



Data Science
Module 4 Project
Marco Nasuto - 2021



*A project on using
deep learning and Copernicus data
to map land cover and land use in Europe*

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Business value

First, an intro to Remote Sensing data: *The power of light*

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Remote sensing images are special.

They capture reality beyond its colours.

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What do we mean?

*Let's take a step back on what light
and colours are.*

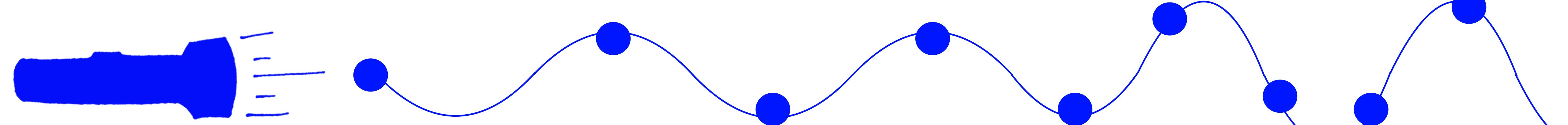
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Light is

energy

and light is made of



*Particles
(called photons)*

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Waves

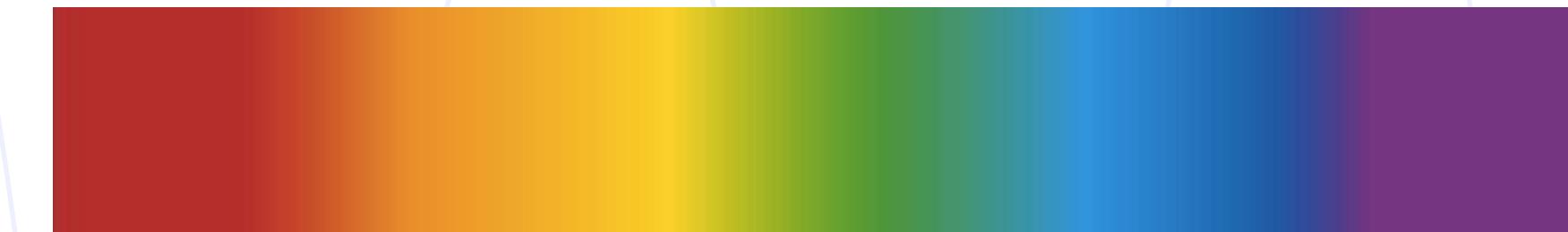
and like all waves, we describe light with

Frequency

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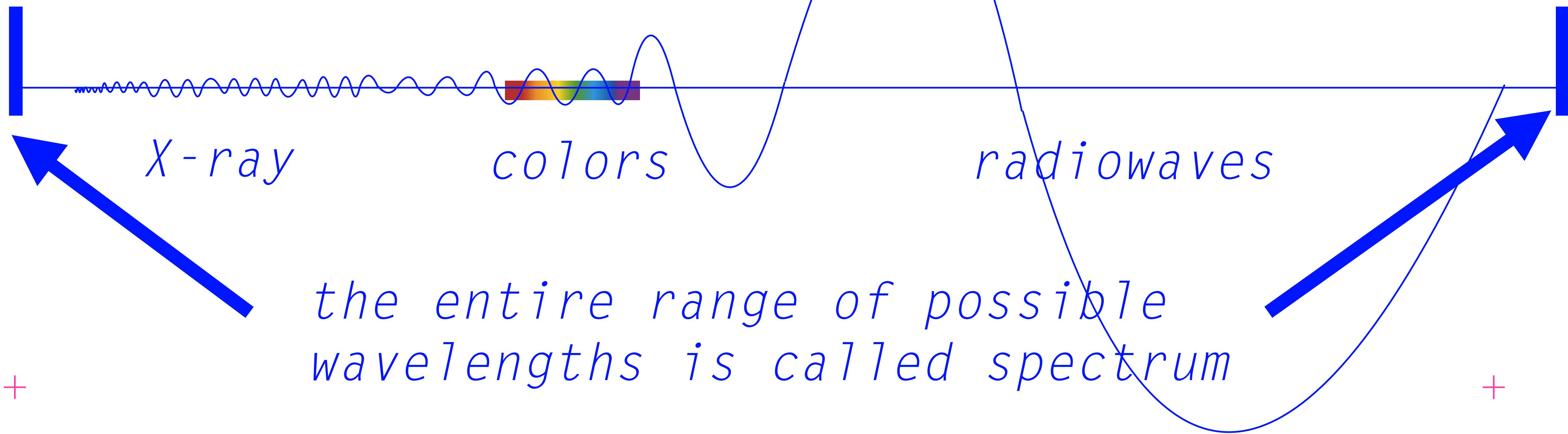
Wavelength

This is how we see light



simply, colors.

however, colors are just one part of light



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colors can give us information about things.

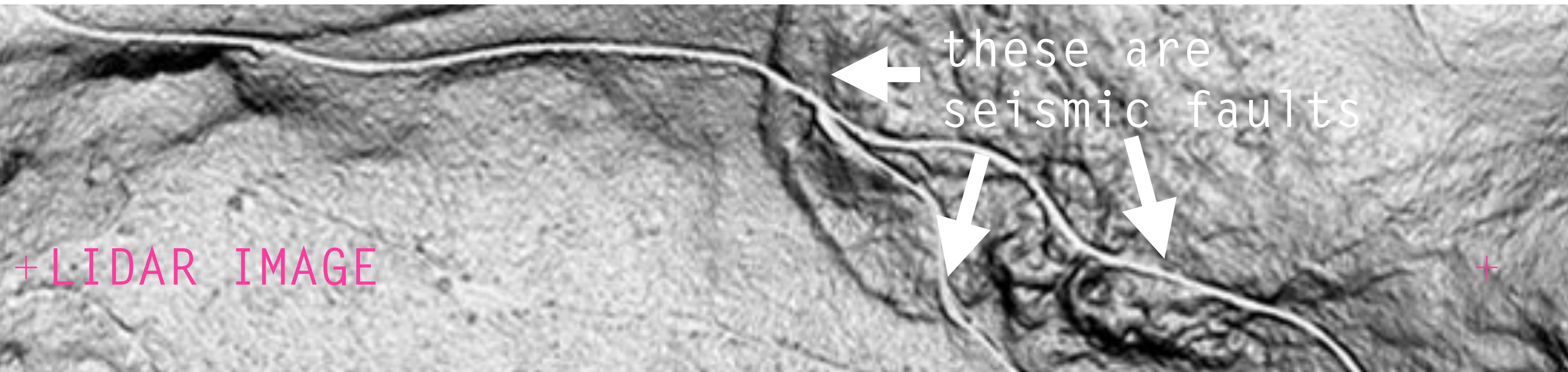
+ TRUE COLOR IMAGE



these are forests

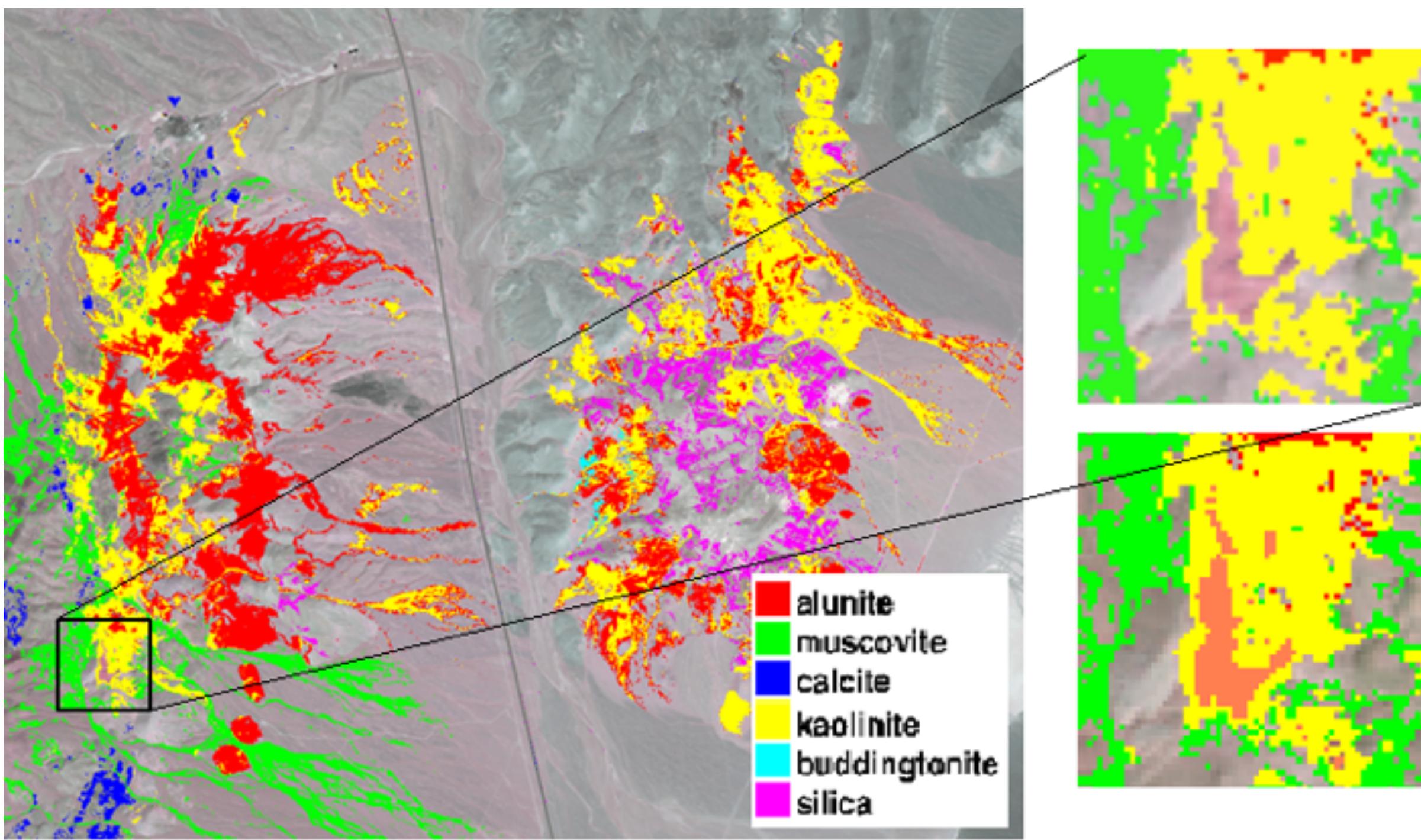
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but what if we include other part of
the spectrum?



Multi and hyper spectral satellite
images do exactly this:
they capture more information about
reality.

Materials and surfaces react in unique ways with light.



Potential
presence of
hydrocarbons

But how these info relate with
land cover & Land use?

*Because we are going to use
multispectral images for our purpose*

Business value

Land cover & Land use

What are Land cover & Land use?

Land cover = physical land type

i.e. forest, sea, lake

Land use = how people are using the land,

i.e. annual crop, industrial area

Why an atlas then?

Atlas of land cover & land use = database

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A strategic tool.

Resources management

Control & Security

Emergencies

Research & Development

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Problem: mapping is expensive!

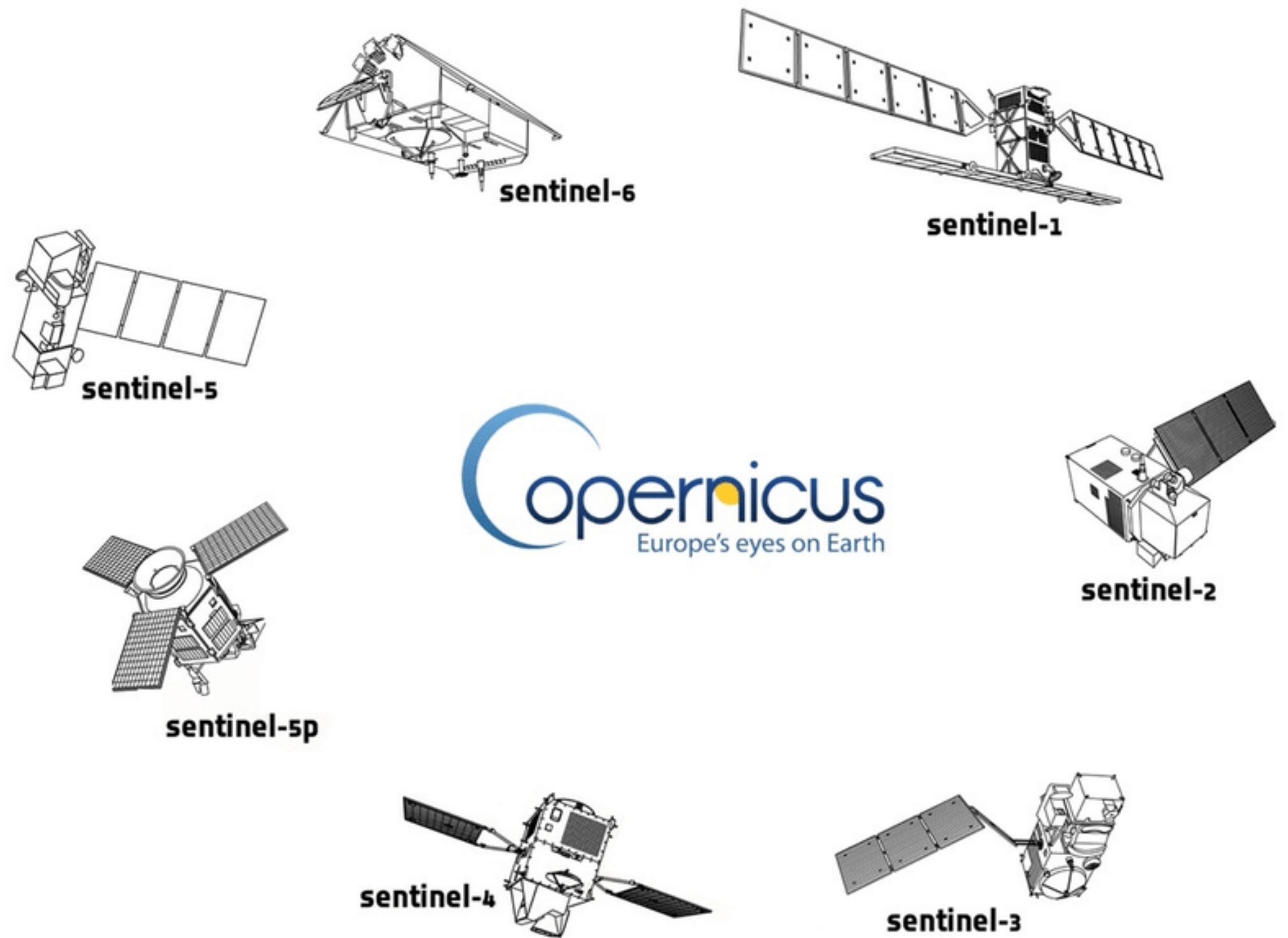
Solution: need for automated methods

How to do automated mapping:

Ingredients

- *Remote sensing data*
- *Ground truth*
- *Algorithms*

This project is
based on data
from
Copernicus: EU
Earth-Observation
Programme



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Copernicus data and business opportunities

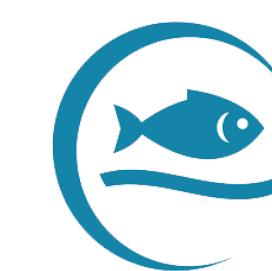
Land-cover & Land-use information key to:



*Land
monitoring*



*Climate
Change*



*Marine
Environment
Monitoring*



Security



*Energy
Management*



*Atmosphere
Monitoring*

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The example of Common Agriculture Policy

- CAP = 40 billion euros budget yearly
- Payments through database of land cover and land use
- Database is updated manually, with physical inspection of only 5% of actual parcels

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Questions we want to address

- 1) Can deep learning help updating an atlas of LULC?
- 2) What are the requirements for generalising this proof of concept?
- 3) Is it possible to train an accurate deep learning model for LULC with a small-to-medium sized dataset?

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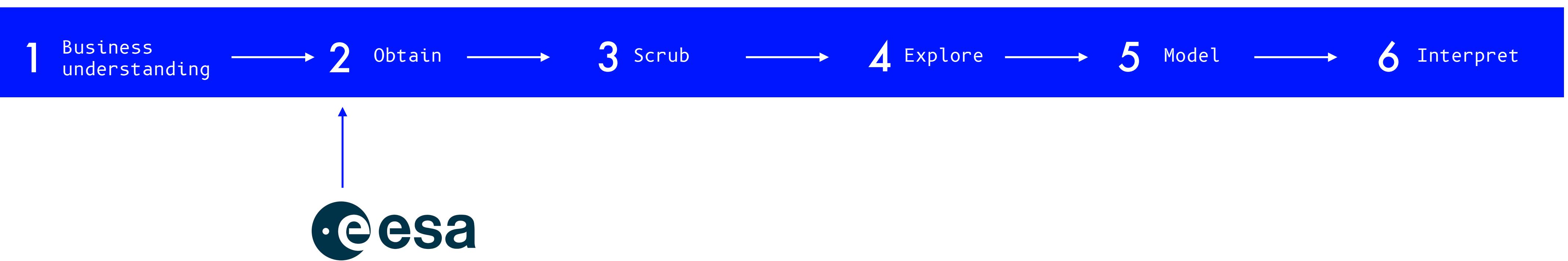
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Methodology

Methodology

Business Understanding +

Obtain Scrub Explore Model iNterpret - OSEMN



Our recommendations



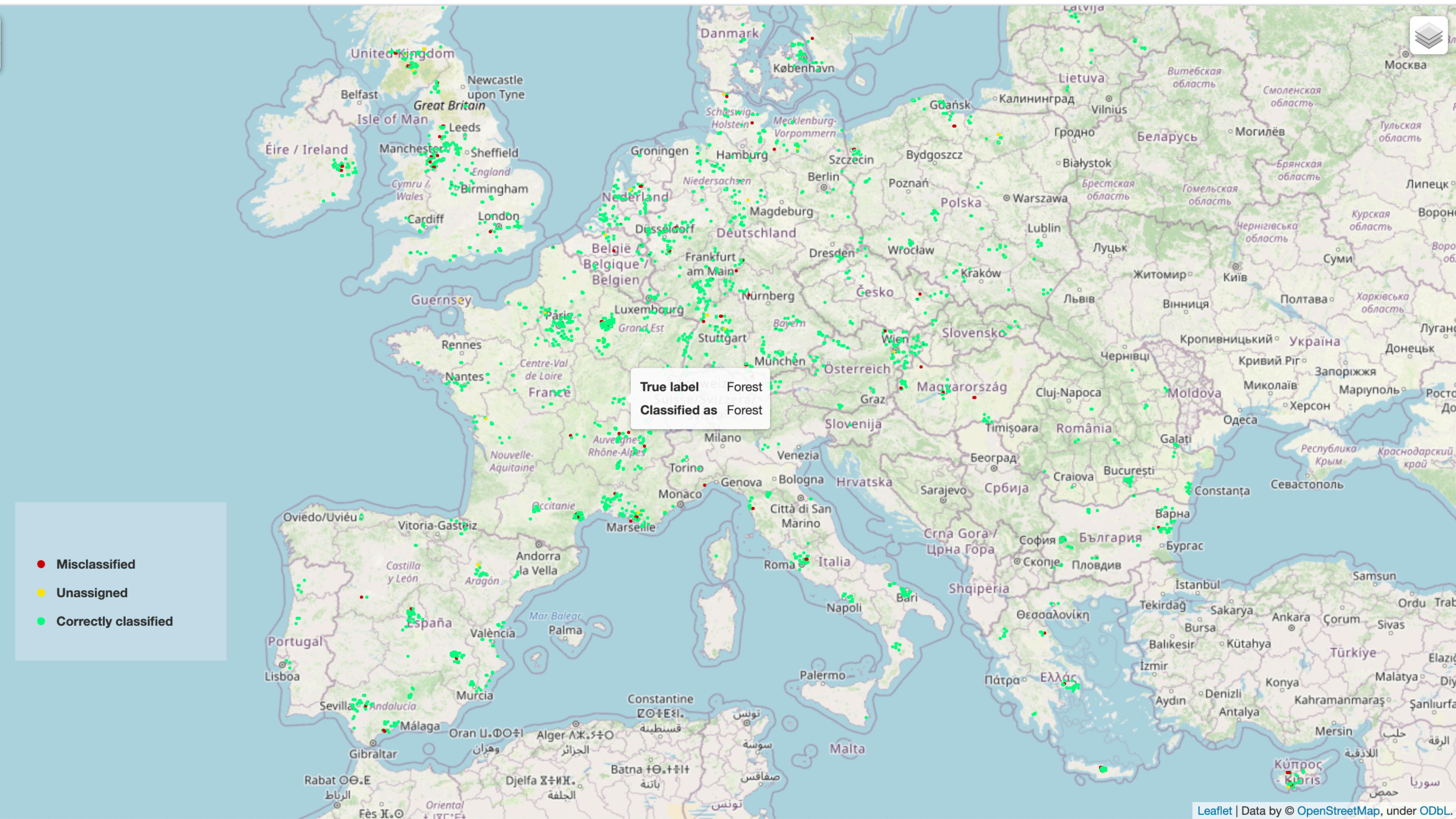
1. Can deep learning
help updating an atlas of LULC?

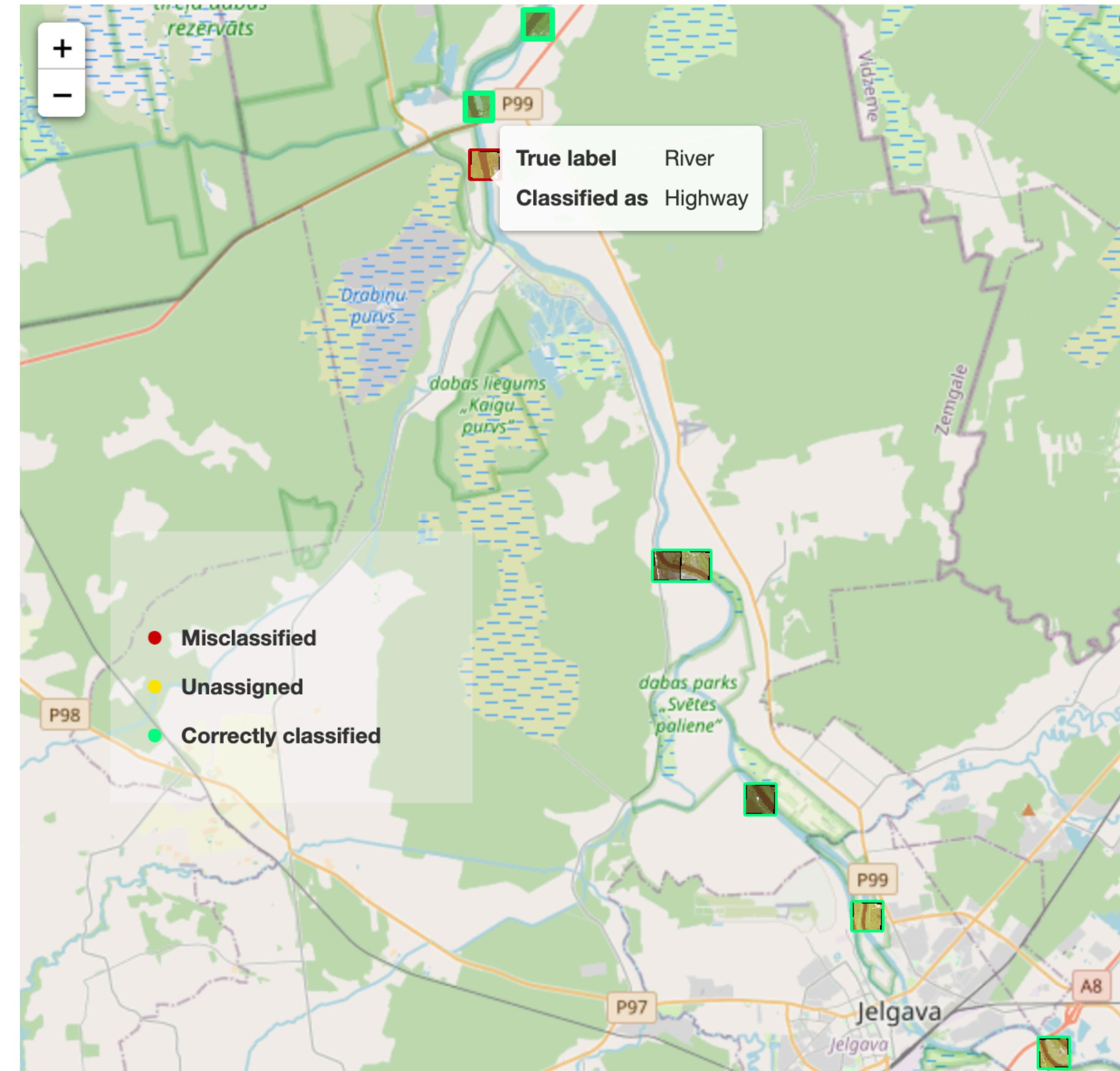
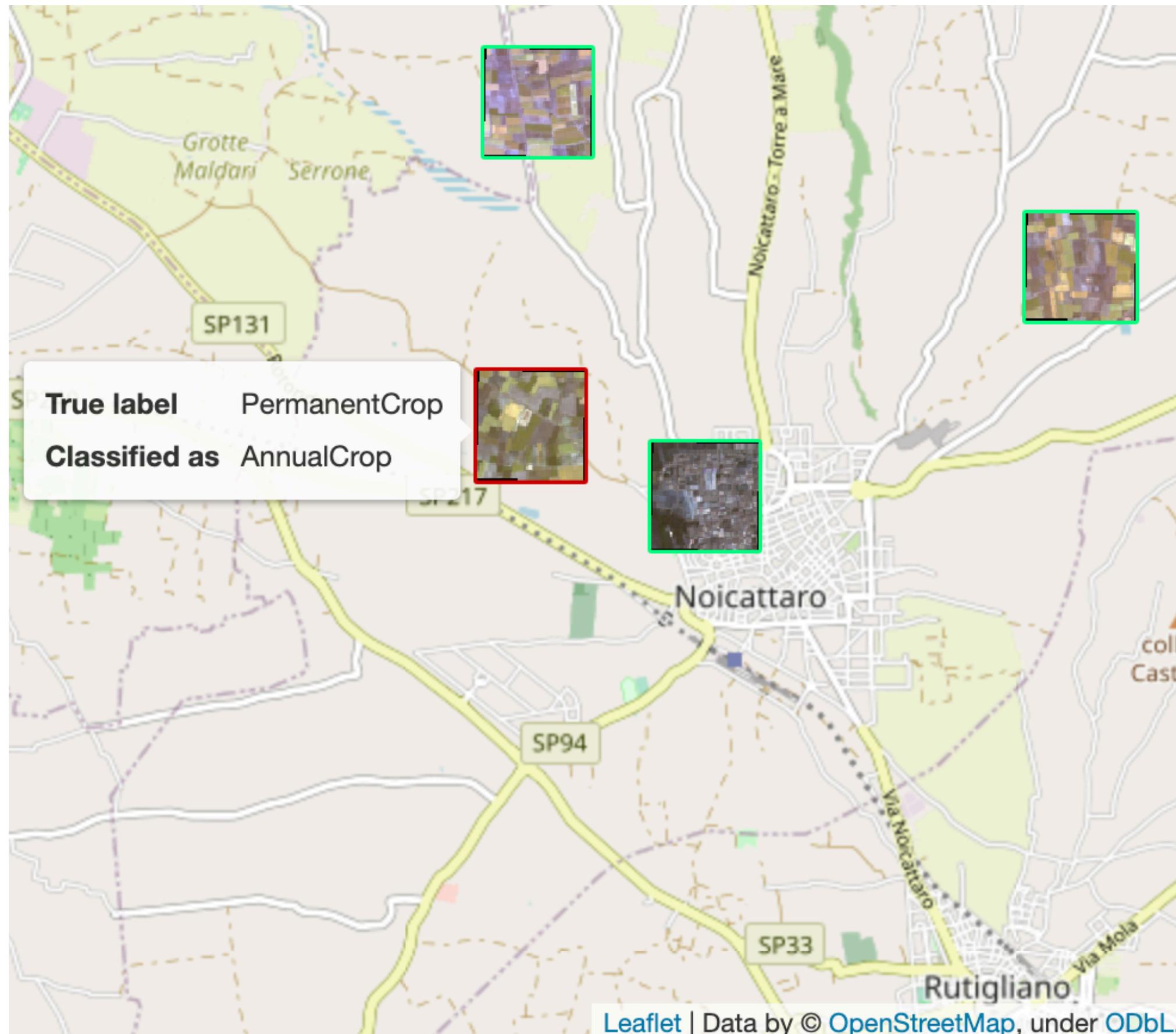


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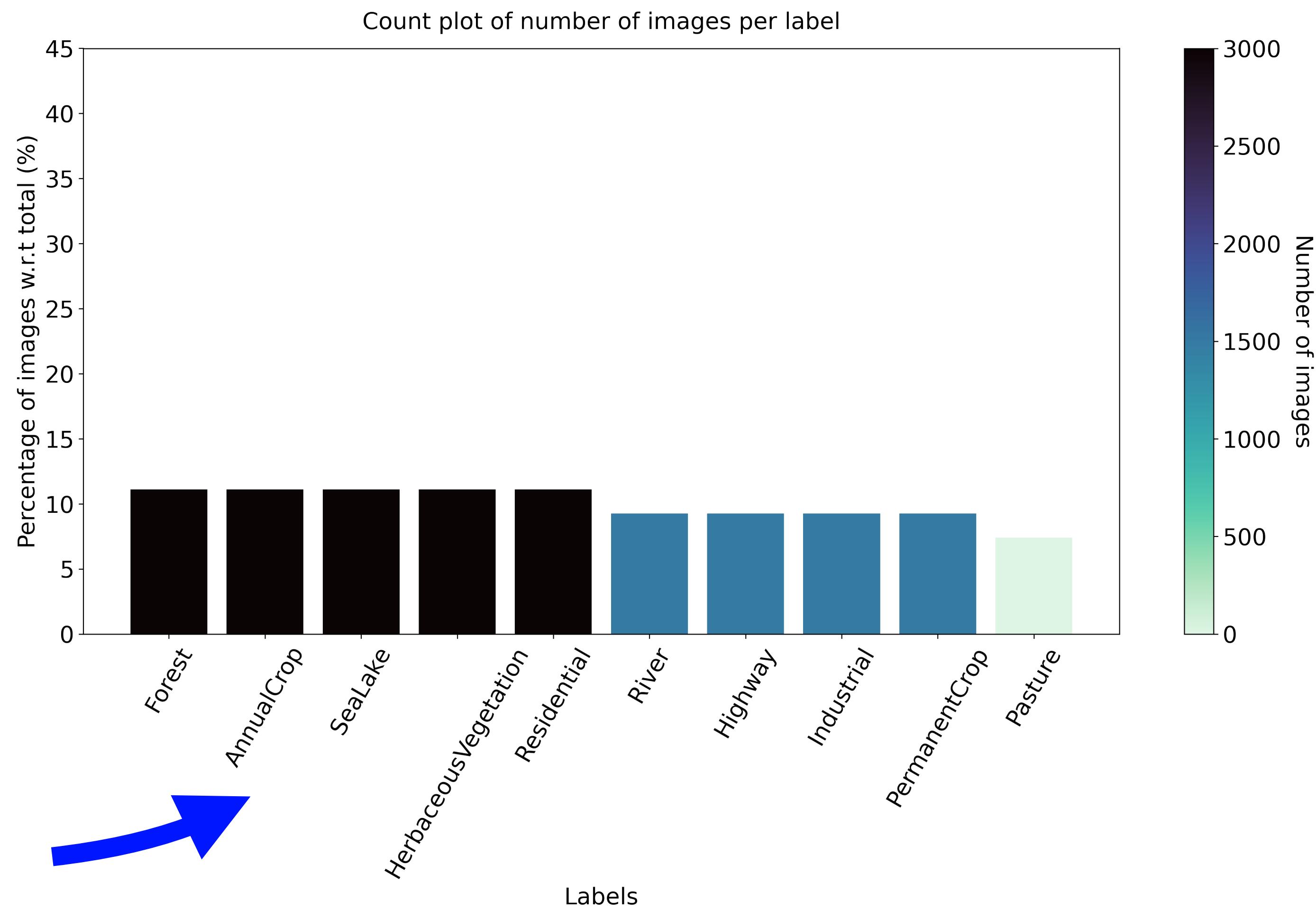
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2. What are the requirements for
generalising this proof of concept?

Application for CAP requires more classes

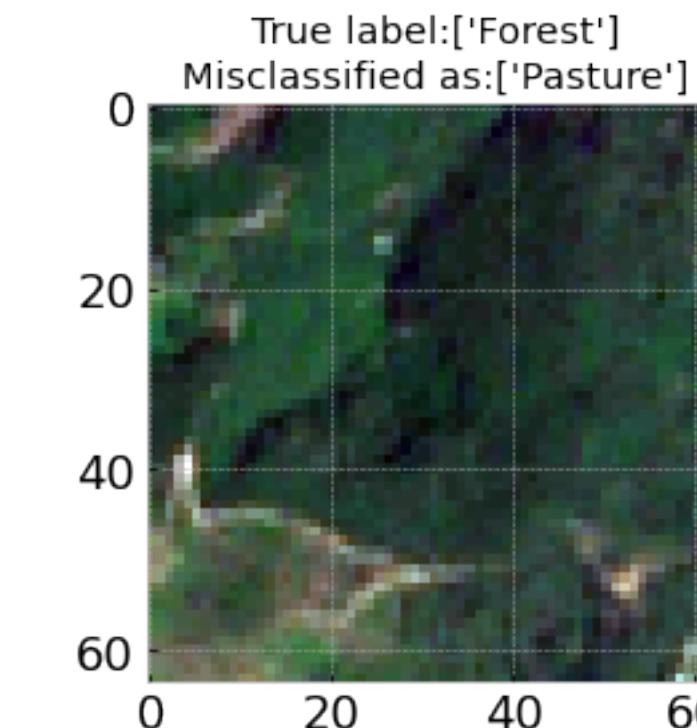
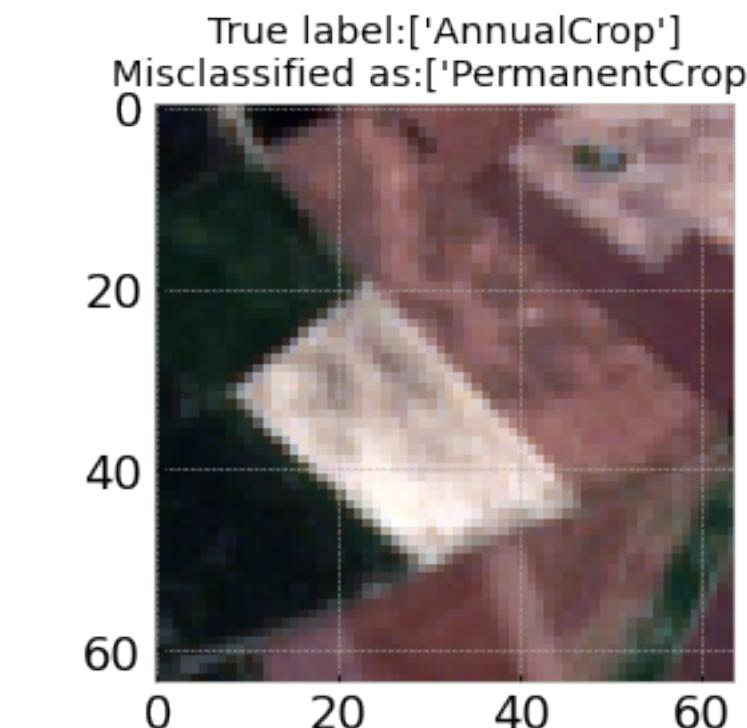
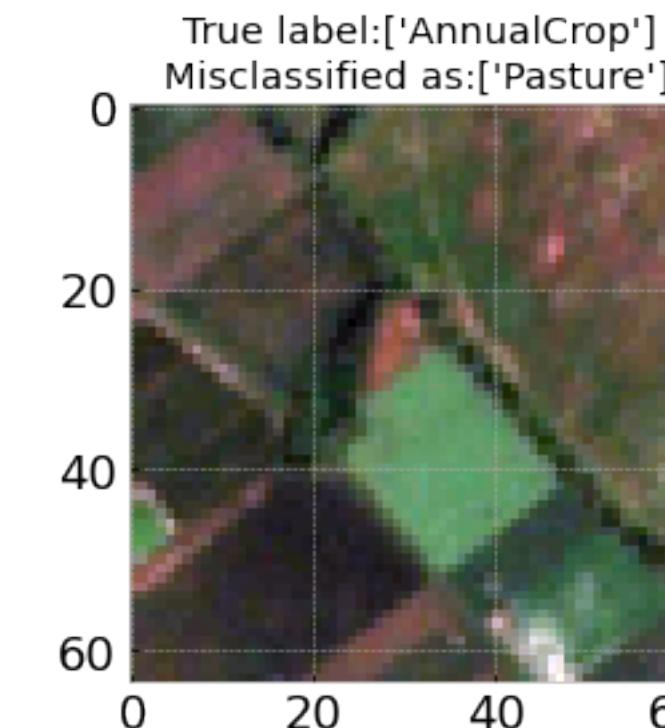
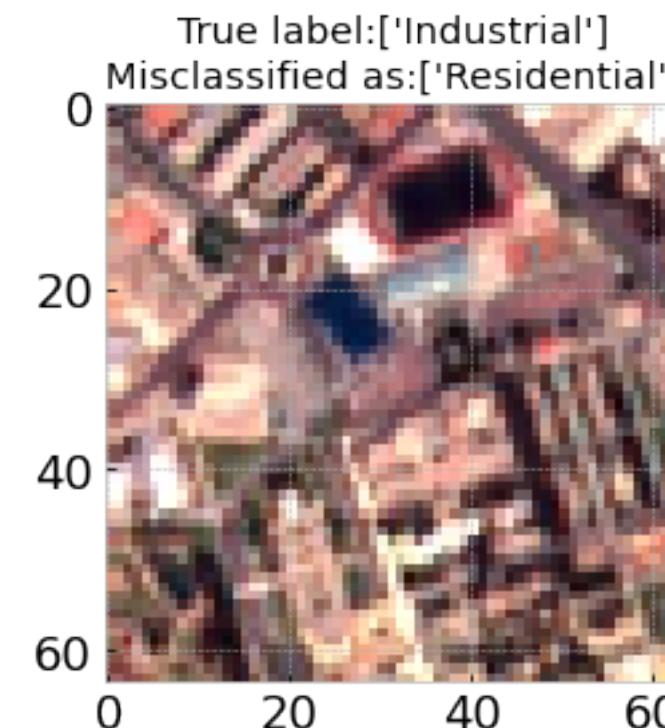
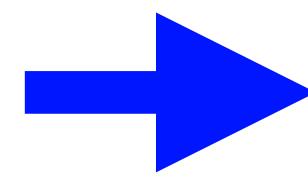


3. Is it possible to train an accurate
deep learning model for LULC
with a small-to-medium sized dataset?

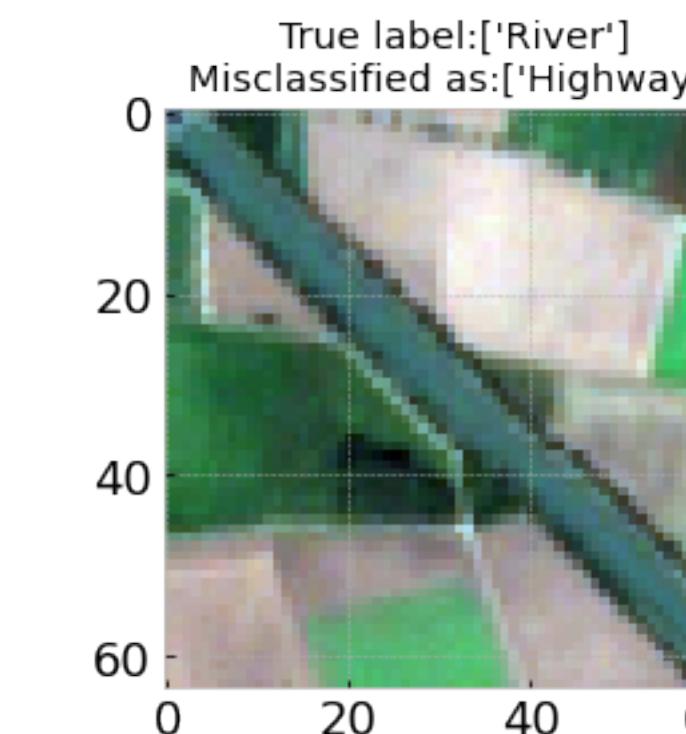
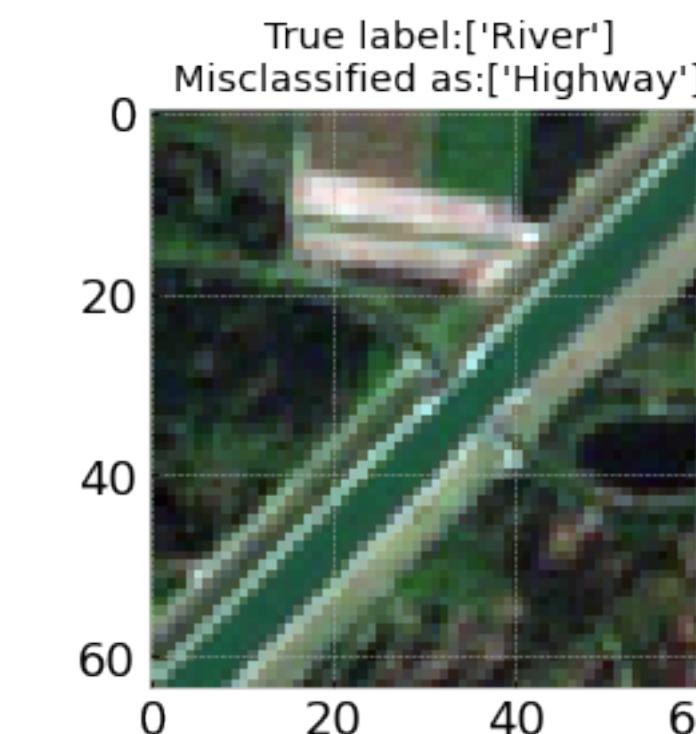
Yes! Best performance: 95% accuracy

However, examples of misclassification

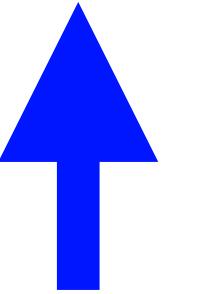
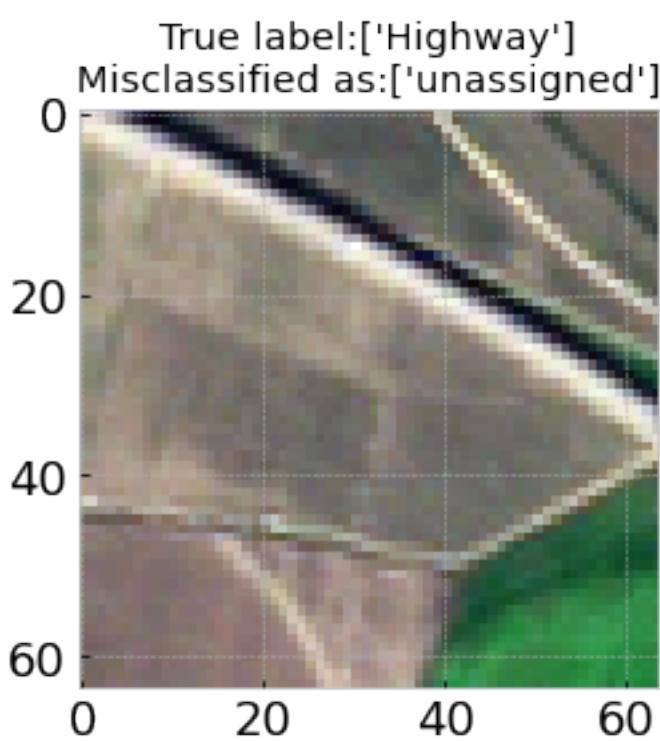
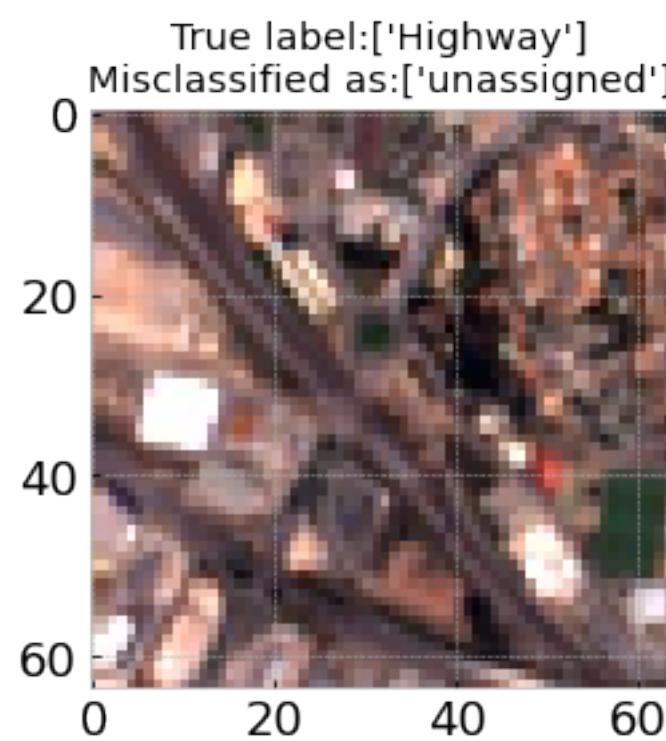
*Hard even
for humans*



*Presence of
river and
highway*



and unclassified examples



Hard even for humans

Future works

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Future works

1. Improving performance investigating alternatives architectures for multi-spectral images
2. Leveraging on different data sources to tackle multi-disciplinary problem (i.e. deforestation)
3. Productionization

Wrapping up

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Wrapping up

Deep learning to map LULC in Europe

- 1) Map showing potential automated atlas of LULC in Europe
- 2) Requirements for generalising its application
- 3) For coarse classification, state-of-the-art accuracies obtainable with small-to-medium sized datasets

Thank you