

Applied Computer Vision R&D in Biomedical Imaging, Industrial Inspection, and National Security



Imaging, Signals and Machine Learning Group

Purpose: The Imaging, Signals, and Machine Learning Group conducts applied computer vision research and development addressing important issues in industrial and economic competitiveness, biomedical measurement science, and national security.

Sponsors: Government agencies such as the Department of Energy and Bureau of Engraving and Printing, nongovernmental agencies, private companies, universities, and various consortia.

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Group Mission and Programs

The Imaging, Signals, and Machine Learning (ISML) Group was established in 1987 to develop technologies that provide human-like decision making capabilities for computers and robots. These methods and systems perform image-based metrology, scene analysis and comprehension, and archival image indexing and management. Today we are one of nine research and development (R&D) groups in the Measurement Science and Systems Engineering Division at Oak Ridge National Laboratory.

Base Technology and Experience

The group consists of 15 researchers with electrical engineering, computer science, and nuclear engineering backgrounds. Using strategic partnerships, we conduct applied computer vision R&D that supports U.S. industry, healthcare, and security. Our research encompasses image processing methods that include image modeling, image transforms, dimensional metrology, object and region segmentation, statistical feature analysis, pattern classification, and content-based indexing and retrieval. We apply these methods to three programmatic areas described below.

Biomedical Imaging

- Neuronal morphology and migration research for disease characterization.
- High-resolution tomographic medical imaging (X-ray CT and awake-animal SPECT).

- Content-based image retrieval (CBIR) and data mining for computer-aided medical diagnostics (e.g., ophthalmology, mammography).

Industrial Inspection

- Semiconductor metrology and inspection.
- Manufacturing-based CBIR
- Energy reduction, waste mitigation, and quality control.

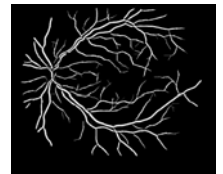
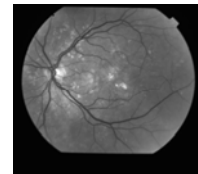
National Security

- Intelligent surveillance.
- Advanced, multimodal biometrics.
- Nuclear materials verification/identification.
- Geographic aerial image analysis.

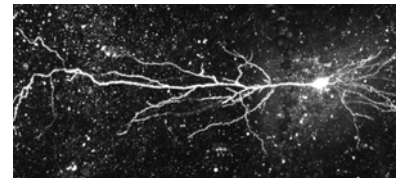
Facilities

Facilities and capabilities include the following:

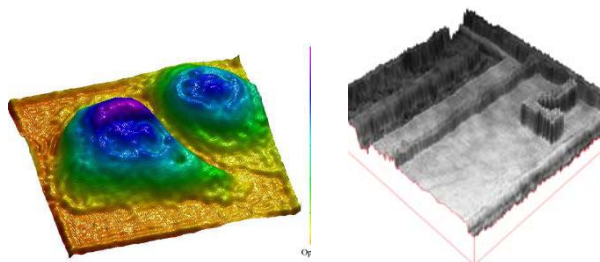
- Digital Holography Microscopy Laboratory.
- Small Animal Imaging Laboratory.
- Oak Ridge Web Test Bed Laboratory.
- Video Analysis Laboratory.



Retinal image analysis for diabetic retinopathy.



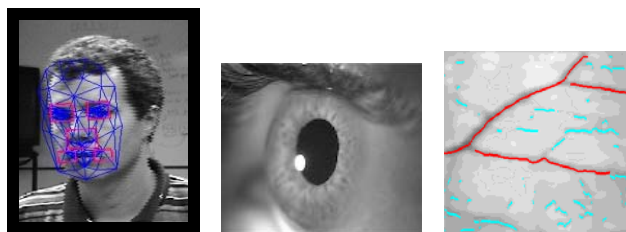
Neuronal image analysis.



Digital holography for bio-analysis and semiconductor characterization.

Contact Information

For more information on our research technologies, capabilities, and facilities, please contact Shaun Gleason (gleasonss@ornl.gov) at 865-574-8521.



Intelligent surveillance and biometrics: face detection/ID, iris and vein-based ID.