

Landscape evolution analysis by semantic segmentation

Context

In 2007, the passage of a hurricane in Martinique caused considerable damage to the island. From that moment, a terrestrial photographic observatory on of the landscape was set up to monitor its transformations.

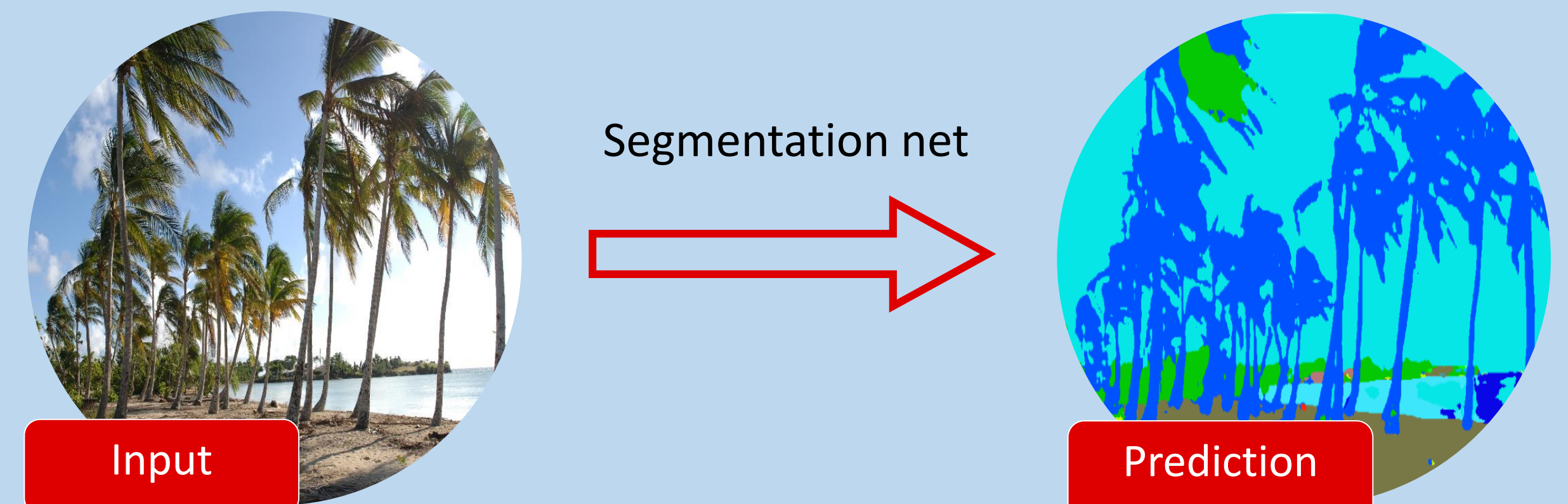
Objectives

The project seeks to enhance the data given by the *Observatoire Photographique du Paysage* (OPP) of the Martinique in an automated way:

- ❖ Explore semantic segmentation techniques
- ❖ Establish relevant indicators for the analysis of landscape evolution

Semantic Segmentation

Definition: Semantic segmentation is a deep-learning method that assign label to every pixel of the image.



Can you see the changes ?

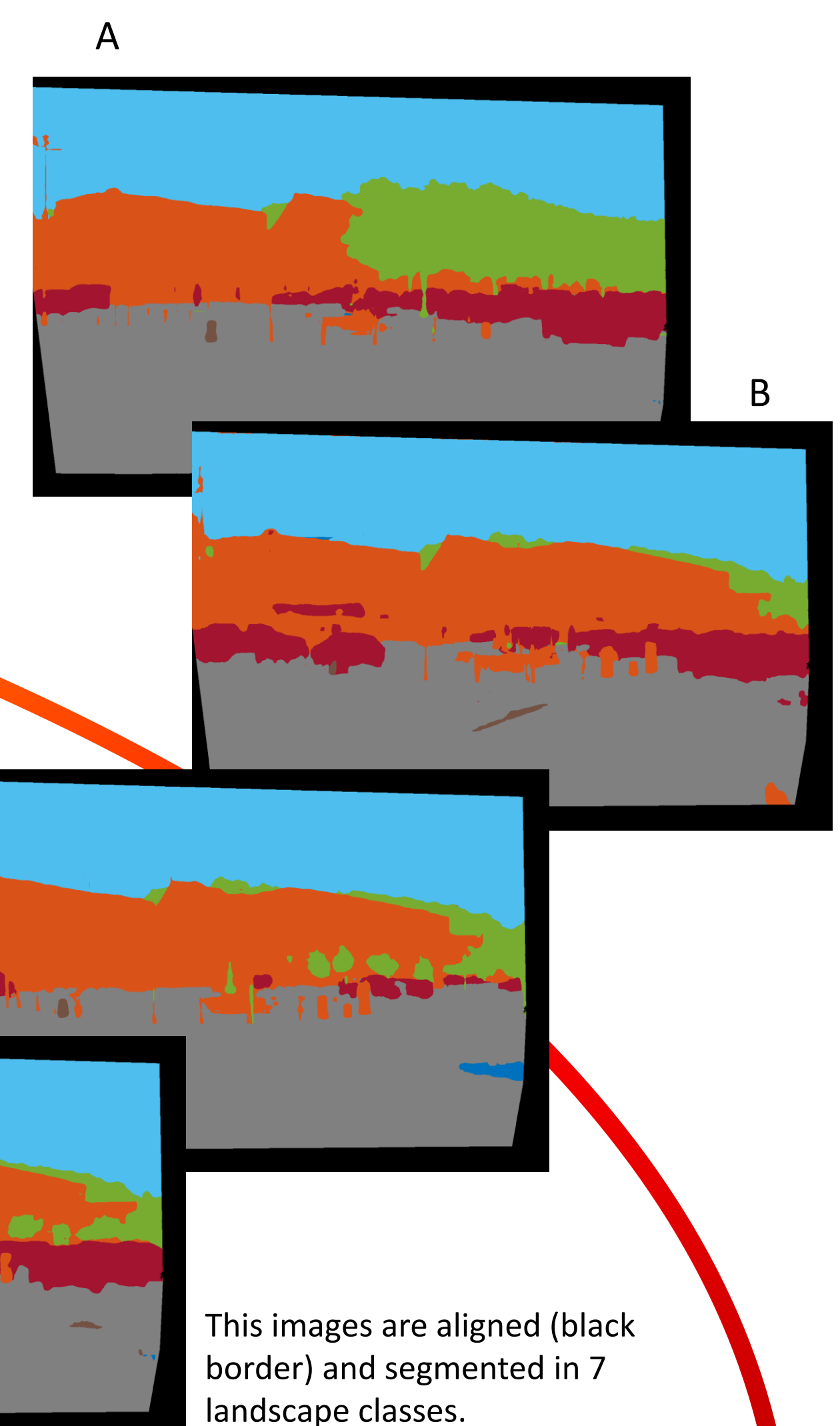


Alignment

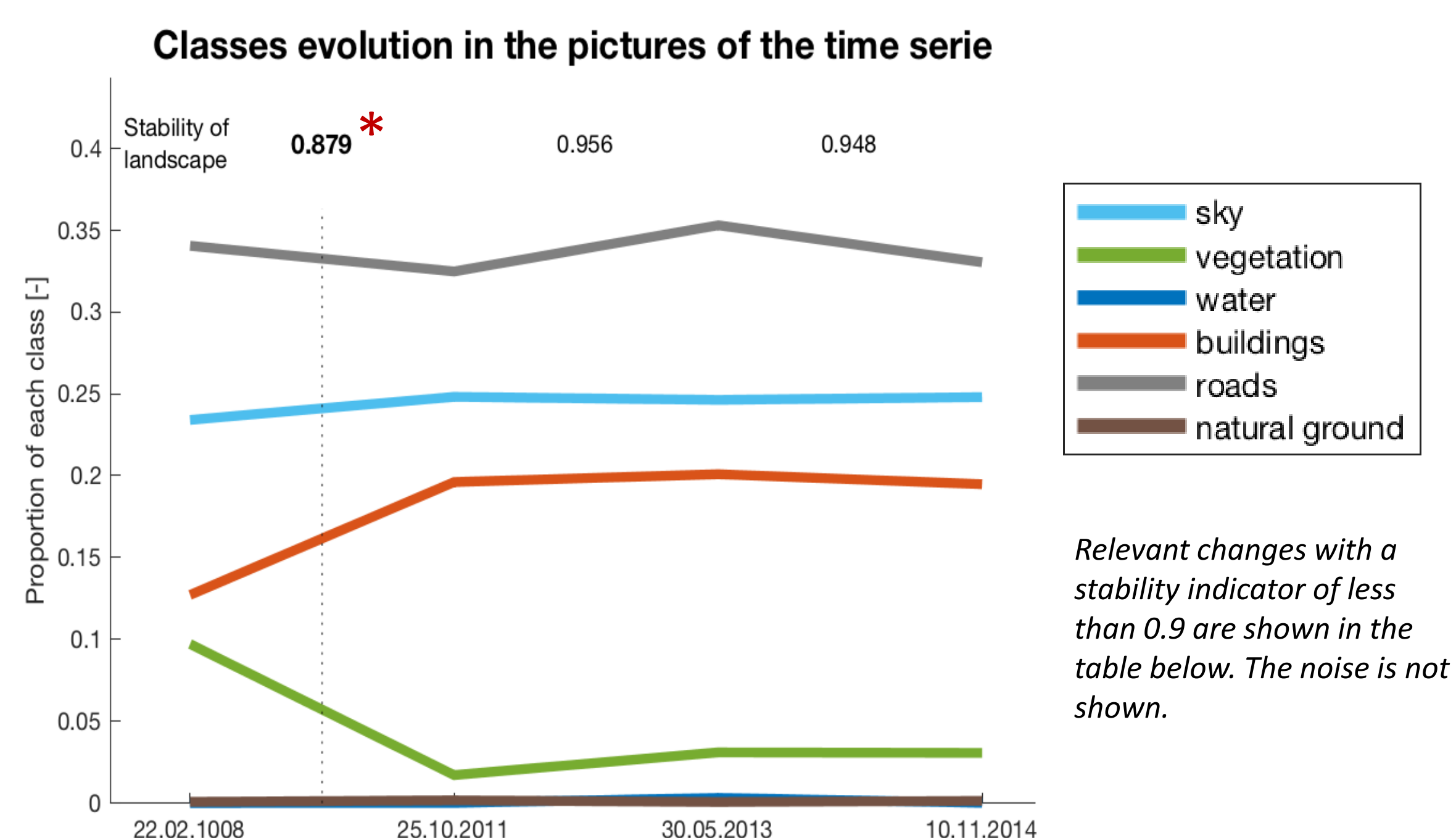
1. The alignment makes the images perfectly overlap.

Segmentation

2. The adjusted images are segmented through an adaptation of the segmentation net ^[1].



Output



| Image B | | sky | vegetation | water | buildings | roads | nat. ground |
|---------|-------------|-----|------------|-------|-----------|-------|-------------|
| Image A | sky | 483 | | | 1 | | |
| | vegetation | 37 | 35 | | 131 | | |
| | water | | | | | | |
| | buildings | 1 | | | 244 | 3 | |
| | roads | | | | 13 | 695 | 4 |
| | nat. ground | | | | | 1 | |

"Confusion matrix and the indicator of landscape stability between image A and B, in thousands of pixels. Noise is not considered"

131*10³ vegetation pixels changed to buildings

Indicator of landscape stability: 0.879* < 0.9

Threshold of change

Change detection

3. The landscape changes are detected through the confusion matrix. The proportion of unchanged pixels gives the stability.

Results and Conclusion

The method is a powerful tool that simplifies the handling of large volumes of data.

- ❖ semantic segmentation automatically and successfully detects change in the landscape
- ❖ The confusion matrix gives a good indicator of the evolution of the landscape

Perspectives

- ❖ The method is limited by the performance of the segmentation. The integration of another segmentation net would improve reliability
- ❖ Alignment is important for a correct comparison of images. So we recommend improving the algorithm or improving the picture framing