

Abstract

Ph.D. THESIS

Cognitive Maps:

Methods and Algorithms for Time Series Modelling

on the Level of Concepts

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The thesis is devoted to Fuzzy Cognitive Maps, a concepts-based modelling framework suitable to represent complex phenomena. The purpose of the research underpinning this thesis was to investigate and supplement existing approach to time series modelling with Fuzzy Cognitive Maps with new methods. Theoretical part presents an overview of a broad range of techniques for time series modelling with Fuzzy Cognitive Maps. Several missing elements are pointed out and new solutions that expand knowledge about properties of modelling with this class of models are proposed. The theoretical study was coupled with empirical research and both served as a thorough demonstration of superior modelling properties of Fuzzy Cognitive Maps. The properties of time series representation for modelling with Fuzzy Cognitive Maps were investigated. A new representation, named history perspective, has been introduced and compared with dynamics perspective, an approach present in the literature. Secondly, it has been emphasised that Fuzzy Cognitive Map design strategy heavily influences modelling outcome and a new method for Fuzzy Cognitive Map design based on cluster validity indexes has been introduced. The discussion is complemented with critical remarks about drawbacks and limitations of this approach. The thesis is concluded with an outline of promising opportunities for further research on a class of models named Granular Cognitive Maps that generalise Fuzzy Cognitive Maps.