**2.6** **Application and documentation**

**Exercise materials and tasks**

Congrats! You made it through the theory part of Remote Sensing!

Let´s now do a practical exercise on this topic:

From *USGS earth explorer website*, download one tile of Landsat 8 (choose any Image of a period between May and September 2022) covering the Eastern part of Rwanda and perform following tasks of Image processing:

1. Click on the following link <https://gisgeography.com/usgs-earth-explorer-download-free-landsat-imagery/>, it will guide on how to download Landsat 8 images.
2. Layer stack of Multispectral bands.

Layer stacking is a process of combining multiple separate bands in order to produce a new multi band image. This type of multi band images is useful in visualizing and identifying the available Land Use Land Cover classes

For additional steps of layer stacking of Multi-spectral Landsat bands in QGIS, follow instructions in this video: <https://www.youtube.com/watch?v=zq6XbuIkk-s>

1. **Subset the image of Nyagatare District (use district shapefile from the GIS dataset).**

Refer to this link [https://www.youtube.com/watch?v=yKNSlRrX28g](https://www.youtube.com/watch?v=yKNSlRrX28g%20)

Satellite data downloaded usually cover more area than you are interested in and near 1 GB in size, it always better to select a portion of the larger image to work with, A subset is a section of a larger downloaded image

1. Create a Pansharpened Image of Nyagatare district Image

To perform this step, refer to [https://www.youtube.com/watch?v=UpFNgWqAN\_U](https://www.youtube.com/watch?v=UpFNgWqAN_U%20)

1. Perform Image classification (supervised one) to create a Land use /land cover map of Nyagatare district.

Supervised classification is mainly performed through the following 3 steps:

* 1. Selection training areas (according the number of desired or identified classes)
  2. Generate signature file

c. Classify (selection a classification method. the following are the most commonly known method for supervised classification: Maximum likelihood, Iso cluster, Class probabi**lity, Principal components and**  Support vector machine (SVM)

To preform image classification step in this exercise, please follow instruction on this link: <https://www.youtube.com/watch?v=HKNS-wsc7lo>

1. Compute NDVI and NDBI indices variation across Nyagatare district

This exercises consists of band ratio:

The NDVI is a band ratioing involving visible red and near-infrared bands of satellite images and determines the vegetation cover over a particular area

Normalized Difference Built-up Index (NDBI) describes the Built-up density of any Geographic area. NDBI is calculated as a ratio between the short-wave infrared (SWIR) and near-infrared (NIR).

Follow the steps in this video on how to Calculate NDVI from Sentinel 2 in QGIS: <https://www.youtube.com/watch?v=EaC5sQpExjg>

Tutorial is for Sentinel 2 band so instead of band 8 use band 5 of Landsat 8.

Repeat the steps using the raster calculator to Calculate NDBI from Landsat 8 in QGIS: <https://www.youtube.com/watch?v=cx8w5QsnvRY>

**Quiz questions**

Instructions: Answer the following questions about the exercise you just performed:

1. When you downloaded Landsat8 file from USGS, in which format was the data saved?

1. **.tiff**
2. .shp
3. .png

2. When we layer stack in QGIS, which operation do we use?

1. Clipper
2. Rasterize
3. **Merge**

3. When calculating NDVI indices of Nyagatare district, values range from?

1. 0 to 1
2. **-1 to 1**
3. -1 to 0

**Additional Resources and Links**

* *Electromagnetic spectrum and remote sensing: https://youtu.be/US8RHxQ\_-qQ*
* *Spatial resolution: https://www.youtube.com/watch?v=HyWcbUbEqaE*
* *More on basic of remote sensing: Rees, W.G. (2010). Physical Principles of Remote Sensing. Cambridge, USA: Cambridge University Press.*

In Rwanda, ArcGIS and Erdas Imagine software are the most used. These softwares are commercial, but most public, educational or non-profit organisations provide licences as the government has signed a memorandum of understanding with ESRI Rwanda to provide licences.