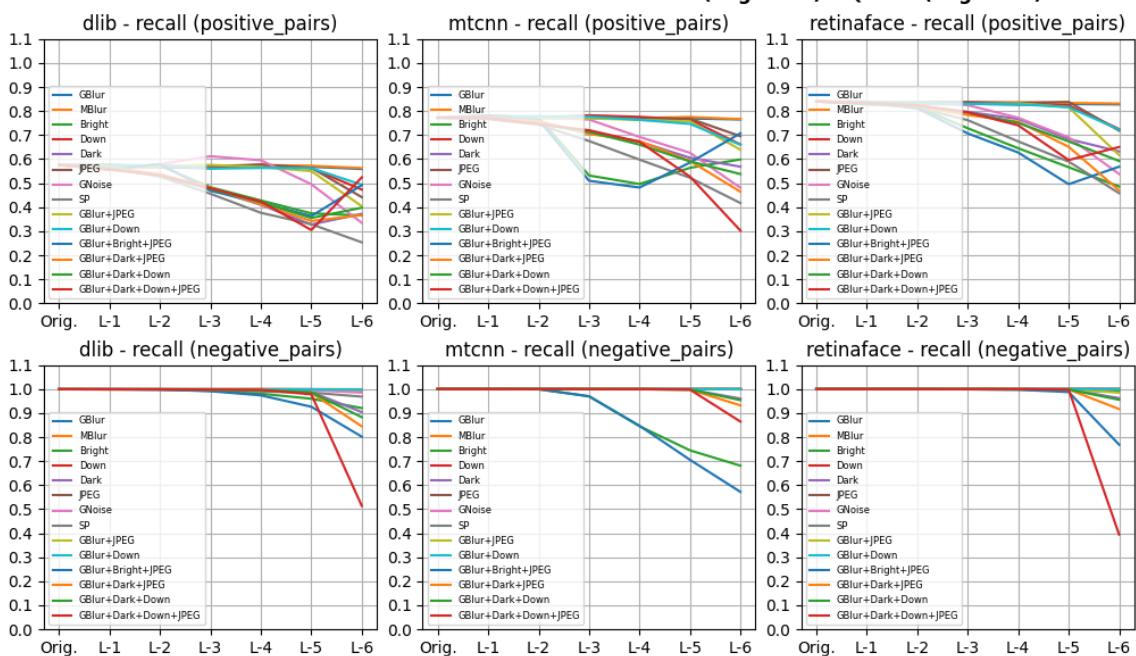
Dataset: SCFace - FR model: Facenet512 - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



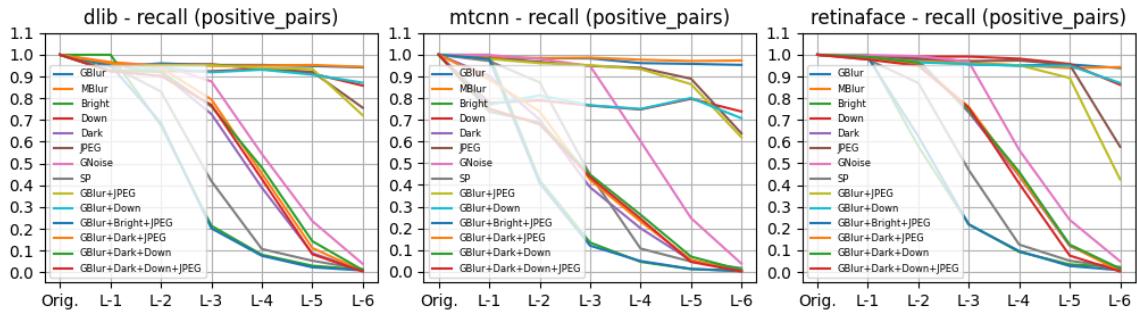
Dataset: SCFace - FR model: Facenet512 - Pair 2: Stand. (non-degraded) x Quest. (degraded)



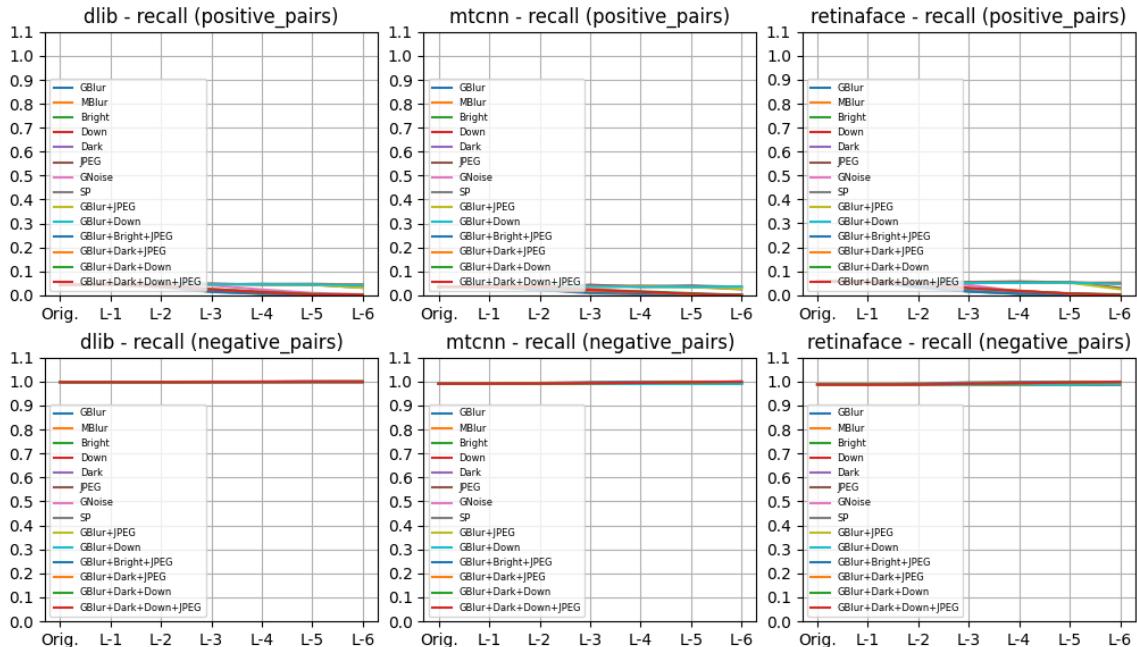
Dataset: SCFace - FR model: Facenet512 - Pair 3: Stand. (degraded) x Quest. (degraded)



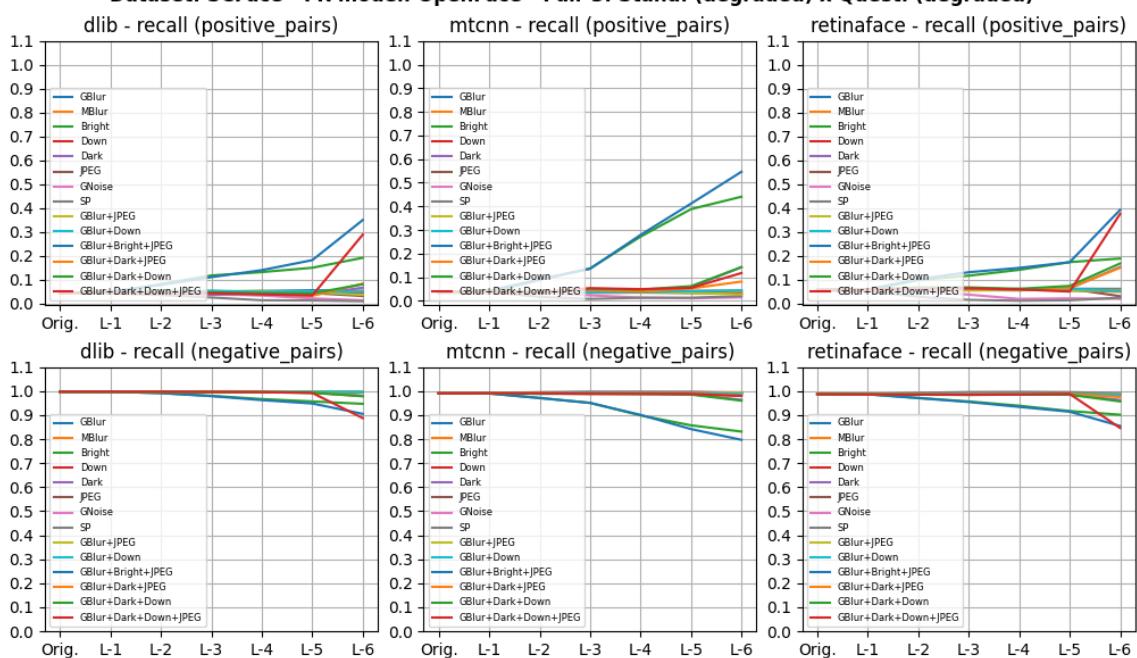
Dataset: SCFace - FR model: OpenFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



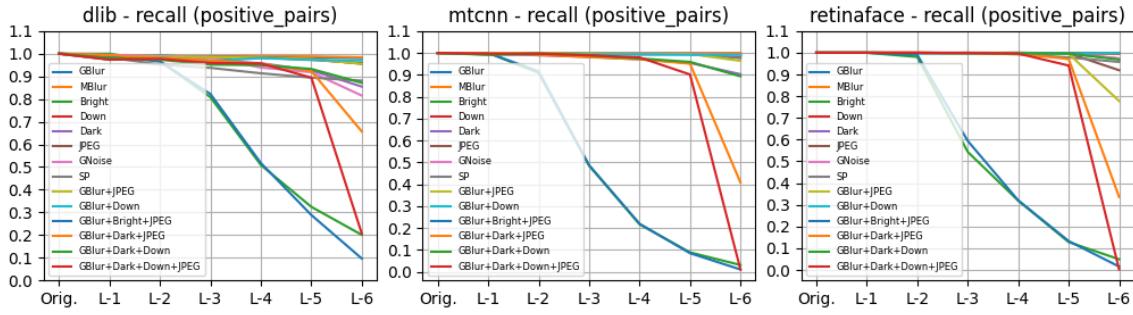
Dataset: SCFace - FR model: OpenFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



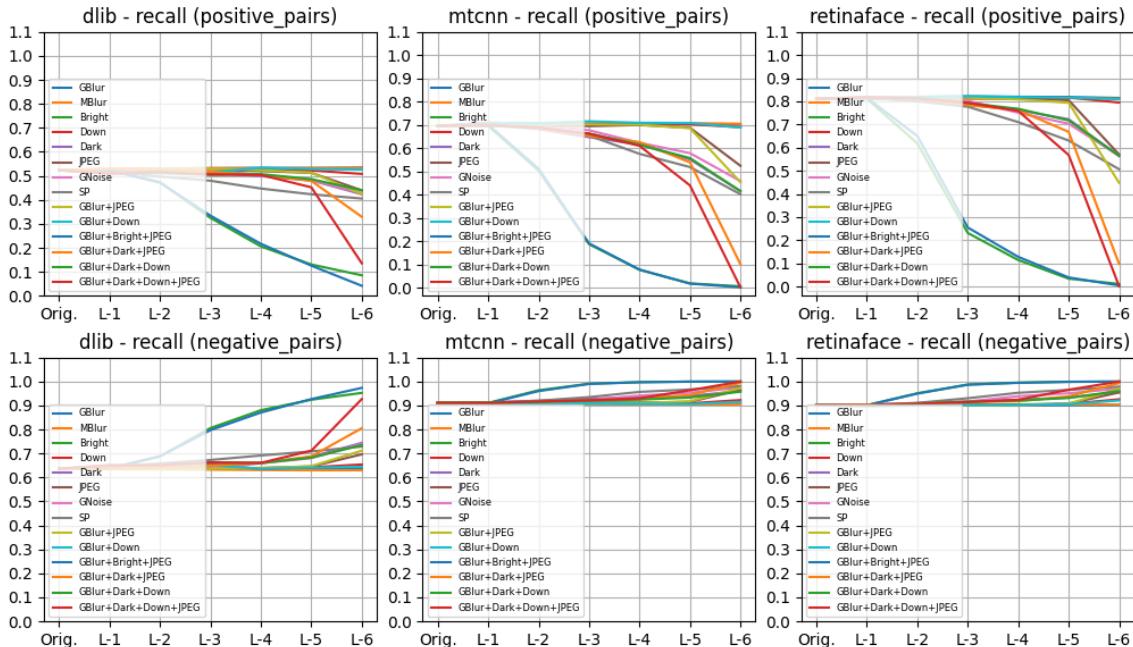
Dataset: SCFace - FR model: OpenFace - Pair 3: Stand. (degraded) x Quest. (degraded)



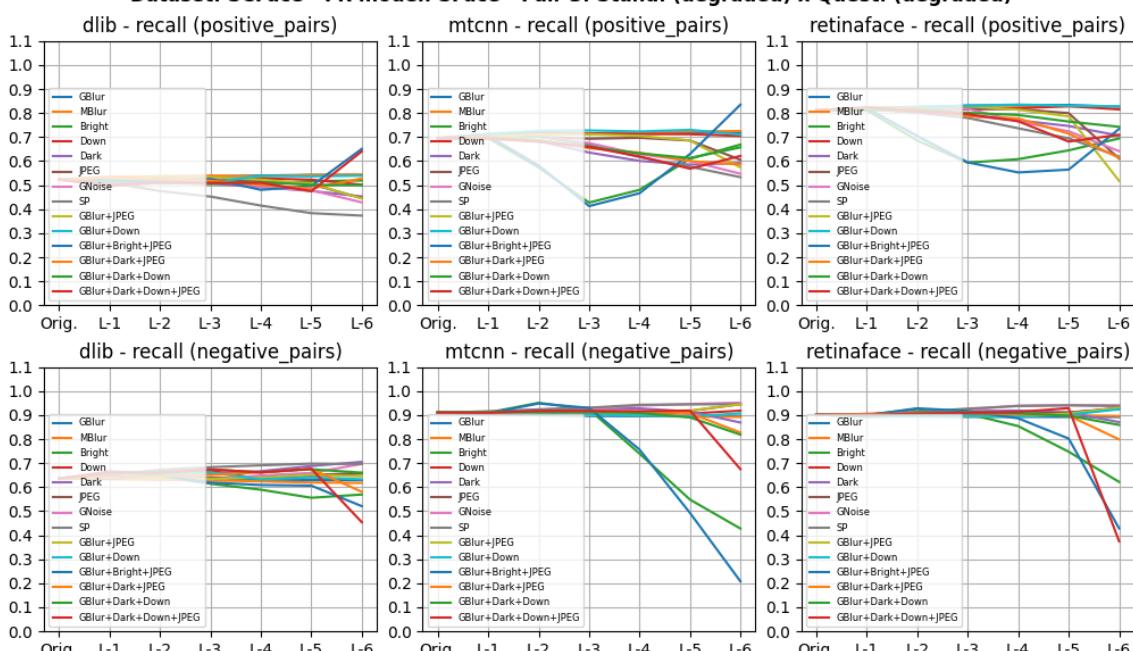
Dataset: SCFace - FR model: SFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



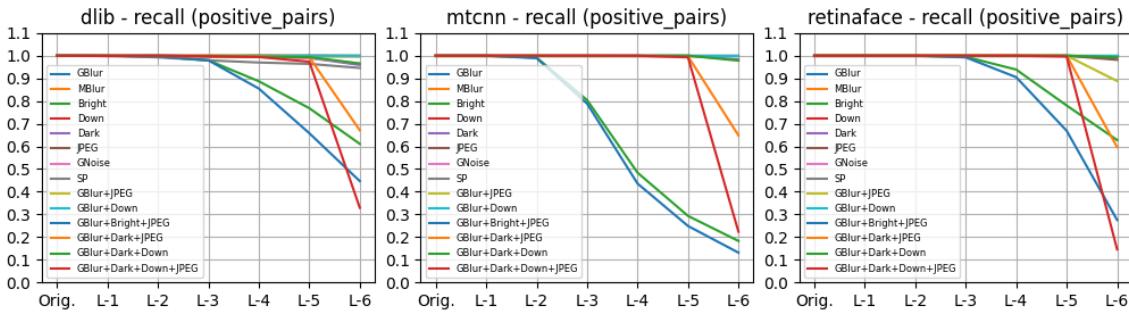
Dataset: SCFace - FR model: SFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



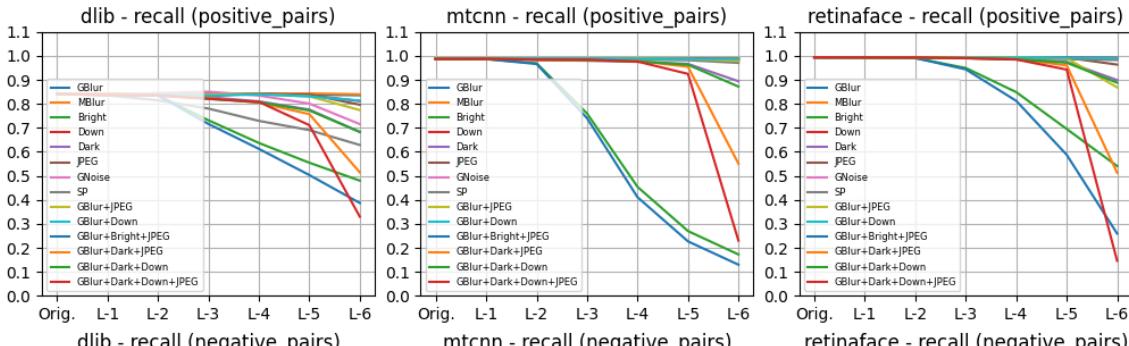
Dataset: SCFace - FR model: SFace - Pair 3: Stand. (degraded) x Quest. (degraded)



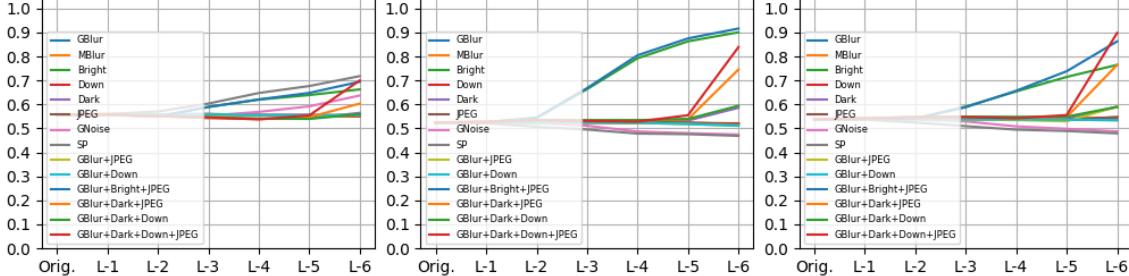
Dataset: SCFace - FR model: VGG-Face - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



Dataset: SCFace - FR model: VGG-Face - Pair 2: Stand. (non-degraded) x Quest. (degraded)



dmb - recall (negative_pairs) 1.1 intern - recall (negative_pairs) 1.1 retinolase - recall (negative_pairs)



Dataset: SCFace - FR model: VGG-Face - Pair 3: Stand. (degraded) x Quest. (degraded)

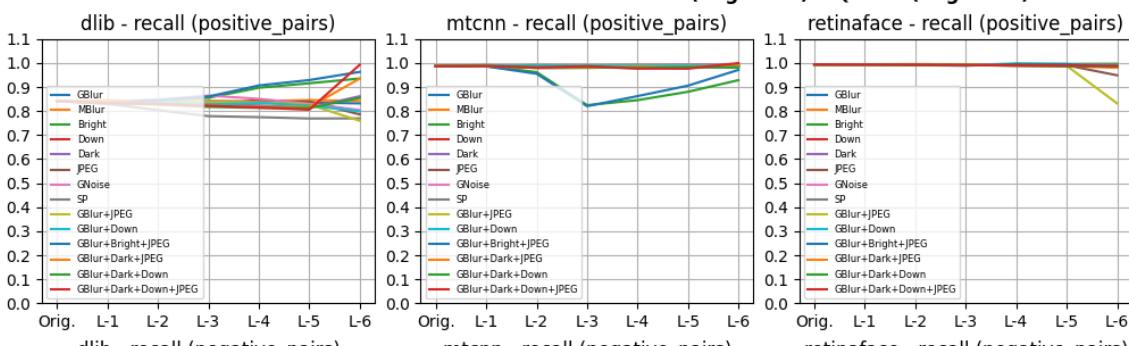
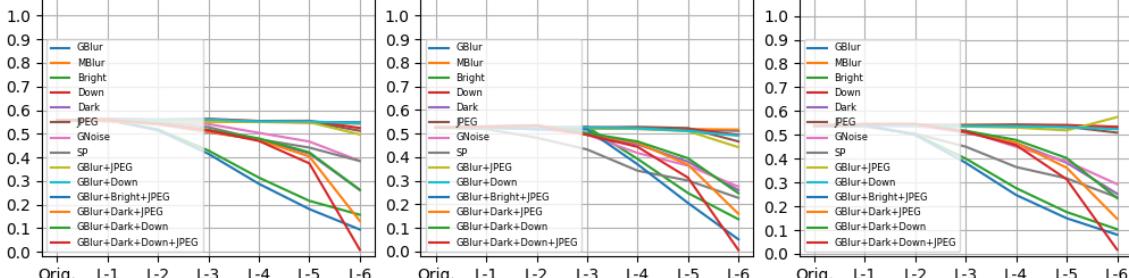
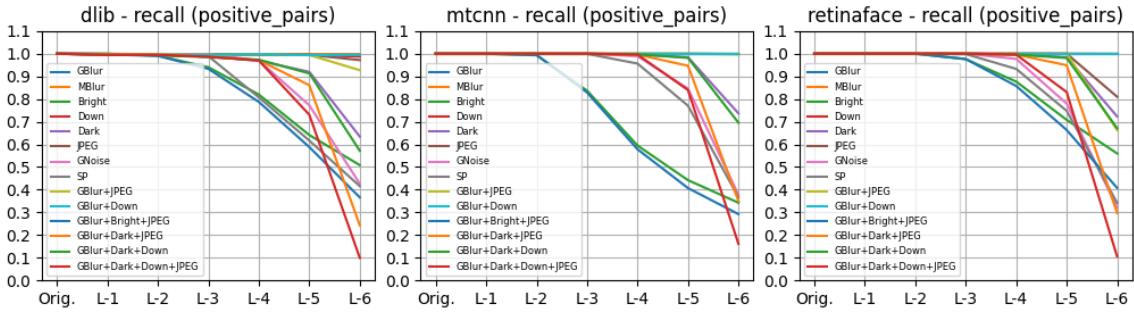


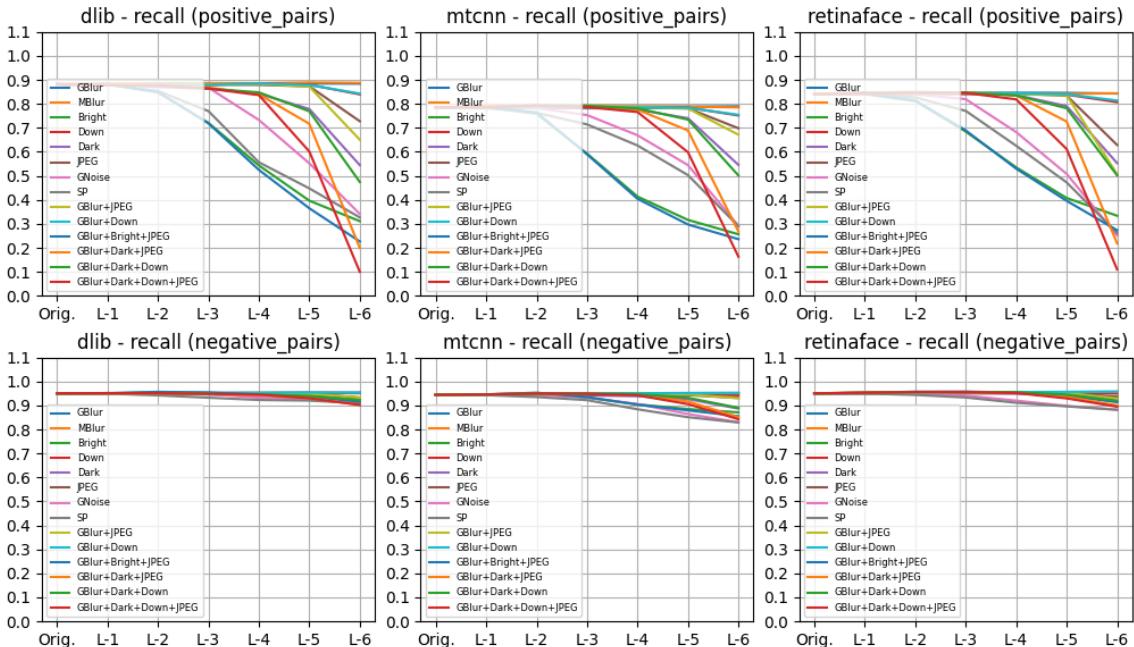
Figure 10: The recall of three face detection models on the negative pairs of the LFW dataset.



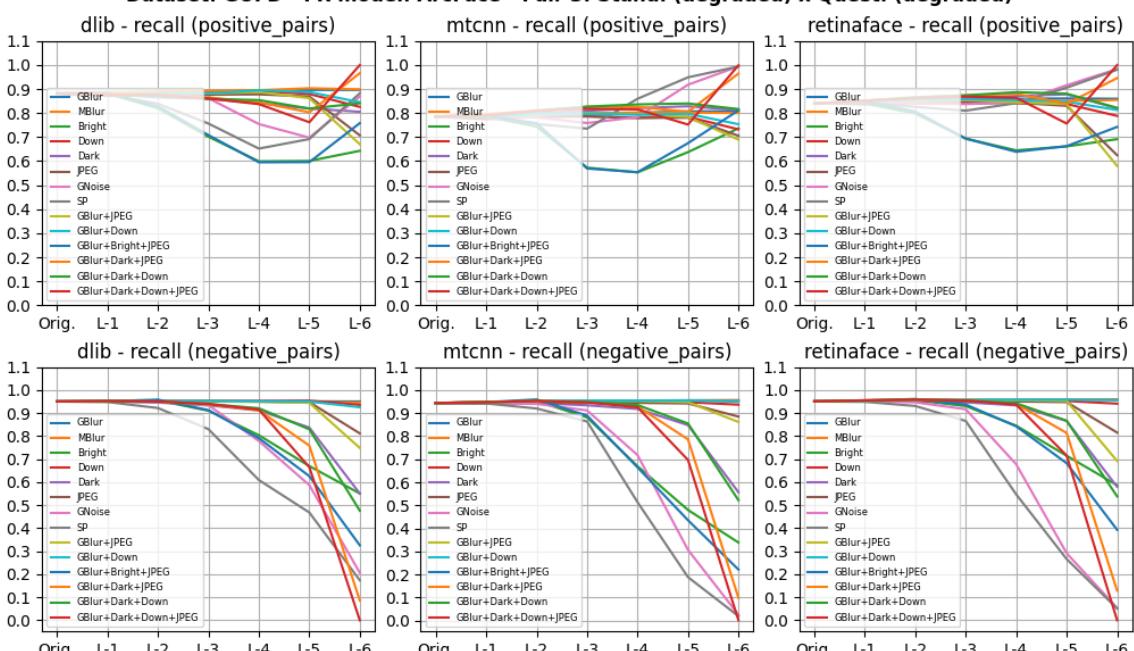
Dataset: GUDF - FR model: ArcFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



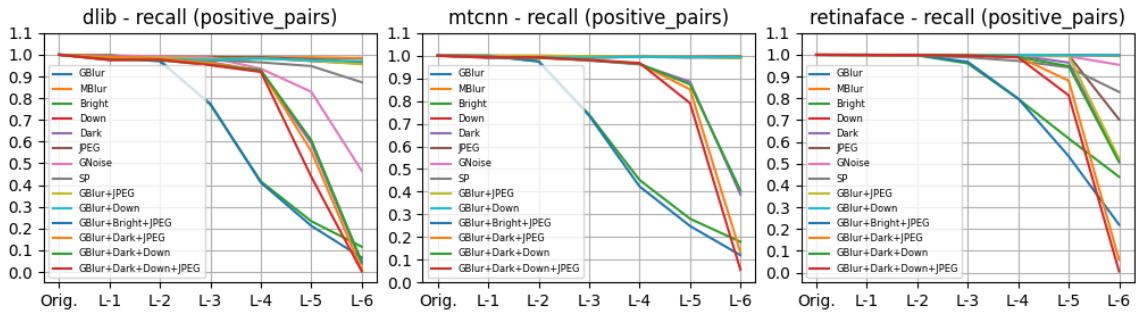
Dataset: GUDF - FR model: ArcFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



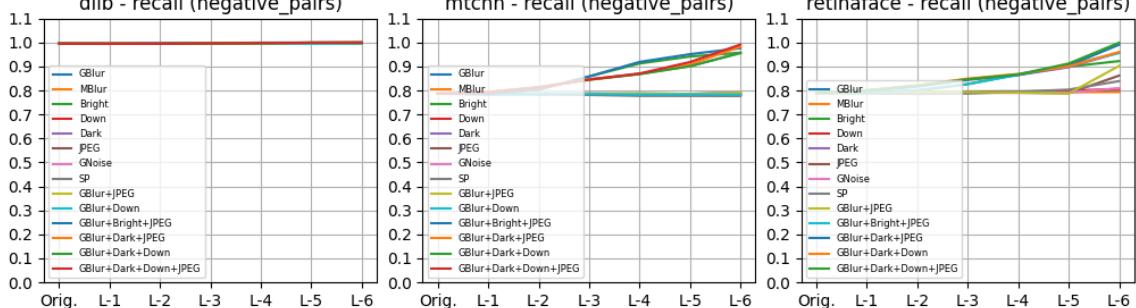
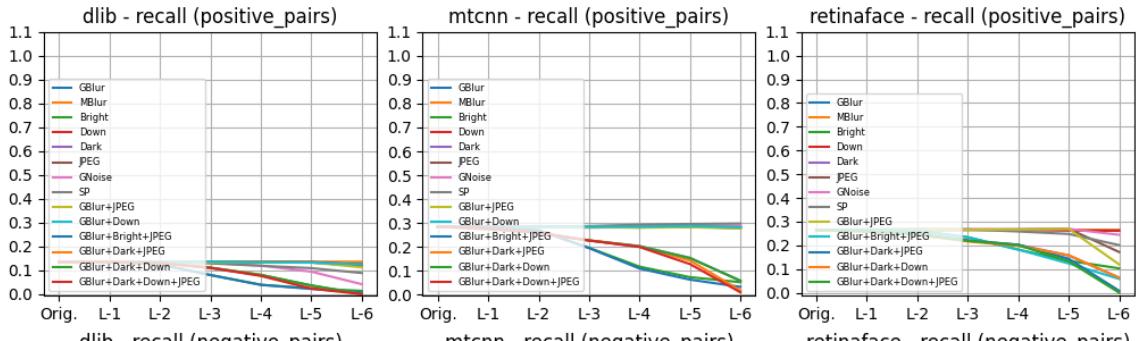
Dataset: GUDF - FR model: ArcFace - Pair 3: Stand. (degraded) x Quest. (degraded)



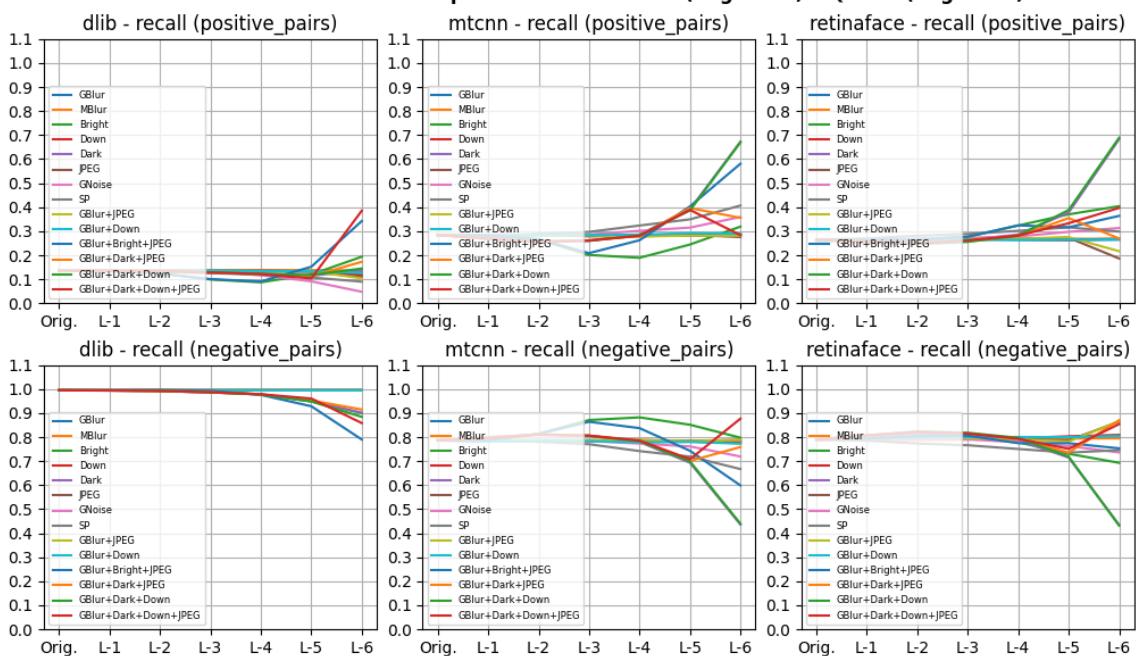
Dataset: GUFD - FR model: DeepFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



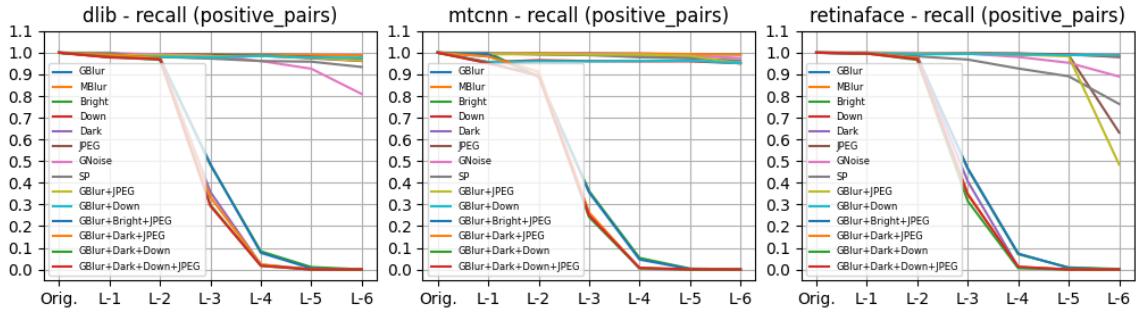
Dataset: GUFD - FR model: DeepFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



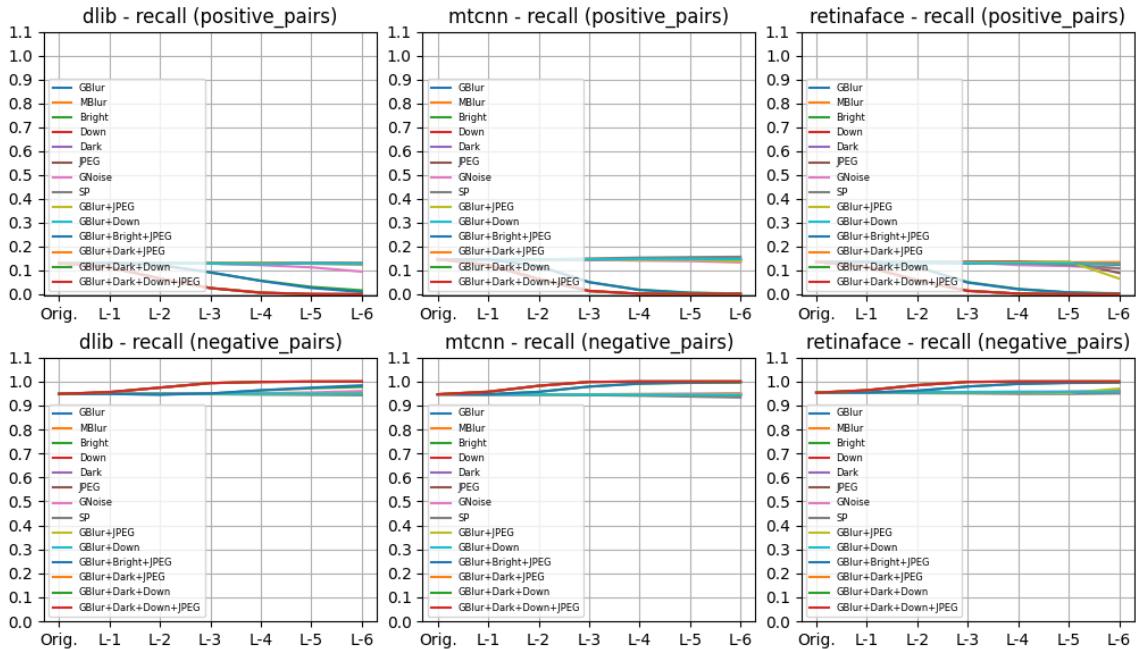
Dataset: GUFD - FR model: DeepFace - Pair 3: Stand. (degraded) x Quest. (degraded)



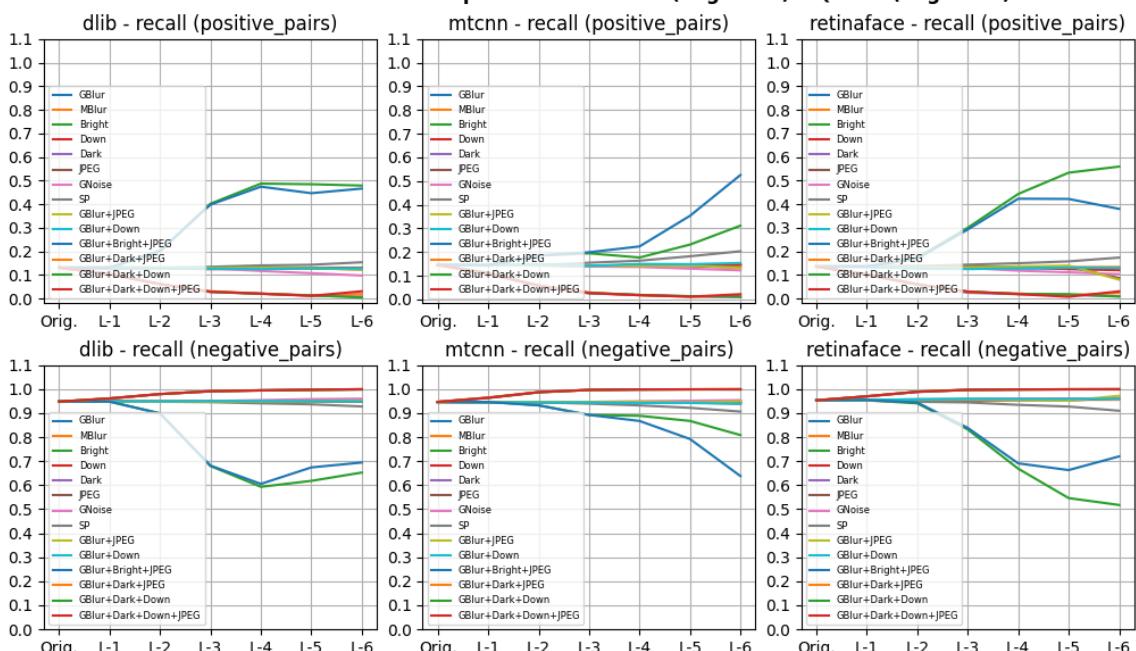
Dataset: GUFD - FR model: DeepID - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)

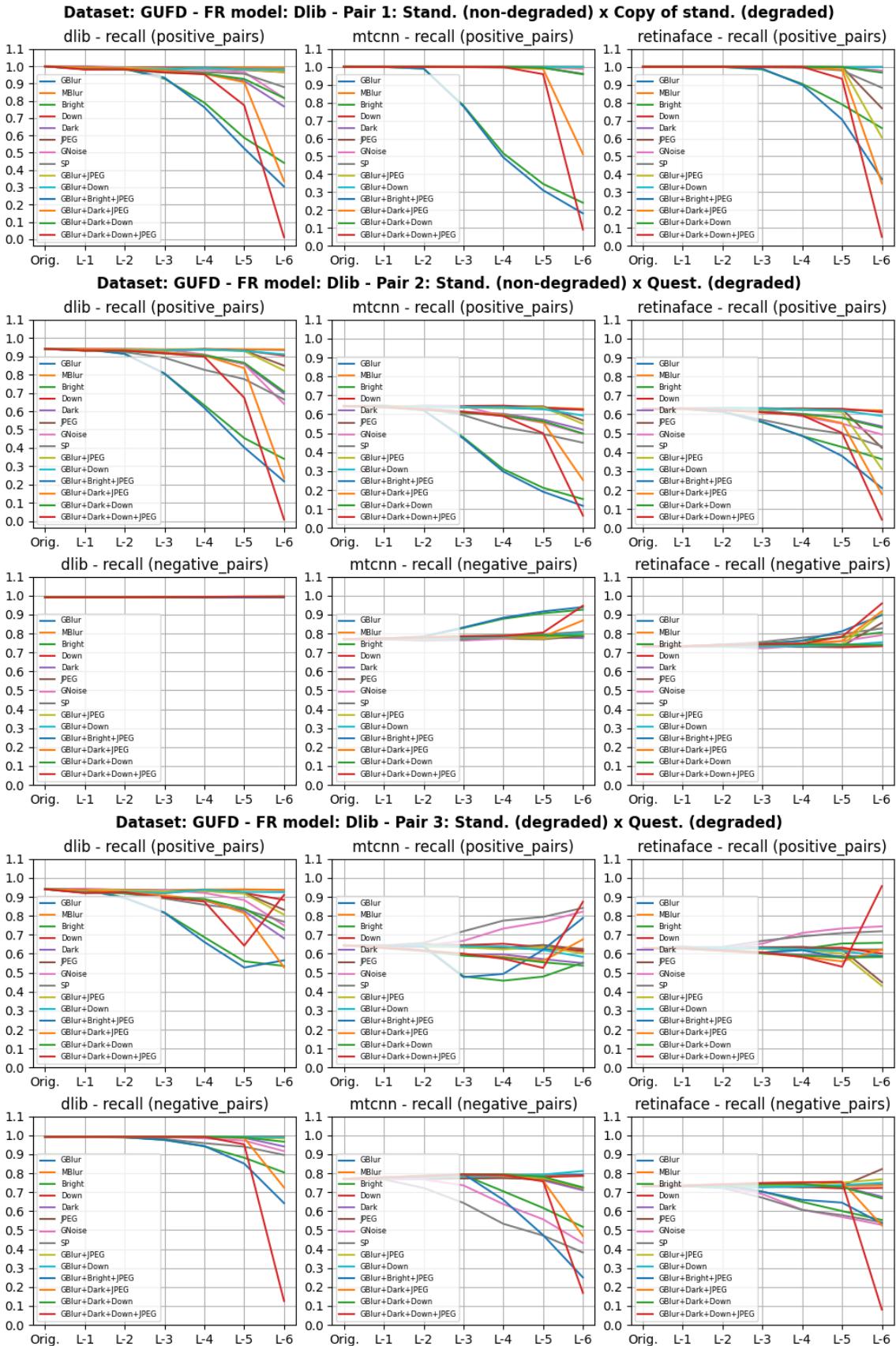


Dataset: GUFD - FR model: DeepID - Pair 2: Stand. (non-degraded) x Quest. (degraded)

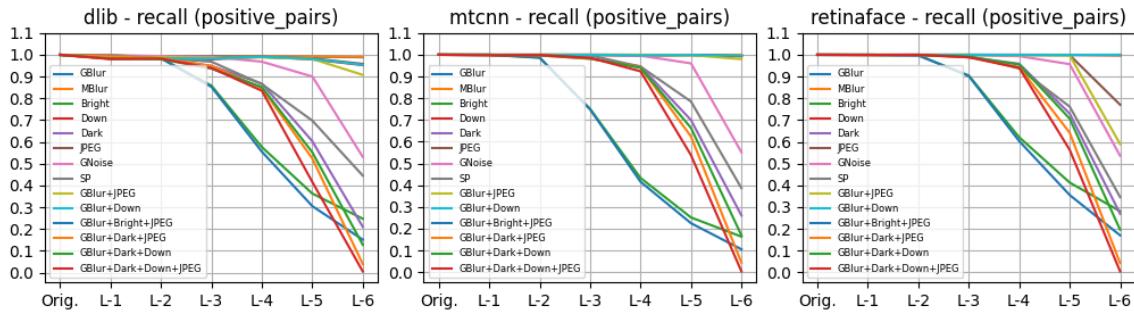


Dataset: GUFD - FR model: DeepID - Pair 3: Stand. (degraded) x Quest. (degraded)

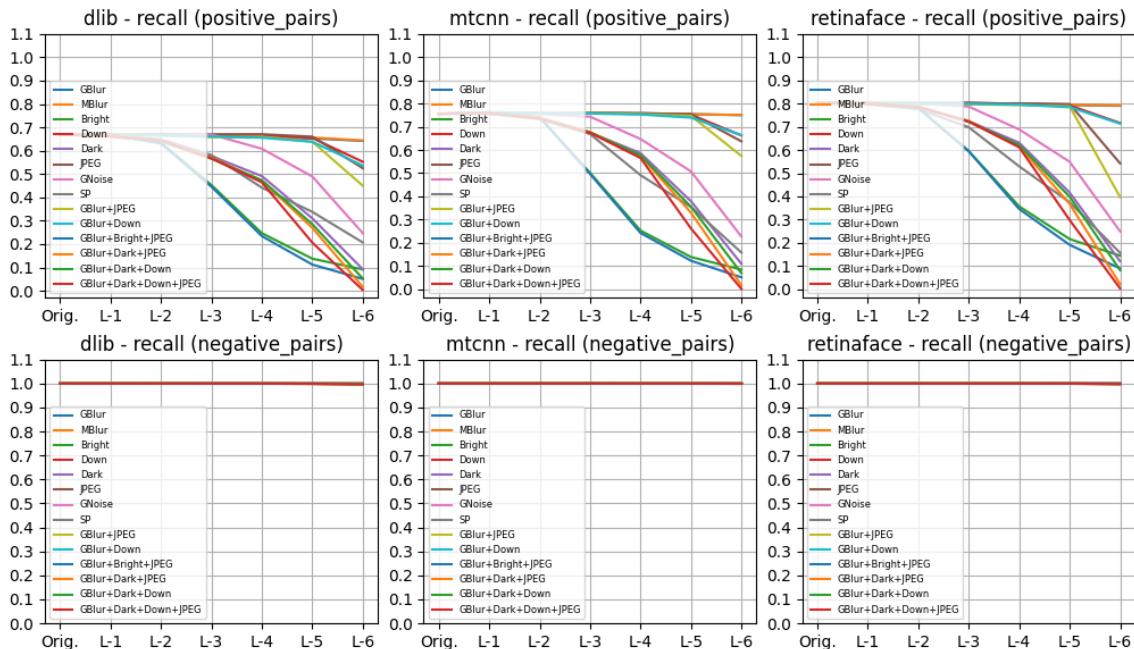




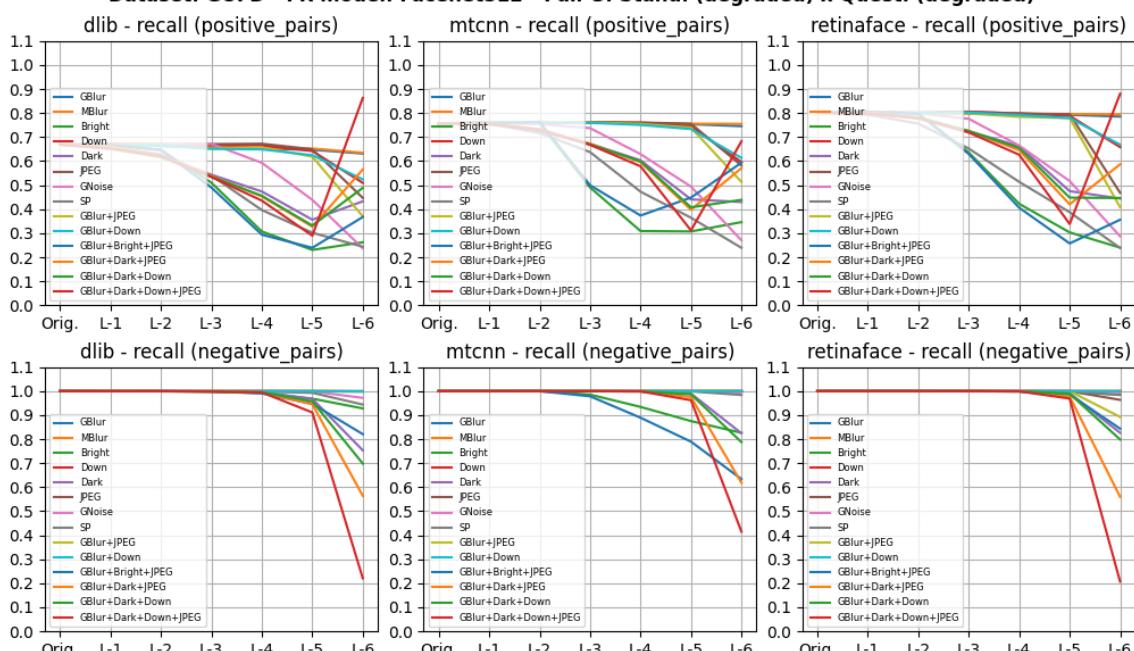
Dataset: GUFID - FR model: Facenet512 - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



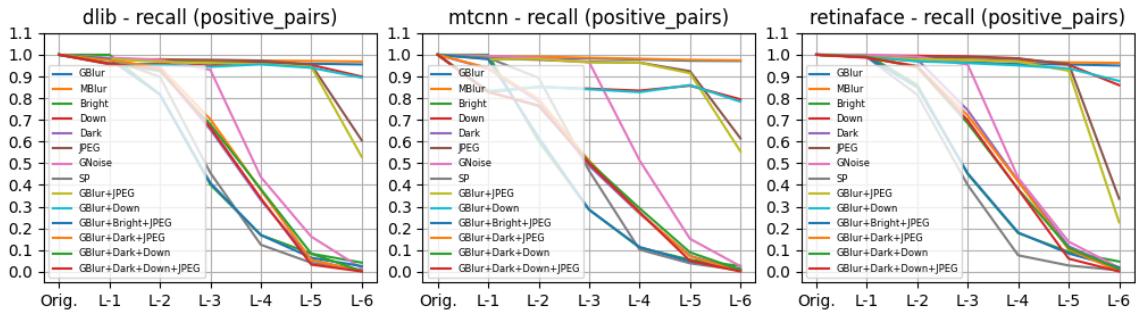
Dataset: GUFID - FR model: Facenet512 - Pair 2: Stand. (non-degraded) x Quest. (degraded)



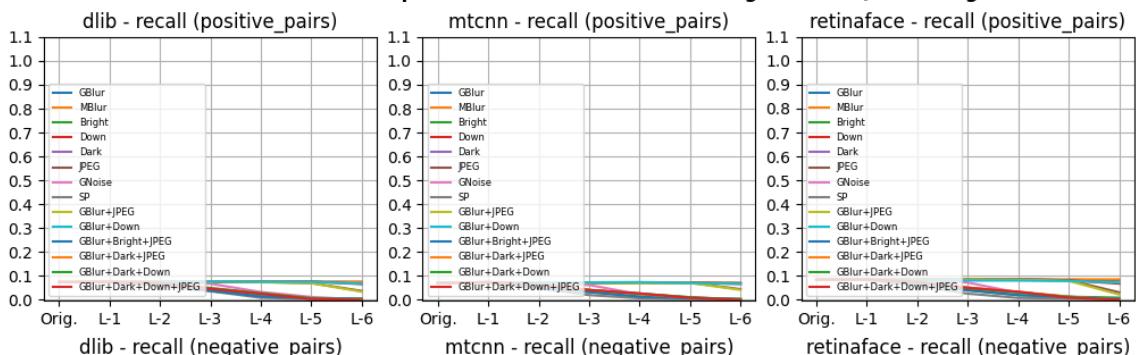
Dataset: GUFID - FR model: Facenet512 - Pair 3: Stand. (degraded) x Quest. (degraded)



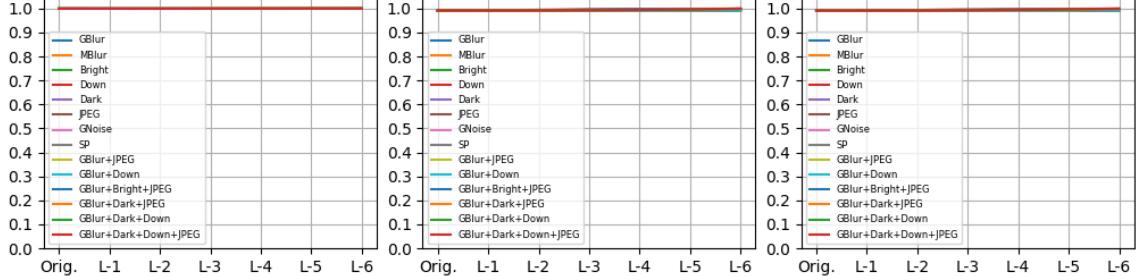
Dataset: GUFID - FR model: OpenFace - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



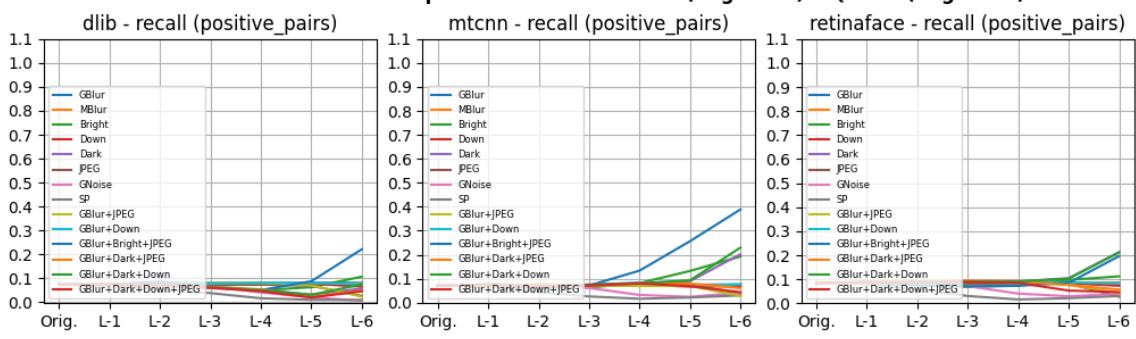
Dataset: GUFID - FR model: OpenFace - Pair 2: Stand. (non-degraded) x Quest. (degraded)



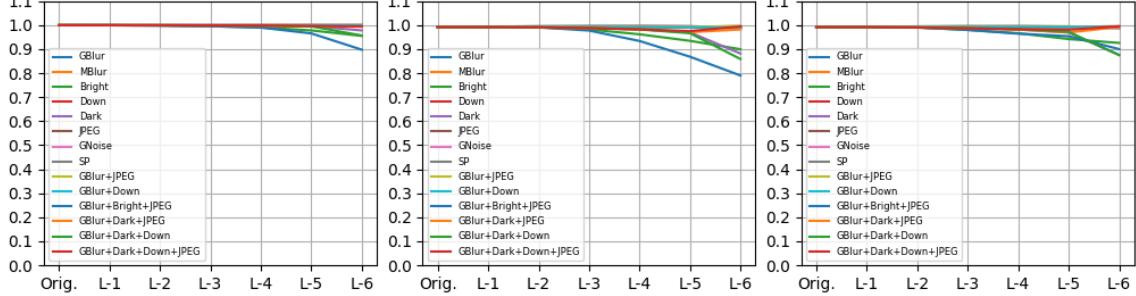
dlib - recall (negative_pairs)

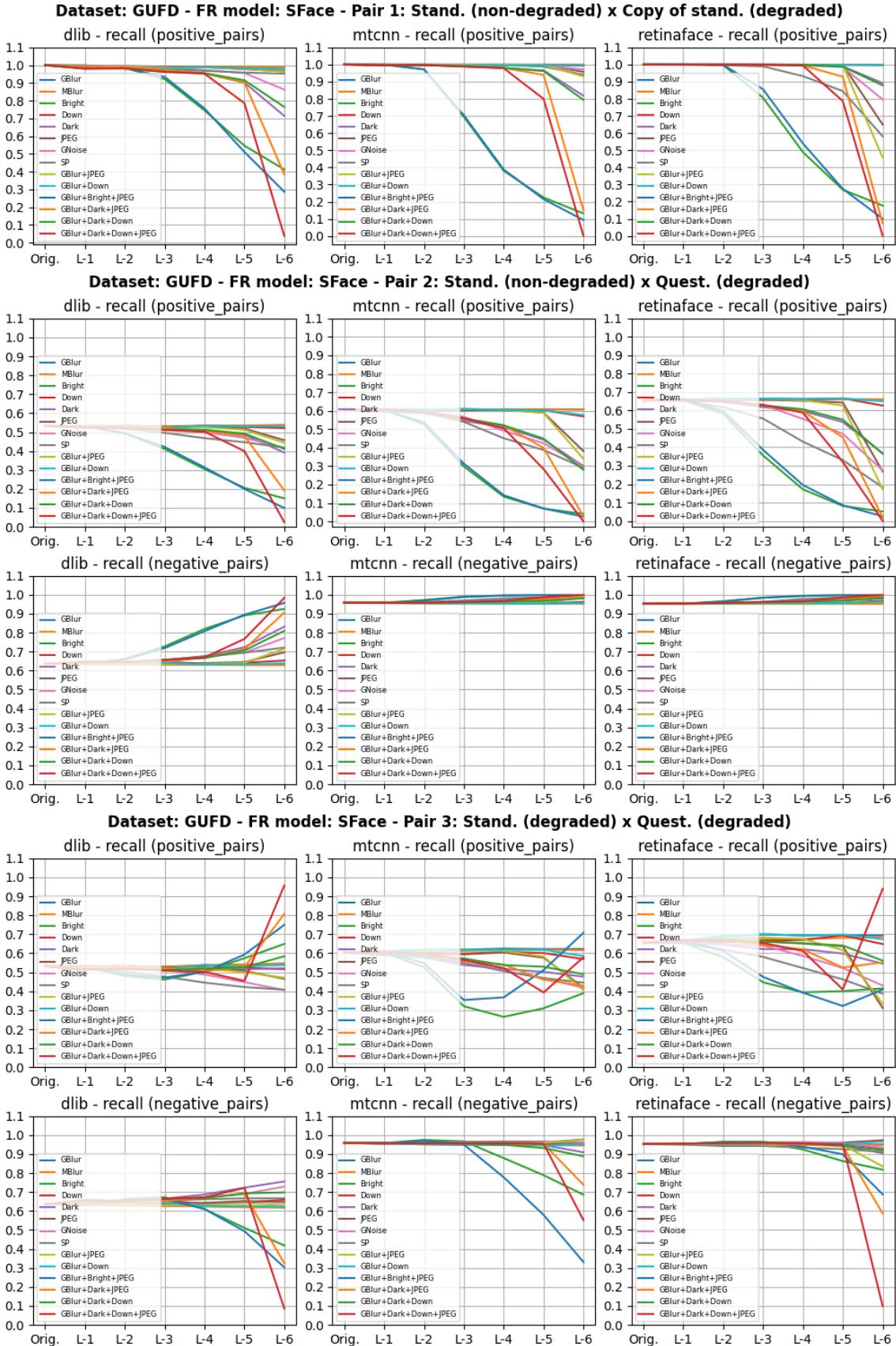


Dataset: GUFID - FR model: OpenFace - Pair 3: Stand. (degraded) x Quest. (degraded)

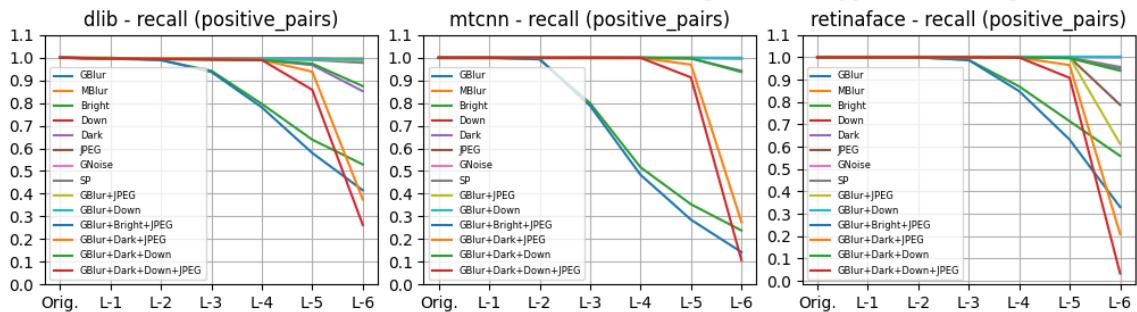


dlib - recall (negative_pairs)

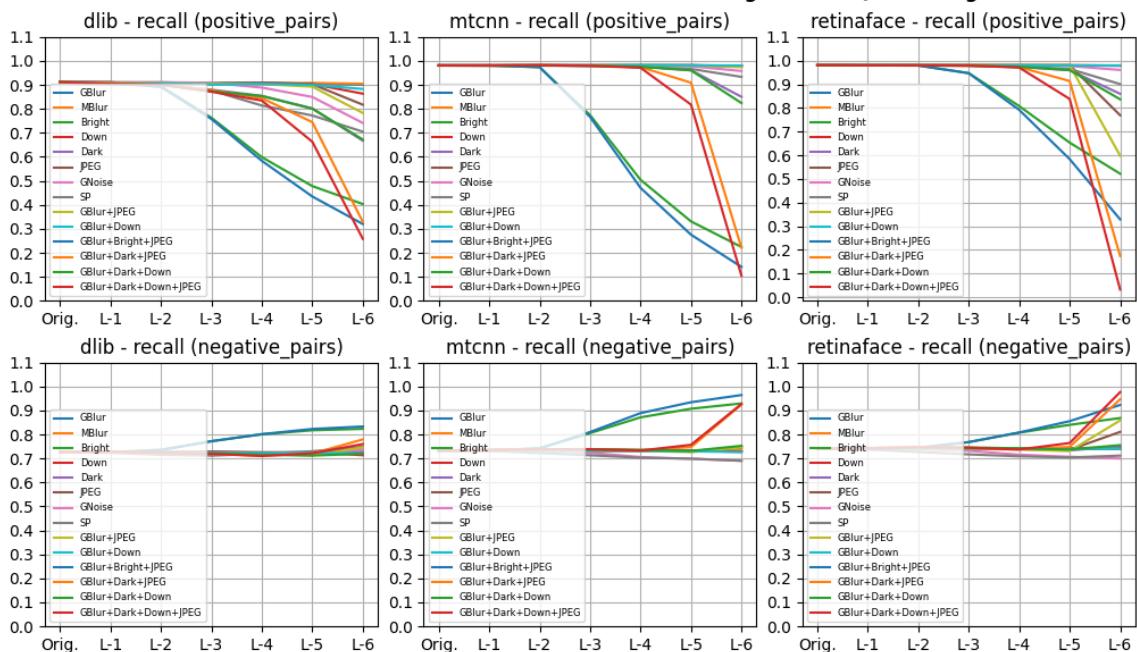




Dataset: GUFID - FR model: VGG-Face - Pair 1: Stand. (non-degraded) x Copy of stand. (degraded)



Dataset: GUFID - FR model: VGG-Face - Pair 2: Stand. (non-degraded) x Quest. (degraded)



Dataset: GUFID - FR model: VGG-Face - Pair 3: Stand. (degraded) x Quest. (degraded)

