Introduction

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1 RS Learning Diary

This is a Quarto book to document my learning journey in **Remote Sensing Cities and Environments** course during my time at CASA UCL 24/25, offering insights learned, its applications, and my own reflections. The module is based on Dr Andrew Maclachlan github page [here].

*For those of you who also want to learn Geographic Information Scicene beyond 'typical GIS' Software, as in use R-Studio, you could also visit his other github page [here].

1.1 Introduction

Hi, I'm Nooriza, a student currently pursuing a Master's degree in Urban Spatial Science at UCL. I have an academic background in Geography with a specialization in Regional Development Studies and have several substantial work experience in government consultancies in Indonesia.

1.2 Why do I choose this module?

The reason I take Remote Sensing course is my desire to know *how it feels to be a bird, seeing things from above, and to see the unseen.* Don't we agree that remote sensing offers perspectives far beyond what our human eyes can naturally perceive?

source : Biomimicry and Birds

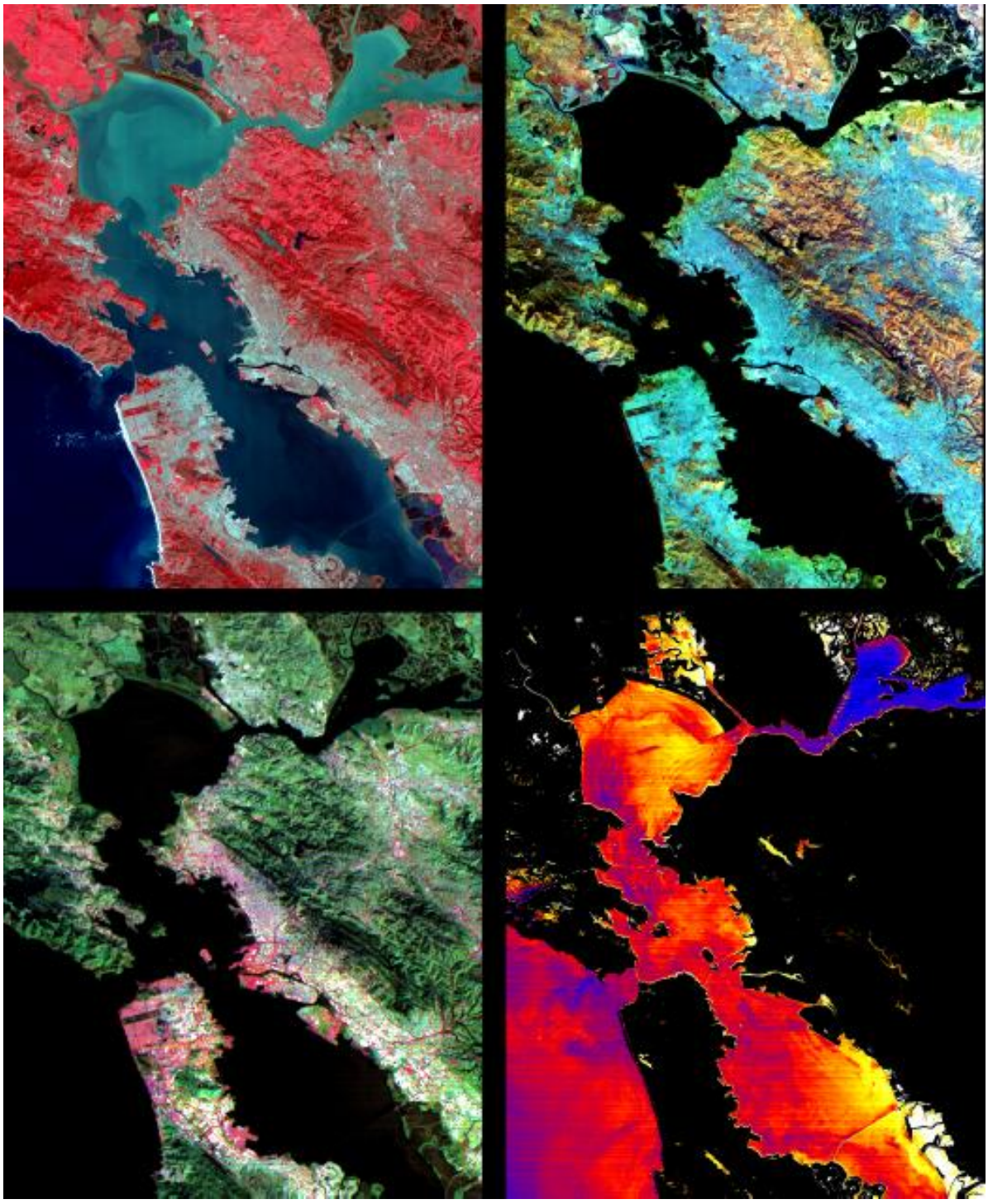
source : NASA/JPL

For example the ASTER images of San Fransisco Bay above, it highlights different object such as vegetation (upper left); soil & rocks in mountainous area (upper right); urban materials (lower left) ; and water temperature (lower right).

Meanwhile, practically, learning this course will, hopefully, help me address the challenges I faced during my previous work in Indonesia. For example, while working on a project focused on healthcare accessibility across hundreds of small islands, we struggled to obtain

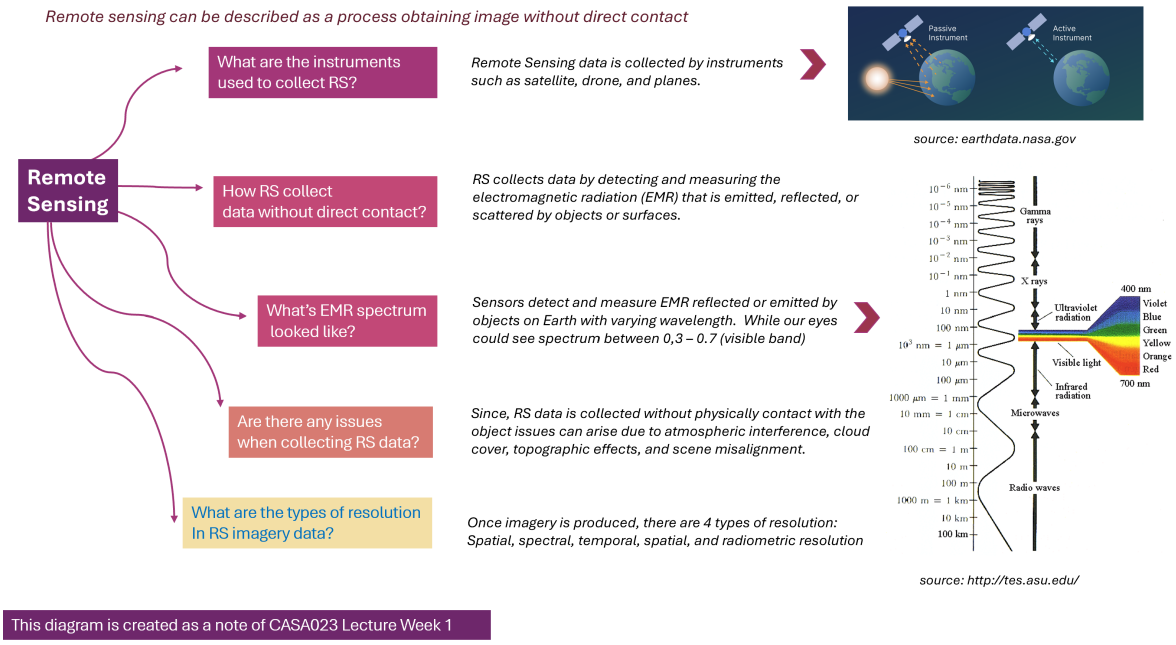
real-time data to identify which islands were inhabited and which were not. Additionally, we faced challenges in determining which islands had ports suitable for docking ships. I believe that applying remote sensing data is both cost- and time-efficient in helping the government maintain more precise and up-to-date data, which is particularly important in world's largest archipelago country like Indonesia.

Feel free to explore my site to learn more about my learning experience. Hope it helps!



2 Getting to Know Remote Sensing

2.1 Summary



Meanwhile, this week practical is introducing 2 sources of imagery :

1. a. Landsat-8

   The Landsat 8 satellite has a 16-day revisit cycle, meaning it can capture imagery of the same location every 16 day. This period would be advantageous to monitor changes at moderate pace, as its revisit time is every 16 days.

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- b. Sentinel 2A

  Sentinel 2 revisits the earth every 5 days (using both satellite A and B), meaning that it provides frequent observations and make it suitable to monitor rapid changes.

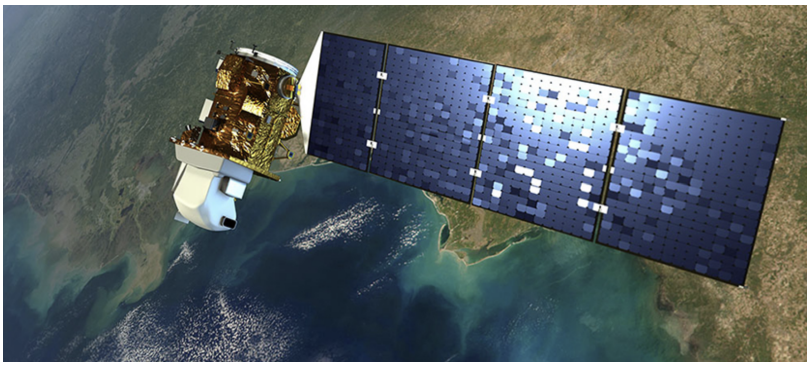

Figure 2.1: Copyright © NASA

Figure 2.2: Copyright © ESA and AIRBUS Defence & Space.

- Each has their own characteristics, while Sentinel-2A has 10m spatial resolution Landsat-8 has 30m resolution. If we want to compare its spectral resolution we have to either upgrade or downgrade, usually downgrading the higher spatial resolution of Sentinel-2 (10m) to match Landsat's (30m) is the preferred approach.

2.2 Application

In what ways can we use Sentinel and Landsat data?

- Sentinel-2 (operated by ESA) has *13 spectral bands* across a wide range of wavelengths, which are especially useful for vegetation monitoring, land cover classification, and agricultural applications.
- Landsat 8 (operated by NASA and USGS) has *11 spectral bands*, which cover a similar range of wavelengths to Sentinel-2 but with fewer bands. Landsat 8 provides excellent coverage for land monitoring and vegetation studies as well.

They both could be used to vegetation monitoring, well……..are they really that difference?

- Sentinel-2 has more bands overall, with additional Red Edge bands, a higher spatial resolution (10m for key bands), and a Water Vapor band. This makes it more suited for ***detailed vegetation analysis***, agricultural monitoring, and atmospheric studies. In the paper…..
- Landsat 8, while having fewer bands, provides excellent coverage with a broader range of SWIR bands, and the addition of two thermal infrared bands makes it strong for land surface temperature and other ***thermal analyses***.

Real world application of Sentinel and Landsat 8

- **Landsat-8 application on detecting of vegetation evolution across China**

  This paper explores 30 years of landsat archive data (spaning of landsat 5 to 8) on 2.125 city to monitor the vegetation evolution. Han et al. (2025) use reflective bands such as Blue, green, red, NIR and SWIR (1 and 2) and highlighting vegetation characteristics using NDVI, EVI, and OSAVI. The NDVI and RGB bands were further processed to derive texture variables, including variance, contrast, entropy, angular second moment, and correlation. These texture metrics capture spatial patterns and fine-scale structural details of urban vegetation that may not be visible through spectral bands alone. I genuinely believe this finding has the potential to serve as a framework for evaluating the implementation of the government's long-term plan or the integration of policies across different administrations, which is often difficult to assess due to the extended time frame and transitions between ruling administrations.

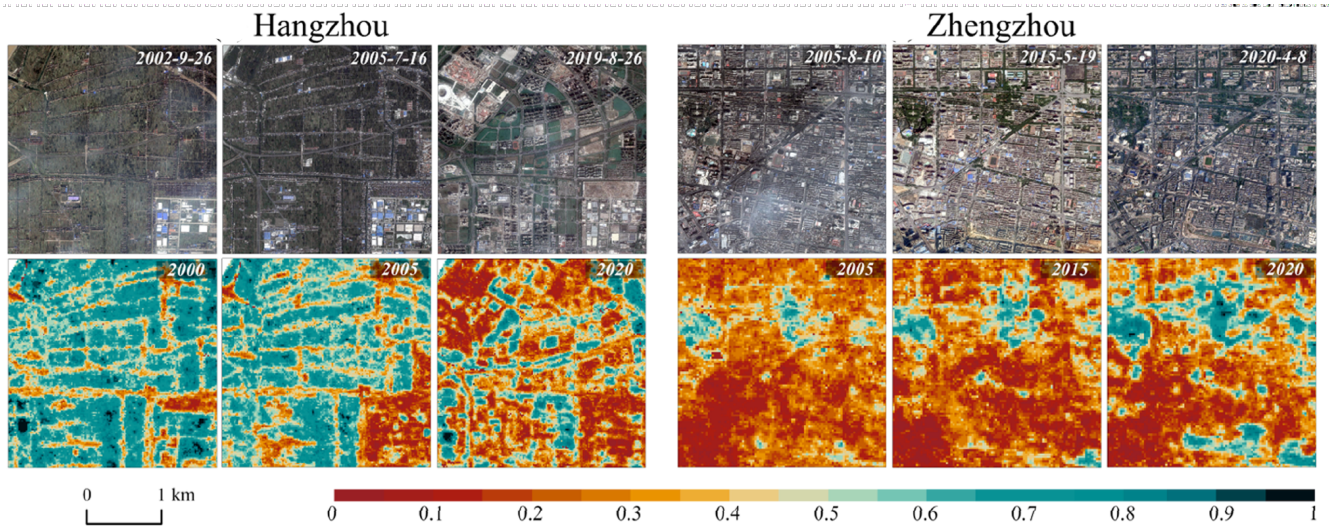

Figure 1: A sample result shows urban vegetation degradation in Hangzhou and an increase in vegetation in Zhengzhou. source : (Han et al. 2025).

- **Sentinel-2 application on plastic debris detecting on coastal area, Brazil**

  In this study, Nivedita et al. (2024) use 4 sensors of Sentinel Data to detect floating debris. After floating debris is detected they analyze spectral signature to differentiate trash by measuring the mean values of spectral signature of plastic and other materials (such as foam or seaweeds. This research, as part of monitoring marine pollution, could identify critical areas for conservation supports.

  Figure 2: Plastic Debris Detection. Source : (Nivedita et al. 2024)

2.3 Reflection

After exploring the application of the two selected satellites, I have concluded that remote sensing data is particularly effective for analyzing large-scale and long-term variations. It can also help mitigate the high costs of manual data collection across vast regions.

This insight made me reflect on a similar challenge in my country, Indonesia, the world's largest archipelago. The country needs to identify which small islands are inhabited in order to provide essential services to all of them. To address this, I'm considering using night imagery data as a tool to distinguish inhabited islands from uninhabited ones. The night time would indicate anthropogenic activities that are associated with light at night

2.4 References

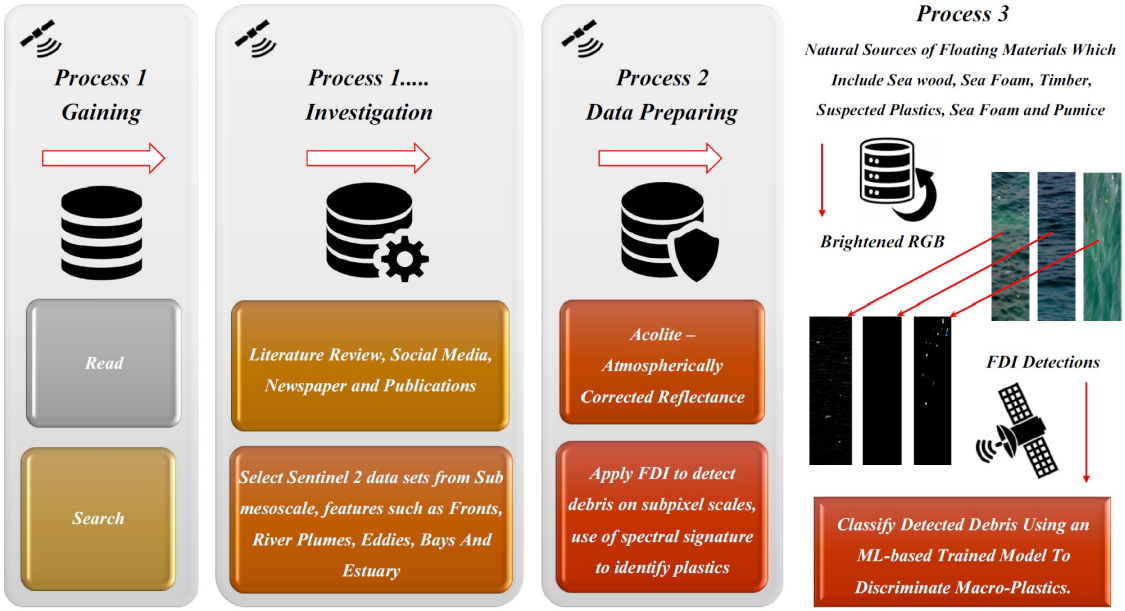

Figure 2.3: source :

3 Xaringan and Quarto Book

Lecture this week reminded me of one of powerful figure in Uchiha Clan, the one who can manipulate reality once he activates this-so-called Xaringan. Well, but this Xaringan is not related to figures in Konoha's world but related to a certain library in R Studio that enable us to create neat HTML slides in R.

3.1 Summary

```
xaringanExtra::embed_xaringan(url = "https://nooriza16.github.io/Xaringan/Xaringan.html",
```

3.2 Reflections

For someone who is not familiar with html, learning Xaringan is definitely challenging compared to powerpoint, as we just usually click tabs on power point. Honestly, I still consider power point provides more themes and more visualization effects that is easily to access compared to Xaringan. However, as I delved further I realize that using Xaringan is providing us with flexibility even such as positioned our picture.

So far, I feel like Xaringan is best at incorporating snippet code on presentation or interactive features that usually too heavy to load in power point. Besides, it helps me to give a sense of what html look like.

4 Image Correction

4.1 Summary

4.2 Application

4.3 Reflections

I think performing Remote Sensing correction on R Studio is quite challenging, as I become more used to using 'button' in Remote Sensing application such as ENVI or SNAP. Besides, after this week's lecture, I genuinely think that Remote Sensing is quite complex as it is not only an image but behind the imagery each pixel is composed by digital number collection and it could be linked with regression too !

5 Policy

We know how remote sensing could benefit us in terms of scaling-analysis, temporal analysis, and its rich information derived within a single imagery. However, today's class is exploring the gap between the potential of remote sensing to its utilization in policy formation.

Project Case : A New Relocated Capital City of Indonesia : Nusantara

5.1 Summary

Recently Indonesia moved its capital city from Jakarta (in Java islands) into Penajam Paser City (Borneo Islands), as

source: (Capital Authority 2024)

Governments project to underlined:

Baseline Documents:

SDGs target:

5.2 Application

5.3 Reflections

During this week, I got a lot of reflections on my mind because finally I found lecture that explicitly bridging the gap of 'academics' to real-world policy. One the most important key-takeaway from the lecture is that "some academics papers are too technical, without clearly addressed policy; some policy don't include academic findings they could benefit for".

My reflections would be:

1. I resonate a lot with the lecture's key takeaway as I genuinely think academics and urban governance still have a distance between them. In terms of human resources, that make the adoption of academics finding hard to implement in governments. Besides, government project is based on annual budget which is make it a fast-paced environment that need an immediate output which make them reluctant to go through experimental phase often found in academics processes.

2. I used to naively think that all published papers *in a renowned journals site* near perfect that It would be hard to find its weakness points. Surprisingly after this week's lecture I found a lot of journals's weakness point "If I could called it that way" pertaining to application of x y z methods applied to support urban planning does not explicitly link to specific policy. In my opinion, this is one of the reasons why academics and policy-making feel disconnected and fail to effectively influence each other

3. What have I learnt about policy, city, and the RS data? In my opinion, using Remote Sensing Data on policy-making in city will generate more-informed policy that contained points it often misses such as where is exactly the place "The location" of the targeted policy. Everything happened somewhere. Additionally, it can serve as an alternative when dealing with the unavailability of baseline data.

Capital Authority, Nusantara. 2024. "Nusantara Sustainable Development GOals (SDGs) Voluntary Local Review Baseline."

Han, Yuan, Jianhua He, Xiaoping Du, Xiao Han, and Yaolin Liu. 2025. "Reconstructing Urban Vegetation Evolution in China Using Multimodal Deep Learning and 30-Years Landsat Archive." *Urban Forestry & Urban Greening* 103 (January): 128582. https://doi.org/10.1016/j.ufug.2024.128582.

Nivedita, V., S. Sabarunisha Begum, Ghadah Aldehim, Abdullah M. Alashjaee, Munya A. Arasi, Mohamed Yacin Sikkandar, T. Jayasankar, and S. Vivek. 2024. "Plastic Debris Detection Along Coastal Waters Using Sentinel-2 Satellite Data and Machine Learning Techniques." *Marine Pollution Bulletin* 209 (December): 117106. https://doi.org/10.1016/j.marpolbul.2024.117106.