Applying deep learning for agricultural classification using multitemporal SAR Sentinel-1 for Camargue, France

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Paper 10789-39

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The development and improvement methods to map agricultural land cover is a timely challenge, especially for radar images. This is due to the speckle noise nature of radar, leading to a less intensive use of radar rather than optical images. Recently, the European Space Agency Sentinel-1 constellation is a satellite system providing the global coverage of Synthetic Aperture Radar (SAR) with a 6-days revisit period at a high spatial resolution about 20 m. These data are valuable aids in providing the spatial information of agricultural crops. The aim of this paper is to provide a better understanding of the capabilities of Sentinel-1 radar images for agricultural land cover mapping through the use of deep learning techniques. Analysis is carried out on a multitemporal Sentinel-1 data over an area around Camargue, France. This data set was processed in order to produce an intensity radar data stack from May 2017 to September 2017. We revealed that even with classical machine learning approaches K nearest neighbors, random forest, and support vector machine), the good performance classification could be achieved with F-measure/Accuracy greater than 94 % and Kappa coefficient better than 0.92. We found that the results of the two deep recurrent neural network (RNN)-based classifiers clearly outperformed the classical approaches. Finally, our analyses in Camargue show that the same performance of two RNN-based classifiers is on the Rice class, the most dominant practice of this region, with the F-measure metric of 99.5%. These results thus highlight that in the next future, these RNN-based techniques will play an important role in the analysis of remote sensing time series.