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Using SOM neural network to improve land use and cover training samples from satellite image time series

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Land use and cover changes (LUCC) have caused a major impact on tropical ecosystems, increasing global greenhouse gases emissions and reducing the planet's biodiversity. The mapping and monitoring of these changes is essential for planning and managing natural resources. Technologies and methods of remote sensing and digital image processing play a crucial role in the identification, mapping, assessment and monitoring of LUCC.

Nowadays, with the big amount of Earth observation satellite images freely available with better temporal and spatial resolution than ever, image time series analysis brings new opportunities and challenges for LUCC mapping over large areas. The use of remote sensing image time series analysis to produce LUCC information has increased greatly in the recent years.

Most classification techniques to create LUCC maps from satellite image time series are based on supervised learning methods. Such methods require a training phase using land use and cover samples labeled a priori. These training samples must properly represent the land use and cover classes to be identified by the classifier. The quality of these samples is crucial in the classification process. Representative samples lead to good LUCC maps.

This abstract presents a method to evaluate and improve the quality of land use and cover training samples from Earth observation satellite image time series using Self-Organizing Map (SOM) neural network. SOM is a clustering method suitable for time series data sets. The method proposed in this abstract uses SOM to produce metrics that indicate the quality and separability of satellite image time series associated to land use and cover samples. This method explores two main feature of SOM: (1) the capacity of mapping high-dimensional input space to low-dimensional map space (two-dimensional grids); and (2) the topological preservation of neighborhood, which generates spatial clusters of similar patterns in the output space.

The proposed method was implemented and LUCC yearly maps, from 2001 to 2017, of the state of Mato Grosso, Brazil were generated using MODIS image time series. The results of this case study show the potential of the proposed method to improve the quality of the training samples and, consequently, the resulting LUCC maps.