



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

HYPERSPECTRAL IMAGING



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

CONTENTS

- Hyperspectral Imaging
- How does Hyperspectral Imaging work
- Acquisition Techniques for Hyper spectral Imaging
- Advantages
- Disadvantages
- Applications
- Conclusion



Centurion
UNIVERSITY

*Shaping Lives...
Empowering Communities...*

Hyper spectral imaging (HSI) is a technique that analyzes a wide spectrum of light instead of just assigning primary colors (red, green, blue) to each pixel. The light striking each pixel is broken down into many different spectral bands in order to provide more information on what is **imaged**.



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

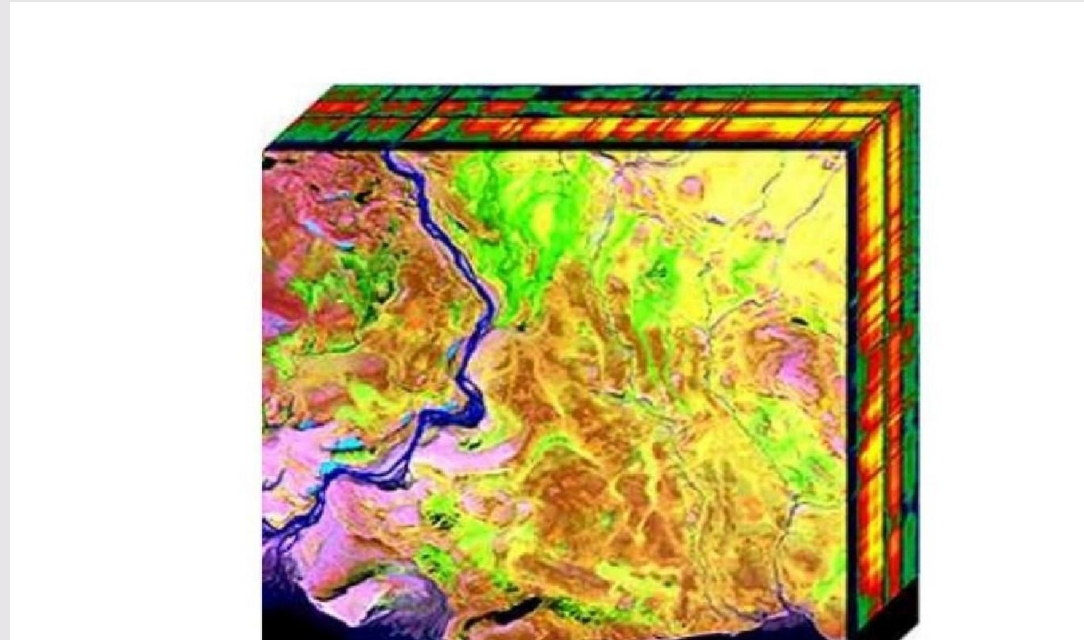
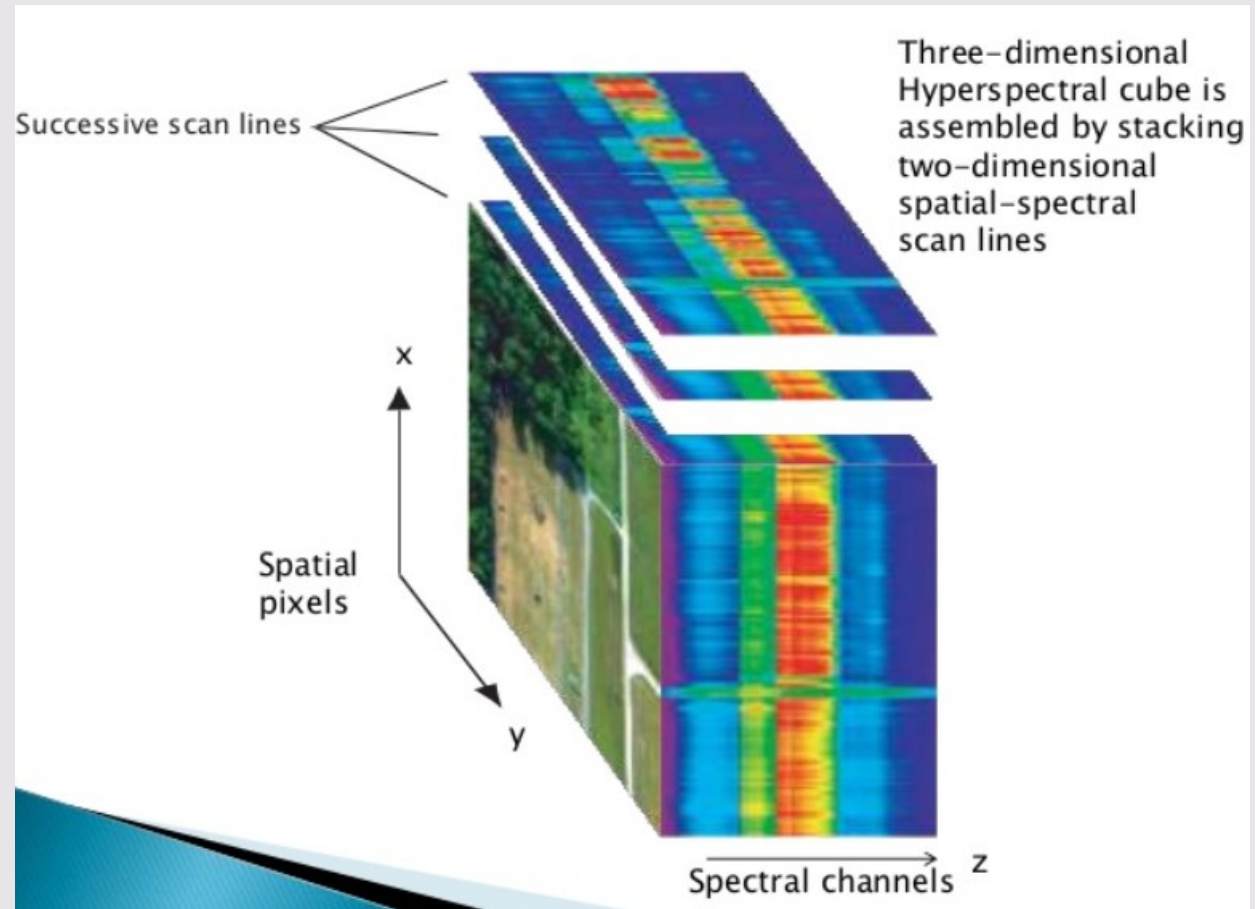


Fig: Two-dimensional projection of a hyperspectral cube



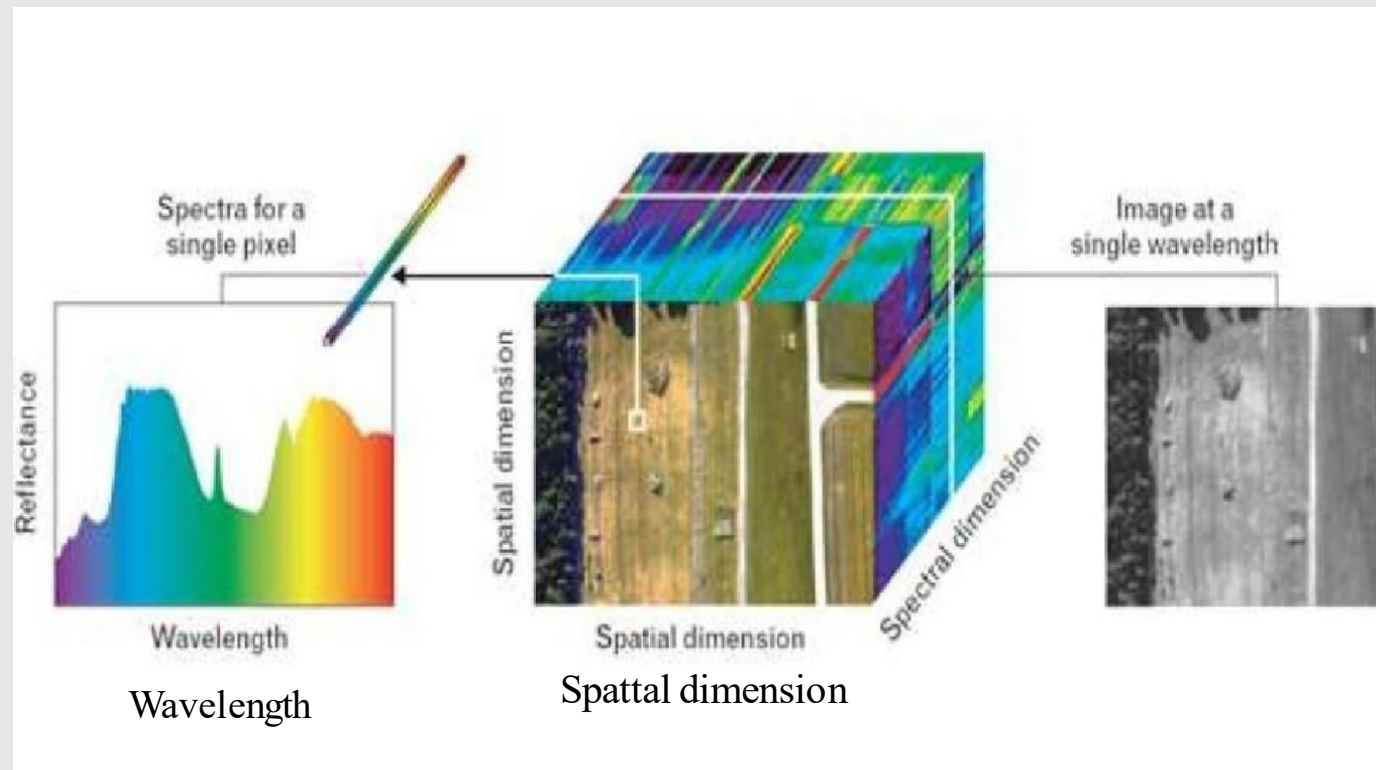
Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*





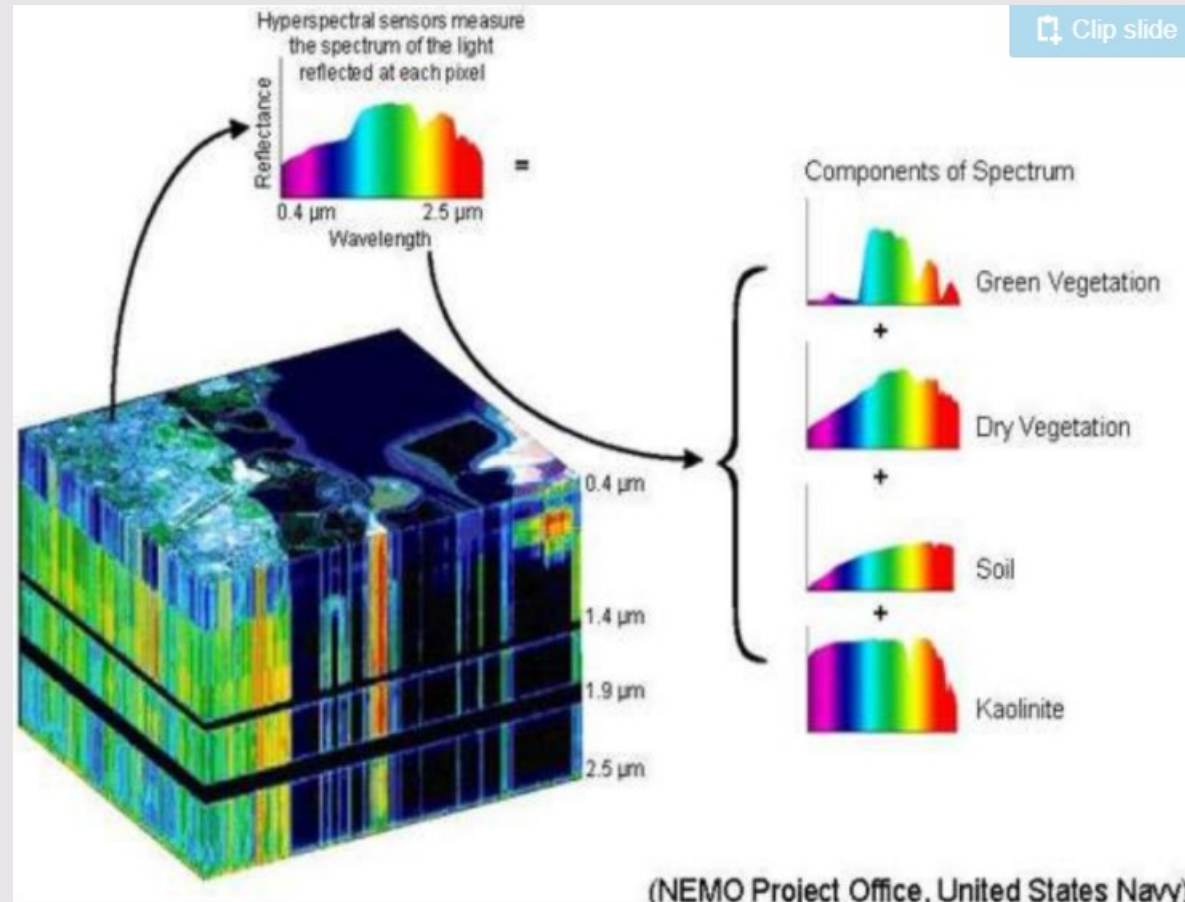
**Centurion
UNIVERSITY**

*Shaping Lives...
Empowering Communities...*





**Centurion
UNIVERSITY**
*Shaping Lives...
Empowering Communities...*





Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

How Does Hyperspectral Imaging work?

- Hyperspectral imaging deals with the imaging of narrow spectral bands over a continuous spectral range, and produces the spectra of all pixels in the scene.
- Hyperspectral sensors collect information as a set of 'images'.
- These 'images' are then combined and formed into a three-dimensional hyperspectral data cube for processing and analysis.



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

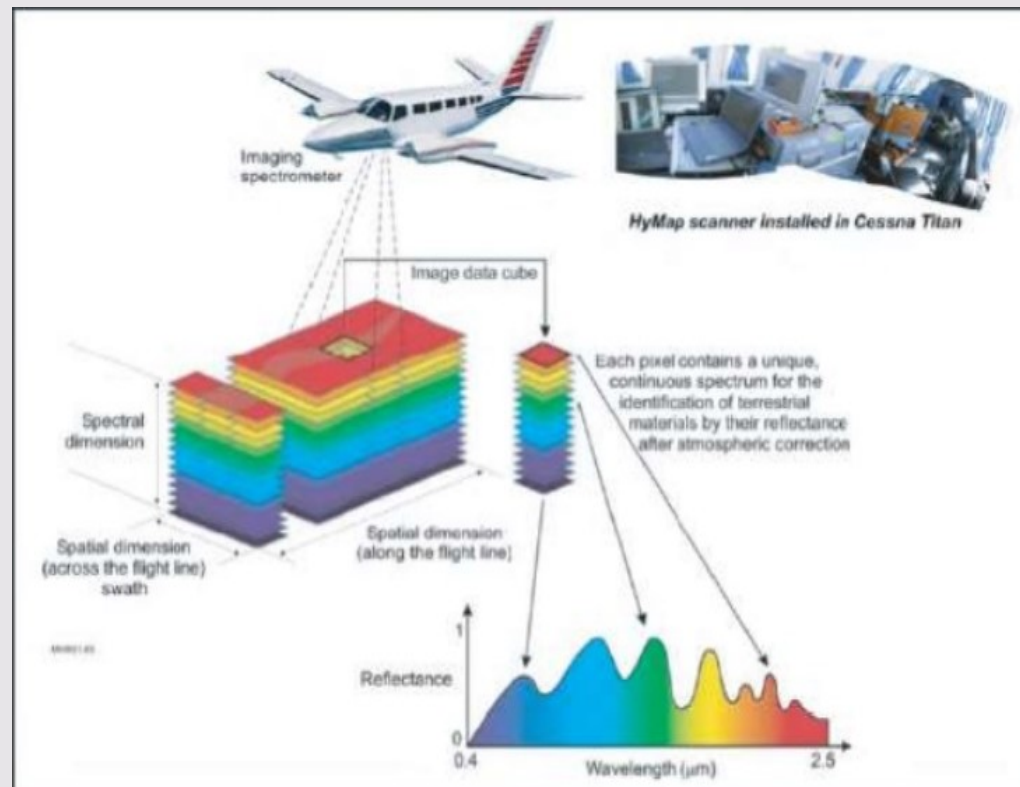
- Hyper spectral imaging does not just measure each pixel in the image, but also measures the reflection, emission and absorption of electromagnetic radiation.
- It provides a unique spectral signature for every pixel, which can be used by processing techniques to identify and discriminate materials.



**Centurion
UNIVERSITY**

*Shaping Lives...
Empowering Communities...*

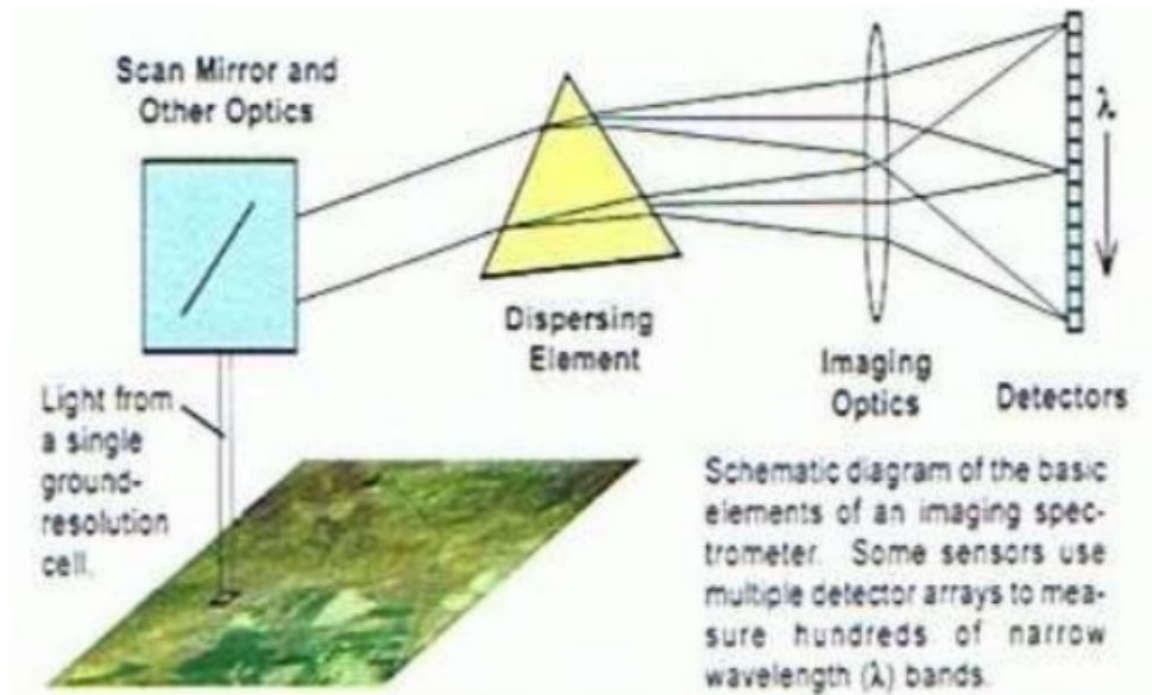
Hyperspectral Data Collection





**Centurion
UNIVERSITY**

*Shaping Lives...
Empowering Communities...*





Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

Acquisition Techniques for Hyperspectral Imaging

- Spatial Scanning-use to read images over time
- Spectral Scanning-it acquire images of an area at different wavelength and snapshot
- Non-Scanning-HSI devices for non-scanning yield the full datacube at once, without any scanning.
- Spatiospectral Scanning-n spatiospectral scanning, each 2-D sensor output represents a wavelength-coded .



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

Advantages

- The primary advantage to hyperspectral imaging is that, because an entire spectrum is acquired at each point, the operator needs no prior knowledge of the sample, and postprocessing allows all available information from the dataset to be mined.
- Hyperspectral imaging can also take the spatial relationships among the different spectra in a neighbourhood, allowing more elaborate segmentation and classification of the image.



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

Disadvantages

- The primary disadvantages are cost and complexity.
- Fast computers, sensitive detectors, and large data storage capacities are needed for analyzing hyperspectral data.
- Also, one of the hurdles researchers have had to face is finding ways to program hyperspectral satellites to sort through data on their own and transmit only the most important images. as both
Transmission and storage of that many data could prove difficult and costly



Centurion
UNIVERSITY
Shaping Lives...
Empowering Communities...

Applications

- Agriculture
- Astronomy
- Chemical Imaging
- Eye care
- Food Processing
- Mineralogy
- Remote Sensing
- Surveillance



Centurion
UNIVERSITY
*Shaping Lives...
Empowering Communities...*

Conclusion

- Active area of Research and Development.
- with hundreds of spectral channels now available, the sampled pixel spectra contain enough detail to allow spectroscopic principles to be applied for image understanding.
- Requires an understanding of the nature and limitations of the data and of various strategies for processing and interpreting it.



Centurion
UNIVERSITY
Shaping Lives...
Empowering Communities...

Thank you