OSAC RESEARCH NEEDS ASSESSMENT FORM

Title of research need:	Near Infrared (NIR) vs Visible-Light (VIS) Iris Recognition
Keywords:	iris image, iris sensor, near infrared imaging, visible-light iris imaging

R&D Need Rank: Low, Medium, High	High	**SAC Approved Date:**	January 9, 2026

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) ANSI/NIST-ITL 1-2011 (data format for biometric image exchange)
b) ISO/IEC 19794-6 (data interchange format for iris images)
c) ISO/IEC 29794-6 (specification of iris image quality metrics)
d) IEC 62471 (photobiological safety)

Identification of gaps:

a) Studies are needed to evaluate whether, and what type of, VIS iris imaging (e.g., still image vs. video acquisition, frontal and/or lateral captures, polarized vs. non-polarized imaging) can provide useful iris samples in forensic scenarios, in which data acquisition is less controlled than in research laboratory NIR↔VIS iris matching studies (e.g., varying distance, motion, intense ambient light, off-axis acquisition).
b) Studies are needed to understand how well NIR↔VIS matching works in forensic contexts, what features survive, where errors arise, and how demographics (e.g., eye color, race, and ethnic group) impact the reliability of NIR↔VIS recognition.
c) Studies are needed to assess whether VIS iris recognition is scientifically valid and robust when done by human examiners collaborating with algorithms, and thus whether NIR↔VIS and VIS↔VIS comparisons provide the scientific basis for expert testimony (e.g., Daubert or Frye standards).
d) Studies are needed to quantify how spoofing risk (in the forensic context) differs for VIS iris samples compared to NIR iris samples.

Relevant research efforts:

The past and current academic research on NIR↔VIS matching is rather limited and based on small data samples [1,2]. There are isolated works assessing differences in fake iris detection under VIS and NIR illumination [3]. NIST has conducted a comprehensive evaluation of NIR↔VIS matching for closed (commercial) solutions [4]. There are also isolated works using modern generative approaches to model and interpret differences in representations of NIR and VIS images in feature spaces [5]. None of the existing studies are specifically positioned within the forensic context.

Impact on forensic services:
Contemporary commercial iris sensors capture images in NIR, but such sensors are rarely present at crime scenes. Building and then confirming interoperability between legacy (NIR, like used in the FBI Next Generation Identification system) and emerging (VIS) iris data sources would significantly increase the use of iris recognition in forensic scenarios and thus add a strong and rapid identification method to the forensic identification toolkit.

References:
[1] R. Pasula, “Iris Recognition in Multiple Spectral Bands: From Visible to Short Wave Infrared,” MS Thesis (directed by Arun Ross), West Virginia University, 2011
[2] P. R. Nalla and A. Kumar, "Toward More Accurate Iris Recognition Using Cross-Spectral Matching," in *IEEE Transactions on Image Processing*, vol. 26, no. 1, pp. 208-221, 2017, doi: 10.1109/TIP.2016.2616281
[3] F. Alonso-Fernandez and J. Bigun, "Fake Iris Detection: A Comparison between Near-Infrared and Visible Images," Tenth International Conference on Signal-Image Technology and Internet-Based Systems, Marrakech, Morocco, 2014, pp. 546-553, doi: 10.1109/SITIS.2014.104
[4] G. W. Quinn, P. Grother and J. Matey, “IREX IX Part Two Multispectral Iris Recognition,” NISTIR 8252, June 2019, doi: 10.6028/NIST.IR.8252
[5] M. Mostofa, F. Taherkhani, J. Dawson and N. M. Nasrabadi, "Cross-Spectral Iris Matching Using Conditional Coupled GAN," IEEE International Joint Conference on Biometrics (IJCB), Houston, TX, USA, 2020, pp. 1-9, doi: 10.1109/IJCB48548.2020.9304929

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