



SYSTEMS AND METHODS FOR STAND-OFF BIOMETRIC DETECTION

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The Invention

Current methods for stand-off biometrics are unable to get accurate readings outside of controlled lighting environments. UW-Madison researchers have developed a system and methods for stand-off biometric detection that does not have a lighting limitation. The system is a lock-in camera-based hyperspectral imaging (HSI) framework where the lock-in feature synergizes frequency-modulated, wavelength-specific illumination with computational phase sensitive detection integrated at the sensor level, effectively suppressing ambient noise. Machine learning is used to train reconstruction models and yields an improvement over conventional HSI for stand-off biometric detection. A lock-in CMOS camera is used to detect photons, which enables rapid and massively parallel dual-phase demodulation of optical signals. Each pixel integrates analog signal processing circuitry within its unit cell, addressing limitations of conventional image sensors in lock-in applications: frame rate constraints and insufficient dynamic range. A fixed focal length lens is employed to focus incoming light onto the CMOS sensor to provide a fixed field of view. This ensures consistent image quality without the need for adjustable optics, aligning with the lock-in camera's high-frequency operation. This innovation enables cameras to isolate the modulated signal (ie physiological data) from ambient noise, enhancing the signal-to-noise ratio and facilitating accurate image reconstruction.

Applications

Physiological monitoring, including blood pressure, pulse, and oxygen levels, in uncontrolled environments for:

Healthcare and telemedicine

Exercise and sport performance

Security and

Public health

Key Benefits

Non-contact

Not sensitive to ambient light fluctuations

Scalable

Accurate

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- [Zongfu Yu](#)

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Publications

- [Robust spectral sensor for standoff biometric detection | Nature Sensors](#)
- [Read a news story about this technology.](#)

Tech Fields

- [Information Technology : Image processing](#)
- [Medical Devices : Medical tools](#)

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