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Abstract

Identification and Control of Non-linear dynamical systems are challenging problems to the control engineers. The topic is equally relevant in communication, weather prediction, bio medical systems and even in social systems, where nonlinearity is an integral part of the system behavior. Most of the real world systems are nonlinear in nature and wide applications are there for nonlinear system identification/modeling. The basic approach in analyzing the nonlinear systems is to build a model from known behavior manifest in the form of system output. The problem of modeling boils down to computing a suitably parameterized model, representing the process. The parameters of the model are adjusted to optimize a performance function, based on error between the given process output and identified process/model output. While the linear system identification is well established with many classical approaches, most of those methods cannot be directly applied for nonlinear system identification.
The problem becomes more complex if the system is completely unknown but only the output time series is available. Blind recognition problem is the direct consequence of such a situation. The thesis concentrates on such problems. Capability of Artificial Neural Networks to approximate many nonlinear input-output maps makes it predominantly suitable for building a function for the identification of nonlinear systems, where only the time series is available. The literature is rich with a variety of algorithms to train the Neural Network model. A comprehensive study of the computation of the model parameters, using the different algorithms and the comparison among them to choose the best technique is still a demanding requirement from practical system designers, which is not available in a concise form in the literature.

The thesis is thus an attempt to develop and evaluate some of the well known algorithms and propose some new techniques, in the context of Blind recognition of nonlinear systems. It also attempts to establish the relative merits and demerits of the different approaches. Comprehensiveness is
achieved in utilizing the benefits of well known evaluation techniques from statistics. The study concludes by providing the results of implementation of the currently available and modified versions and newly introduced techniques for nonlinear blind system modeling followed by a comparison of their performance.

It is expected that, such comprehensive study and the comparison process can be of great relevance in many fields including chemical, electrical, biological, financial and weather data analysis. Further the results reported would be of immense help for practical system designers and analysts in selecting the most appropriate method based on the goodness of the model for the particular context.