

Snapshot Hyperspectral Imaging with Hyperspectral Learning

Deep learning algorithm that extracts spectral data from standard cameras for portable imaging.

Researchers at Purdue University have discovered a statistical deep-learning algorithm that generates fast snapshot hyperspectral imaging with high temporal resolution. Typically, hyperspectral imaging systems rely on mechanical scanning elements either in the spectral or spatial domains and these scanning elements result in bulky instruments and yield suboptimal temporal resolutions. Hyperspectral imaging technologies developed to solve these problems often have limitations such as tradeoffs between spectral and spatial resolutions, sensitivity to light conditions and imaging configurations, or difficulty in manufacturability due to the need for high-precision fabrication or nanofabrication. These new hyperspectral imaging technologies have also generally only been utilized in laboratory settings or with stationary biological samples, thereby hampering the practical and widespread utilization.

Purdue researchers have developed a statistical deep-learning algorithm that enables spectral information recovery from RGB color values acquired through conventional cameras and renders tradeoffs unnecessary between spatial and spectral resolutions. Intended for various machine-learning techniques, the hyperspectral imaging can be applied in multiple contexts, ranging from biomedicine to defense domains. To remediate the intrinsic bulkiness of conventional technologies, this instantaneous hyperspectral imaging's hardware simplicity supports smartphone camera usage and provides a full reflectance spectrum in the visible range. Its fast data acquisition rate designed to predict extensive physical and biological information is a versatile, simplistic option for device and system development.

Technology Validation:

Technology ID

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Category

Artificial Intelligence & Machine
Learning/Computer Vision &
Image Recognition
Artificial Intelligence & Machine
Learning/Multimodal &
Generative Visual AI
Digital Health & Medtech/AI in
Medical Imaging
Biotechnology & Life
Sciences/Analytical & Diagnostic
Instrumentation

Further information

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The hyperspectral learning method was applied to smartphone video recording to demonstrate the dynamic imaging of peripheral microcirculation and ultrafast imaging of oxygen depletion in tissue phantoms.

Advantages:

- Hardware simplicity
- High temporal resolution
- Machine learning augmentation

Applications:

- Forensic medicine
- Security
- Geology
- Agriculture

TRL: 3

Intellectual Property:

Provisional-Patent, 2023-02-09, United States

Utility-Gov. Funding, 2024-01-26, United States

PCT-Gov. Funding, 2024-01-26, WO

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