Pansharpened vs Multispectral Bands for Remote Sensing Analysis

Difference between two types of imagery

Bands in Remote sensing

In remote sensing, the visible spectrum is divided into different bands. The information from a narrow wavelength range is gathered and stored in these **bands**. These bands are measured as a range of wavelengths in nanometers (nm) or micrometers (μm). For sensors collecting in the visible and near-infrared parts of the spectrum, these bands are related to the colours red, green, and blue, as well as slightly longer wavelengths in near-infrared. We can combine and display bands of information digitally using the three primary colours (blue, green, and red). The data from each band is represented as one of the primary colours and, depending on the relative brightness (i.e. the digital value) of each pixel in each channel, the primary colours combine in different proportions to represent different colours.

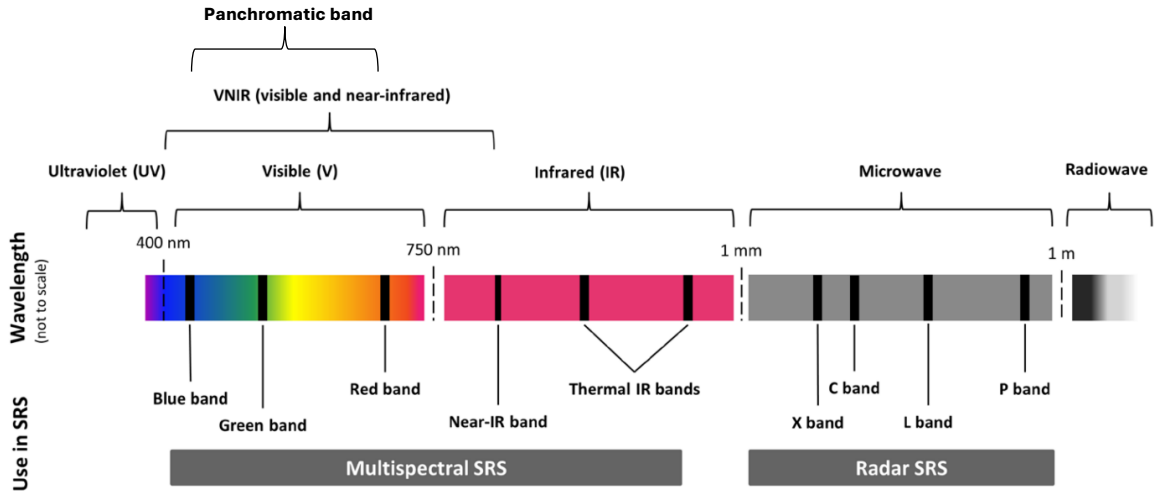
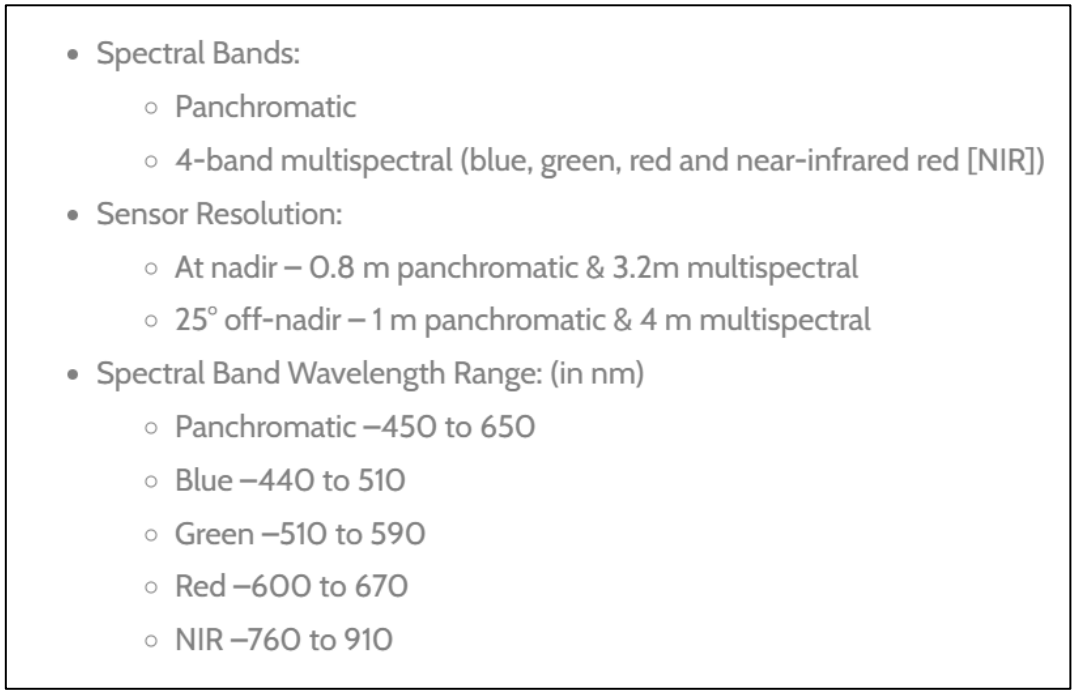


Fig. 1 Electromagnetic spectrum, and its use in satellite remote sensing (SRS) *(Source: Pettorelli et al., 2018)*

Multispectral and Panchromatic Imagery

Panchromatic images are greyscale (black-and-white) and have high spatial resolution but low spectral resolution. Multispectral images have lower spatial resolution but capture data across multiple spectral bands. Fig. 2 shows the sensor resolution and spectral band wavelength of Triplesat satellite. Multispectral imagery typically refers to 3 to 10 bands, while panchromatic imagery consists of a single band covering the entire visible spectrum. Please note that the Panchromatic band of Triplesat covers almost the entire wavelength (450 – 650 nm) of Blue, Green and Red part of the visible spectrum (Figs. 1-2).



- Spectral Bands:
  - Panchromatic
  - 4-band multispectral (blue, green, red and near-infrared red [NIR])
- Sensor Resolution:
  - At nadir – 0.8 m panchromatic & 3.2m multispectral
  - 25° off-nadir – 1 m panchromatic & 4 m multispectral
- Spectral Band Wavelength Range: (in nm)
  - Panchromatic –450 to 650
  - Blue –440 to 510
  - Green –510 to 590
  - Red –600 to 670
  - NIR –760 to 910

Fig 2: Imaging System Specifications of Triplesat Satellite

Pansharpening (short for Panchromatic Sharpening)

Pansharpening is a technique used in remote sensing to enhance the spatial resolution of multispectral images by combining them with high-resolution panchromatic images. It merges these two types of images to create a single image that retains the high spatial resolution of the panchromatic image and the spectral information of the multispectral image (Fig. 3). Pansharpening is widely used in various applications such as environmental monitoring, urban planning, agriculture, and military reconnaissance.

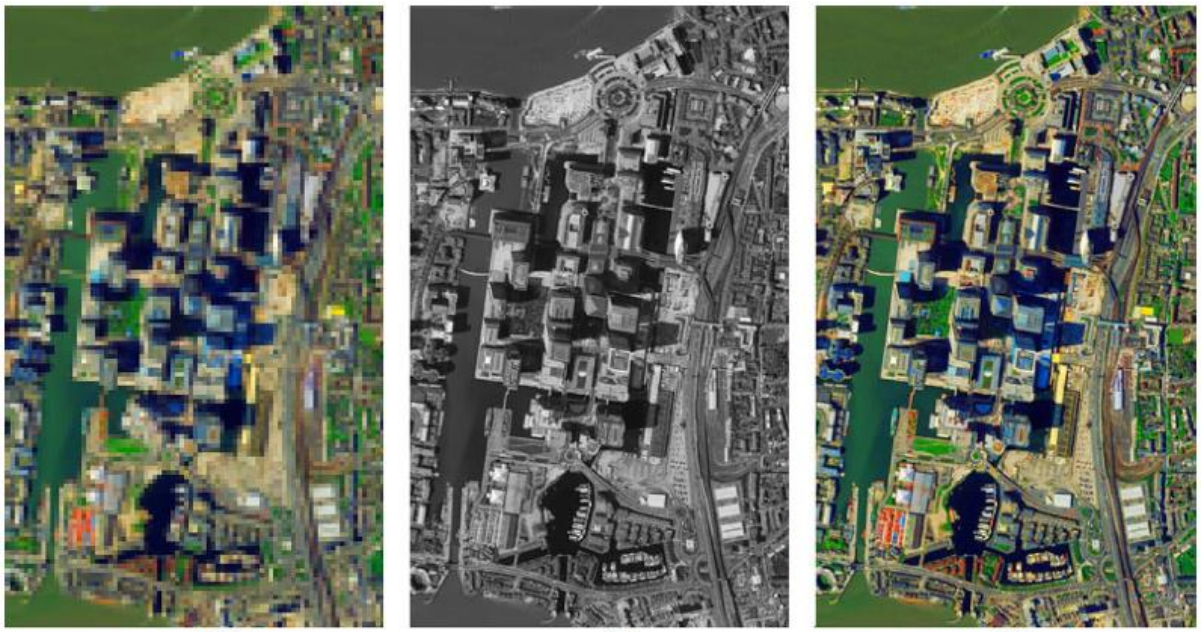


Fig. 3 (a) Multispectral Image with low resolution, (b) corresponding Panchromatic high-resolution imagery, and (c) Pansharpened imagery (Source: Kaur et al., 2021)

Advantages and Disadvantages of Pansharpening

- Advantages:
  - *Increased Visualization and Detail*: Produces images with both high spatial and spectral resolution enhancing the visual clarity of images and thus allowing for more detailed analysis, easy identification
  - *Easier Classification:* The added detail and colour information help in more accurate object identification and classification.
- Disadvantages:
  - *Spectral Integrity:* A disadvantage of pansharpening is that it doesn't maintain the spectral integrity of the data which may not be suitable for certain analyses like NDVI (Normalized Difference Vegetation Index).

Further Information

For more information, please email: spatial.imagery@environment.nsw.gov.au