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Complex Environmental Data Modelling Using Adaptive General Regression Neural Networks

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The research deals with an adaptation and application of Adaptive General Regression Neural Networks (GRNN) to high dimensional environmental data. GRNN [1,2,3] are efficient modelling tools both for spatial and temporal data and are based on nonparametric kernel methods closely related to classical Nadaraya-Watson estimator. Adaptive GRNN, using anisotropic kernels, can be also applied for features selection tasks when working with high dimensional data [1,3]. In the present research Adaptive GRNN are used to study geospatial data predictability and relevant feature selection using both simulated and real data case studies. The original raw data were either three dimensional monthly precipitation data or monthly wind speeds embedded into 13 dimensional space constructed by geographical coordinates and geo-features calculated from digital elevation model. GRNN were applied in two different ways: 1) adaptive GRNN with the resulting list of features ordered according to their relevancy; and 2) adaptive GRNN applied to evaluate all possible models N [in case of wind fields N=(2^13 -1)=8191] and rank them according to the cross-validation error. In both cases training were carried out applying leave-one-out procedure. An important result of the study is that the set of the most relevant features depends on the month (strong seasonal effect) and year. The predictabilities of precipitation and wind field patterns, estimated using the cross-validation and testing errors of raw and shuffled data, were studied in detail. The results of both approaches were qualitatively and quantitatively compared. In conclusion, Adaptive GRNN with their ability to select features and efficient modelling of complex high dimensional data can be widely used in automatic/on-line mapping and as an integrated part of environmental decision support systems.

1. Kanevski M., Pozdnoukhov A., Timonin V. Machine Learning for Spatial Environmental Data. Theory, applications and software. EPFL Press. With a CD: data, software, guides. (2009).
2. Kanevski M. Spatial Predictions of Soil Contamination Using General Regression Neural Networks. Systems Research and Information Systems, Volume 8, number 4, 1999.
3. Robert S., Foresti L., Kanevski M. Spatial prediction of monthly wind speeds in complex terrain with adaptive general regression neural networks. International Journal of Climatology, 33 pp. 1793-1804, 2013.