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Soil pollution characterisation using Support Vector Machines: from monitoring network design to multiscale mapping

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The paper presents an overview of the applications of two basic algorithms of Statistical Learning Theory (SLT) - Support Vector Machines (SVM) and Support Vector Regression (SVR), for soil pollution characterisation. At present SLT and corresponding kernel based methods are the most influential machine learning algorithms in many fundamental and applied studies in the field of data mining. Recently SVM/SVR were successfully applied to analyse and to model geospatial data including pollution of soil, water and air environmental systems. SVM/SVR are robust nonlinear tools proving their efficiency in learning and modelling data in high dimensional spaces. The main attention of the current study is paid to two important topics: decision-oriented spatial sampling design (environmental monitoring networks optimisation) and to multiscale modelling of environmental phenomena variable at several geographical scales. Both problems are fundamental for the characterisation of soil pollution usually dealing with highly variable phenomena - from local variability in hot spots to regional trends. Spatial sampling design/redesign problem based on SVM solutions is a decision-oriented approach which can be used in order to 1) optimise monitoring resources; 2) improve the quality of mapping; and 3) reduce the uncertainty in pollution risk mapping. The real case studies consider soil pollution by heavy metals in different countries and radioactively contaminated territories after the Chernobyl accident. The feasibility of the development of on-line web-based environmental decision support systems by using proposed methodology and recent developments in GIS and remote

sensing technologies is discussed.