Deep learning for intertidal-flats mapping from remote sensing imagery

Spatiotemporal geomorphological mapping of intertidal areas is essential for understanding system dynamics and provides information for ecological conservation and management. Ecological quality of intertidal areas is important because of the European Water Framework Directive and as they are designated as Natura 2000 areas, which is the implementation of the European birds directive and the European habitat directive. Mapping the geomorphology of intertidal areas is a considerable challenge mainly because spectral differences are oftentimes relatively small while transitions between geomorphological units are oftentimes gradual. Also, the intertidal areas are highly dynamic. Surface water, saltmarsh, and tidal flats are relatively simple to distinguish but considerable challenges remain for distinguishing between different types of tidal flats, specifically, low and high dynamic shoal flats, sandy and silty low dynamic flats, and mega-ripple areas. The challenge is reflected in recent studies using rule-based OBIA (Object-based Image Analysis) methods to classify aerial imagery at 0.25 m resolution with spectral bands of red, blue, and NIR. In addition, monitoring and modelling the coastal tidal-flat dynamics over time is essential for coastal tidal-flat conservation and understanding, but has not been addressed.

In recent decades, deep convolutional neural networks, as a powerful representation learning method, have brought a breakthrough in information extraction from imagery. Predicting each pixel of images to a category is called segmentation. This study aims to apply and develop semantic segmentation neural networks to address challenges inter-tidal area classification. The results will also be compared with rule-based and tree-based OBIA methods.

Keywords: deep learning, classification, natural environment, remote sensing, coastal geomorphology