A Collaborative Multiplicative Holt-Winters Forecasting Approach with Dynamic Fuzzy-Level Component

By: Kays, HME (Kays, H. M. Emrul)[1]; Karim, ANM (Karim, A. N. M.)[2]; Daud, MRC (Daud, Mohd Radzi C.)[1]; Varela, MLR (Varela, Maria L. R.)[3]; Putnik, GD (Putnik, Goran D.)[3]; Machado, J (Machado, Jose)[4]

View ResearcherID and ORCID

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Abstract

The adoption of forecasting approaches such as the multiplicative Holt-Winters (MHW) model is preferred in business, especially for the prediction of future events having seasonal and other causal variations. However, in the MHW model the initial values of the time-series parameters and smoothing constants are incorporated by a recursion process to estimate and update the level (L-T), growth rate (b(T)) and seasonal component (SNT). The current practice of integrating and/or determining the initial value of L-T is a stationary process, as it restricts the scope of adjustment with the progression of time and, thereby, the forecasting accuracy is compromised, while the periodic updating of L-T is avoided, presumably due to the computational complexity. To overcome this obstacle, a fuzzy logic-based prediction model is developed to evaluate L-T dynamically and to embed its value into the conventional MHW approach. The developed model is implemented in the MATLAB Fuzzy Logic Toolbox along with an optimal smoothing constant-seeking program. The new model, proposed as a collaborative approach, is tested with real-life data gathered from a local manufacturer and also for two industrial cases extracted from literature. In all cases, a significant improvement in forecasting accuracy is achieved.

Keywords

Author Keywords: collaborative forecasting; fuzzy logic-based model; level-prediction model; multiplicative Holt-Winters method; seasonal demand forecasting

KeyWords Plus: WEIGHTED MOVING AVERAGES; INFERENCE SYSTEM; TIME-SERIES; PREDICTION INTERVALS; DEMAND; MODELS; TREND; OPTIMIZATION; PARAMETERS; BEHAVIOR

Author Information

Reprint Address: Varela, MLR (reprint author)

Univ Minho, Sch Engn, Dept Prod & Syst, P-4800058 Guimaraes, Portugal.

Addresses:

[1] Int Islamic Univ Malaysia, Dept Mfg & Mat Engn, Jalan Gombak, Kuala Lumpur 53100, Malaysia

[2] Queensland Univ Technol, Fac Sci & Engn, 2 George St, Brisbane, Qld 4000, Australia

[3] Univ Minho, Sch Engn, Dept Prod & Syst, P-4800058 Guimaraes, Portugal

[4] Univ Minho, Sch Engn, Dept Mech Engn, P-4800058 Guimaraes, Portugal

E-mail Addresses: h.m.emrul.kays@gmail.com; anmustafizul.karim@qut.edu.au; mradzi@iium.edu.my; leonilde@dps.uminho.pt; putnikgd@dps.uminho.pt; jmachado@dem.uminho.pt

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