# OSAC RESEARCH NEEDS ASSESSMENT FORM

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| **Title of research need:** | Iris Anomaly Effects on Iris Recognition |
| **Keywords:** | iris image, generative artificial intelligence, data augmentations |

| **R&D Need Rank:** Low, Medium, High | High | **SAC Approved Date:** | February 11, 2026 |
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**Submitting subcommittee(s):** Facial and Iris Identification – Iris Systems and Capture Task Group

**Research Need Summary:**

The purpose of these research needs is to build a stronger scientific foundation for forensic science standards. The information provided herein will help to evaluate and strengthen existing standards, and/or fill any standards related gaps. In the space below, please provide a brief narrative of the need to be addressed. This should include:

- The identity of any specific standards that would be affected/improved/evaluated
- A discussion on gaps that exist within the standards or standards related gaps that need to be filled
- How this work would fill those gaps
- An overview of any current or past research efforts that may be relevant to this effort
- A discussion regarding how this research might improve current laboratory capabilities and/or forensic services within the criminal justice system
- Any relevant references

**Standards evaluated / adopted / referenced:**

a) ISO/IEC 19794-6 (data interchange format for iris images)
b) ISO/IEC 29794-6 (specification of iris image quality metrics)

**Identification of gaps:** Large-scale studies on how iris and eye diseases and injuries impact iris recognition (both machine- and human expert-based) are missing. Current studies are limited to small datasets and selected pathologies. Future studies, especially on large datasets of iris images representing a wide spectrum of anomalies, would provide directions for iris recognition and image quality algorithm design, as well as for human examiner training programs to appropriately account for the observed anomalies.

**Relevant research efforts:** Prior academic works report the sensitivity of iris recognition to acute inflammation of the iris (iritis/anterior uveitis) [1] and conditions affecting the geometry or tissue structure of the iris (like synechiae, iris trauma, or significant cataract surgery complications) [2,3]. It is also known that post-mortem deformations significantly impact iris recognition, which may cease to be viable after a few hours in outdoor conditions [4] and may offer correct matches up to two months after death in cool indoor conditions [5].

**Impact on forensic services:** Understanding the effects of iris anomalies on iris recognition will provide the scientific foundation required for iris recognition to be deemed reliable and admissible as evidence when the subject's eye condition is a factor. In particular, this research will provide the crucial data to quantify how eye conditions and post-operative changes impact the False Non-Match Rate when comparing a healthy enrollment scan to a later scan of a diseased eye. This research also will allow

forensic experts to testify that the failure is due to a quantifiable, known biometric degradation caused by the pathology, not a flaw in the underlying technology, human examination procedure, or a false exclusion of the suspect. Additionally, this research will aid in setting validated protocols for human forensic iris examiners when assessing diseased or injured irises, to help in designing objective, scientifically-backed standards. Finally, based on the results of this research, law enforcement agencies can develop evidence retention policies that mandate re-enrollment after recovery or that appropriately tag affected images to minimize errors in later comparisons.

**References:**

[1] T. M. Aslam, S. Z. Tan and B. Dhillon, "Iris recognition in the presence of ocular disease," *Journal of the Royal Society Interface*, Vol. 6, pp. 489–493, May 2009

[2] M. Trokielewicz, A. Czajka and P. Maciejewicz, "Assessment of iris recognition reliability for eyes affected by ocular pathologies," IEEE International Conference on Biometrics Theory, Applications and Systems (BTAS), Arlington, VA, USA, 2015

[3] M. Trokielewicz, A. Czajka, P. Maciejewicz, "Implications of ocular pathologies for iris recognition reliability," *Image and Vision Computing*, Vol. 58, 2017

[4] D. S. Bolme, R. A. Tokola, C. B. Boehnen, T. B. Saul, K. A. Sauerwein and D. W. Steadman, "Impact of environmental factors on biometric matching during human decomposition," IEEE International Conference on Biometrics Theory, Applications and Systems (BTAS), Niagara Falls, NY, USA, 2016

[5] R. A. Bhuyian, P. Farmanifard, R. Sharma, A. Kuehlkamp, A. Boyd, P. J. Flynn, K. W. Bowyer, A. Ross, D. Chute and A. Czajka, "Beyond Mortality: Advancements in Post-Mortem Iris Recognition through Data Collection and Computer-Aided Forensic Examination," *IEEE Transactions on Biometrics, Behavior, and Identity Science*, July 2025

*This research need has been identified by one or more subcommittees of OSAC and is being provided as an informational resource to the community.*