learning diary

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Preface

This is a Quarto book.

To learn more about Quarto books visit https://quarto.org/docs/books.

1 Introduction

This is a book created from markdown and executable code.

See Knuth (1984) for additional discussion of literate programming.

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1 + 1
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[1] 2
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2 self_introduction

3 Introduction of myself

3.1 My academic background

The Bartlett School of Planning, University College London (UCL) Sep 2020-Jun 2023 Programme of Study: BSc Urban Planning, Design and Management

CASA (UCL) Sep 2023-Now Programme of Study: Urban Spatial Science

3.2 My previous research projects

3.2.1 Sep 2022-present

Whether Green Space Intervention Triggers Housing Premium and Gentrification: evidence from Olympic Park, London

This project aims to fill current knowledge gap by assessing the multiple gentrification indicators and providing the causal inference of green space and gentrification. Conduct data processing and analysis with STATA and Difference in Differences (DID) Models based on the census data in 2011 and 2021

3.2.2 Nov 2021-Dec 2021

Examining the Association Between Housing Price and Birth Rate: evidence from London

Investigated the association between housing price and fertility rate in London based on the 2011 census dataset through data crawling, calculation and visualisation, linear regression model and QGIS analysis, offered feasible advice on promoting fertility rate to the government according to the research result.

3.2.3 Apr 2022

Analysis of Acclimatization and Mitigation Concerning Urban Climate—A Case Study of London

This project focused on mitigation and adaptation of greenhouse gases emission from transport and food security, examined how these problems are being tackled from city competence, instrument, and socio-technical solution aspects respectively, identified the effectiveness and limitations of these approaches, and introduced successful cases of other countries to propose an improvement plan for the climate governance of London.

3.2.4 Nov 2021-Dec 2021

Influence of Growing Gentrification on Historic Small Commodity Street—A Case Study of Chapel Market in Islington

Searched online materials and carried out field investigations and interviews with street pedlars, studied the negative impacts caused by gentrification (the surge in housing price and emergence of chain supermarkets and shopping malls) and the continuity of residents' habit of shopping online which was formed during COVID-19 pandemic, offered feasible advice to revive Chapel Market with redevelopment plans

3.2.5 Jan 2022-Mar 2022

Better and Healthier Manchester—Analysis and Strategic Planning of Manchester

Dissected existing urban problems of Manchester, provided well-planned strategies from 5 aspects including housing, greenery, economic, transportation and public health, hoping to achieve four objectives, including improvements in access to services, promotion of healthier lifestyles, reductions in economic inequality and betterment of housing provision to help Manchester to be a more sustainable, livable, and equitable city by 2040

3.3 My interested fields

environment science, climate change and sustainability

3.4 What I hope to get from the module

Monitoring environmental changes, e.g.land use, deforestation, desertification and so on which are important indicators of environmental health and climate change.

Assessing natural resources and identify patterns of resource use and detect unsustainable practices.

Climate modeling and analysis as well as predict future climate change.

Disaster management and response, in the event of natural disasters such as floods, assess the damage and plan effective responses.

Urban planning and sustainability, for instance monitor urban expanding, and assessing the environmental impact of urbanization.

Agriculture and soil monitoring, monitor health of crop and soil, ensuring food security and sustainable agriculture.

4 Week_1

The definition of remote sensing

4.1 Summary

Remotely sensed images and the corresponding analytical techniques offer a comprehensive approach to observing and monitoring urban environments in real-time through high spatial-temporal-spectral-resolution data

4.1.1 Passive sensor and active sensors

There are passive sensor and active sensors, which the difference is the passive sensor reflect energy from the sun, but active sensors actively emits electormagentic waves and then waits to receive them. Example of passive sensors: camera, infrared,thermometers, human eyes; example of active sensors: radar, sonar, x-ray

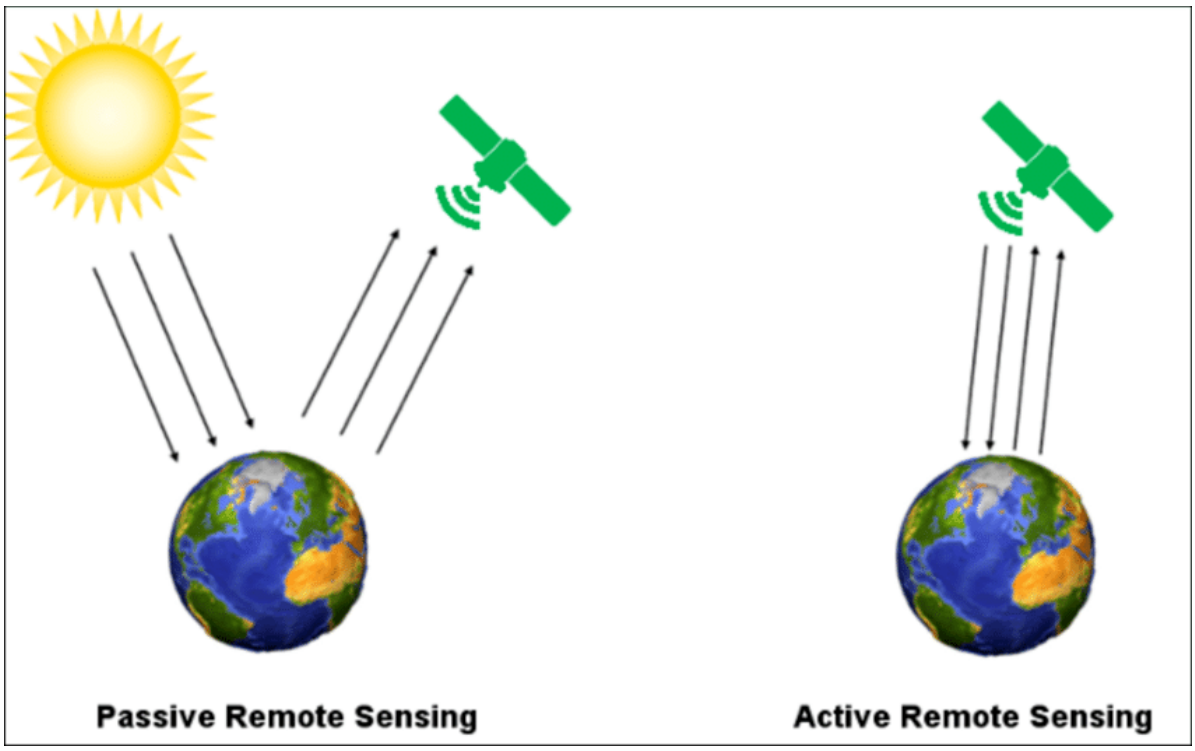

Figure from (ResearchGate 2016)

4.1.2 Formula

Λ(wavelength) = c (velocity of light) / v (frequency)

4.1.3 Scatter in action

Why the sky is blue: blue lights have smaller wavelengths which can scatter easier.

Why the sky is orange and red at sunset: when the sun's angle changes, the blue light scatter doesn't reach our eyes as the distance is increased, so longer wavelengths like reds and oranges can be seen as they are the longest wavelengths. We can see the color since there is atmosphere so molecules scatter the light. The other colors are scattered so we can only see orange or red color.

4.1.4 Interacting with earth's surface

BRDF quantifies how a surface reflects light, varying with illumination and viewing angles, wavelength, and surface properties, factors like shadowing, scattering, reflection, ab-

sorption, and surface texture (including facet orientation and density) influence the BRDF (Massachusetts Boston 2023).

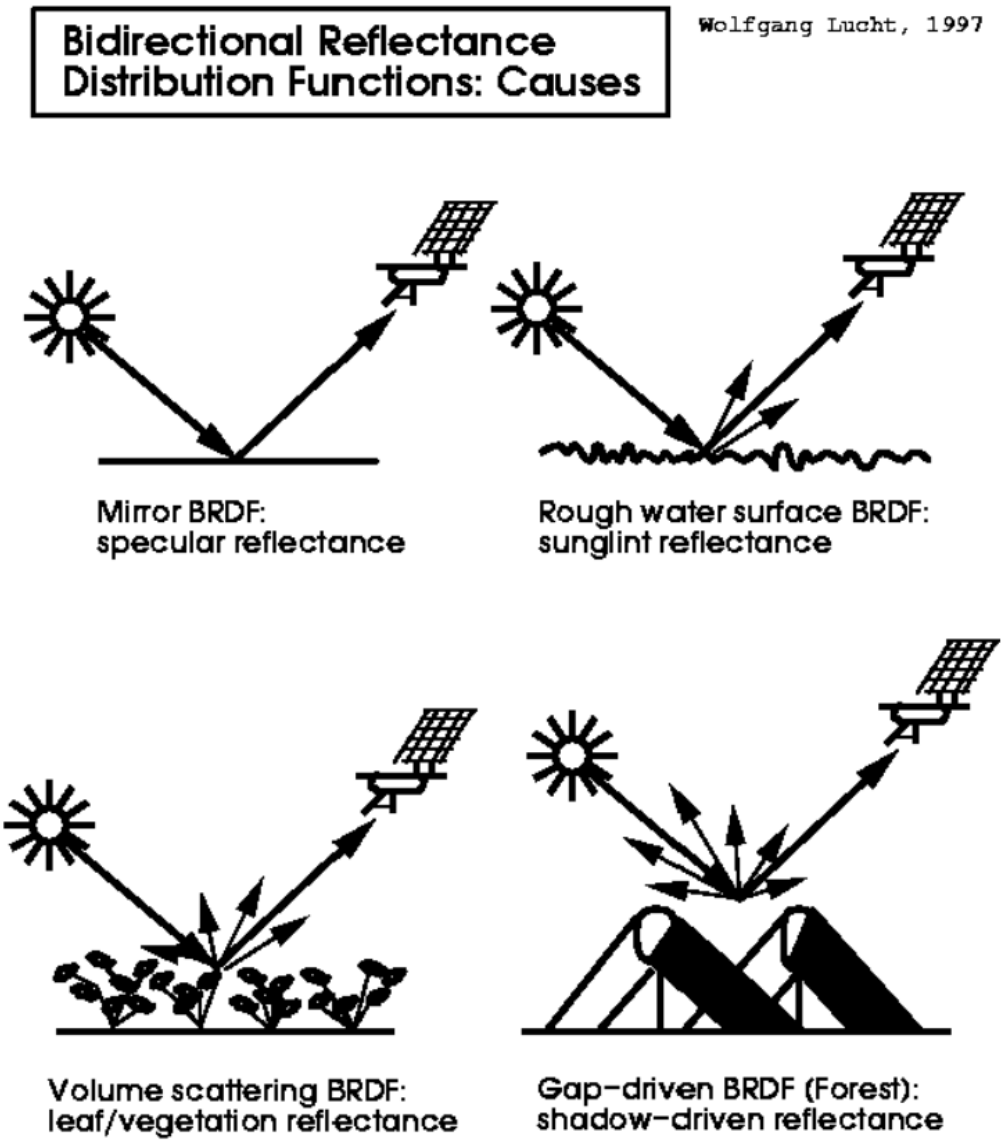

Figure from (Massachusetts Boston 2023)

SAR data, or Synthetic Aperture Radar, involves active data obtain in which the sensor emits its own energy and then measures the amount of this energy that is reflected back after it interacts with the Earth's surface (NASA Earthdata 2023). The detail of it will be in week 9.

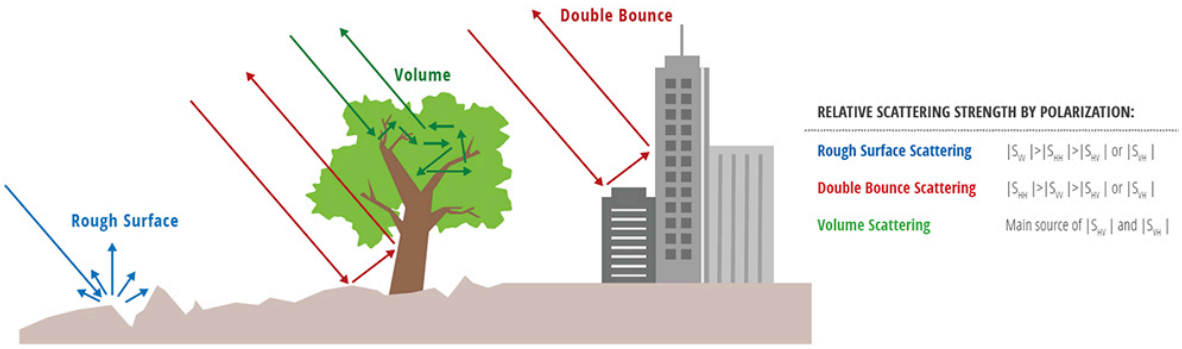

Figure from (NASA Earthdata 2023)

4.2 Four resolutions

4.2.1 Spatial

Size of raster cells varies from 10cm to several kilometers.

4.2.2 Spectral

Spectral resolution describes the capacity of a sensor to define fine wavelength intervals (Canada 2015), not just the visible light (red, green, blue). An object's color depend on which wavelengths they reflect, with others being absorbed or scattered. Our observation are limited due to the wavelengths absorbed by water vapour, ozone, and other gases. Spectral resolution classification is based on the number of observed bands Measuring spectral reflectance isn't limited to remote sensors; it can also be conducted using 'spectroradiometers' in labs or fields, requiring calibration with a pure white reference panel.

4.2.3 Temporal

Sensor's sensitivity to energy is different, with higher resolution offering more details (8 bit = 256 values, 4 bit = 16 values).

4.2.4 Radiometric

Radiometric resolution refers to the level of detail in a pixel's recorded energy, quantified in bits, ach bit doubles the range of energy values, so an 8-bit resolution means the sensor can distinguish between 256 different energy levels, ranging from 0 to 255 (Earthdata 2024).

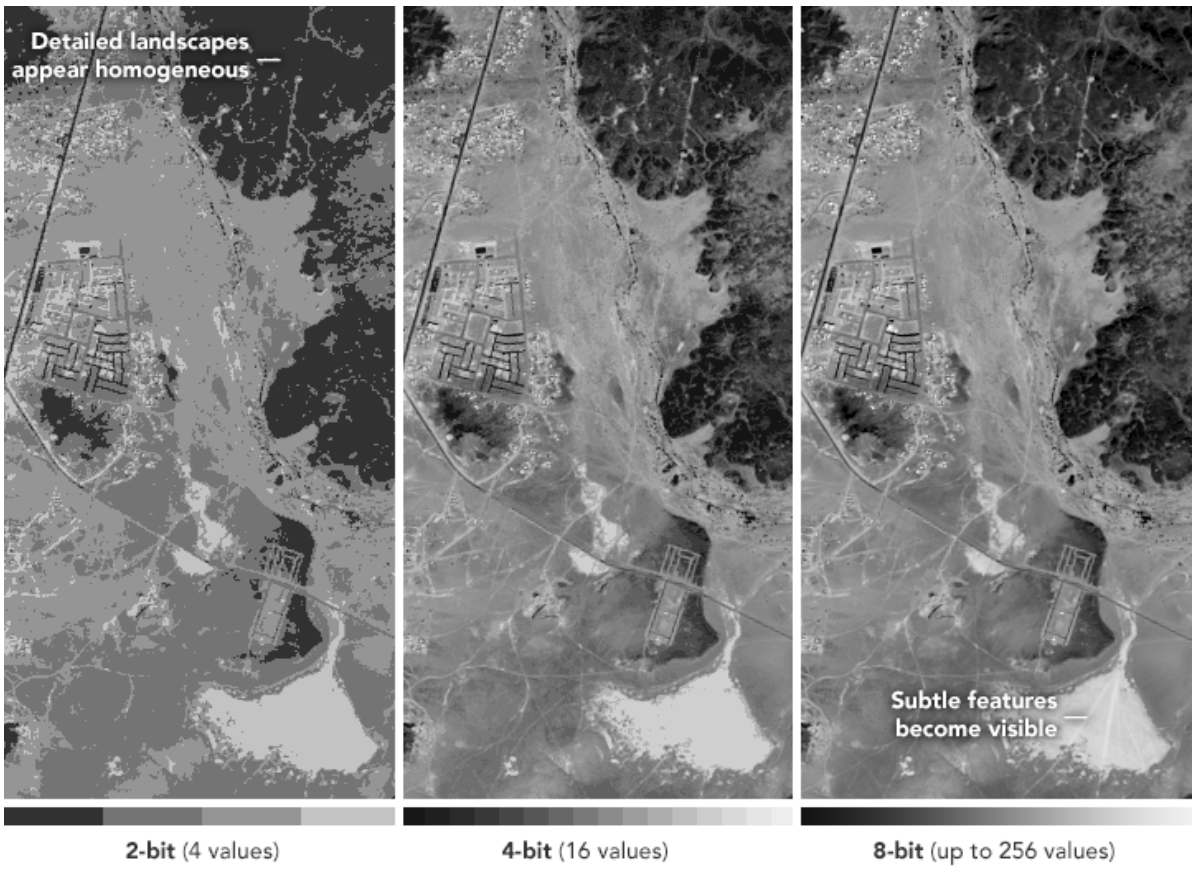

Figure from (Earthdata 2024)

4.3 Biases

In the UK, cloud cover and atmospheric constituents like water vapor and carbon dioxide can significantly impact remote sensing data. These factors obstruct parts of the electromagnetic spectrum, preventing certain wavelengths from reaching the Earth's surface or sensors. This interference distorts accurate observations and analysis, leading to challenges in capturing clear remote sensing imagery. Thus, atmospheric conditions and clouds are key considerations in remote sensing applications in the UK.

4.4 Application

I am particularly interested in the resolutions of remote sensing data, since I learnt urban design before, and I used to think of resolution is something that can directly change in Photoshop, and it is the first time of knowing how the remote sensing technique are being