Deep Learning Techniques Applied to classification of Remote Sensing Images

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Remote Sensing (RS) techniques have become increasingly important in data-collection tasks and location-based services. Recent increased accessibility of new generation multispectral sensors has improved the complexity required in the analysis techniques. Produce efficient representations and understandings of the scenes has become a challenging problem. To improve knowledge representation and feature description, huge number of algorithms have been developed considering not only the local pixel information, but contextual information obtained from homogeneous regions in images (KÖRTING; GARCIA FONSECA; CÂMARA, 2013; WAçLTER, 2004). However, most approaches lack on learning efficient representations of the images, extracting only shallow features that cannot easily represent the details of complex real data (LECUN; BENGIO; HINTON, 2015; ZHANG; ZHANG; KUMAR, 2016). Deep Learning (DL) techniques, which can learn representative and discriminative features from data, has become a hotspot in the Machine Learning community. They are composed of multiple levels of feature extraction layers. Each level transforms the representation of the previous level into a higher, slightly more abstract model, mapping different levels of abstractions and combining them to model and explore intrinsic correlations of the data (Lecun et al., 2015). DL algorithms have recently started to be used by the RS community, being successfully used in several tasks, from pre-processing to classification. Despite the great potential of these techniques, many questions are still unknown for its use in RS applications. The large number of bands and the way to consider the spectral curves represent a great challenge. Only few labeled samples are available, leading to difficulties to train the network. Images acquired from different sensors or in different seasons have large differences among them, leading to problems to transfer the network knowledge between different images (ZHANG; ZHANG; KUMAR, 2016). The main goal of this work is to investigate the use of Deep Learning based approaches for classification of remote sensing images. We believe that designing an architecture to a Deep Neural Network considering the particularities and complexities of RS images, we can achieve good results for classification. With this approach, we expect to answer some opened questions about the use of DL in RS image

analysis, filling in some gaps in the image analysis. Therefore, the main question we aim to answer is "What is the best architecture to a Deep Neural Network to classify high resolution remote sensing Images?". A case study was developed in the classification of Land Cover in Brazilian Amazon, with main focus on the deforestation. To train the network and evaluate the results, PRODES deforestation data was used. It is important to emphasize that although this study is in a preliminary stage, the results are promising and reached improvements in the accuracy of the classification.

Deep Learning. Remote Sensing. Machine Learning. Image classification