Analysis of geological features with artificial neural networks – methodology and examples

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Artificial neural networks (ANN) are used for analysing complex data sets for a long time. In the past, applications in geosciences met big difficulties because of the related spatial and temporal aspects, the complexity of relationships and the lack of easy to use application software. Since 2007, Beak has
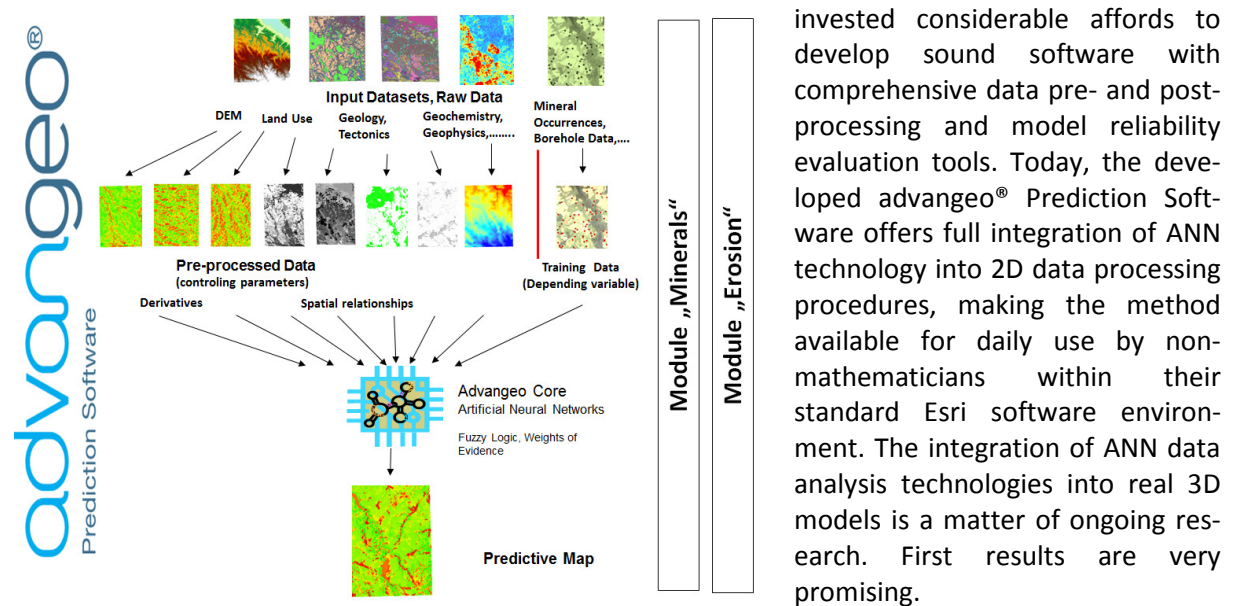

invested considerable affords to develop sound software with comprehensive data pre- and post-processing and model reliability evaluation tools. Today, the developed advangeo® Prediction Software offers full integration of ANN technology into 2D data processing procedures, making the method available for daily use by non-mathematicians within their standard Esri software environment. The integration of ANN data analysis technologies into real 3D models is a matter of ongoing research. First results are very promising.

Figure 1: Advangeo Prediction Software workflow

ANN have proven themselves as a valuable tool for analysing geological features with their complex and often not clear and un-sharp relationships and to understand the weighting of the many potentially influencing factors. With great accuracy, ANNs recognise dependencies between multiple controlling parameters and a dependent variable. ANNs are applicable for analysing quantitative and qualitative spatial as well as temporal relationships. They can be used for real 4D modelling, too. Successful application cases cover the fields of mineral resources estimation, 2D and 3D exploration targeting, geo-hazard predictive mapping, coal fire prediction, environmental and soil contamination, pest infestation and geological mapping.
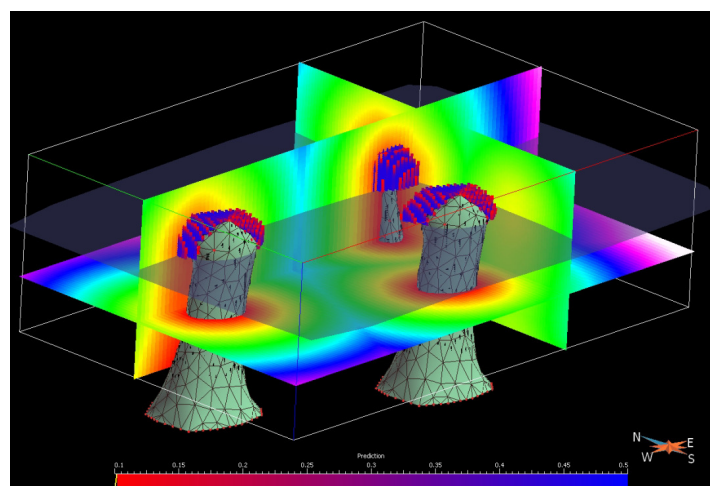

Figure 2: 3D mineral deposit predictive model

The paper discusses shortly the theoretical background of the approach, describes workflows, data pre-processing steps and result reliability evaluation procedures. Focus is made on practical applications and use cases: 2D and 4D geo-hazard predictive mapping, mineral resource estimation, 2D and 3D mineral exploration targeting, and environmental pollution predictive mapping.