Time Series Decomposition: An Application to Dengue Data with Climatic Variables

06 Nov.
NSM03

A. M. C. H. Attanayake[1(*)], S. S. N. Perera[2], U. P. Liyanage[1]

[1]*Department of Statistics & Computer Science, Faculty of Science, University of Kelaniya, Sri Lanka,* [2]*Research & Development Centre for Mathematical Modelling, Faculty of Science, University of Colombo, Sri Lanka*

[(*)]Email: succ@kln.ac.lk

Time series decomposition is a method which employs the division of a series into seasonal, trend and random components. Additive decomposition is appropriate when variation around the trend does not vary with the level of the series whereas, multiplicative decomposition is applicable when it varies. This method was applied to dengue data with climatic variables to find the relationships of decomposed components of the mentioned series. This is particularly important because understanding relationships of decomposed components of these variables will lead to better modelling of dengue. Data consists of weekly reported dengue cases, weekly average rainfall, weekly average maximum temperature and weekly average minimum temperature in Colombo district from 2009 to 2017. The main hypothesis tested in the study is whether the seasonality in the dengue data can be explained by the seasonality of other climatic variables in the study. Alternatively, explanatory ability of the trend component and the random component of the dengue series by the same components of other climatic variables were investigated. A stepwise regression analysis was applied to model the relationships of components of the series. Results revealed that 57% of the variability in multiplicative seasonality and 53% additive seasonality of dengue series can be explained by multiplicative seasonal components of three climatic variables. Only 38% of the variability in the trend component of dengue series can explain by trend components of three climatic variables. The random component of dengue series represents poor fit with random components of three climatic variables and hence, may not be modelled with random components of three climatic variables. Ours study indicates that dengue incidence may not be predicted with sufficient accuracy only with trend and seasonality of climatic variables.

Keywords: Random, seasonal, stepwise regression, time series decomposition, trend