AI4DSpeckle: Label-Free SLC Despeckling & Practical Applications

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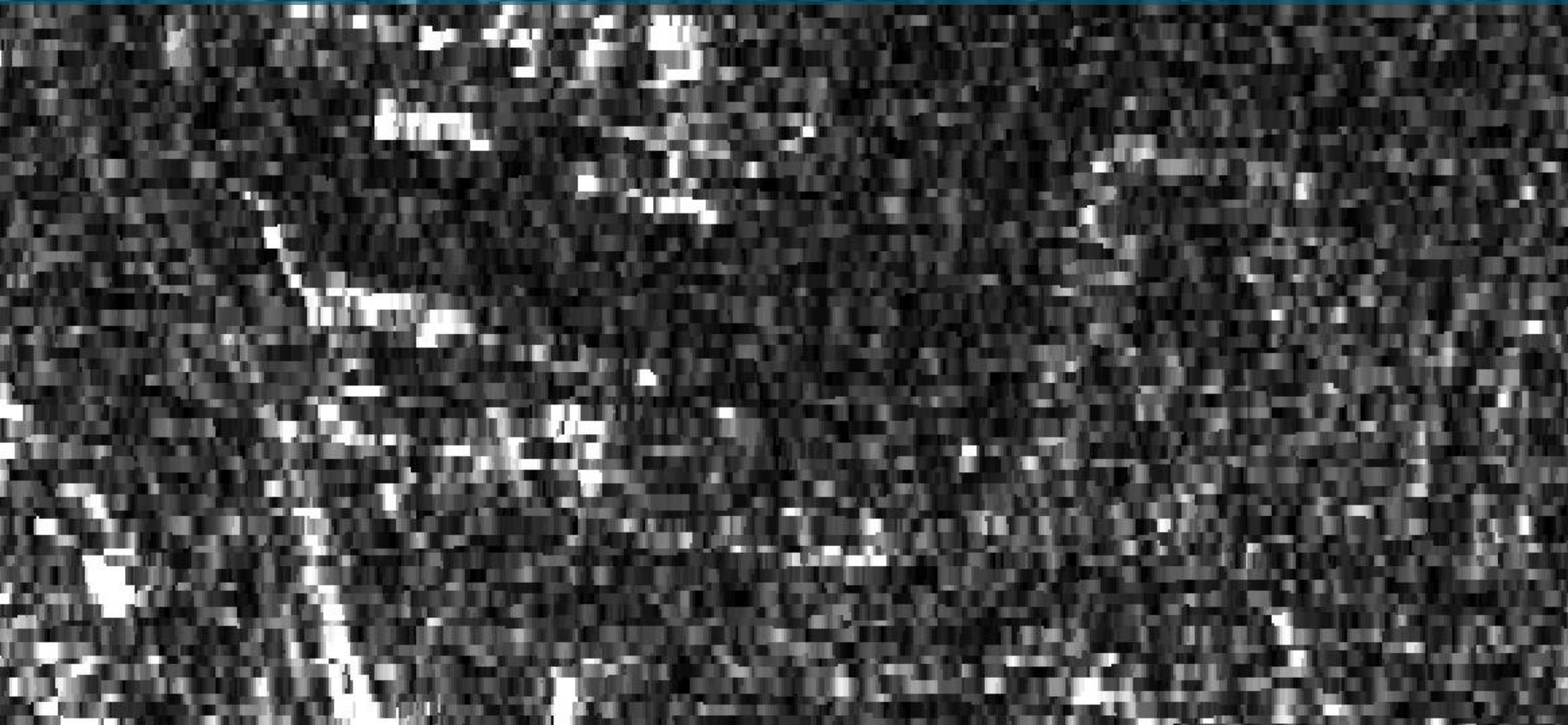
Optical image

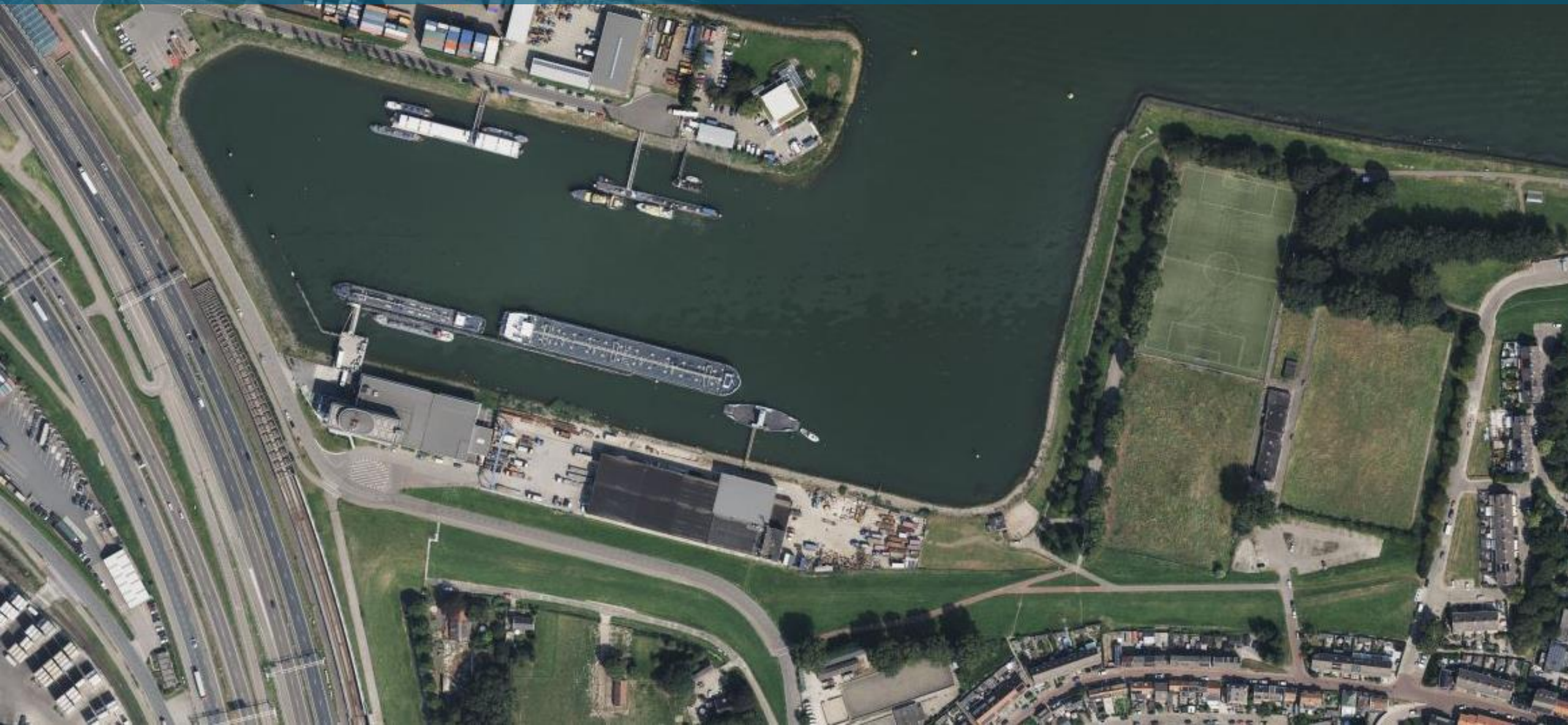
Synthetic Aperture Radar (SAR)

SENSAR

Speckle



Optical image

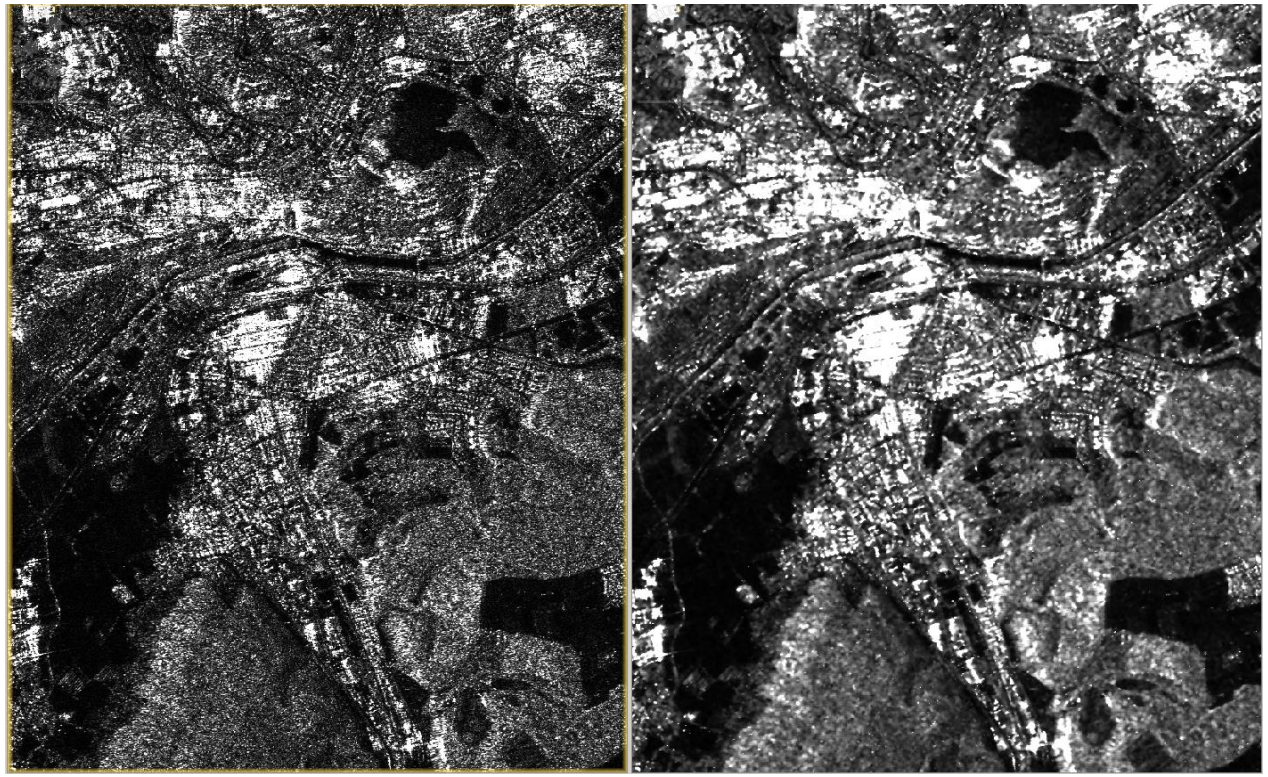


Despeckling – Traditional methods

- Limitations
  - **Resolution loss**
  - **Parameterization**

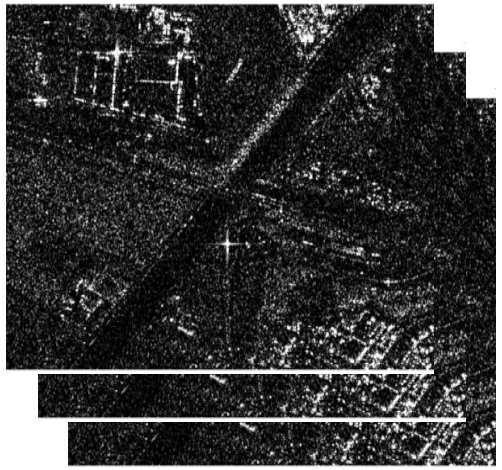
Speckled amplitude

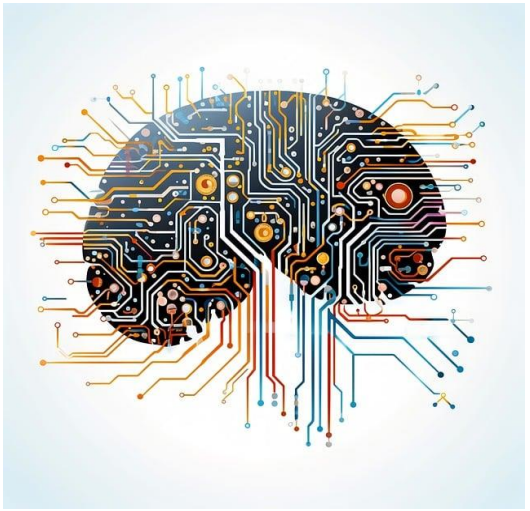
Lee Sigma



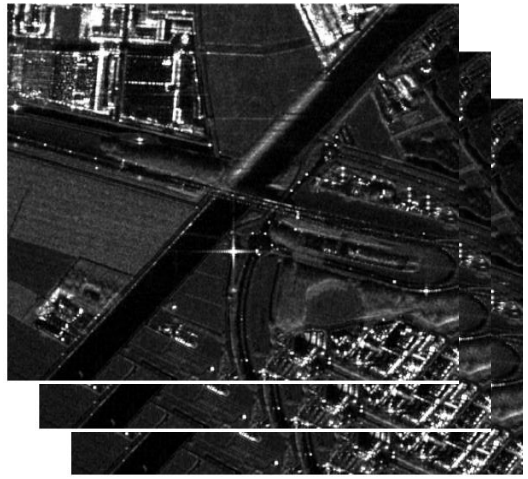
Despeckling – Deep Learning

Input: **speckled**





Target: **despeckled**



Require labels!

How will we deal with labels then?

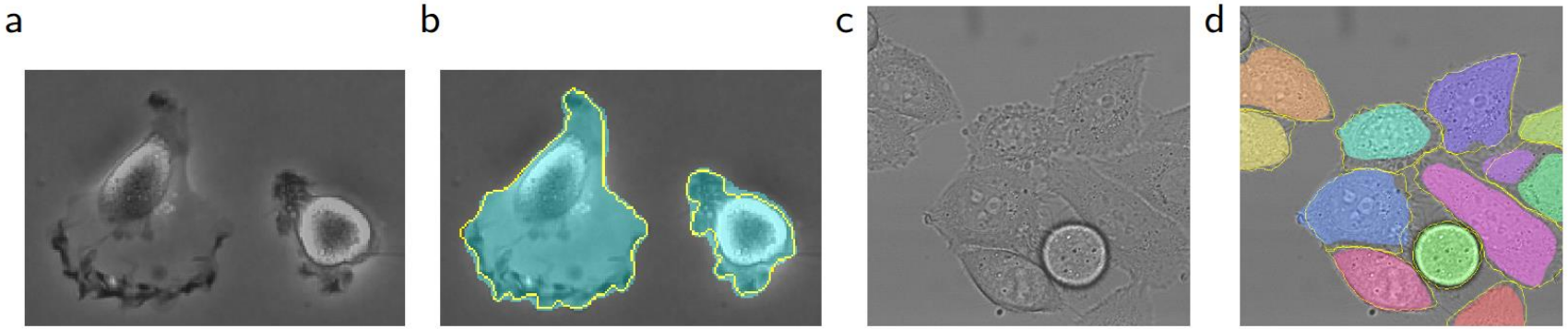
SENSAR

How will we deal with labels then?

We won't!

U-Net

- **Convolutional Neural Network**
- **Biomedical image segmentation**



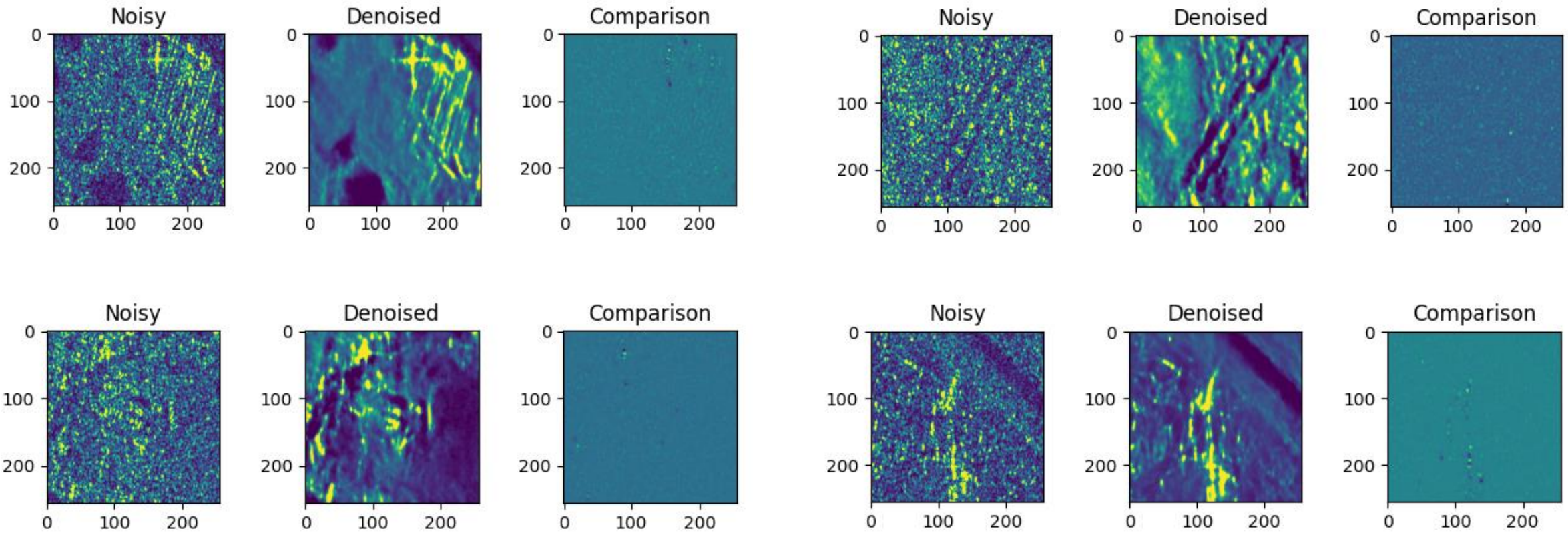
Segmentation results with U-net. Adapted from:

Olaf Ronneberger, Philipp Fischer, Thomas Brox, *U-Net: Convolutional Networks for Biomedical Image Segmentation* arXiv:1505.04597 18 May, 2015

Speckled input

AI4DSpeckle output

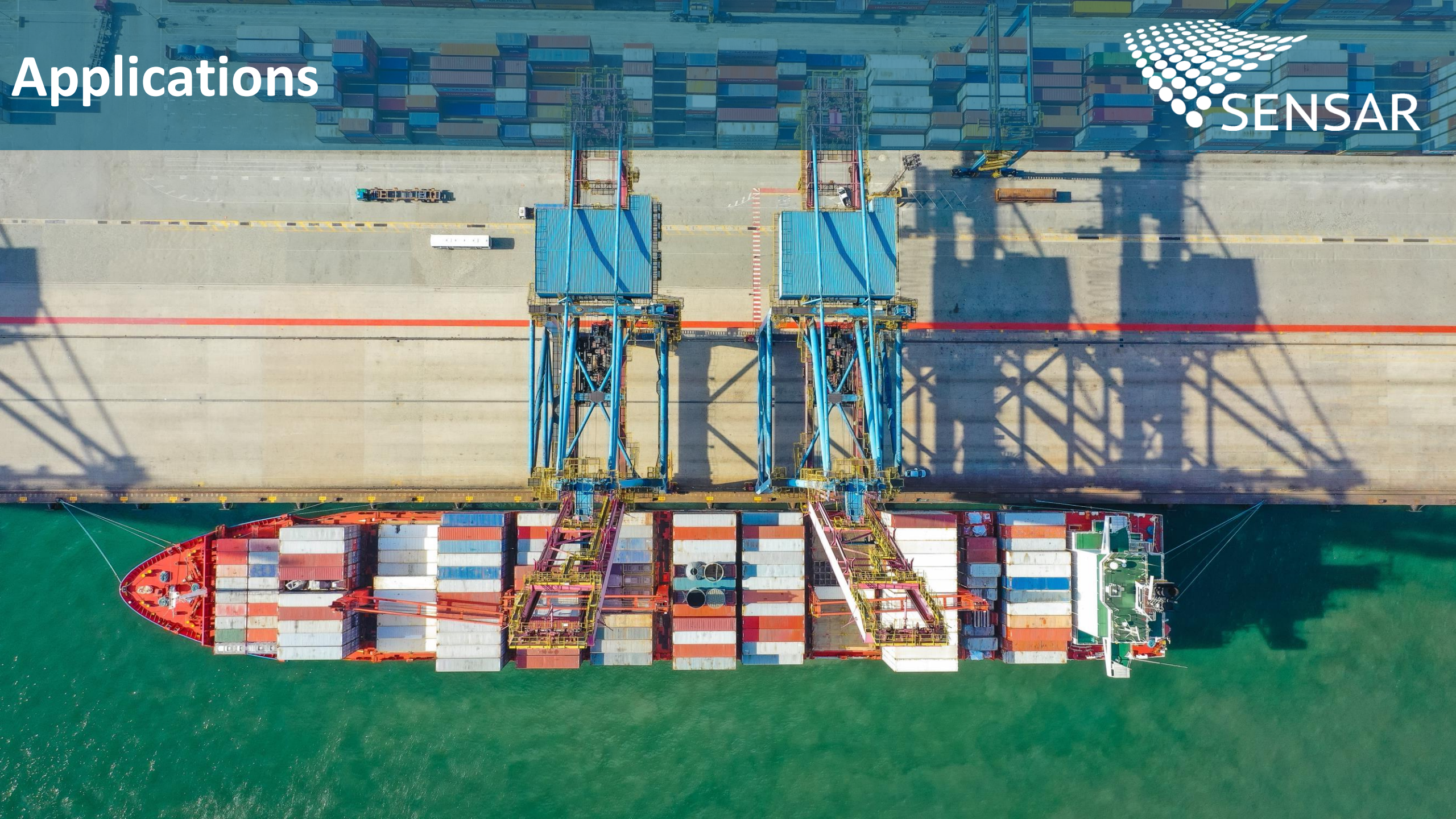
Some results in detail



Comparison against Lee Sigma

Satellite	Raw image [dB]	Lee Sigma [dB]	AI4DSpeckle [dB]
Sentinel-1	33.0	7.12	**7.01**
RadarSAT-2 XF	0.081	0.032	**0.009**
TerraSAR-X SM	0.054	0.026	**0.013**

Applications



Idea:

- **Increasing coverage** on quay walls
- How: using **AI4DSpeckle** and **outlier removal methods**
- Tests on **areas of high activity**

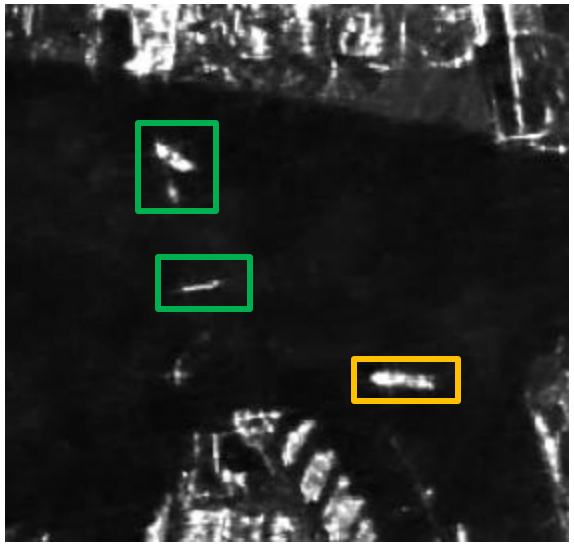
- Joint effort with the **Port of Rotterdam**

Port of Rotterdam by **Dkvtig**, **19 April 2023.** https://commons.wikimedia.org/wiki/File:Haven_van_Rotterdam_2023_(06).jpg

Results

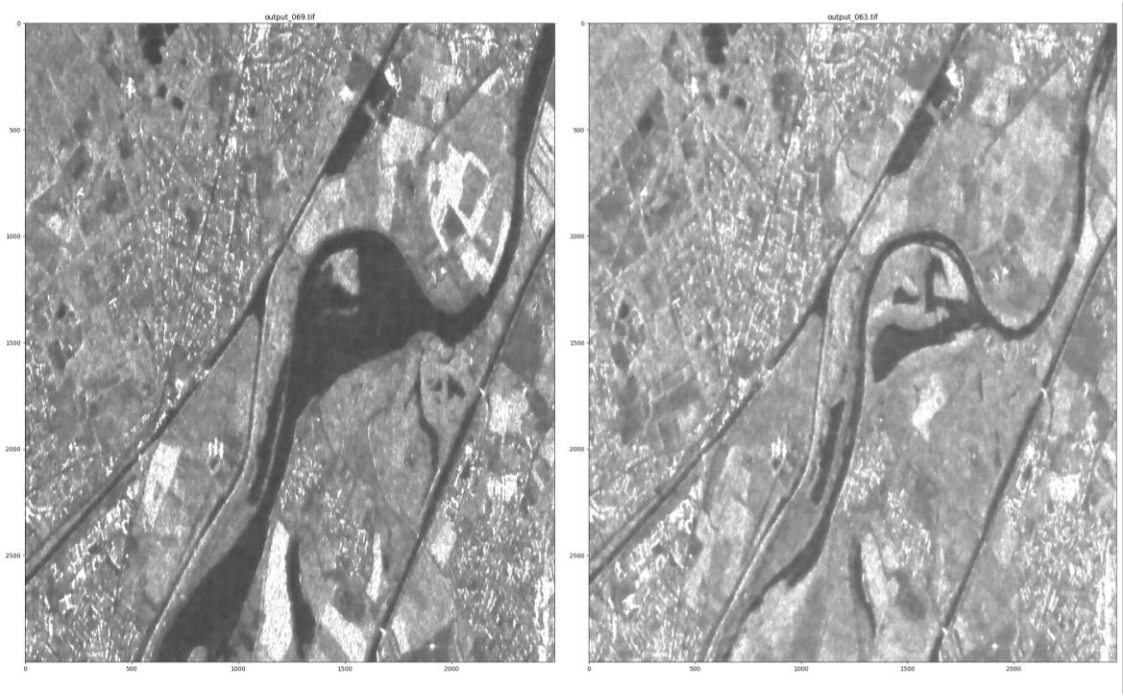
- Coverage improvement: **26%**
- **Without loss of quality**

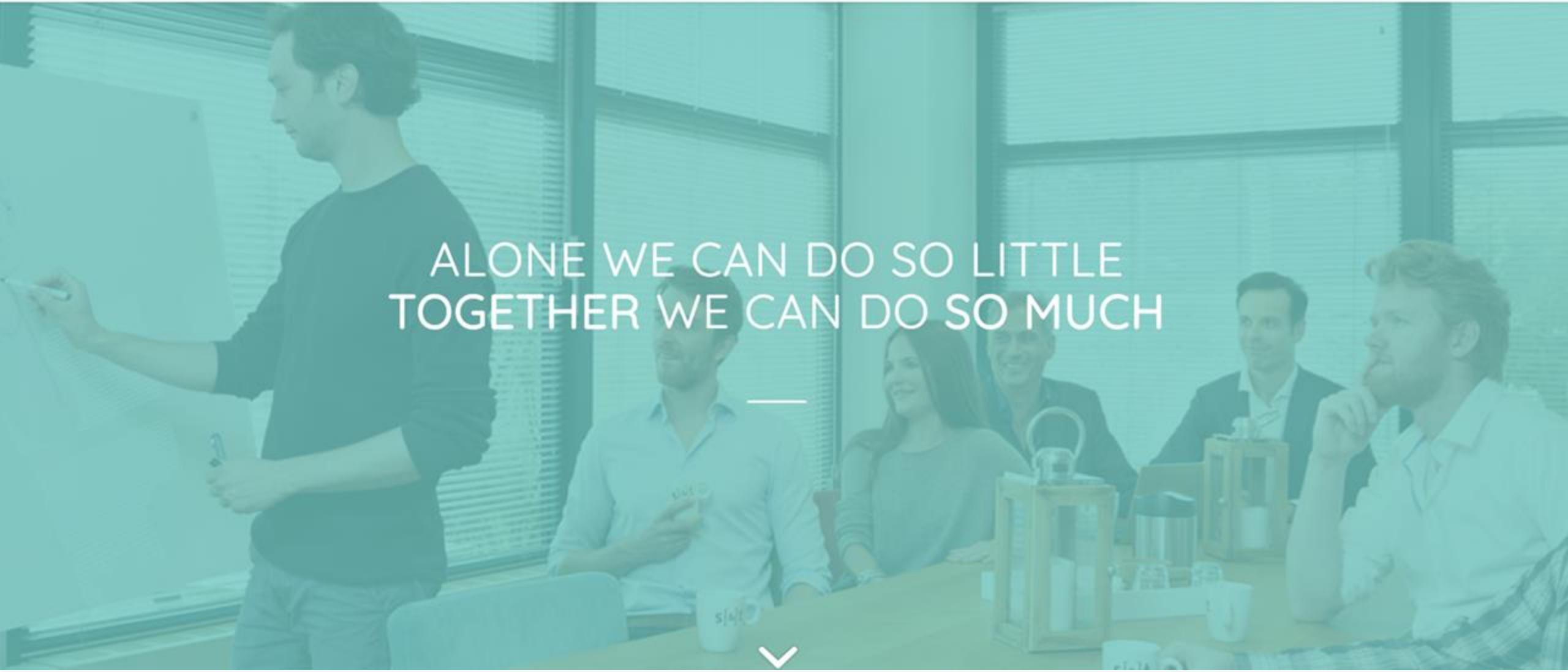
Other applications



Object identification

Monitoring of water bodies



New infrastructure

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