SPATIAL PREDICTIVE MAPPING USING ARTIFICIAL NEURAL NETWORKS

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ABSTRACT:

Geo-related events or phenomena are usually based on complex and non-linear relationships between a wide variety of controlling factors. Therefore, artificial neural networks (ANN) are a powerful tool for interpretation and analysis of these relationships.
ANN`s are able to model not only sites with a high risk potential of the appearance of an event (e.g. landslides in a certain area) but also quantities (e.g. grades of contaminations in soils). The used approach is based on the ability of ANNs to learn from "examples" (e.g. known sites of landslides) and the subsequent transfer of this "knowledge" into a larger area with similar conditions.

In the past, the application of the technology in geo-science was difficult due to its low awareness level and difficulties to integrate it into geo-data processing algorithms. In this situation, the software advangeo® was created to provide a "normal" GIS user with a powerful tool to use ANNs for prediction mapping within their standard ESRI ArcGIS environment. Besides this, our approach provides useful data-processing and data-analysis tools that are adjusted to the solution of special problems: geo-hazards and mineral deposits. Among others there are algorithms for preparation of vector data, vector/raster data transformation, analysis of raster data and data processing reliability analysis.

In different case studies ANN's has shown their capabilities in modelling and prediction of a wide variety of geological, environmental and geo-economic issues:
- soil erosion processes,
- surface stability,
- mineral occurrences,
- soil contaminations,
- ground water chemistry and pollution,
- coal fires,
- forest pests,
- bird species distribution and frequency of the individual species and
- estimation of manganese nodule resources at the Pacific sea floor.

Generally, the application of the prediction software helps to add value to existing data especially in the fields of investment attraction and guidance, land use planning, geo-hazards analysis and prevention, agriculture and many others.

The article will briefly explain the theoretical background. In the main part, the functionality, workflow and usage of the developed software solution will be described. Finally, some different case studies including the used source data, the data processing and the modelling will be presented.

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