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FUZZY CLASSIFICATION BY REGION OF SEGMENTED NOAA-AVHRR IMAGES AND MULTISOURCE DATA

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ABSTRACT

This work joins the assets of two different classification procedures for National Oceanic and Atmospheric Administration Advanced Very High Resolution Radiometer (NOAA AVHRR) data. The first procedure presented by Rodríguez Yi et al. (2000) was based on image segmentation following supervised classification by regions. Eight vegetation classes were identified using this procedure. A Kappa coefficient of 0.4 indicated that image segmentation associated to supervised classification by regions is a procedure that is useful for mapping vegetation classes on a regional scale. SPRING software was used to perform image segmentation and supervised classification using AVHRR channel 1 and 2 mosaics. Prior to image segmentation (region growing algorithm), the histograms of these channels were equalized to avoid a preference for a channel with large variance. The best segmentation treshold values for area and similarity were 2 and 25, respectively. Supervised classification by regions was based on the Bhattacharrya distance with a threshold of 95% for correct classification. Twelve Landsat images together with field information were used as ancillary data to support the training sample selection in the supervised classification procedure. The second procedure presented by Durieux et al. (2000) was based on fuzzy logic classification of multisource data and NOAA-AVHRR images. This methodology used jointly overlay operations, multiple criteria analysis methods and fuzzy procedure. Vegetation classification was based on the biogeographical analysis of relationships between geographical data and vegetation distribution associated to remote sensing information given by the spectral response of each vegetation type. Multi-source data were associated to expert knowledge using a fuzzy ponderation. Resulting maps described the potentiality of each vegetation class to be present in a pixel in relation with the considered criterion. Fusions of possibility distribution for each vegetation class were done using a new individualized method. Finally a maximum operator was used to discriminate vegetation class potentialities in the final integration. The main characteristics of this method were the use of possibility theory to handle imprecision due to pixel classification, and the ability to merge numerical sources (satellite image spectral bands, climatic map, DEM, soil map) and symbolic sources (expert knowledge about best localization of classes).

Nine vegetation classes were mapped: Woodland Savanna, Tree Savanna, Parkland Savanna, Dense Evergreen Forest, Open Evergreen Forest, Seasonal Forest, Transition OE, Transition SF, Transition T. This method showed limitation in correct vegetation classes discrimination (Kappa coefficient < 0.4) but globally respected the forest-savanna transition. Results are not significantly different from those of the first procedure while being much more reproducible, faster and cheaper.

Here the supervised classification by regions will be replaced by a simple classification by regions to limit ground data collection. Both procedures will be applied for vegetation classification of Mato Grosso state, Brazil The joint procedure will be applied to channel 1 (0.58 – 0.68 µm) and channel 2 (0.72 – 1.1 µm) AVHRR mosaics composed of images acquired between 13 and 26 june 1993 and multisource biogeographical data used for fuzzy classification including deforestation, soil and climate data as well as elevation information. All data are stored and processed using the GIS SPRING 3.4 developed by INPE (INPE, 2000). The results of the classification will be compared with the result obtained by the two original procedures independently and validated using an existing map of vegetation of Mato Grosso state (PRODEAGRO, 1997) using Kappa statistics. We are expecting that the results will benefit of the quality of NOAA_AVHRR segmentation by region and of the rapidity and low cost of the fuzzy procedure.

The high diversity of vegetation physiognomy encountered in Mato Grosso State is representative of the forest-savanna transition in Brazil. This joint methodology could be used for vegetation mapping of the entire South Amazonian arc of deforestation in association with existing deforestation data to provide an homogeneous vegetation database for this region.

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