An Integrated Framework for Simultaneous Classification and Regression of Time-Series Data

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Abstract

Zero-inflated time series data are commonly encountered in many applications, including climate and ecological modeling, disease monitoring, manufacturing defect detection, and traffic monitoring. Such data often leads to poor model fitting using standard regression methods because they tend to underestimate the frequency of zeros and the magnitude of non-zero values. We present an integrated framework that simultaneously performs classification and regression to accurately predict future values of a zero-inflated time series. A regression model is initially applied to predict the value of the time series. The regression output is then fed into a classification model to determine whether the predicted value should be adjusted to zero. Our regression and classification models are trained to optimize a joint objective function that considers both classification errors on the time series and regression errors on data points that have non-zero values. We demonstrate the effectiveness of our framework in the context of its application to a precipitation downscaling problem for climate impact assessment studies.