Simultaneous Prediction Intervals: An Application to Forecasting U.S. and Canadian Mortality

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Abstract

In recent years, there has been a new wave of work that is focused on the forecasting of uncertainty in mortality projections. Such work aims to forecast a range of possible outcomes along with associated probabilities, instead of a single prediction that will almost surely be wrong. Conventionally, isolated (pointwise) prediction intervals are used to quantify the uncertainty in future mortality rates and other demographic quantities such as life expectancy. A pointwise interval wreaks uncertainty in a variable at a single time point, but it does not account for any dynamic property of the time-series. As a result, in situations when the path or trajectory of future mortality rates is important, a band of pointwise intervals might lead to invalid inference. To improve the communication of uncertainty, a simultaneous prediction band may be used. The primary objective of this paper is to demonstrate how simultaneous prediction bands can be created for prevalent stochastic models. The illustrations in this paper are based on mortality data from the general populations of US and Canada.