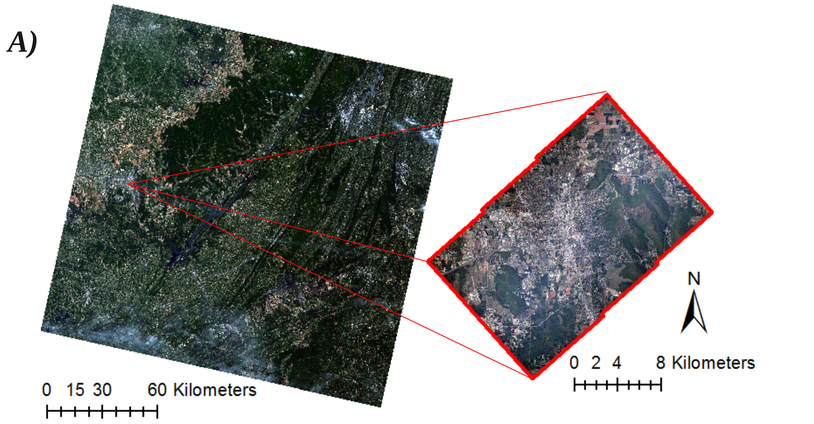
Using ISERV Imagery to Pan Sharpen Landsat 8 Spectral Data: A Vegetation Analysis of Huntsville, Alabama

Jeanné le Roux, Dr. Robert Griffin, Eric Anderson
University of Alabama Huntsville Earth System Science Program

THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Introduction and Background

The ISS SERVIR Environmental Research and Visualization System (ISERV) is a payload on board the International Space Station (ISS). ISERV is a telescopic imager which takes rapid, automated, high-resolution photos of the Earth from space. The purpose of this research was to test the feasibility of pan-sharpening Landsat 8 near-infrared data with ISERV data in order to run a normalized difference vegetation index (NDVI) on the resulting image. This new image was compared to an NDVI of a Landsat 8 image pan-sharpened with its own panchromatic band. Feature extraction was performed to extract vegetation features from both results and compared. The ISERV result was chosen for display.



Above: A) Area of Study over Huntsville, AL. B) Landsat image over Huntsville pan-sharpened with Landsat 8's panchromatic band (15 x 15 m resolution). C) Landsat image pan-sharpened with ISERV (5 x 5 m resolution).

Purpose

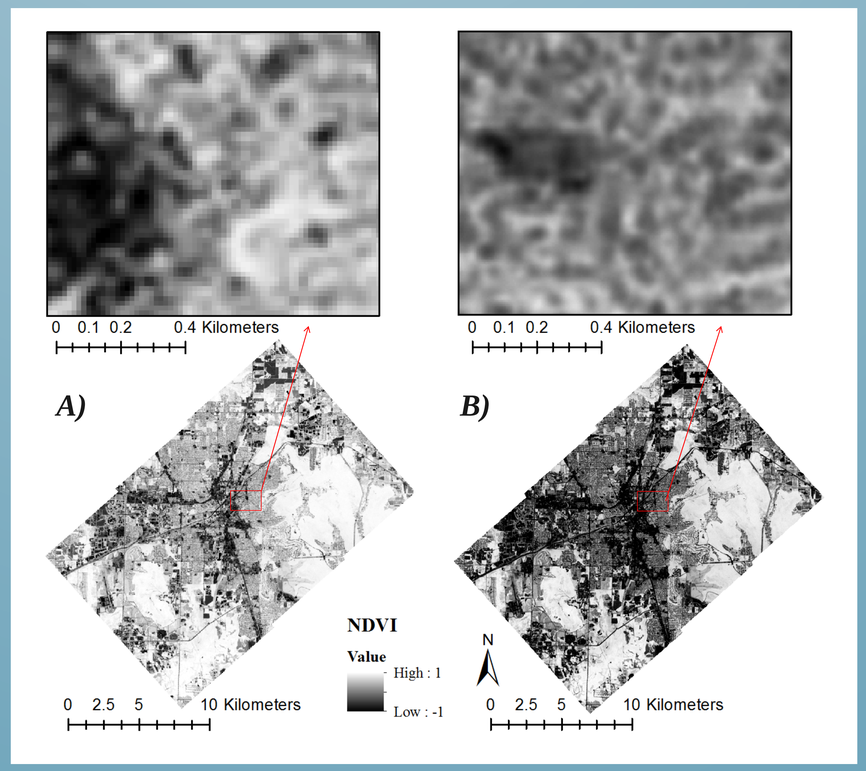
ISERV images only encompass the visible spectrum with red, green, and blue bands, making it impossible to run a NDVI or similar analysis without the introduction of NIR data. Fusing the ISERV imagery with a Landsat 8 image introduced NIR data while enhancing Landsat 8's spatial resolution.

Workflow

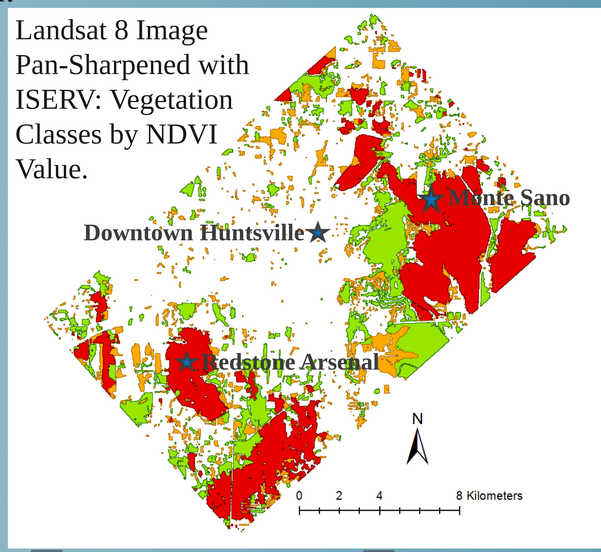
Preprocessing
- Raw ISERV Image>> Flat field correction>> Convert to grayscale>> Resample>> Mosaic.
- Raw Landsat Image>> Radiometric correction>>Atmospheric correction.

Pan-Sharpening
- Pan-sharpen Landsat image with Landsat panchromatic band (15m resolution).
- Pan-sharpen Landsat image with ISERV image (5m resolution).

NDVI & Feature Extraction (FX)
- NDVI calculated for original Landsat image, Landsat image pan-sharpened with pan band 8, and Landsat image pan-sharpened with ISERV.
- FX on each image to distinguish vegetated from non-vegetated surfaces.



Above: A) 1:3,000 zoom above the Landsat 8 scene pan-sharpened with its panchromatic band. B) 1:3,000 zoom above an NDVI of the Landsat 8 scene pan-sharpened with ISERV. NDVI values closer to 1 represent denser, healthier vegetation. Image B was chosen for feature extraction due to greater heterogeneity in vegetation.



Conclusion

It is evident from this research that it is feasible to pan-sharpen Landsat 8 imagery with ISERV images. This opens up the possibility to conduct various image analyses, such as NDVI illustrated here, through utilizing ISERV's high resolution data. Future research can investigate statistical features of pan-sharpening with ISERV as well as additional applications applicable via this technique. Furthermore, this technique can prove useful for end users of ISERV including NASA- SERVIR scientists.

Acknowledgements

I would like to thank Dr. Robert Griffin, Eric Anderson, Dan Irwin, Burgess Howell, Jagan Ranganathan, the NASA-SERVIR program, and Dr. Bernhard Vogler. This research was funded by the RCEU Program with funds provided by: the UAH President/Provosts Office, the UAH Vice President of Research, the UAH Chemistry Department, and the Alabama Space Grant Consortium.