Class 02 - Reading Images

1Digital Image

A digital image can be defined as a bidimensional function of the intensity of the light reflected or emitted by a scene, in the form I(x,y), where the values of I represent, for each spatial coordinate (x,y) the intensity of the image on that point. This intensity is represented by a ***finite*** *and* ***non-negative integer value****, called the* ***gray level****. For each point imaged by the sensors, there corresponds a minimum area called "pixel" (picture element), that should be geographically identified, and where the digital value related to the intensity of the energy reflected in very well defined bands of the electromagnetic spectrum is recorded.*

2Image characterization

We can represent an image by a data matrix where the lines and columns define the spatial coordinates of each pixel. A finite number of bits is used to represent the radiance of each pixel.

Radiance *is the radiant flux that originates from a source, in a certain direction, per unit of area.*

The quantification of the continuous radiance in a scene is represented by the discrete gray levels in the digital image, these gray levels are expressed as a digital number with a certain number of bits representing each a certain range of radiance values. The present generation sensors usually generate images with 8 or 10 bits (equivalent to 256 and 1024 gray levels, respectively).

Currently there are sensors that collect images with more than 10 Bits if the Ikonos and Quickbird in which images of 11 bit (2048 gray levels).

3Resolution and bands

The SPRING allows the direct input of images from the CBERS, LANDSAT, SPOT, NOAA, and ERS-1 satellites. Each one of these images present distinct characteristics as far as their ***resolution*** *is concerned. Analog images like paper photographs ca also be treated by Spring, they can be imported in the TIFF, GeoTIFF, or RAW format after having been scanned (digitized).*

Resolution *is a measure of the capability of a sensor system of discriminating among responses that are spectrally similar or spatially close. The resolution can be classified in spatial, spectral, and radiometric.*

Spatial resolution*: measures the smallest angular or linear separation between two objects. For example, a resolution of 20 meters means that objects separated by less than 20 meters will in general not be discriminated by the system.*

Spectral resolution*: is a measure of the width of the spectral bands of a sensor system. For example, a sensor that works in the 0.4 to 0.45 μm has a spectral resolution that is less than the one of sensor which operates in the 0.4 to 0.5 μm.*

Radiometric resolution*: is associated to the sensitivity of the sensor system in discriminating between two levels of intensity of the return signal. For example, a resolution of 10 bits (1024 digital levels) is better than one of 8 bits.*

*With the "Open Image" option in "****Spring****" application the user can read the digital images (satellite, scanned photos, etc...) and convert them to the SPG format used by SPRING.*

4Image Reading and Conversion

Running Open Image*:*

Windows: - #Start – Spring <version> <language><system> - Spring<version><language>

Linux: Command to be typed on the Console (Shell): - # s_spring

*MAC: #Dock – Launchpad – Spring <version> < **language** >*

**The following image presentrs the module for reading images in Spring.*

***Note**: The procedures to visualize and convert a TIFF image are presented next.*

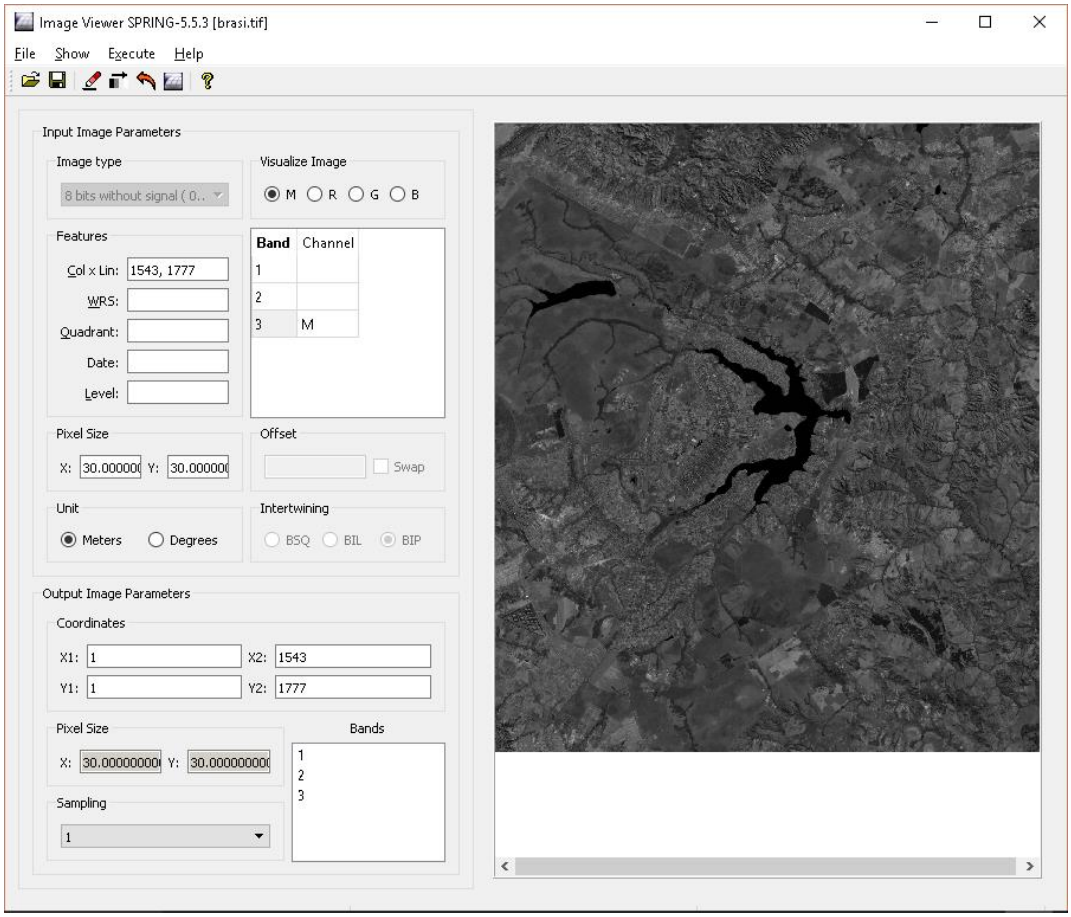
4.1Image conversion (TIFF)

⇒ ***Selecting and visualizing the TIFF image:***
Spring

- *[File] [Open Image...]*
  - *Open or button* 
  - *(Files of type: ⇔ TIFF files (*.tif, *.tiff))*
  - *(Folder | Windows: C:|Tutor_10classes|Images)*
    Linux: ~/Tutor_10_classes/Images
    MAC: ~/Tutor_10_classes/Images
  - *(File | brasi.tif)*
  - *(Open)*

note that the **Input Image Parameters are presented.*

- *{Pixel size: X=30 and Y=30}, (Enter)*
- *(Bands | 3) select a band to be drawn*
- *[Apply][Draw] or button* 



Selecting bands and regions of interest in the image to record

**Select the area with the cursor over the image (like doing a zoom). The area to be worked must cover the region shown in the figure below. If you prefer type in the values of X1, X2, Y1, and Y2 presented in the TIP below.*

- [Apply] [Draw] or button 

**If you want use the button*  *to recompose the whole image and also the contrast button*  *to enhance the selection of the area of interest.*

- (Bands | 1, 2, and 3) in ***Output Image Parameters***

- (Sampling ⇔ 1) - to keep the 30 meters resolution

- [File][Save As...] or button 

Save As

**Select the place where you want to save the SPG file.*

- (Folder | Windows:Tutor_10classes|Images)
Linux: ~/Tutor_10classes/Images
MAC: ~/Tutor_10classes/Images

- {File Name: Brasilia}

**Just replace the * from (*.spg) for the name above.*

- (Save)

Image Viewer

- *[File][Exit]*

***Note**: The image is automatically recorded on disk with the extension *.**spg**. Thus this image file is ready to be georeferenced in SPRING, and be included in a project, for further treatment.*

TIP: To facilitate the choice of the region of the image in order to cover the whole project area, use the following values in the Output File Parameters; X1=300, X2= 1160, Y1=400, and Y2=1280. Click on Draw to select the area before saving the image.