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Modeling Dengue Vector Population Using Remotely Sensed Data and Machine Learning

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Abstract

Mosquitoes are vectors of many human diseases. In particular, Aedes æqupti (Linnaeus) is the main vector for Chikungunya, Dengue, and Zika viruses in Latin America and it represents a global threat. Public health policies that aim at combating this vector require dependable and timely information, which is usually expensive to obtain with field campaigns. For this reason, several efforts have been done to use remote sensing due to its reduced cost. The present work includes the temporal modeling of the oviposition activity (measured weekly on 50 ovitraps in a north Argentinean city) of Aedes æqypti (Linnaeus), based on time series of data extracted from operational earth observation satellite images. We use are NDVI, NDWI, LST night, LST day and TRMM-GPM rain from 2012 to 2016 as predictive variables. In contrast to previous works which use linear models, we employ Machine Learning techniques using completely accessible open source toolkits. These models have the advantages of being non-parametric and capable of describing nonlinear relationships between variables. Specifically, in addition to two linear approaches, we assess a Support Vector Machine, an Artificial Neural Networks, a K-nearest neighbors and a Decision Tree Regressor. Considerations are made on parameter tuning and the validation and training approach. The results are compared to linear models used in previous works with similar data sets for generating temporal predictive models. These new tools perform better than linear approaches, in particular Nearest Neighbor Regression (KNNR) performs the best. These results provide better alterna-

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