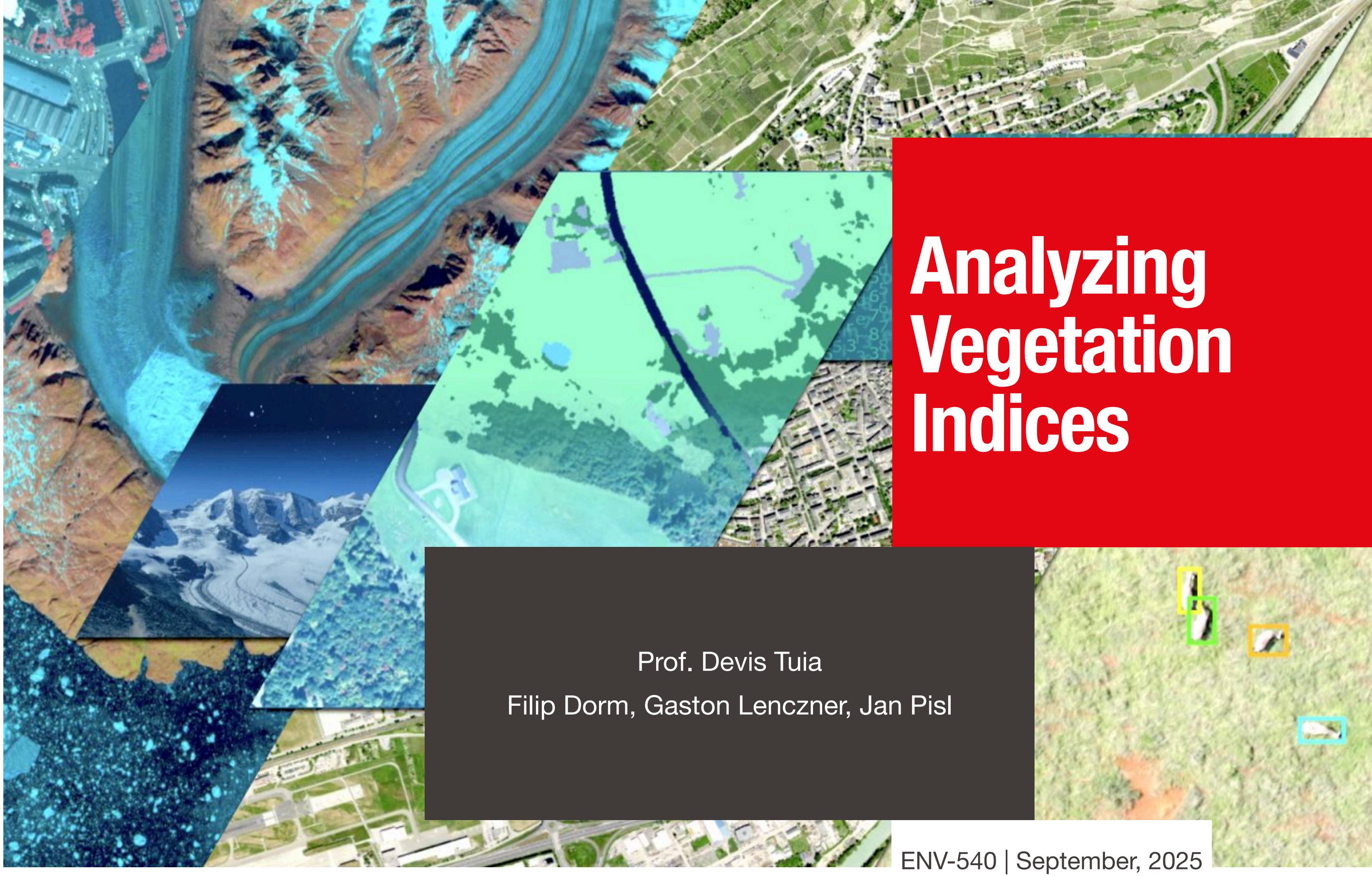
EPFL



Analyzing Vegetation Indices

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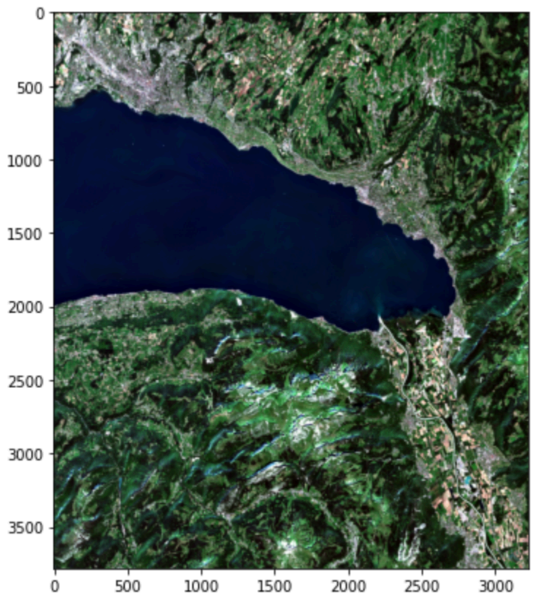
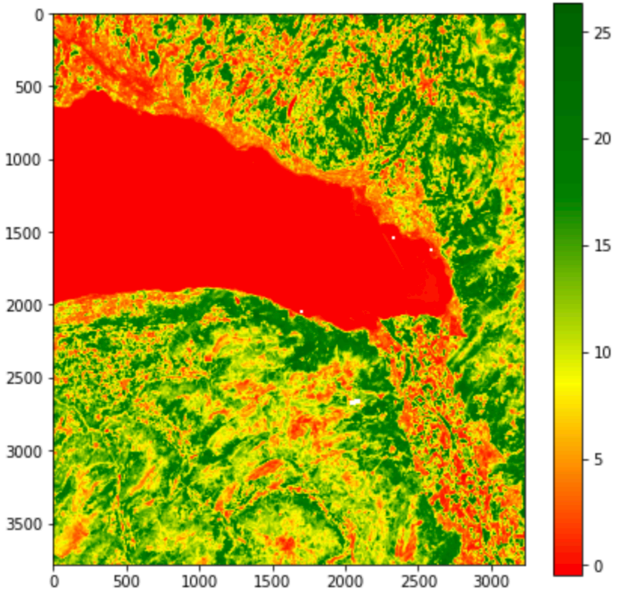
Green Chlorophyll Index (GCI)

The Green Chlorophyll Index (GCI) estimates leaf chlorophyll content in the plants based on near-infrared and green. It is computed as follow:

$$GCI = NIR / Green - 1$$

The following image shows and example using a colour map





Computing the Green Chlorophyll Index

Using Numpy and Matplotlib to compute and visualize the Green Chlorophyll Index of an image

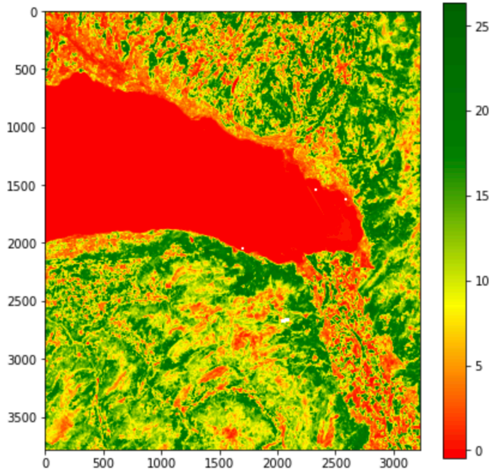
```
import numpy as np
from  matplotlib.colors import LinearSegmentedColormap

def plot_vegetation_index(image_arr):
    # Remove outliers
    p_min, p_max = np.percentile(image_arr[~np.isnan(image_arr)], (2, 98))
    image_arr_clipped = image_arr.clip(p_min, p_max)
    # Create a color map
    cmap_rg=LinearSegmentedColormap.from_list('rg',
                    ["red", "yellow", "green", "darkgreen"], N=256)
    # Show image
    plt.imshow(image_arr_clipped, cmap=cmap_rg)
    plt.colorbar()
```

```
from skimage.io import imread
band4_arr = imread("image_directory/band4.jp2") # Green
band8_arr = imread("image_directory/band8.jp2") # Near-infrared
```

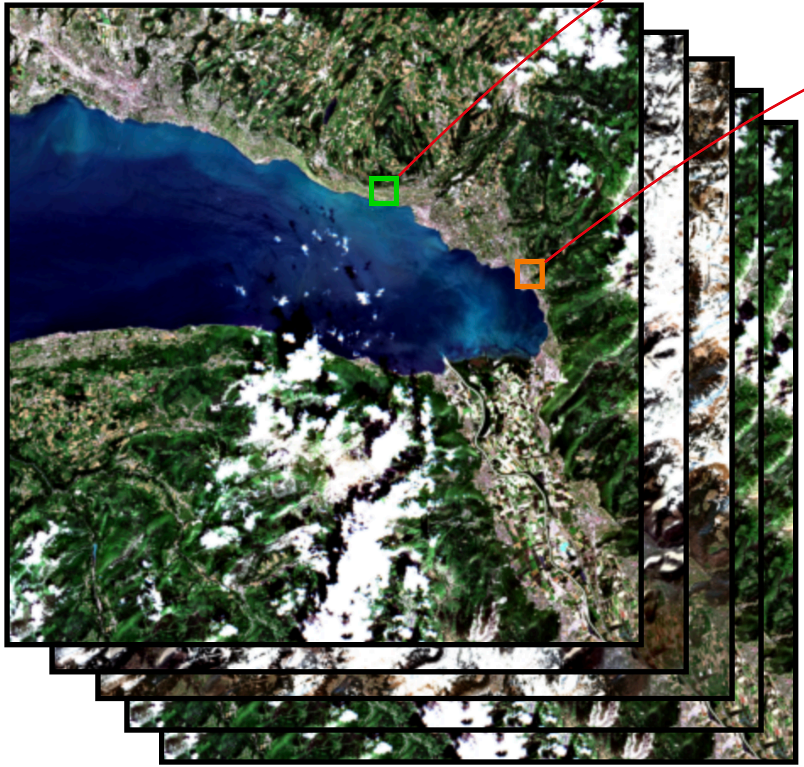
```
gci = (band8_arr / band4_arr) - 1.0
```

```
plot_vegetation_index(gci)
```

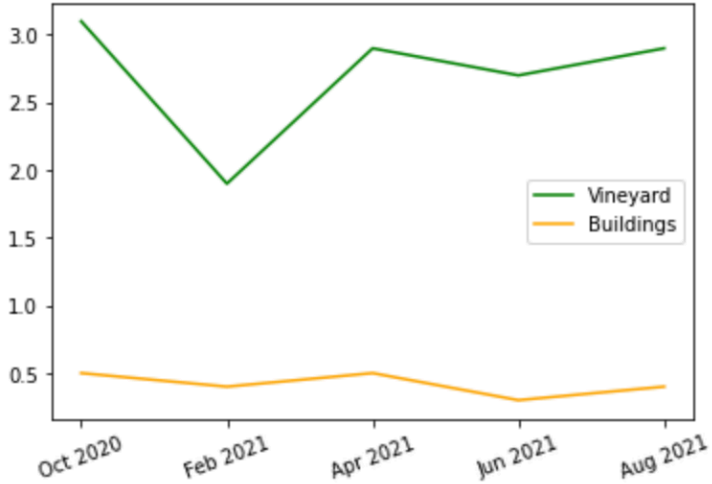


Analyzing vegetation indices through time

Average GCI
in the crop



```python
x = np.arange(5)
gci_vineyard = [3.1, 1.9, 2.9, 2.7, 2.9]
gci_building = [0.5, 0.4, 0.5, 0.3, 0.4]
plt.plot(x, gci_vineyard, label='Vineyard', color='green')
plt.plot(x, gci_building, label='Buildings', color='orange')
plt.xticks(x, ['Oct 2020', 'Feb 2021', 'Apr 2021',
               'Jun 2021', 'Aug 2021'],
           rotation=20)
plt.legend()
```



Exercise

- Read the provided PDF file and Jupyter Notebook with detailed instructions
- Tasks:
  1. Read the provided sentinel imagery, and compute the Normalized Difference Vegetation Index (**NDVI**) of the images. Visualize one of the NDVI images as a color map, using matplotlib
     - NDVI = (NIR - Red) / (NIR + Red)
  2. Plot the temporal series of the average NDVI values of four regions (containing vineyards, trees, buildings, and a sport field) in the five images provided (images acquired on Oct 2020, Feb 2021, Apr 2021, Jun 2021, and Aug 2021)
  3. Answer the questions of the PDF file of instructions

What is new in this exercise?

```
num_students_dict = {"classroom1" : 2, "classroom2" : 3}
print(num_students_dict.keys())
```

```
dict_keys(['classroom1', 'classroom2'])
```

```
# Let's create a dictionary with the age of each student
#    age_students_dict = { "classroom1" : [21, 22],
#                          "classroom2" : [21, 22, 23] }
age_students_dict = {}
```

```
for classroom in num_students_dict.keys():
    age_students_dict[classroom] = []
print(age_students_dict)
```

```
{'classroom1': [], 'classroom2': []}
```

```
for classroom in num_students_dict.keys():
    num_students = num_students_dict[classroom]
    for age in range(21, 21+num_students):
        age_students_dict[classroom].append(age)
        print(age_students_dict)
```

```
{'classroom1': [21], 'classroom2': []}
{'classroom1': [21, 22], 'classroom2': []}
{'classroom1': [21, 22], 'classroom2': [21]}
{'classroom1': [21, 22], 'classroom2': [21, 22]}
{'classroom1': [21, 22], 'classroom2': [21, 22, 23]}
```

← Using more dictionaries