EMVA-YPA

Hyperspectral Recovery from RGB

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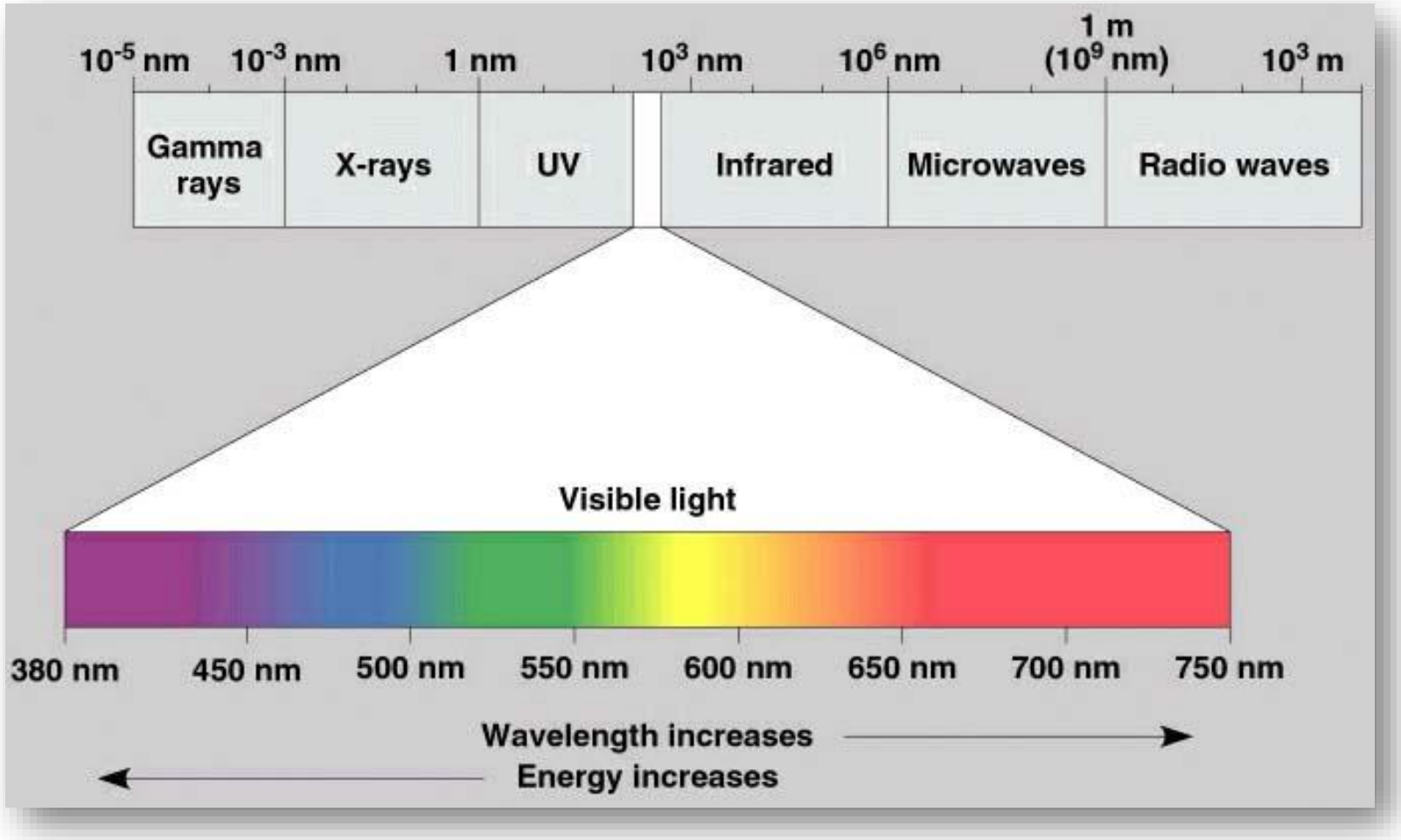
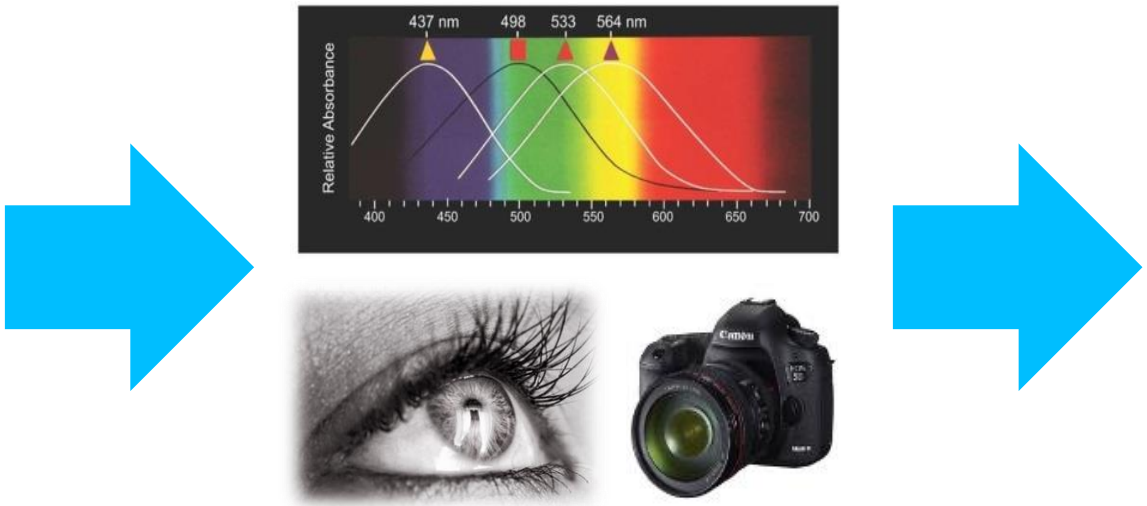
Hyperspectral Imaging



Hyperspectral Imaging

Most vision systems reduce observed spectrum to a **small set of measurements**, such as RGB



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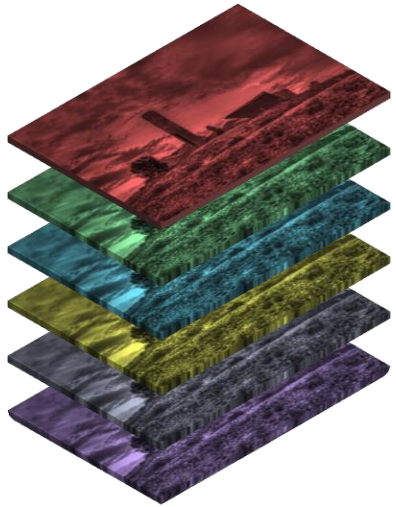
Hyperspectral Imaging

Hyperspectral imaging systems attempt to record the entire observed spectrum by measuring a **large amount of narrow bands**



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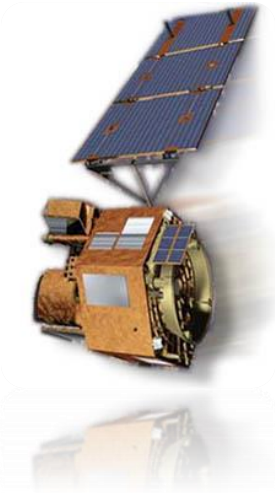
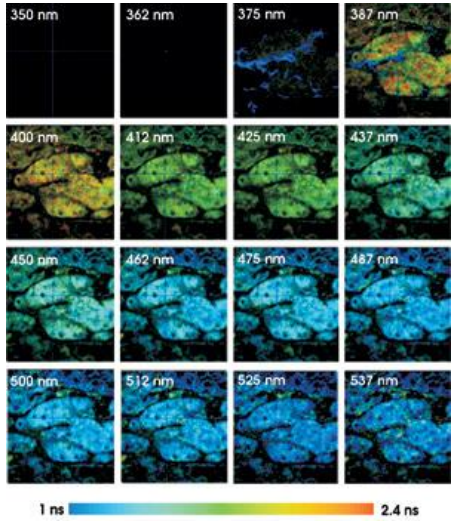
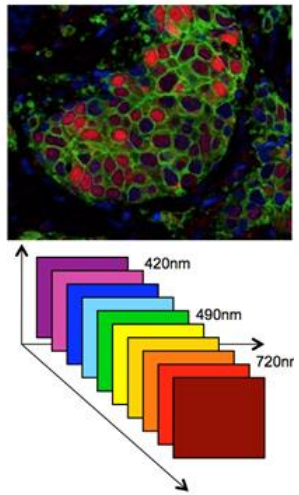
Hyperspectral Imaging

Such systems have been widely used in laboratory or airborne settings.

They require **scanning** to collect data.







AVIRIS 2015

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Hyperspectral Imaging

Tattile
Custom Vision Solutions

imec

ximea

S200 Hyp

MQ022HG-IM Series

Natural Hyperspectral Images?

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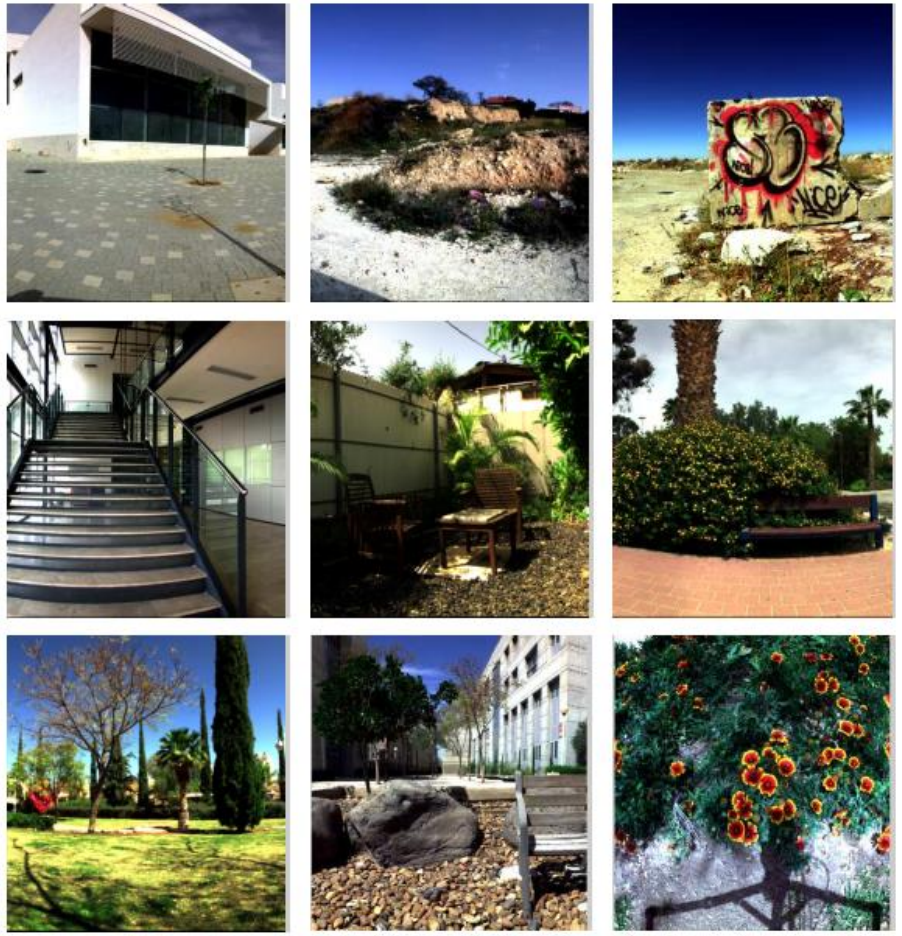
Hyperspectral Database

The BGU Hyperspectral DB

- 200 images (and growing)
- Large variety of environments and scenes
- 519 spectral channels
- 1392x1300 spatial resolution
- $O(10^8)$ unique spectra
- Each HS cube is 1.8GB in size (raw format)

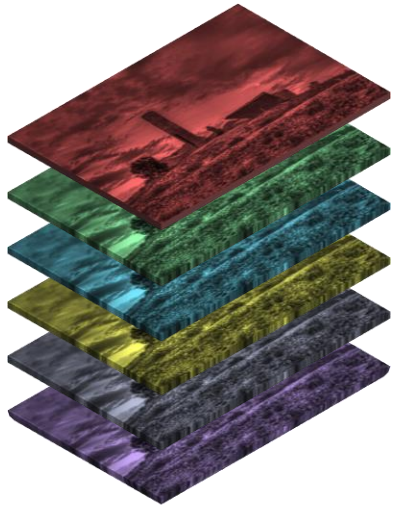
http://icvl.cs.bgu.ac.il/hyperspectral



Natural Hyperspectral Images

Attempting to recover HS from RGB should reveal where **additional information** is available is HS images.

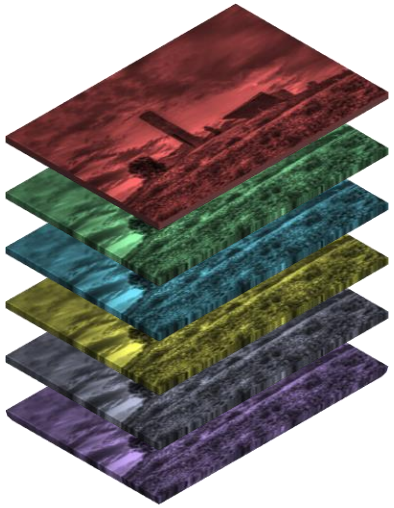
Hyperspectral Input



Reduced to RGB

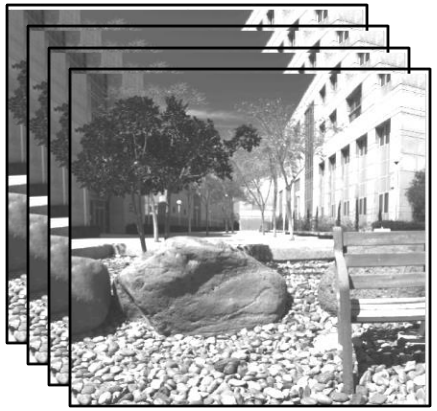
?

Recovered HS

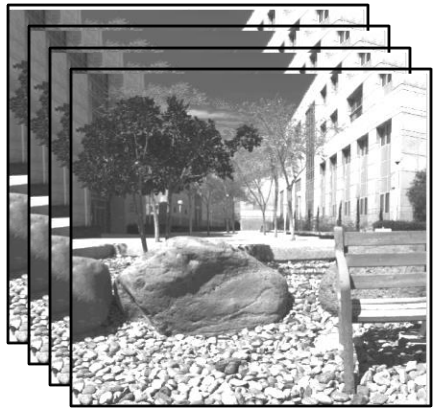


… this didn’t work so well …

Ground Truth



Reconstruction



Error Map

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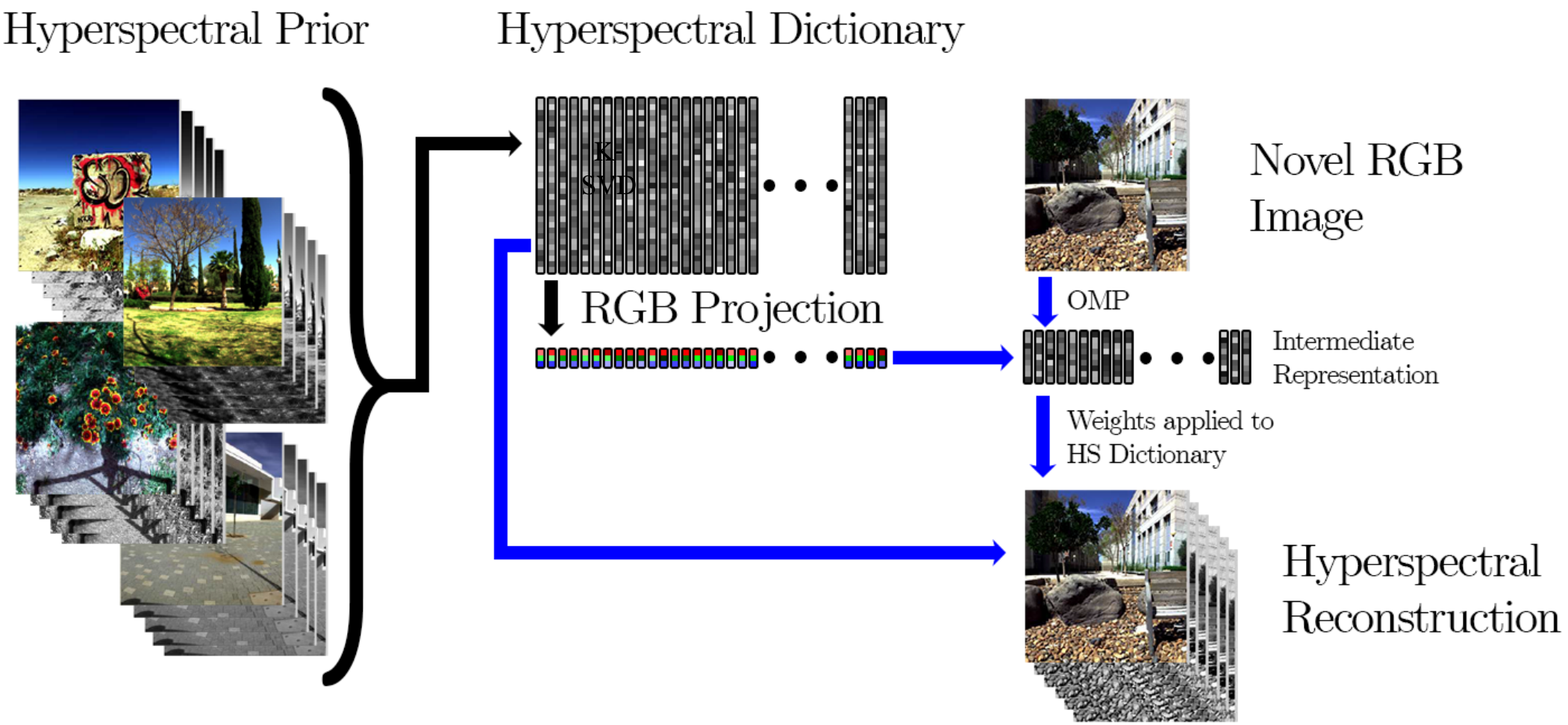
Hyperspectral From RGB



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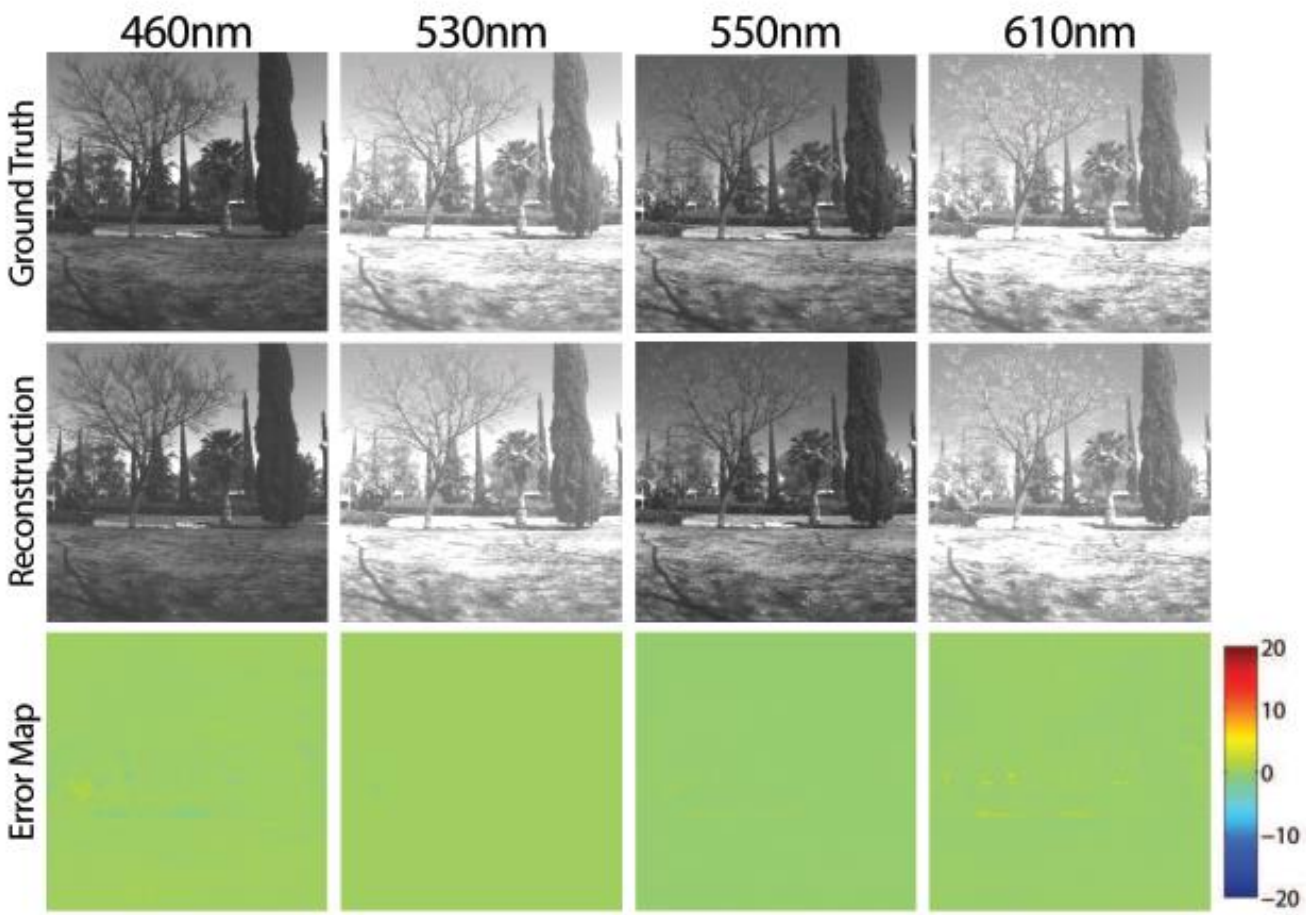
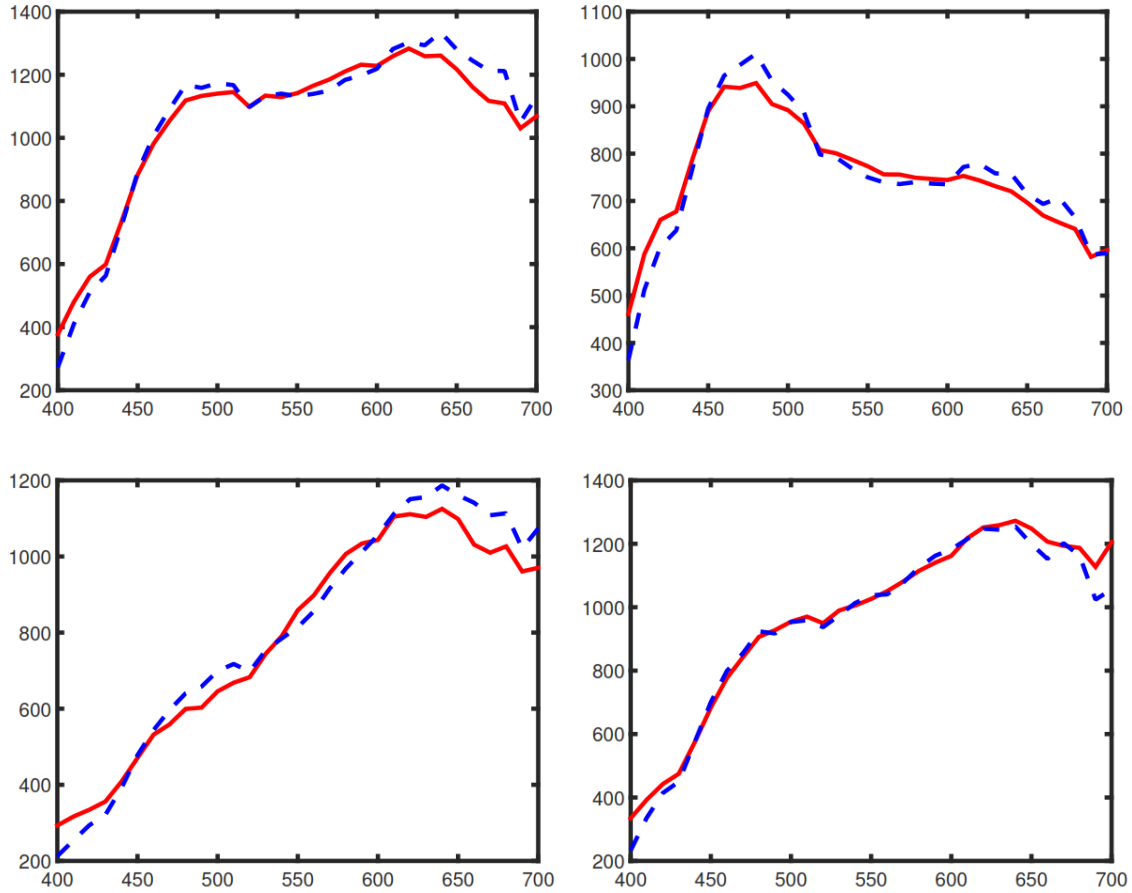
Experimental Results





Ground Truth

Reconstruction

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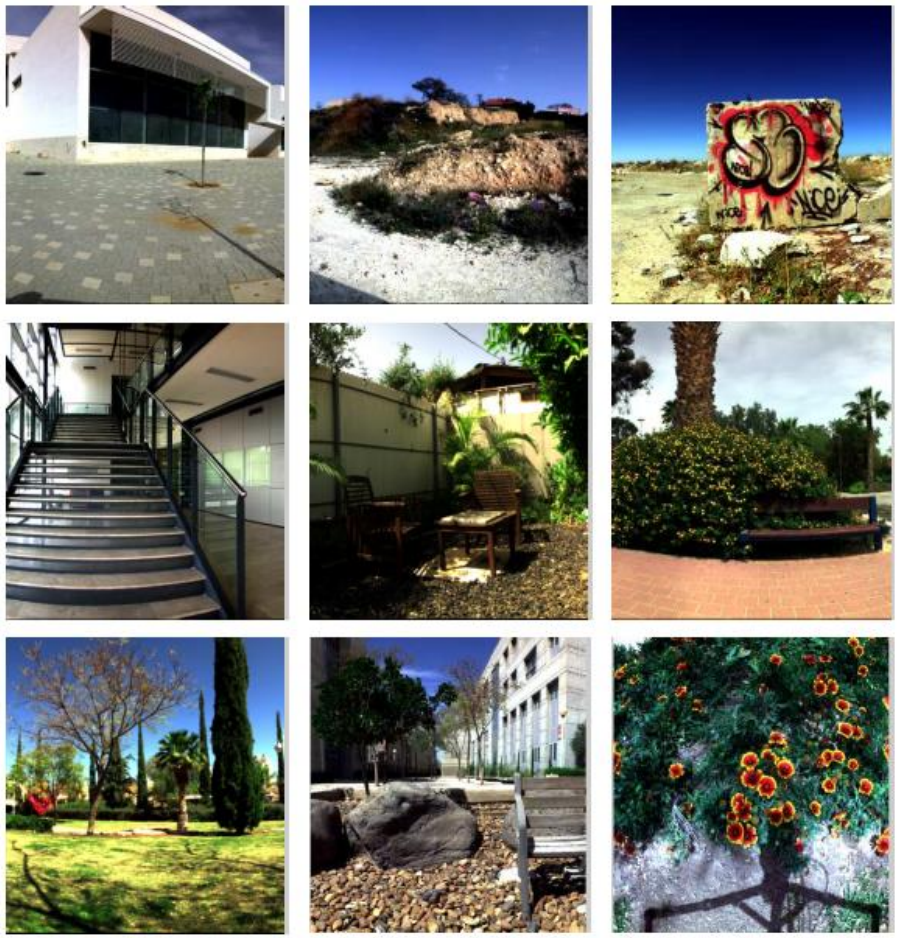
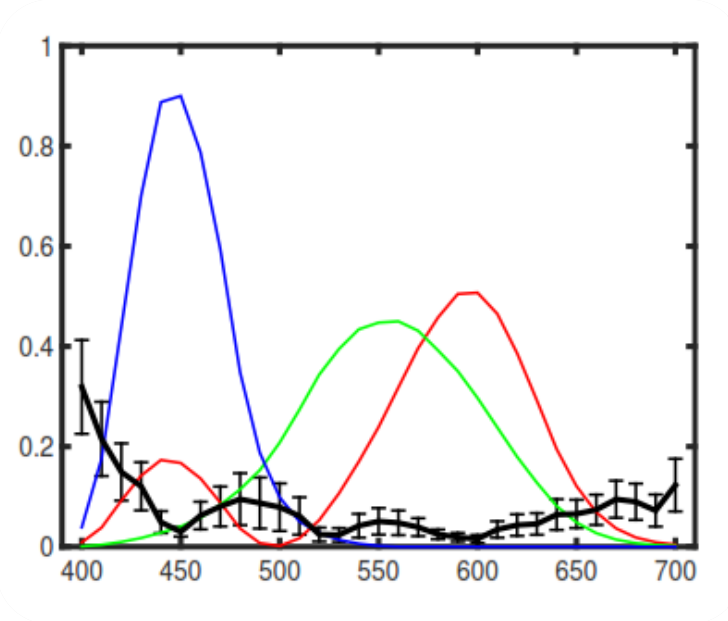
Experimental Results



Data Set	Relative RMSE
Complete Data Set	**0.0756**
Park Subset	0.0589
Indoor Subset	0.0507
Urban Subset	0.0617
Rural Subset	0.0354
Plant-life Subset	0.0469
Cross Domain	
Park Subset from Rural Prior	0.0801
Rural Subset from Park Prior	0.0592



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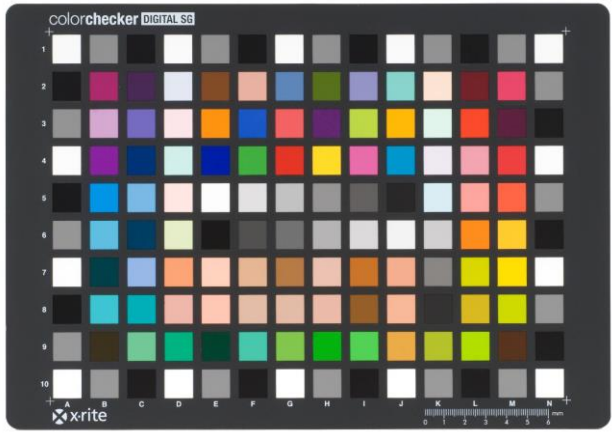
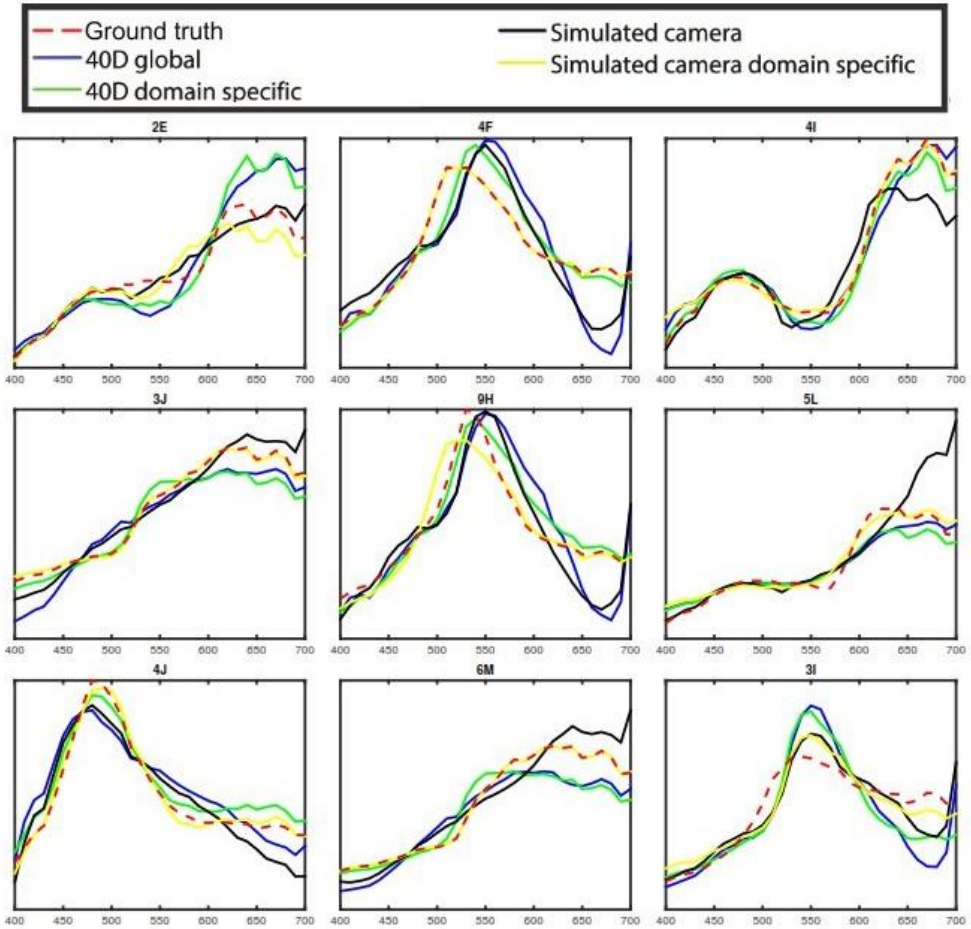
Experimental Results

Physical camera experiment:

Color-Checker reconstruction.





(a) Reconstructed color-checker swatches.

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Applications – industry and consumer market

- High resolution, handheld **snapshot hyperspectral imaging.**
- Low cost, compact sensors – **consumer class HS imager**.

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Applications – illumination improvement

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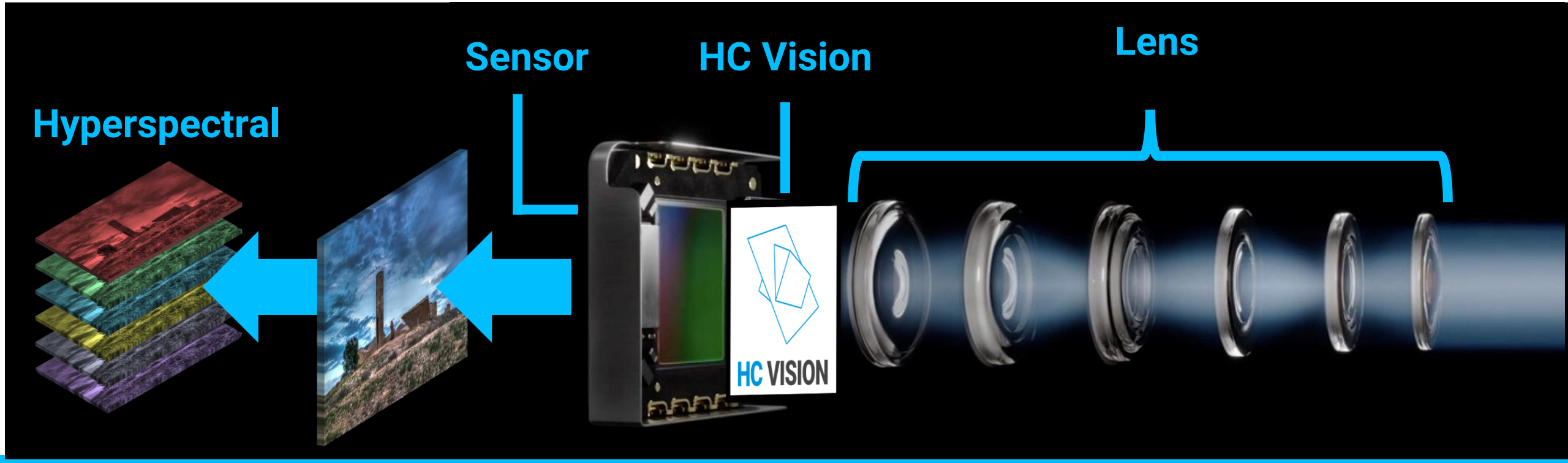
Applications – illumination improvement

Our patented technology **recovers hyperspectral information** from **existing sensors** providing a unique and novel avenue for image enhancement and material sensing.



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Thank you!

Questions?

Snapshot Hyperspectral Imaging with RGB Sensors

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2nd European Machine Vision Forum 2

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