computar

WELCOME TO THE MULTISPECTRAL & HYPERSPECTRAL IMAGING IN SECURITY WEBINAR

Please turn off your video, open your chat, and ask any questions in the chat

Jonathan Hackney

Director of Sales for
the West Region

Computar brand launch, 1981

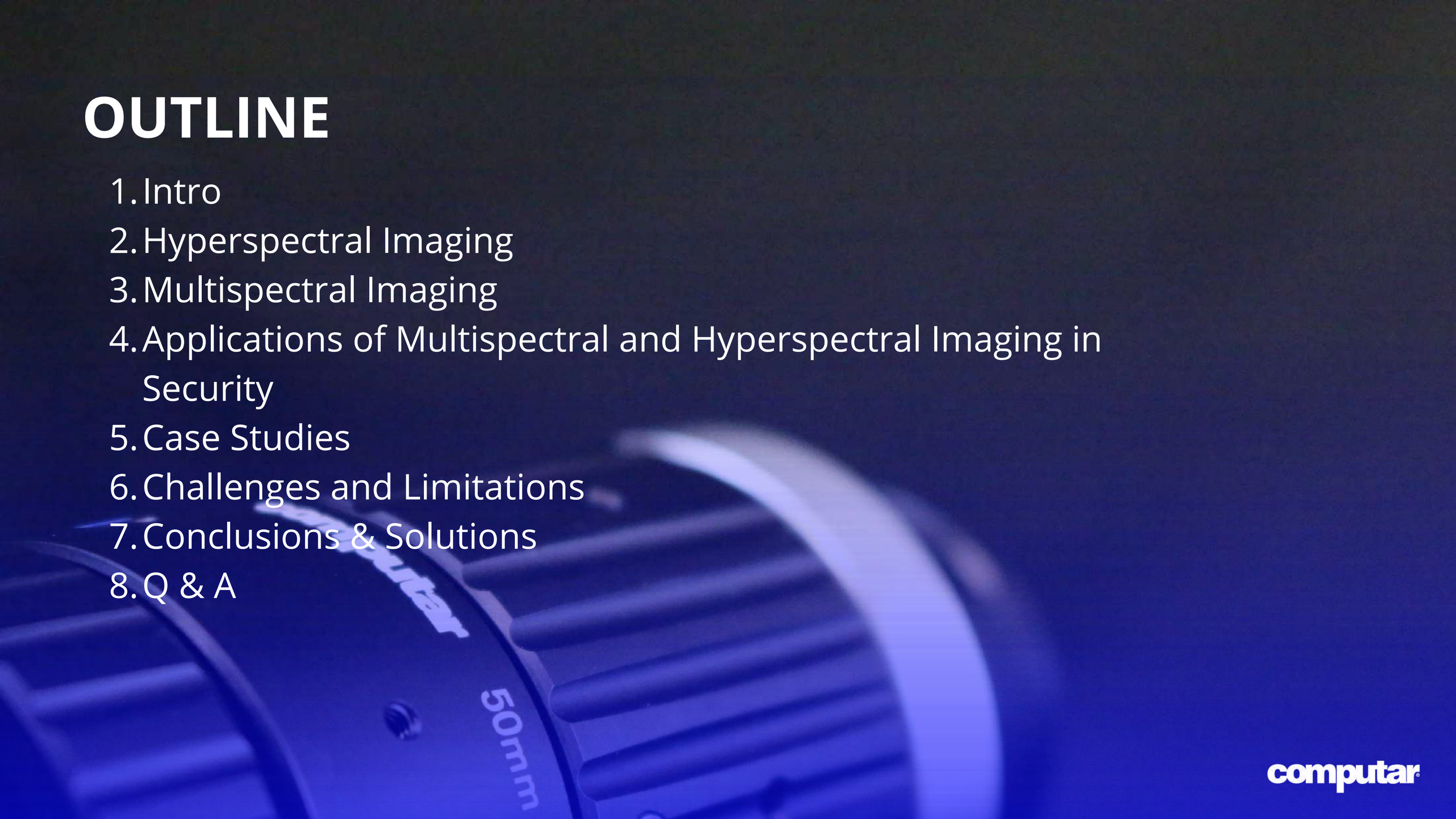
MEET THE EXPERTS

- Jonathan has a history of working in the industrial automation industry
  - Enjoys talking & learning about technological advancements, especially machine vision
- Computar has 40+ years of innovative optics using Japanese engineering & global agile production facilities

computar

OUTLINE

1. Intro
2. Hyperspectral Imaging
3. Multispectral Imaging
4. Applications of Multispectral and Hyperspectral Imaging in Security
5. Case Studies
6. Challenges and Limitations
7. Conclusions & Solutions
8. Q & A



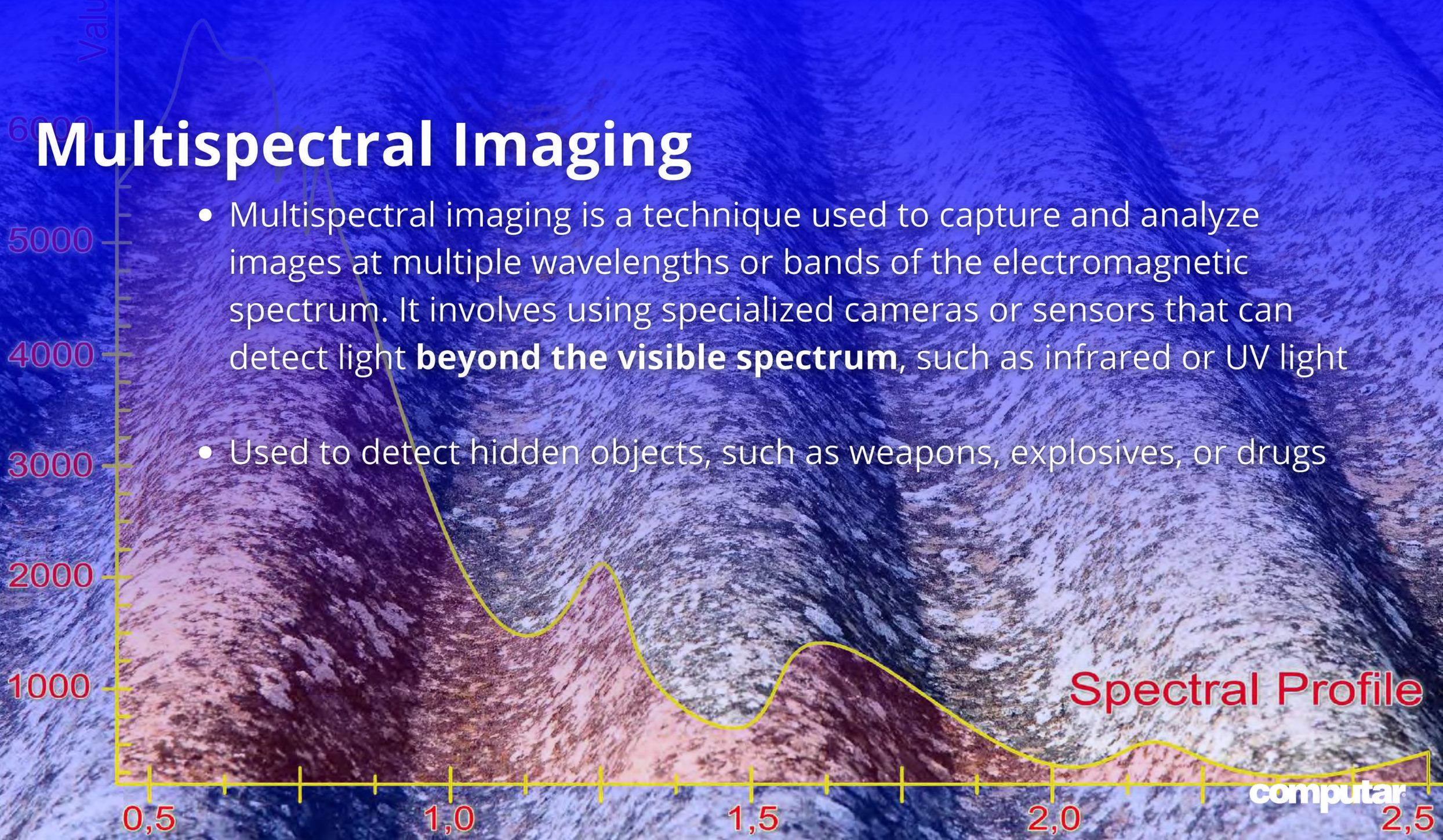
Introduction

Multispectral and hyperspectral imaging are advanced technologies that have found applications in various fields, including security. These technologies are used to capture and analyze images of objects or scenes using multiple spectral bands or wavelengths of light.

Multispectral Imaging

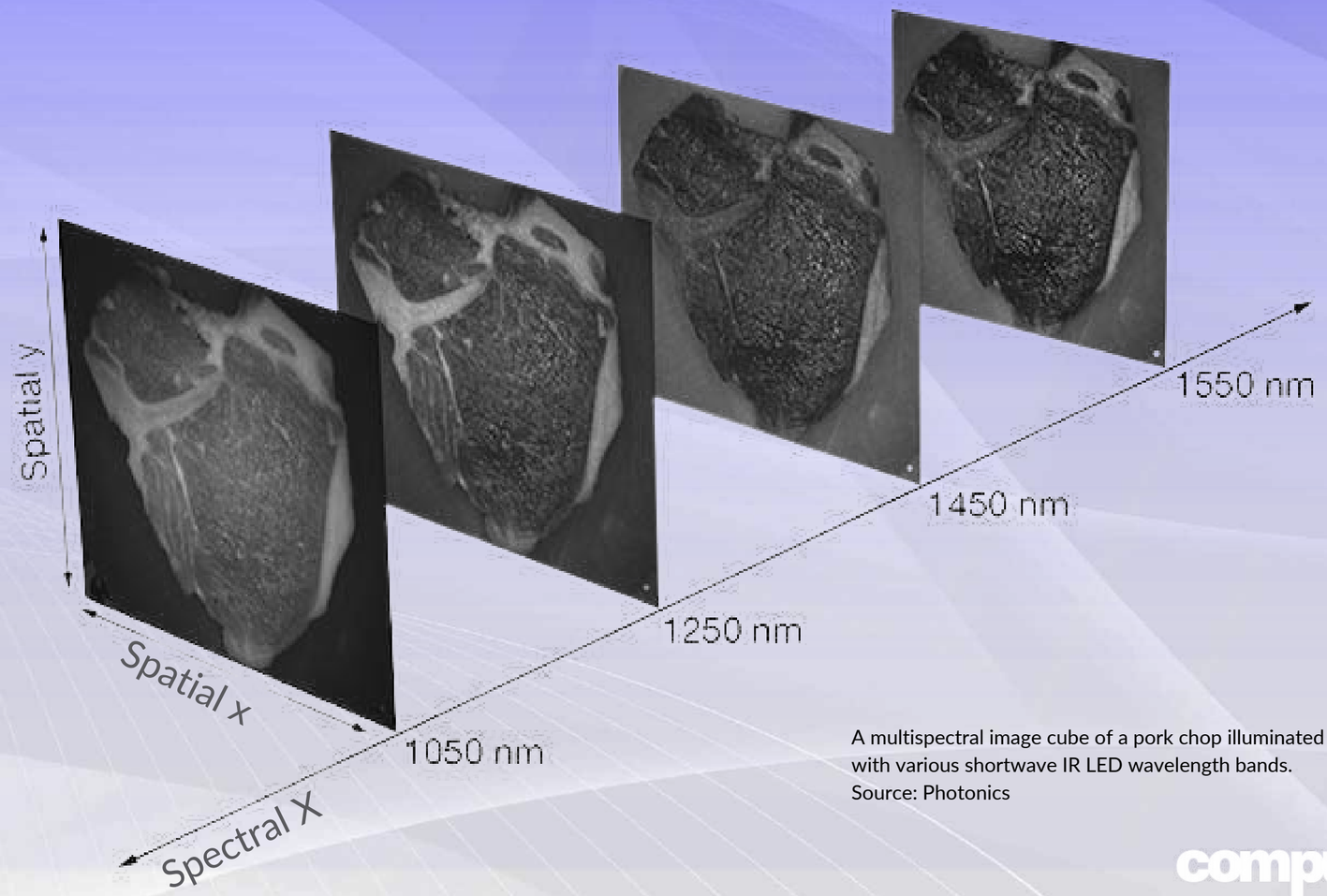
- Multispectral imaging is a technique used to capture and analyze images at multiple wavelengths or bands of the electromagnetic spectrum. It involves using specialized cameras or sensors that can detect light **beyond the visible spectrum**, such as infrared or UV light

- Used to detect hidden objects, such as weapons, explosives, or drugs



How Multispectral Imaging Works

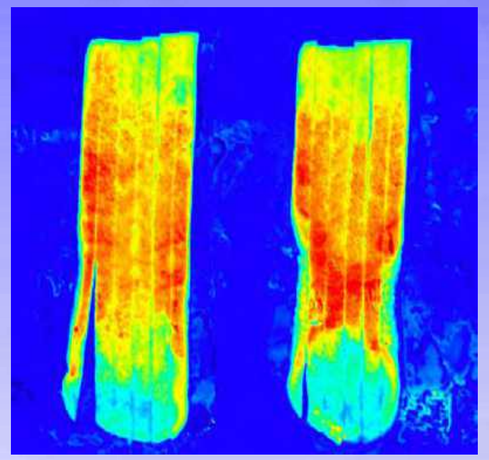
- Typically uses 3-10 spectral bands to capture images of objects or scenes
- The scene is typically imaged using a camera or sensor with filters designed to capture light in specific wavelength bands



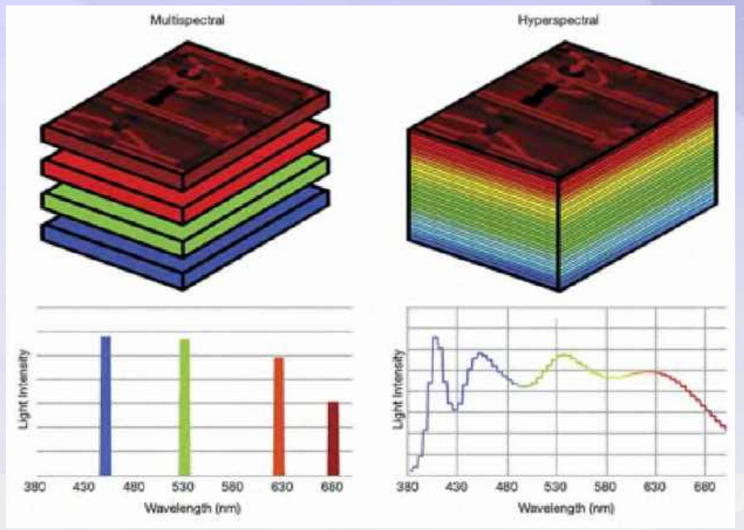
A multispectral image cube of a pork chop illuminated with various shortwave IR LED wavelength bands.
Source: Photonics

computar

Hyperspectral Imaging



Hyperspectral image of "sugar end" potato strips shows invisible defects.
Source: SortingExpert, CC BY-SA 3.0 <https://creativecommons.org/licenses/by-sa/3.0>, via Wikimedia Commons



Photonics

- Hyperspectral imaging (HSI) is typically defined as a spectral sensing technique which takes hundreds of contiguous narrow waveband images in the visible and infrared regions of the electromagnetic spectrum

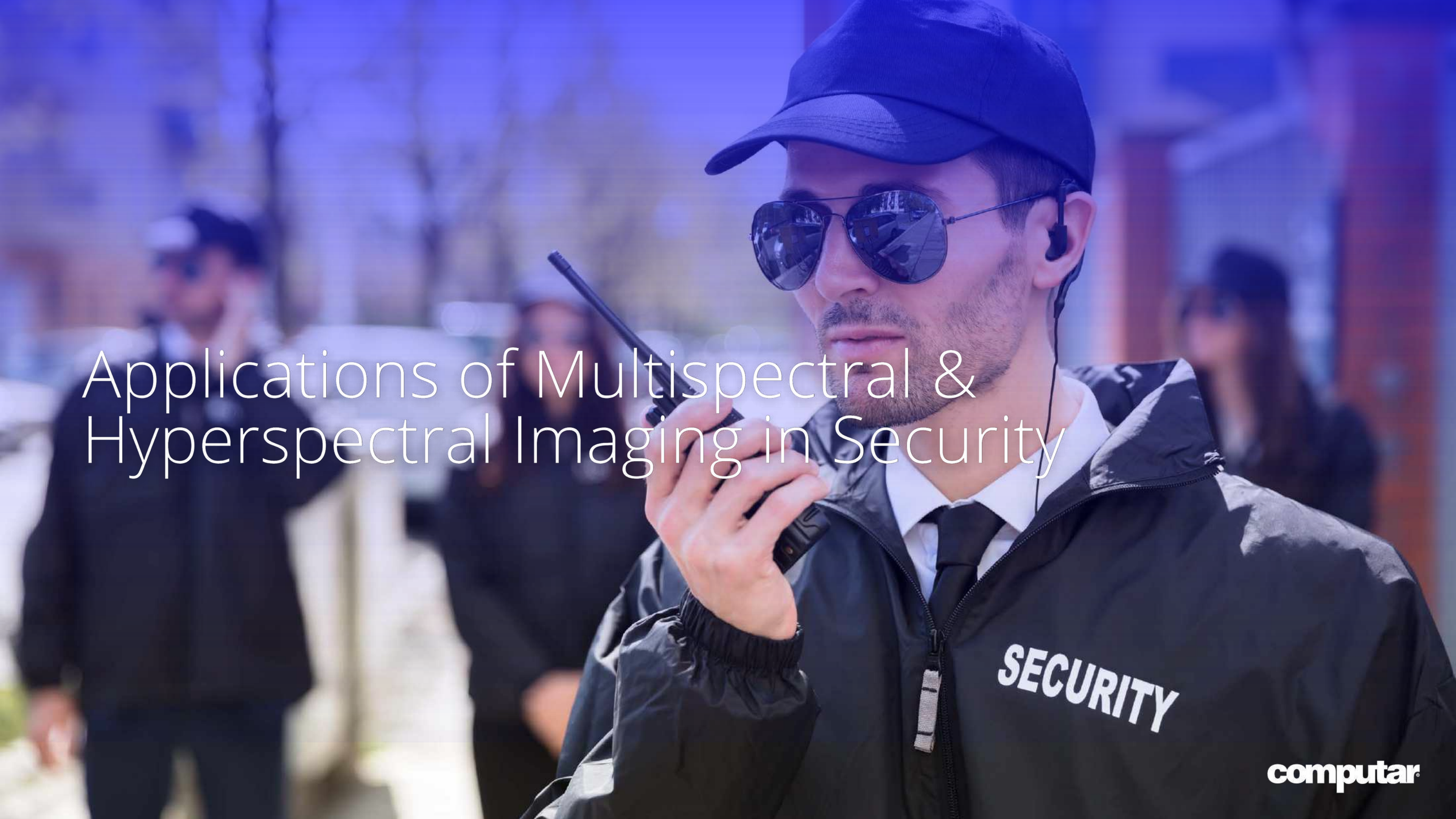
How Hyperspectral Imaging Works

1. The hyperspectral cube is created by acquiring multiple images of a scene, each at a different wavelength
2. HSI can detect and differentiate between subtle differences in the spectral signatures of different materials, allowing for identifying and classifying objects in the scene
3. Specialized sensors are used that can capture images at very narrow wavelength bands
4. Once the hyperspectral cube is created, various processing techniques can be applied to extract information from the data

How Hyperspectral Imaging Works, *continued*

Although HSI was initially developed for mining and geology applications, its usage has quickly spread into other civilian sectors and, more recently, into the military sector due to the ability to differentiate between materials.

HSI has been specifically adopted for the detection and recognition of targets that are normally well camouflaged concerning the background

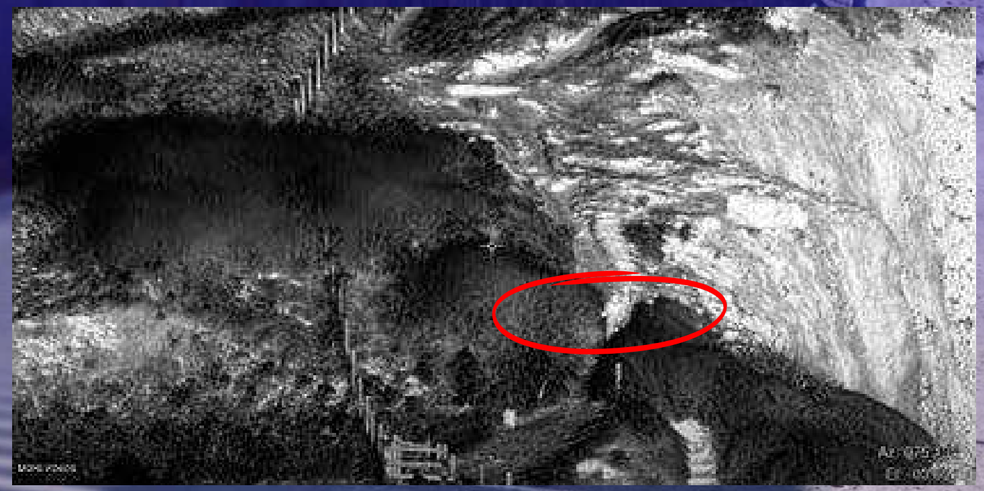


Applications of Multispectral & Hyperspectral Imaging in Security

computar

Border Control & Enhanced Detection Capabilities

- Remote sensing: can be used for remote sensing to detect and monitor various security threats such as illegal mining, deforestation, and land-use changes.
  - Infrared cameras and drones used for finding anomalies
- **Low Light/Night Vision Imaging** can operate down to starlight conditions
- **Landmine detection**



Biometrics & Recognition of Persons

Photonics

- Whereas long- and medium-wavelength infrared sensors can spot targets based solely on their heat emissions, SWIR cameras and sensors see reflected light in the shorter wavelengths just beyond the visible range.
  - Typical differences: hair shows as white due to the lack of moisture in hair; conversely, skin shows darker, due to its high moisture content.

Additional Applications

- **Improved identification and classification of objects**
  - Concealed explosives and weapons
- **Increased accuracy and efficiency in surveillance**
  - Illegal drug production facilities
- **Forensic analysis:** Hyperspectral and multispectral lenses can be used for forensic investigation to detect and analyze trace evidence, such as fingerprints, fibers, and DNA.

Application Systems

- **Airport security scanners:** Airport security scanners detect potential threats in luggage and cargo using multispectral and hyperspectral imaging lenses.
  - Analyzing the images' spectral properties can identify weapons, explosives, or other dangerous items.
- **Chemical detection systems:** lenses are used to identify and analyze the spectral properties of chemicals and other substances.
  - These systems may be used in security applications to detect the presence of potential chemical threats, such as explosives or hazardous materials.

Case Studies

- The University of Bradford tested different infrared bans against visible face images to evaluate the performance.
  - An accuracy of 100% was obtained with visible image versus the (SWIR) of the IR band.
  - Data collected with infrared cameras offer significant benefits over those collected with visible spectrum cameras for face identification

Challenges & Limitations

- Cost
- Complexity
- Limited FOV
- Environmental factors

computar

Solutions

- Competitive pricing
- User- and installer-friendly
- Wide FOVs & a range of 11 ViSWIR lenses to fit your needs
- Custom mounting solutions via sister company Broadsight Systems to suit harsh environmental conditions
  - Drone/UAV capabilities

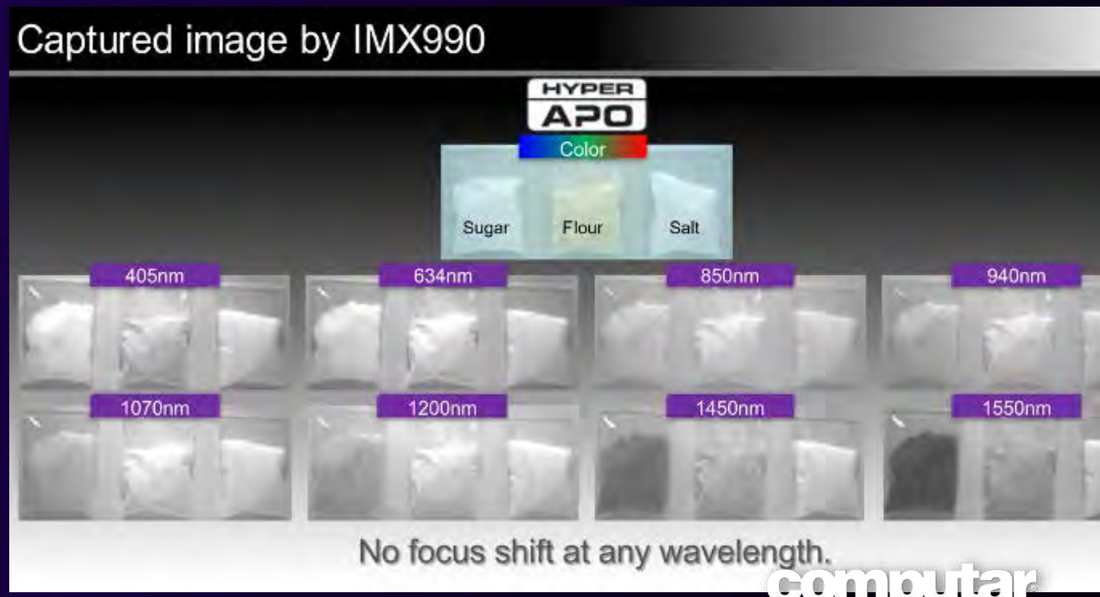
Recommendations

Capture more precise & detailed info in different spectral bands

Computar ViSWIR Series: See Past the Visible

Better analysis & data interpretation

Increase Efficiency & Reduce Costs



Other Recommendations (non-SWIR)

- MPT Series—45MP C-Mount series
- MPY—1.1" 12 MP, lightweight C-Mount, IR corrected series
- MPZ—1" 20MP compact, C-mount MP series

MPT

computar

The beauty of SWIR is that recognition can be achieved covertly in darkness

—Photonics

Conclusions

computar

Continued Research

- As research and development in hyperspectral and multispectral imaging continue, these technologies are likely to become even more effective and widely used in various security applications.
- This will result in improved safety and security for individuals, organizations, and entire countries.

Q & A

computar.com/mvresources

computar

SOURCES

- Business Insider
- Computar.com
- Harvard
- Photonics
- Research Gate
- University of Bradford
- Washington Post
- Wikipedia

computar

THANK YOU!

CONTACT ME

+1 (919)-414-8098

jhackney@cbcamerica.com

computar.com

computar