GMDH Structures in Time-series Modeling for Prediction

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Abstract

Inherently selective and inductive, the Group Method of Data Handling (GMDH) is extensively used in forecasting. Three types of modeling the process behind the observed time-series can be discerned: as purely deterministic (small-dimensional state-space presumed), stochastic (large-dimensional state-space presumed) and chaotic (presumption of a small-dimensional process that manifests characteristics of deterministic chaos). The focus will be on the latter two. When no appropriate state-space model of the process can be found, stochastic approach to modeling can be used. Fundamental stochastic linear models, the autoregressive (AR) and autoregressive moving average (ARMA) models will be addressed here and futher generalized as nonlinear models, with GMDH networks as nonlinearities. If a chaotic attractor underlying the observed time series is suspected, an effort can be made to reconstruct it in a small-dimensional state-space. The basics of chaos modeling will be addressed next, the Lyapunov exponent, time-delayed state-space embedding and methods for short-term prediction. Furthermore, a multi-output GMDH structure for state-space prediction as an alternative to commonly used averaging of nearest-neighbours in state-space will be suggested.