ORIGINAL ARTICLE

Prediction of selected Indian stock using a partitioning–interpolation based ARIMA–GARCH model

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Abstract   Accurate long-term prediction of time series data (TSD) is a very useful research challenge in diversified fields. As financial TSD are highly volatile, multi-step prediction of financial TSD is a major research problem in TSD mining. The two challenges encountered are, maintaining high prediction accuracy and preserving the data trend across the forecast horizon. The linear traditional models such as autoregressive integrated moving average (ARIMA) and generalized autoregressive conditional heteroscedastic (GARCH) preserve data trend to some extent, at the cost of prediction accuracy. Non-linear models like ANN maintain prediction accuracy by sacrificing data trend. In this paper, a linear hybrid model, which maintains prediction accuracy while preserving data trend, is proposed. A quantitative reasoning analysis justifying the accuracy of proposed model is also presented. A moving-average (MA) filter based preprocessing, partitioning and interpolation (PI) technique are incorporated by the proposed model. Some existing models and the proposed model are applied on selected NSE India stock market data. Performance results show that for

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multi-step ahead prediction, the proposed model outperforms the others in terms of both prediction accuracy and preserving data trend.

1. Introduction

Financial TSD mining provides useful information for the investors, banks and insurance companies to channel their funds properly for better returns. This decision making is the primary motivation for prediction of financial TSD. Accurate multi-step ahead prediction of financial TSD becomes more difficult, as the financial TSD is highly volatile. If prediction is one-step ahead preserving data trend is irrelevant. However, as the forecast horizon increases, preserving data trend becomes significant. In either case, prediction accuracy should remain high. Hence, the two basic requirements for multi-step ahead prediction model are maintaining high prediction accuracy and preserving the data trend across the prediction horizon.

Traditional models like ARIMA, GARCH or ANN cannot meet both the requirements simultaneously. However, a hybrid model may provide scope for preserving data trend across the forecast horizon while maintaining good prediction accuracy, which motivates the research work of this paper. Most of the traditional models such as ARIMA, GARCH and ANN are applied for one-step ahead forecasting in many works of the literature, where prediction accuracy is of major concern. However, in the present paper, we target multi-step ahead prediction, which requires preserving data trend in addition to high prediction accuracy. Such a model should account for the nature of TSD at every stage in the model.

Rest of the paper is organized as follows. Section 2 presents a literature survey of different prediction models existing in the literature. The proposed PI based hybrid ARIMA–GARCH model is detailed in Section 3. A quantitative analysis of the proposed model is discussed in 4. The proposed and the traditional models are applied on selected NSE India data and the performance is compared in Section 6. The paper ends with conclusion in 7.

2. Related work

ARIMA models are popularized after Box and Jenkins, who developed a coherent, versatile three-stage iterative cycle for time series identification, estimation, and verification. This method is also known as the BoxJenkins approach [1]. In [2] quarterly automobile insurance paid claim costs are forecasted using econometric and ARIMA models. In [3] the performance of ARIMA model is compared with extended Wiener filtering for short term load forecasting in electric power