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Notice for the PhD Viva Voce Examination

Mr T Baskaran (Registration Number: 2090236), PhD Scholar at the School of Sciences, CHRIST (Deemed to be University), Bangalore Central Campus will defend his PhD thesis at the public viva-voce examination on Monday, 07 April 2025 at 11.00 am in Room No. 044, Ground Floor, R & D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis	:	**Hybrid Time Series Models with Interacted Lagged Variables**
Discipline	:	**Statistics**
External Examiner - I	:	**Dr Santosha Rathod** Senior Scientist ICAR - Indian Institute of Rice Research Rajendranagar Hyderabad - 500030, Telangana
External Examiner - II	:	**Dr B S Biradar** Senior Professor and Chairman Department of Studies in Statistics University of Mysore, Manasagangothri Mysuru - 570006, Karnataka
Supervisor	:	**Dr Nimitha John** Assistant professor Department of Statistics and Data Science School of Sciences CHRIST (Deemed to be University) Bengaluru - 560029, Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva-voce examination.

Registrar (Academics)

Place: Bengaluru
Date: 26 March 2025

ABSTRACT

Time series forecasting predicts the future trend based on historical data. This research introduces a new concept called Interacted Lagged Variables (ILVs) to address the limitation of neglecting potential interactions among lagged variables in traditional Autoregressive Integrated Moving Average (ARIMA) models and propels it forward by developing a distinctive model known as Interacted-ARIMA (INTARIMA). The new approach captures interactions among lagged variables and integrates into the traditional ARIMA approach. It promises to surpass the limitations of ARIMA and raise the precision and reliability of time series forecasting. While developing the INTARIMA model, the research proposes a methodology for identifying interactions among the lagged variables and including them in the model. With interactions, it defines the INTARIMA process and explores its characteristic properties such as mean, variance, autocovariance function, and autocorrelation function. The research also sheds light on the stationarity conditions and devises parameter estimation procedures. It further delves into the algorithm for forecasting using the proposed INTARIMA model. The validity and the superiority of the model in terms of forecast-accuracy is established through simulation and empirical analysis. Simulation studies also confirm the credibility of the expressions derived for the properties of the INTARIMA model and authenticate the parameter estimation procedures. A notable feature of the INTARIMA model is thatit seamlessly transforms itself into the traditional ARIMA model, when the interactions are absent in the process. All the properties also reduce to those of the ARIMA model in such cases.

The research further extends the scope and utility of the INTARIMA model by developing a hybrid model by amalgamating INTARIMA with Artificial Neural Network (ANN). The credibility of the hybrid model is demonstrated through empirical analysis of real-world datasets. The study also investigates the applicability of INTARIMA in resolving the problem of serial correlations among residuals in linear regression models. By identifying the appropriate INTARIMA structure, and making necessary adjustments to parameter estimates, the model significantly enhances the forecast-accuracy. This is demonstrated through simulation and real-world data analyses. Thus, the research introduces and validates interacted lagged variables through the INTARIMA model. It fills a critical gap in time series forecasting. The originality of the research lies in its conceptual contributions and practical applications, establishing a new approach for robust and improved time series forecasting. The INTARIMA model is notdomain specific and therefore, can be applied to the time series of any domain whenever the series has interactions.

Keywords: *Time series, Forecasting, ARIMA, Lagged variables, INTARIMA, Hybrid model, Serially correlated residuals*

Publications:

1. **Thangarajan, B.**, Nagaraja, M. S., & Dhandra, B. V. (2022, August). Exploring ARIMA Models with Interacted Lagged Variables for Forecasting. In International Conference on Recent Developments in Mathematics (pp. 735-745). Cham: Springer International Publishing.
2. **Thangarajan, B.**, Nagaraja, M. S., & Dhandra, B. V. (2022, August). A Novel HybridModel for Time Series Forecasting Using Artificial Neural Network and Autoregressive Integrated Moving Average Models. In International Conference on Recent Developments in Mathematics (pp. 747-754). Cham: Springer International Publishing.
3. **Baskaran, T.**, John, N., & Dhandra, B. V. (2023, June). Hybrid Model Using Interacted-ARIMA and ANN Models for Efficient Forecasting. In International Conference on Multi-disciplinary Trends in Artificial Intelligence (pp. 747-756). Cham: Springer Nature Switzerland.