Coverage Properties of Weibull Prediction Interval Procedures to Contain a Future Number of Failures

by

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ABSTRACT

Prediction intervals are needed to quantify prediction uncertainty in, for example, warranty prediction. Naïve prediction intervals (also known as intervals from the “plug-in method”) ignore the uncertainty in parameter estimates. Simulation-based calibration methods can be used to improve prediction interval coverage probabilities. This article evaluates the coverage probabilities for naive and calibrated prediction intervals for the number of future failures within a single sample, based on the failure-time information obtained before a censoring time. We have designed and conducted a simulation experiment over combinations of factors with levels covering the ranges that are commonly encountered in practical applications. Our results confirm that the prediction intervals obtained by the calibrated method are of superior coverage properties and suggest when the approximations will be adequate. The simulation also uncovered exceptional cases, caused by the discreteness of the number of failures being predicted.