Self-Organizing Maps to determine global distribution patterns of mangrove plant species and analysis of threats using socio-economic indicators

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Abstract

Commonly, the distribution of each mangrove species is shown by localizing them in a geographic map using coordinates and this information is not so much explored using socio-economic influences. Furthermore, it is difficult to visualize which species of mangroves have the same distribution on a global scale and how the socio-economic influences can affect the species with a restricted distribution. Therefore, we ask the following questions: Which species are more affected by human pressure? Which biogeographic regions are more threatened? Which human impacts are influencing the degradation of mangroves? In order to answer these questions, we used the technique of neural networks called Self-Organizing Maps (SOM), because it is an efficient tool for geovisualizing high-dimensional data. In addition, SOM approximate the probability density function of input data and it has been used as an alternative to traditional statistical methods to efficiently deal with datasets ruled by complex, non-linear relationships. The input data are the distribution of plant species that contain the presence/absence data for each country extracted from the Mangrove Reference Database and Herbarium (Massó i Alemán et al., 2010), which includes the World Atlas of Mangroves (Spalding et al., 2010) and many other distribution references from peer-reviewed literature, herbarium sheets and personal observations. We confronted this information on species distribution with socio-economic country indicators such as population density, mangrove degradation, coastal population size and density, etc. In conclusion, the novelty of this work was to use a global approach to analyzing mangrove distribution, analyze it using SOM, a method widely used by researches in several areas of science, but never by mangrove scientists, and explain mangrove degradation using socio-economic indicators.

Keywords
neural network, Kohonen map, geovisualization, high-dimensional data, change detection

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