ABSTRACT

AN EXTENSION OF GEOGRAPHICALLY AND TEMPORALLY WEIGHTED REGRESSION
(Case Study: Dengue Fever Incidence in Surabaya)

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One of the problems associated with regression modeling on the spatial and temporal data is that parameter of the model is not the same for each location and/or time. Another problem is that modeling on the time series data usually results temporally correlated errors. In this study, three regression models have extended to solve the problems, those are: geographically weighted regression (GWR) with autocorrelation, temporally weighted regression (TWR) with autocorrelation, and geographically and temporally weighted regression (GTWR).

The purposes of this study are (1) to gain the parameter estimations of GWR, TWR, and GTWR models; (2) to get the statistic in testing the accuracy of the GWR, TWR, and GTWR models; (3) to analyze the spatial and/or temporal relationships between dengue fever incidence and climatic factors in Surabaya.

The result using weighted least squares shows that parameter estimation of GWR with autocorrelation is $\hat{\underset{\sim}{\beta}}(u_i, v_i) = (\mathbf{X}^T \mathbf{W}(u_i, v_i)_t \mathbf{X})^{-1} \mathbf{X}^T \mathbf{W}(u_i, v_i)_t \underset{\sim}{Y}$. The parameter estimation of TWR with autocorrelation is $\hat{\underset{\sim}{\beta}}(h_t) = (\mathbf{X}^T \mathbf{W}(h_t)_i \mathbf{X})^{-1} \mathbf{X}^T \mathbf{W}(h_t)_i \underset{\sim}{Y}$. The parameter estimation of GTWR model is $\hat{\underset{\sim}{\beta}}(u_i, v_i, h_t) = (\mathbf{X}^T \mathbf{W}(u_i, v_i, h_t) \mathbf{X})^{-1} \mathbf{X}^T \mathbf{W}(u_i, v_i, h_t) \underset{\sim}{Y}$.

The statistic for testing the goodness of fit of the GWR, TWR, and GTWR models is based on *F*-statistic by comparing its significance with global regression model. Meanwhile, the significance test for variation of each set of β_k parameters is based on F_k-statistic.

Dengue fever incidence in Surabaya has a correlation with relative humidity and minimum atmospheric pressure. The relationship between dengue fever incidence and relative humidity is spatially different, while the effect of minimum atmospheric pressure is constant for all study regions. The relationships between dengue fever incidence and both climatic factors are temporally different. Spatially and temporally, the relationships between dengue fever incidence and both climatic variables are non-stationary for each district and month.

Keywords: geographically and temporally weighted regression, dengue fever, Surabaya