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Discrimination of sea ice leads and floes using Deep Learning applied to Sentinel-3 Ocean and Land Colour Instrument (OLCI) imaging spectrometer

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The Sentinel-3A and Sentinel-3B satellites, launched in February 2016 and April 2018 respectively, build on the legacy of CryoSat-2 by providing high-resolution radar altimetry data over the polar regions up to 81 degrees North. The combination of synthetic aperture radar (SAR) mode altimetry from Sentinel-3A and Sentinel-3B, and the Ocean and Land Colour Instrument (OLCI) imaging spectrometer, results in the creation of the first satellite platform that offers coincident optical imagery and SAR radar altimetry. We utilise these datasets to validate existing surface classification algorithms, in addition to investigating novel applications of deep learning to classify sea-ice from leads. This is important for estimating sea-ice thickness and to predict future changes in the Arctic and Antarctic regions. In particular, we propose the use of Vision Transformers (ViT) for this task and demonstrate their effectiveness, with accuracy reaching above 92%. We compare our automated results with human classification using the software IRIS.