

B10 Algorithm Performance

The following three diagrams show the performance of the current B10 algorithm and, for reference, the previous algorithm B9 in the closed-set identification, the open-set identification and the verification scenario.

All measurements were done using the same set of mugshot-type facial images from law enforcement databases. For the performance measurements, the set was divided into a gallery containing 4108 images of 4108 subjects (one image per subject) and a probe set consisting of another 7677 images of the same subjects.

The performance measures applied in the diagrams are defined in the ISO/IEC 19795-1 standard: "Information technology - Biometric performance testing and reporting - Part 1: Principles and framework", 2006. Occasional failures-to-encode are accounted for by treating the affected comparisons as rejections (i.e., we assign a minimum score or, respectively, a maximum rank). Furthermore, for all performance measurements presented in this report there is, of course, no overlap between the test data (galleries and probe sets) and the data used for training the algorithms: no common images and no common subjects.

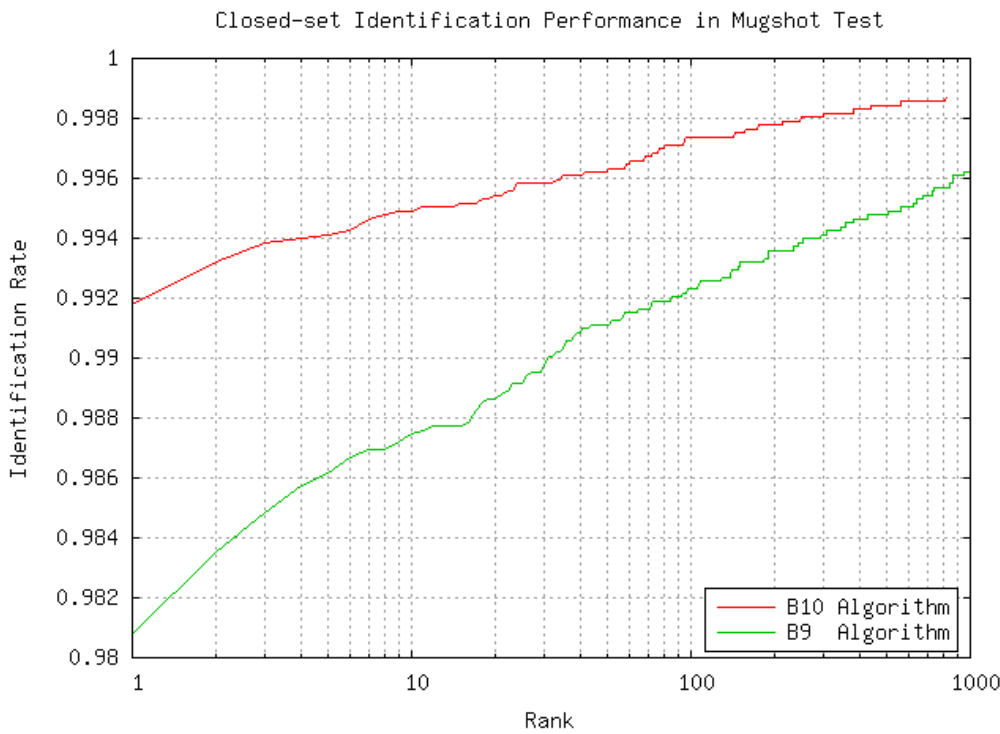


Diagram 1

Open-set Identification Performance (at Candidate List Size = 1)
in Mugshot Test

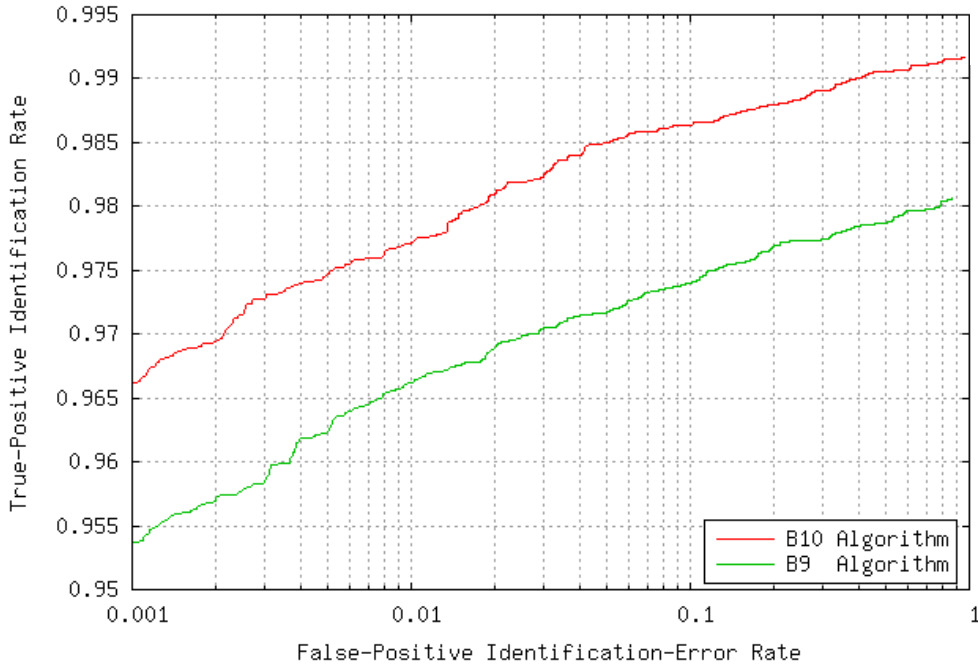


Diagram 2

Verification Performance in Mugshot Test

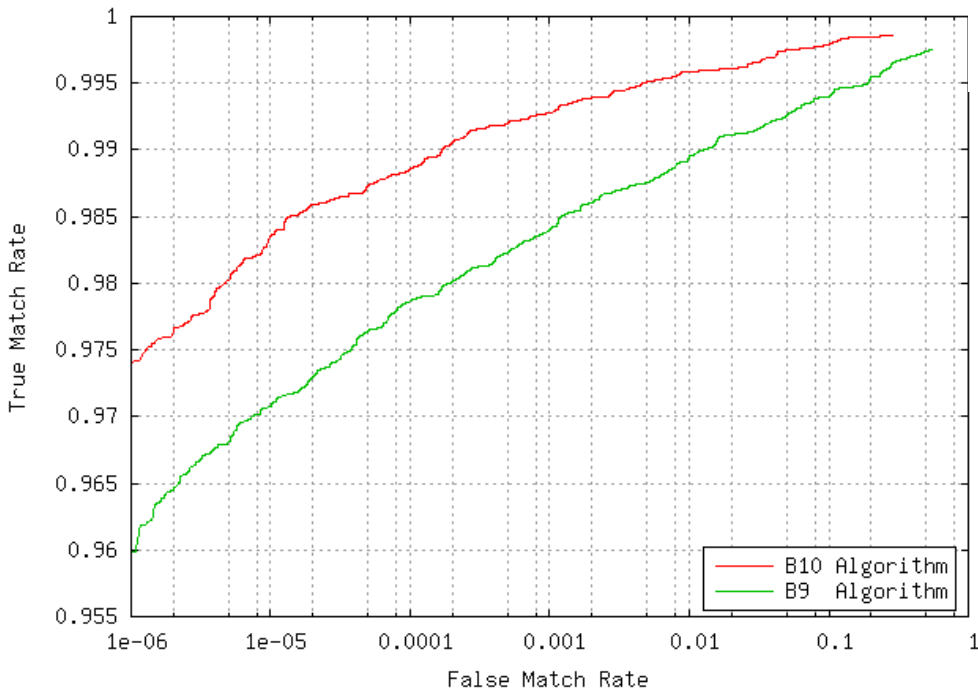


Diagram 3

Further improvements over the previous algorithm B9

Development of the algorithm B10 focused on improving the recognition performance on difficult image material, in particular images with non-frontal poses or strong illumination artifacts typical for video surveillance applications.

Non-frontal poses

In diagrams 4, 5 and 6, the performances of B9 and B10 are compared under head pose variation, using a set of 994 frontal pose images in the public Color FERET database as the gallery (one image per subject). The probe set consists of all non-frontal pose images from the Color FERET database in which both eyes are visible (4415 images). Head poses up to half-profile are included in the probe set. For more information on the Color FERET database, see the articles listed under References.

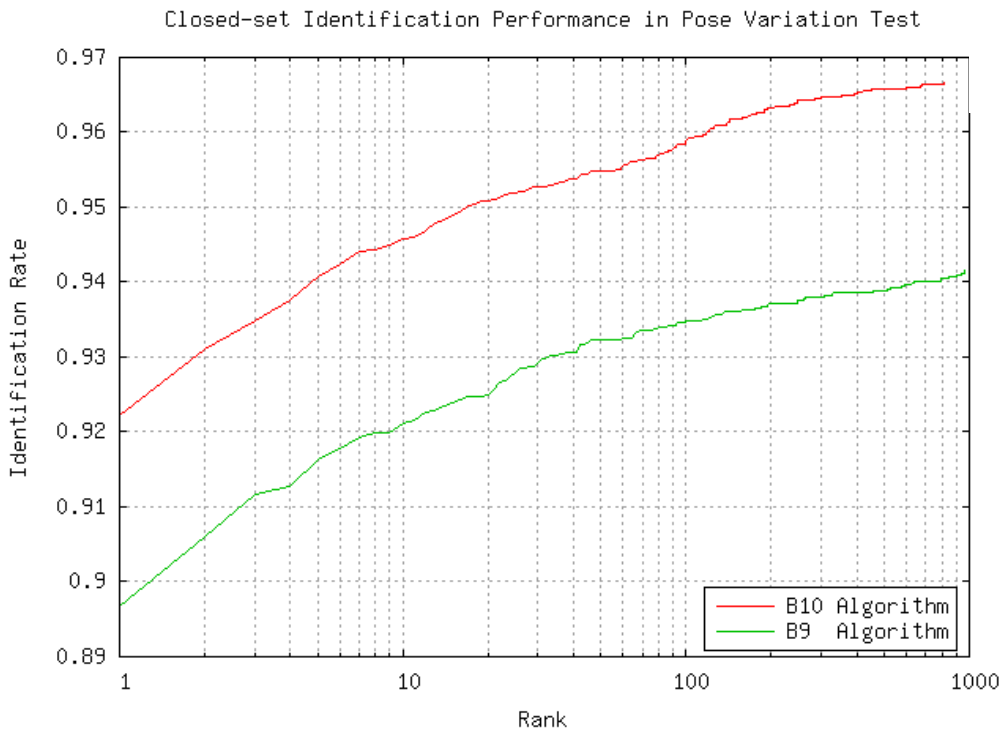


Diagram 4

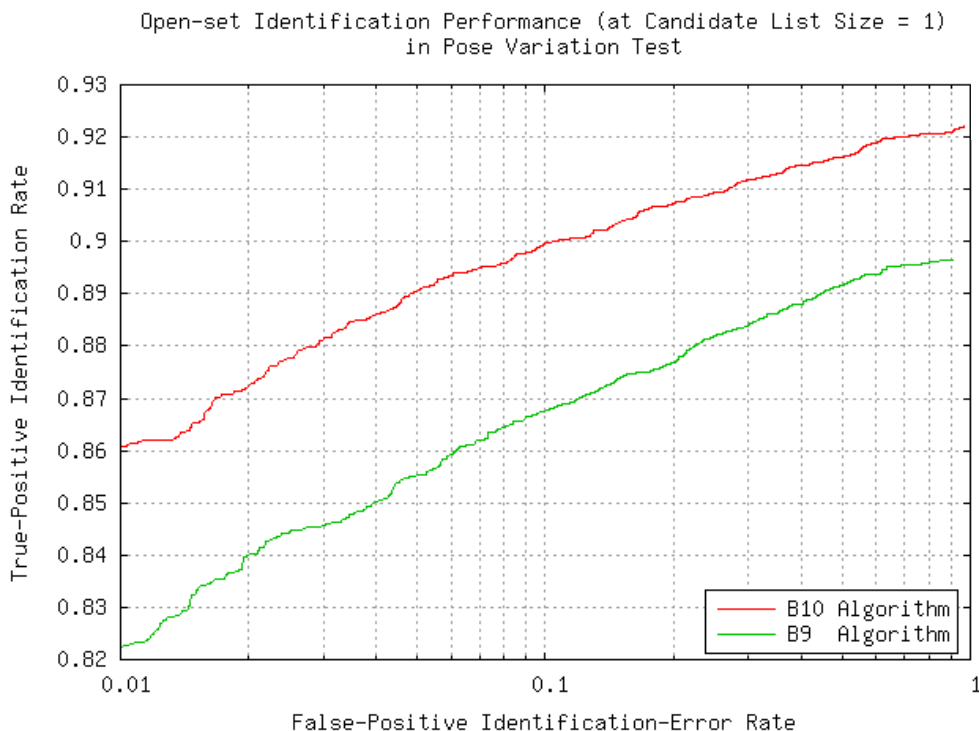


Diagram 5

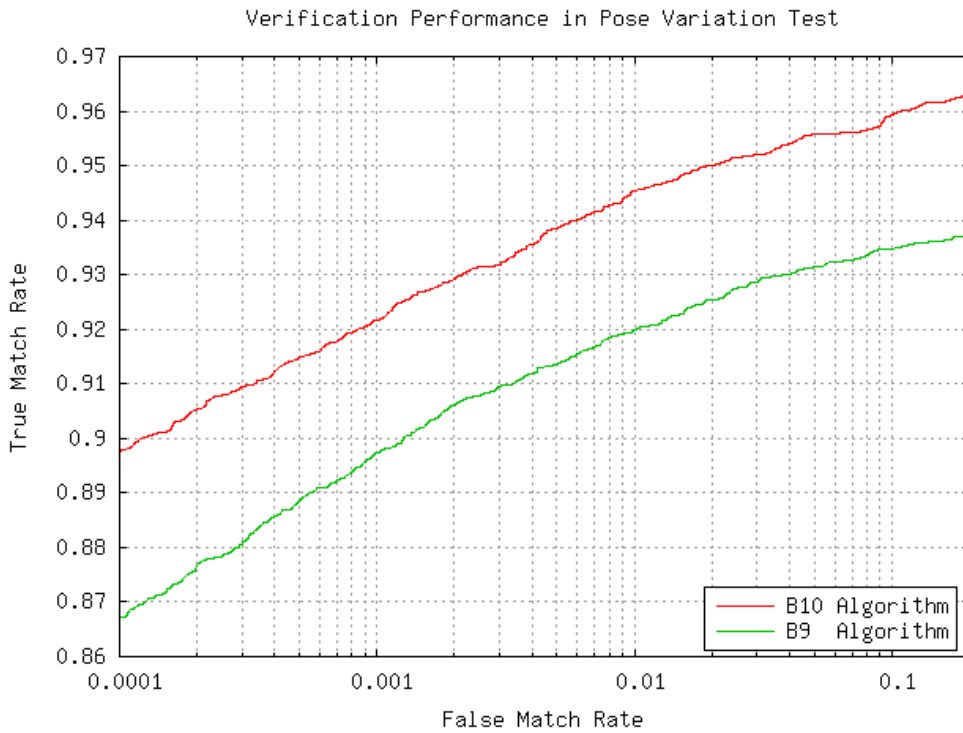


Diagram 6

Illumination artifacts

Diagrams 7, 8, and 9 show a comparison of performance in the presence of strong illumination artifacts. The data set contains frontal images of 294 subjects. A few images have good uniform illumination, but most of them have been taken outside in various lighting conditions. Those images show significant illumination gradients and/or strong cast shadows from various objects (branches, leaves, etc.) and some bright highlights. The set has been split into a gallery containing 294 images (one image per subject) and a probe set consisting of 1727 images.

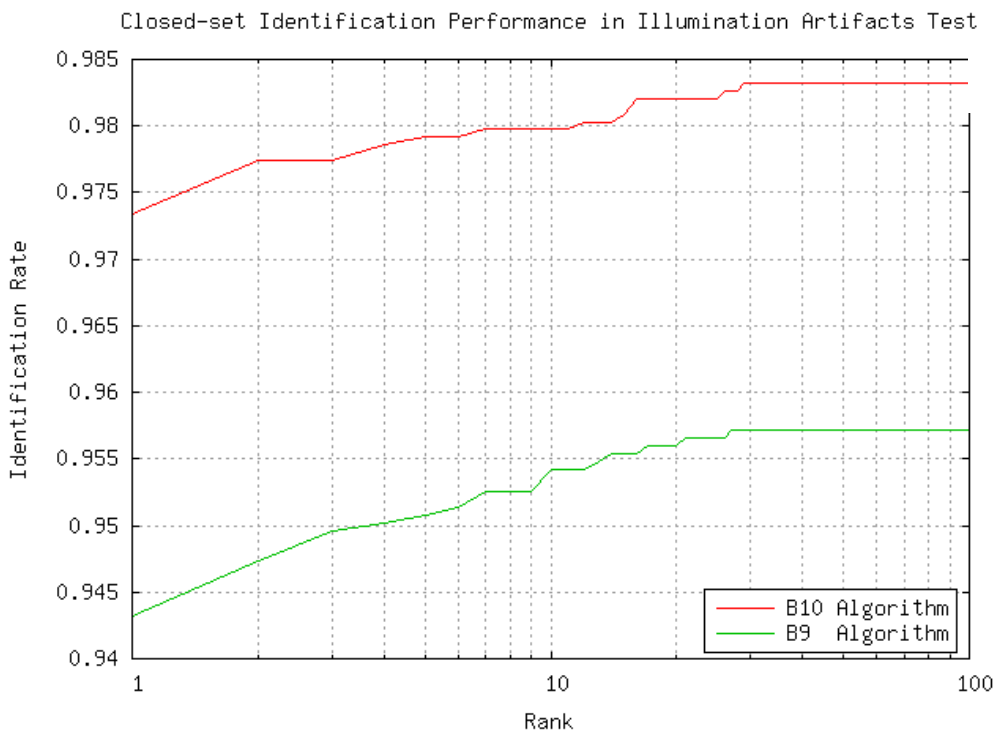


Diagram 7

Open-set Identification Performance (at Candidate List Size = 1)
in Illumination Artifacts Test

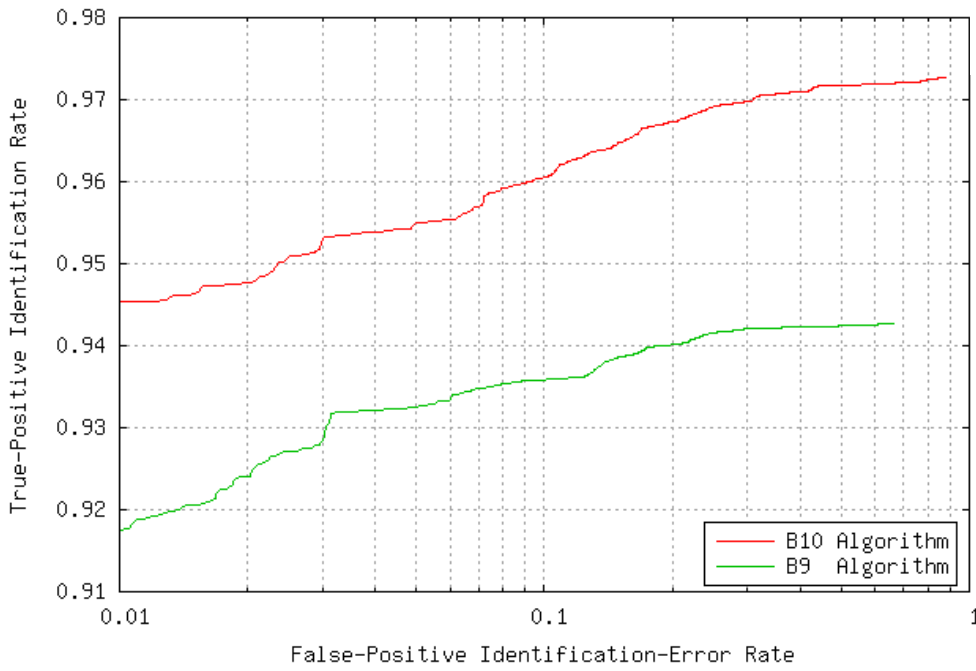


Diagram 8

Verification Performance in Illumination Artifacts Test

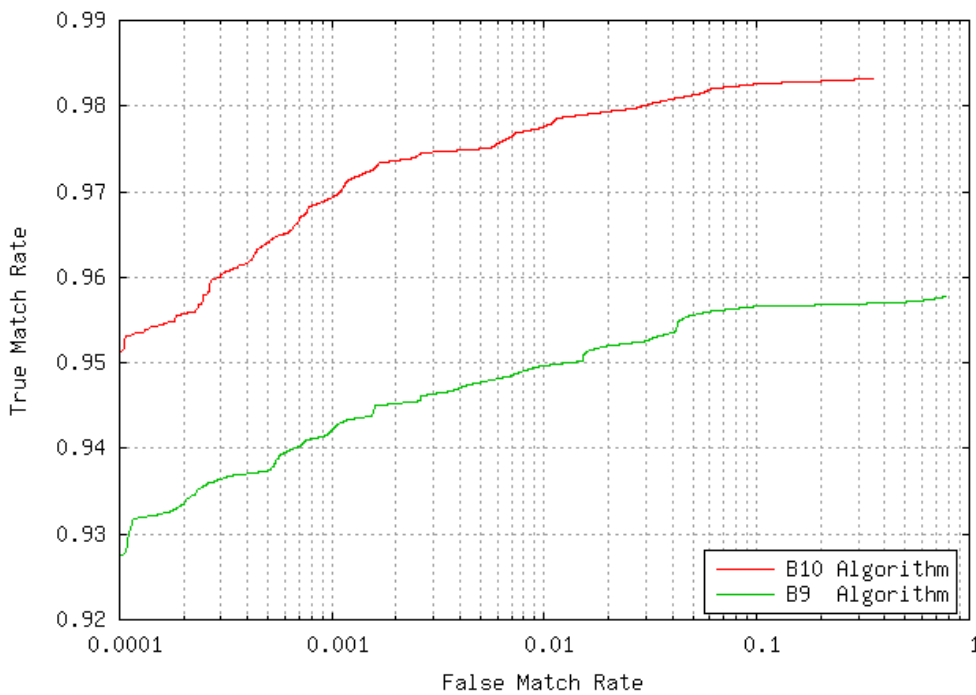


Diagram 9

Acknowledgement

Portions of the research in this paper use the Color FERET database of facial images collected under the FERET program [4].

References

1. Face Recognition Vendor Tests, <http://www.nist.gov/itl/iad/ig/frvt-home.cfm>
2. "The Facial Recognition Technology (FERET) Database", http://www.itl.nist.gov/iad/humanid/feret/feret_master.html
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4. P. J. Phillips, H. Moon, S. A. Rizvi and P. J. Rauss, "The FERET Evaluation Methodology for Face Recognition Algorithms," IEEE Trans. Pattern Analysis and Machine Intelligence, Volume 22, October 2000, pp. 1090-1104.
5. S. Rizvi, P. J. Phillips and H. Moon, "The FERET Verification Testing Protocol for Face Recognition Algorithms".
6. P. J. Phillips, H. Wechsler, J. Huang, and P. Rauss, "The FERET database and evaluation procedure for face recognition algorithms, " Image and Vision Computing J, Vol. 16, No. 5, pp 295-306, 1998.
7. ISO/IEC 19795-1, "Information technology -- Biometric performance testing and reporting -- Part 1: Principles and framework", 2006.