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Neural network sieve bootstrap prediction intervals for hydrological time series

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When analyzing time series data, the estimation of forecast intervals, based on an observed sample path of the process, is a key issue. If the process is linear and the distribution of the error process is known, the methodology is well developed but, for departures from the true underlying distribution, the prediction intervals perform poorly. In this latter case several distribution free alternatives, based on the bootstrap and on the specification of finite dimensional linear models, have been discussed. More recently, an AR-Sieve bootstrap approach has been proposed with the interesting property of being model-free within the class of linear processes. The approach, which does not impose the choice of a particular model, is effective for linear and "weakly" nonlinear processes.

Unfortunately, hydrological time series are usually characterised by complex non-linear structures which cannot be easily modeled by the classical linear parametric approach.

In this framework, a new method to construct nonparametric prediction intervals for nonlinear time series hydrological data is proposed. The approach is in the spirit of the Sieve bootstrap but it uses the class of neural network models to approximate the original unknown nonlinear process. The novel procedure will be illustrated by an application to real data sets.