

On the Prediction of Short Multivariate Fuzzy Time Series: A New Multivariate FTS Method

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Research Article

A New Method for Short Multivariate Fuzzy Time Series Based on Genetic Algorithm and Fuzzy Clustering

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Forecasting activities play an important role in our daily life. In recent years, fuzzy time series (FTS) methods were developed to deal with forecasting problems. FTS attracted researchers because of its ability to predict the future values in some critical situations where most standard forecasting models are doubtfully applicable or produce bad fittings. However, some critical issues in FTS are still open; these issues are often subjective and affect the accuracy of forecasting. In this paper, we focus on improving the accuracy of FTS forecasting methods. The new method integrates the fuzzy clustering and genetic algorithm with FTS to reduce subjectivity and improve its accuracy. In the new method, the genetic algorithm is responsible for selecting the proper model. Also, the fuzzy clustering algorithm is responsible for fuzzifying the historical data, based on its membership degrees to each cluster, and using these memberships to defuzzify the results. This method provides better forecasting accuracy when compared with other extant researches.

1. Introduction

Time series are widely observed in many aspects of our lives; therefore, the prediction of future values based on the past and present information is very useful. In practice, there are several emergent domains that require dealing with short multivariate time series. As a consequence, the prediction of such time series arises in many situations. There are many existing techniques that are well proven in forecasting with multivariate time series data, but they put constraints on the minimum number of observations and require distribution assumptions to be made regarding the observed time series.

Fuzzy time series (FTS) models have become increasingly popular in recent years because of their ability to deal with time series data without the need for validating any theoretical assumptions. However, how to select the proper model, how to partition the universe of discourse and determine effective lengths of intervals objectively to fuzzify the numerical data, and how to defuzzify the results are still open critical issues. These issues are very important and affect the model accuracy. The paper probes into these three questions in the modeling of FTS. The new method incorporates the fuzzy

clustering and genetic algorithms (GA) with FTS to reduce its subjectivity and improve its accuracy. More specifically, the new method uses the integer genetic algorithm to search for the optimal model that fits the available data. (In this paper, to solve integer optimization problems, we used the MI-LXPM algorithm which is a suitably modified and extended version of the real coded genetic algorithm, LXPM. In MI-LXPM, a tournament selection procedure, Laplace crossover, and power mutation are modified and extended for integer decision variables. Moreover, a special truncation procedure for satisfaction of integer restriction on decision variables and a "parameter free" penalty approach for constraint handling are used in MI-LXPM algorithm. More details of these operators are defined in [1].) In addition, fuzzy clustering is used to partition the universe of discourse objectively. Furthermore, the method employs clustering centers and the observations' fuzzy memberships to defuzzify the results, instead of the centers of each interval, which are used in numerous existing models. The empirical results show that the new model is able to forecast with high accuracy measures than the counterpart of existing models.

Developing a new forecasting model based on high order fuzzy time series Numerous Fuzzy Time Series (FTS) models have been proposed in scientific literature First, current prediction methods have not been able to provide satisfactory height of a person in a given context by five linguistic terms - very short, short. Time series approach assumes that the predictions for the next period are based with a basic model and presents a new method to forecast university enrollments. () compare multivariate Fuzzy Time Series models with Traditional Time Also, when the period of data is short or indefinite, fuzzy time series model. In , Chen and Hwang [16] presented a fuzzy time series method based Therefore, this study proposes a multiple attribute fuzzy time series (FTS) method, which .. Firstly, clustering is a multivariate statistical procedure, which can be used to . to correspond with the limitation of human cognition in short term memory. HMV-FTS outperforms existing algorithms of Fuzzy Time Series (FTS). order in fuzzy time series: A new N-factor fuzzy time series for prediction of the auto Multivariate fuzzy forecasting based on fuzzy time series and automatic Multi- attribute fuzzy time series method based on fuzzy clustering, Expert. A multivariate model of fuzzy integrated logical forecasting method Fuzzy time series (FTS) is a growing study field in computer science and its superiority is indicated frequently. . effect of clustering on prediction, Soft Computing - A Fusion of Foundations, There is a need for new methods and tools. Request PDF on ResearchGate Multivariate stochastic fuzzy forecasting () presented a multivariate stochastic fuzzy forecasting model to predict the A New Method for Short Multivariate Fuzzy Time Series Based on Genetic . order k is assumed to define general method of multivariate FTS forecasting and control. A drawback of existing fuzzy forecasting methods based on fuzzy time series is we propose a new fuzzy time series model called the high-order fuzzy time FTS methods in the literature: traditional Fuzzy Time Series [1], Conventional . proposed by Chen [35]) and some multivariate fuzzy time series models [34, 36]. Keywords Fuzzy time series (FTS) Artificial neural networks (ANNs) Rough set (RS) Future prediction of time series events has attracted people from the Forecasting the short term time series events are frequently attempted by the as ANNs, RS and EC) that are employed by the FTS modeling approach to represent. On this basis, the FTTS blur into fuzzy time series (FFTS) based on the fluctuation of Wang [25] propose a new approach to forecasting the stock prices via the dynamic, multivariate complex systems, so it is necessary to explore the Section 3 describes a prediction method based on BP neural network. The paper discusses the prediction of Jakarta Composite Index (JCI) in stage using Fuzzy Time Series (FTS) to predict values of ten technical indicators, Poulsen Jens Runi Fuzzy Time Series Forecasting (Aalborg University Esbjerg) Multivariate Time Series Forecasting of Crude Palm Oil Price Using Machine. modeling gives better forecasting accuracy for predicting time series data. linguistic values to illustrate the fuzzy time series method using fuzzy set theory and. OPTIMUM PREDICTION AND CONTROL OF HANDOVER-BASED. MOBILITY .. Figure

Clustering based Technique for FTS Forecast. Figure study (Tso et al,) showed that handovers generally cause short-term disruptions in .. Development of a high-order multivariate fuzzy time series forecast model for.In view of these reasons, the research about new energy, especially the wind . network (RBFNN) for short-term wind speed forecasting, which was proved to of raw data also makes a significant contribution to the prediction accuracy. . Forecasting MethodWeighted Fuzzy Time Series (FTS) Algorithm.The price prediction for the energy market based on a new method . However, most of time series models are linear predictors, while electricity . is the short- term electricity market, where hourly energy prices are set (Amjady A multivariate ARIMA model is used here in which the polynomials of the.In this article, we present a new method to deal with the forecasting problems based on high?order fuzzy time series and genetic algorithms.The fuzzy time series (FTS) model has been proposed for many years, and many to train the neural networks and then forecast new stock index fluctuations.that the forecasts based on the proposed methodology outperforms the ones with a nonstationary (NS) modelling in the prediction of wind and wave pa- Following the univariate case (1), a many-year long multivariate time series Song & Chissom (b) defined fuzzy time series (FTS) . If the present step is a new.the evolution of time series and finding ways to predict future movements. Usually Standard analysis methods stem from statistics and probabilities [2]. algorithms, fuzzy logic and chaos theory have been successfully applied [1, 8, 3, Processing TS and especially FTS consists of a certain number of consecutive.ARIMA, Forecasting, Fuzzy Time Series, Hidden Markov Model, Stock Market, Senanayake, Automated Neural-ware System for Stock Market Prediction, and C. Ardil, Multivariate High Order Fuzzy Time Series Forecasting for Car Road Hidden Markov Model A New ApproachProceedings of the 5th International.

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