

Analysis of satellite images for tracking **tree-cutting** in Africa

Master Thesis Design
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Problem statement

- Organised theft
- No hard evidence
- Large region

Small organised groups are stealing trees in multiple regions in West Africa. For the lack of hard evidence it is hard for authorities to fight the crime.

Why is it a problem?

Savanna in Mali



Why is it a problem?

Savannas as the dominant biome

In these grasslands, the sparse trees have huge importance for the closest surroundings.



Agricultural importance



Climate regulation



Biodiversity



Water supply

Research Question

Sub-Questions

1. What other data in addition to the satellite images can be used to improve the accuracy of the potential system?
2. Considering both object detection approach and pixel based analysis, which method is better suited for the introduced problem?

"What is a promising approach for analyzing public satellite images to identify tree-loss in West Africa?"

How to use satellite images

2 main approaches:

- **Object detection**

- based on shape identify objects in picture
- sensitive to image resolution
- involves AI

- **Pixel based classification**

- for every pixel assign a value
- group pixels based on the value into predefined categories
- uses spectral signature

Object detection



Pixel based classification



Satellite images

Most important parameters:

- Price
- Spatial resolution
- Radiometric resolution
- Temporal resolution

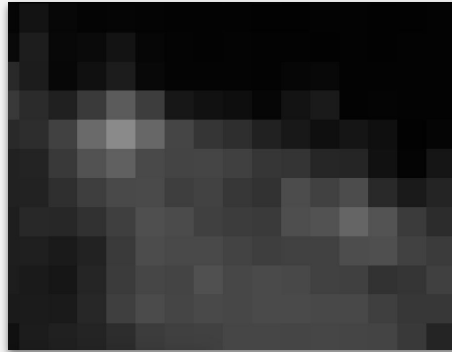
Spatial resolution:



WorldView-3 - 0.3m



QuickBird - 0.5m



Sentinel - 10m



Landsat - 30m

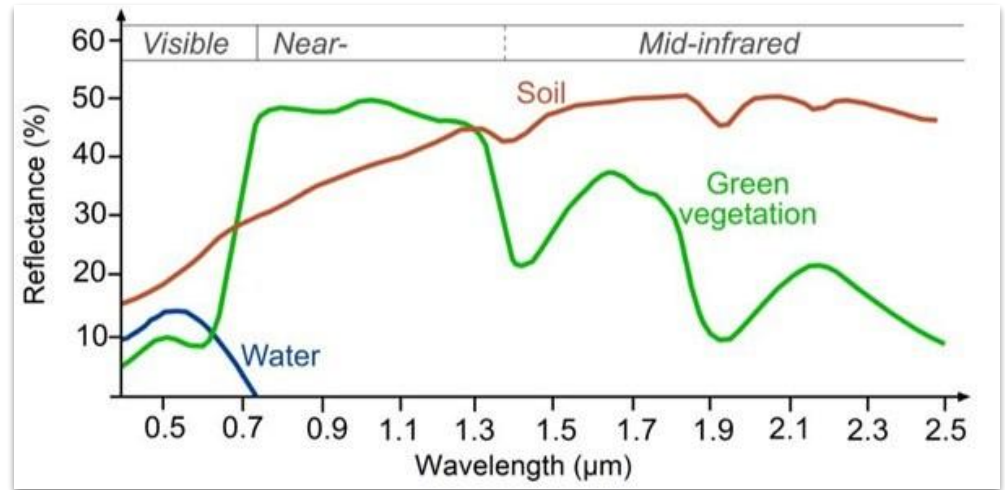
Spectral signature

Every material can be characterized by its *spectral signature*.

Different vegetation by:

- Chlorophyll absorption
- Water absorption
- Cell structure
- ...

Reflectance comparison: Vegetation, Soil, Water

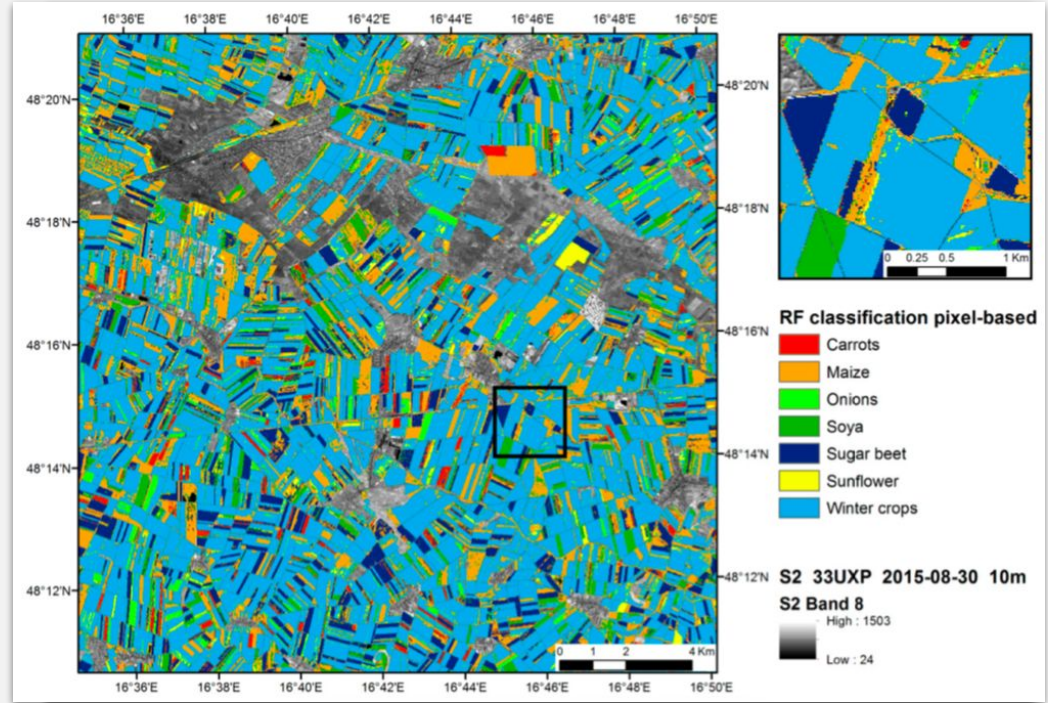


Existing use-cases

Pixel-based classification

- Focus on areas not individual objects
 - Forest gain / loss
 - Crop fields species classification
- Uses lower resolution satellite images

Global Forest Watch App:

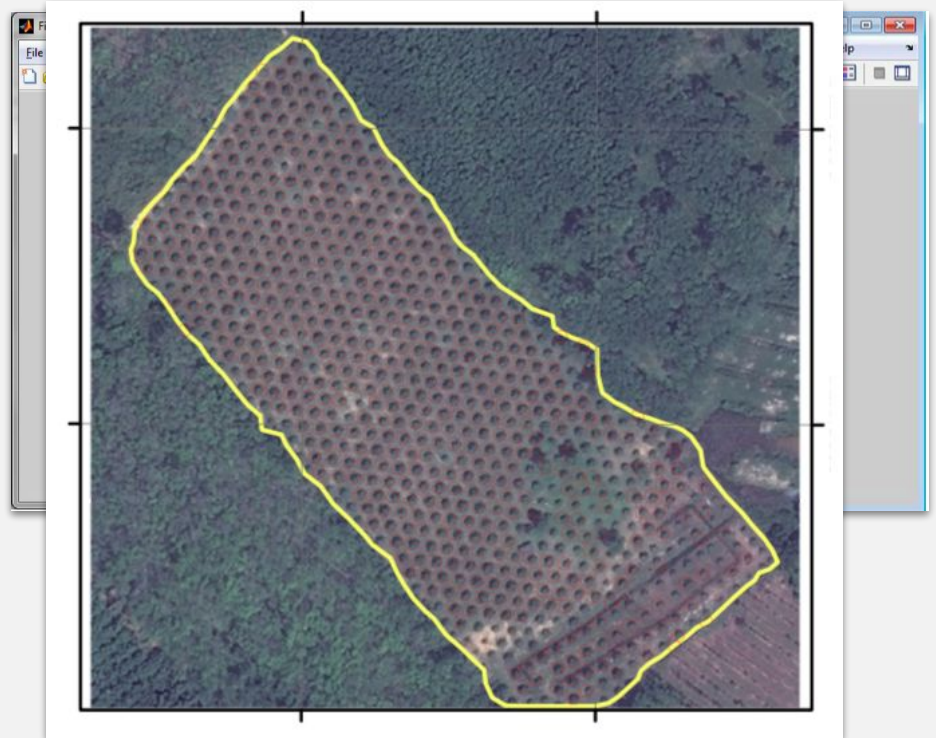


Existing **use-cases**

Object detection

- Focus individual objects
 - Tree counting
- Reliant on very high resolution satellite images
- Usually utilizes AI/ML
- Problems with overlapping trees

Tree counting - pattern matching:



My approach

- Focus on pre-processing to highlight interesting features from spectral bands
- Examine the use of ML algorithms
- Consider both approaches (pixel-based + object detection)



Classification map
Classification map
Classification map
Classification map
Classification map

What needs to be done



Thank you!

I am happy to answer any questions.

