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A high order fuzzy time series forecasting model based on adaptive expectation and artificial neural networks

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Abstract

Many fuzzy time series approaches have been proposed in recent years. These methods include three main phases such as fuzzification, defining fuzzy relationships and, defuzzification. Aladag et al. [2] improved the forecasting accuracy by utilizing feed forward neural networks to determine fuzzy relationships in high order fuzzy time series. Another study for increasing forecasting accuracy was made by Cheng et al. [6]. In their study, they employ adaptive expectation model to adopt forecasts obtained from first order fuzzy time series forecasting model. In this study, we propose a novel high order fuzzy time series method in order to obtain more accurate forecasts. In the proposed method, fuzzy relationships are defined by feed forward neural networks and adaptive expectation model is used for adjusting forecasted values. Unlike the papers of Cheng et al. [6] and Liu et al. [14], forecast adjusting is done by using constraint optimization for weighted parameter. The proposed method is applied to the enrollments of the University of Alabama and the obtained forecasting results compared to those obtained from other approaches are available in the literature. As a result of comparison, it is clearly seen that the proposed method significantly increases the forecasting accuracy.

Key words: Adaptive expectation model; Feed forward neural networks; Forecasting; Fuzzy relations; Fuzzy time series

1. Introduction

In recent years, fuzzy time series approach introduced by Song and Chissom [16,17] has been used widely. In the literature, many studies have been made to improve forecasting accuracy in fuzzy time series model. Chen [4] proposed a method which is simpler than the method proposed by Song and Chissom [16,17] in forecasting fuzzy time series. The method proposed by Chen [4] does not include complex matrix operations in defining fuzzy relation. Huarng [11] pointed out that the interval length influences the forecasting performance and proposed two methods, which are based on the average and the distribution, for defining the length of interval. Egrioglu et al. [8] suggested a new approach which is based on the optimization of the interval length. Cheng et al. [6] introduced a method based on adaptive expectation model. In the method proposed by Cheng et al. [6], the forecasts obtained from the first order fuzzy time series model are adjusted by employing adaptive expectation model. Cheng et al. [6] and Liu et al. [14] introduced a method based on adaptive expectation model. In the methods proposed by Cheng et al. [6] and Liu et al. [14], the

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