A NEURAL APPROACH TO CLASSIFICATION OF SATELLITE IMAGES

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Abstract. This paper shows the results obtained using a traditional statistical method (Gaussian Maximum Likelihood) and Artificial Neural Networks (Back-Propagation and Cascade-Correlation) applied to multispectral Landsat Thematic Mapper data classification. The studied images cover a region situated in Rio Grande do Sul State - Brazil.

1 Introduction

Nowadays, we observe an increasing use of remotely sensed data, obtained through orbital and suborbital platforms, applied to the monitoring of natural resources and mapping of our planet. Among these different sources of remotely sensed data, satellites are specially distinguished, mainly due to easiness of data acquisition, low cost and suitable spatial and temporal resolution. However, we need to apply different pre-processing and classification processes in order to provide useful information to end-users. Many traditional image classification methods have been used with satellite data, such as Gaussian Maximum Likelihood [1], but these methods have drawbacks [2] and in several cases are inadequate to the user's needs of high accuracy on classification tasks required for a correct decision taking.

2 Classifiers and Experiments

The study area (Fig. 1) was classified using a multi-layer Back-propagation (BPNet) Artificial Neural Network, a Gaussian Maximum Likelihood method (GML) and a Cascade-Correlation algorithm provided by the NEUSIM Simulator [3]. For the two first classifiers it was used a pixel-by-pixel approach, and with NEUSIM, which is the main focus of this work, the following experiments were made: pixel-by-pixel (simple input) and 3x3 matrix (contextual input); using original data, rearranged data and Ten-Fold-Cross-Validation approach. Data samples were divided into 6 classes: Native Forest, Eucalyptus, Acacia, Soil, Pasture and Water, which can be found on the study area [4]. The training set was composed by 6 inputs representing each satellite frequency band (1,2,3,4,5 and 7) with values ranging from 0 to 255.

3 Final Considerations

The Cascade-Correlation results obtained using contextual input within the rearranged data and the Ten-Fold-Cross-Validation data, reached 68.7% and 84.8% of accuracy. These results show a significant improvement from previous work (GML and BPNet accuracy ranging from 51.7% to 58.9%) [4]. The above results suggest that learning was seriously influenced by the origin and content of databases. In future work we will study a new database construction method. We also plan to do new experiments aiming to compare the contextual approach applied here with the contextual classifier included on SPRING (Georeferenced Information Processing System) developed by the Brazilian National Institute for Space Research (INPE/MCT).

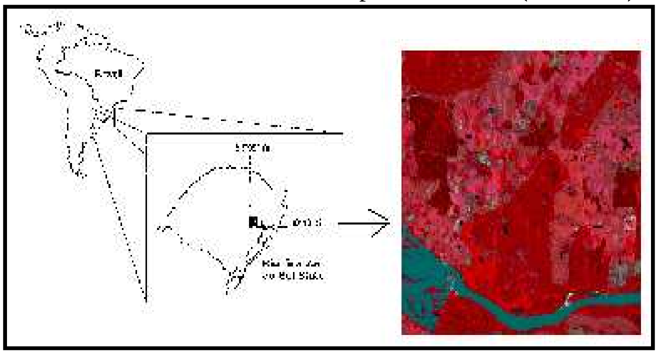

Figure 1 *Landsat* 5-TM image and localization of study area

4 References

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