Professor Tilmann Gneiting

Editor-in-Chief, Annals of Applied Statistics

Dear Professor Gneiting:

On behalf of myself and my co-authors, I would like to submit our paper “A Hierarchical Failure-Time Model for Observational Data Exhibiting Infant-Mortality and Wearout Failure Modes” for consideration for publication in the Annals of Applied Statistics.

This work began as a class project for Dr. Meeker’s course on Reliability. We found a publicly available data set with failure information on over 60 hard drive models. Only basic summary statistics had been computed on the data, so our initial goal was to model the lifetime distribution for each drive-model. The data were heavily censored and left-truncated so we used a likelihood-based approach with a parametric model. We chose to use a Weibull distribution and model the parameters hierarchically because there were not enough data to fit many of the drive-models independently. At the end of the semester, Dr. Meeker encouraged us to develop the project into a journal article because hierarchical modeling is an approach not widely implemented in the field of Reliability.

Careful evaluation of the results showed that the Weibull was inadequate for several drives, since there was evidence of infant mortality. Dr. Meeker suggested that we consider the Generalized Limited Failure Population (GLFP) model which can handle lifetime data with multiple failure modes. While more somewhat more difficult to work with, we found it not only provided a more realistic model for hard-drive lifetimes, but that our hierarchical approach enabled us to model lifetime using the GLFP even when the data for a particular drive-model were extremely limited.

I presented this work at JSM this past year and researchers from companies such as Gortex and Regeneron expressed strong interest in the model. Both companies have data that rarely fails making it difficult to fit realistic failure time models when to comparing lifetime distributions across products.

We hope that you and the reviewers like the paper. We will look forward to hearing from you at the completion of the review process.

Sincerely,