

A Fuzzy Linear Model Using Possibilistic Linear Regression with Least Squares Method: An Application to Dengue and Rainfall Data

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Fuzzy linear models deal with vague and imprecise phenomenon in order to represent better models. These type of models are especially suitable in modelling and predicting dengue disease as the disease associated with various unknown and uncontrollable factors. Further, modelling and predicting the dengue disease is important as it is one of the leading diseases in the world which reports higher number of deaths. This study focuses on modelling reported dengue cases in the Colombo district, Sri Lanka. Particularly, Possibilistic Linear Regression with Least Squares (PLRLS) Method was applied as the modelling procedure. This method was proposed by H. Lee and H. Tanaka in 1999 to deal with crisp inputs and fuzzy output. The rainfall as one of the leading climatic factors that associated with dengue disease included in the model as an independent variable. Data consists of weekly reported dengue cases and weekly average rainfall in the Colombo district from 46th week of 2009 to 12th week of 2015. 2009 to 2014 data were used for model development and rest of the data for model validation. Cross correlation analysis revealed that the rainfall with 10 lags was associated with the reported dengue cases. By considering dengue and rainfall data as crisp inputs, the upper approximation model and lower approximation model were obtained to reflect the fuzziness of the dengue count in the district. The developed coefficients of the fuzzy linear regression were in the form of non-symmetric triangular fuzzy numbers. The left and the right spreads of the central value determined the lower and upper boundary of the interval, respectively, where the corresponding degree of membership equals to 0. The predicted values from the fuzzy regression model and the actual values of the validation set were within the upper and lower approximation models which indicated the possibility of the dengue prediction through PLRLS method. The authors are in the process of testing additional fuzzy linear models by changing fuzzy input/output combinations with incorporating more independent variables.

Keywords: Dengue; Fuzzy Linear Model; Possibilistic Linear Regression with Least Squares Method

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