Automating Satellite-Based Ice Charting Using AI

Synthetic Aperture Radar (SAR) satellite images are used extensively for producing sea ice charts in support for Arctic navigation. However, due to ambiguities in the relationship between C-band SAR backscatter and ice conditions (different ice types and concentrations as well as different wind conditions have the same backscatter signature) the process of producing ice charts is done by manual interpretation of the satellite data. The process is labor intensive and time consuming, and thus, the amount of charts that are produced on a given day is limited.
Automatically generated high resolution sea ice maps have the potential to increase the use of satellite imagery in ice charting by providing more products and at shorter delays between acquisition and product availability.
In this work we explore data fusion and image segmentation techniques with Convolutional Neural Networks to produce per pixel predictions from Sentinel 1 (S1) SAR images and AMSR2 microwave radiometer measurements of Ice/water. The work is carried out under the Danish Automated Sea Ice Products (ASIP) project in a collaboration between the Danish Meteorological Institute and the Technical University of Denmark. The aim is automating a substantial part of the current manual process of providing artic marine users with ice information.
For the study a dataset of more than 900 ice charts and corresponding Sentinel-1 SAR imagery has been collected. The core of our algorithm consists of a Convolutional Neural Network that models image features at different scales by the use of dilated convolutional filters. The architecture of the algorithm further allows us to merge S1 images with AMSR2 measurements in a data fusion approach that exploits the best properties of each measurement. While the 40m pixel size in Sentinel-1 data enables extraction of ice information at an unprecedented high resolution, the AMSR2 measurements contributes with a high contrast between ice and water independent of wind conditions. Future studies in the project will investigate the importance of additional meta data in the ice prediction, such as weather information, sensor viewing angles, geographic location, etc.

AI4EO (3)

Tuesday, September 10, 2019

2:30 PM - 4:00 PM

Big Hall - Building 14

1. Oral Presentation preferred

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