PREDICTION MODELS FOR SPATIAL DATA ANALYSIS:
Application to landslide hazard mapping and mineral exploration

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Abstract

For the planning of future land use for economic activities, an essential component is the identification of the vulnerable areas for natural hazard and environmental impacts from the activities. Also, exploration for mineral and energy resources is carried out by a step by step approach. At each step, a selection of the target area for the next exploration strategy is made based on all the data harnessed from the previous steps. The uncertainty of the selected target area containing undiscovered resources is a critical factor for estimating the exploration risk. We have developed not only spatial prediction models based on adapted artificial intelligence techniques to predict target and vulnerable areas but also validation techniques to estimate the uncertainties associated with the predictions. The prediction models will assist the scientists and decision-makers to make two critical decisions: (i) of the selections of the target or vulnerable areas, and (ii) of estimating the risks associated with the selections.

This presentation will provide an overview of spatial prediction models to identify target areas for natural resource exploration and areas vulnerable to natural hazard, and validation techniques to estimate the uncertainties associated with the predictions. It also covers a wide range of models and estimation procedures from simple to complex modern quantitative techniques. Although a firm theoretical motivation will be presented, the emphasis will be on practical applications and implementations. The talk will include many examples, covering both current scientific research topics as well as current case studies.

After a brief overview of motivation and background, the prediction models based on favourability function idea are presented. These include three mathematical frameworks for the models, estimation procedures, and visualisation of prediction results and cross-validation techniques. All of these can be adapted to many different topics, from the landslide hazard mappings and environmental impact studies to resource exploration. The presentation will cover data mining issues such as selection of input layers, classes and models using the cross-validation techniques. Software for these techniques will be illustrated.