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Transfer Learning for LULC Classification on multi-modal data in the Amazon Basin

Maximilian Hell[1], Melanie Brandmeier[1], and Andreas Nüchter[2]
[1]Technical University of Applied Sciences Würzburg-Schweinfurt, Würzburg, Germany (maximilian.hell@fhws.de)
[2]Julius-Maximilians-Universität Würzburg

Mapping of Land use and land cover (LULC) changes over time requires automated processes and has been investigated using various machine learning algorithms and, more recently, deep learning models for semantic classification. New applications of these models to different satellite data and areas are regularly published. However, studies on the transfer of these models to other data and study areas are rather scarce. In a previous study [1], we used multi-modal and –temporal Sentinel data for LULC classification using traditional and novel deep learning models. The data covered parts of the Amazon basin and was comprised of a twelve-month time series of radar imagery (Sentinel-1), combined with a singular multi-spectral image (Sentinel-2). All satellite images were captured throughout the year 2018. The label map (Collection 4) of the Amazon produced by the MapBiomas project [2] was used as training and test labels. Besides state-of-the-art models, we developed five variations of a deep learning model—DeepForest—which leverages on the multi-temporal and -modal aspect of the data. The best model variation (DF1c) reached an overall accuracy of 74.4% on the test data.

Currently we are investigating the transferability of these models to more recent data of the same region. The new dataset was processed in the same way as in the previous study. It comprises a Sentinel-1 time-series and a single Sentinel-2 images from 2020, with an updated version of the label map of the MapBiomas project (Collection 6). This posed some challenges, as the classification scheme changed and is not fully backwards compatible with the one used to train the DeepForest models. A test dataset was chosen in the state of Mato Grosso, as the satellite scenes cover most classes used in the classification scheme. However, this data exhibits some class imbalance, as two of the eleven classes are dominating the scene. All five DeepForest variations reached accuracies higher than 79% and thus generalize well on the major LULC classes. For comparison and to further improve our models, we currently retrain the models on the new, larger data set (114,376 training image tiles compared to 18,074). Preliminary results will be shown during the session.

References

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