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Predicting dengue fever cases using Time Series Model and Hidden Markov Model in Sri Lanka

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Dengue fever is one of Sri Lanka's most serious health problems, wreaking havoc on the country's social and economic infrastructure. Dengue fever is a mosquito-borne viral disease that has recently risen considerably. A few studies were conducted using time series analysis to investigate the dengue outbreak in Sri Lanka. It does not appear that the models' accuracy can be leveraged to produce more accurate forecasts. The objective of this study is to develop Markov and time series models for forecasting monthly dengue patients in Sri Lanka and identify the most suitable model. The findings of this study are critical for many stakeholders, including the medical community and policymakers, to allocate health resources and create prevention programs. According to the statistical analysis, the highest number of dengue cases were recorded in the western province. The highest number of dengue cases were recorded in July 2017 (41,121) when considering the data from 2010-January to 2021-August. By using the unit root test, the p-values for the Augmented-Dickey-Fuller *test* and Phillips-Perron test were 0.0189 and 0.008 respectively. Since p-values were less than 0.05, the time series was stationary. The number of dengue cases was predicted using the ARMA (1,1) model, which has the lowest AIC value. The Gaussian HMM was developed using Python's GaussianHMM function. Parameter values were obtained by changing the number of hidden states. For concealed states 4, 5, and 6, relevant performance measurements were taken. The most accurate model based on the data was obtained for five hidden states. Mean error, mean absolute error, and mean absolute percentage error of HMM were 6.21, 10.22 and 0.005016 respectively and these values were less than the values obtained from the time series model. As a consequence, the HMM model is more accurate and can be used to predict dengue cases in Sri Lanka.

Keywords: Dengue, Time Series Model, Hidden Markov Model

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