Nonparametric Estimation of the Cumulative Intensity Function for a Nonhomogeneous Poisson Process from Multiple Realizations with Nonoverlapping and Overlapping Intervals

Lawrence M. Leemis
Department of Mathematics
The College of William & Mary
Williamsburg, VA 23187-8795

Extended Abstract

A nonparametric technique for estimating the cumulative intensity function of a nonhomogeneous Poisson process (NHPP) from one or more realizations on nonoverlapping or overlapping intervals is presented and applied to data sets. This technique does not require any arbitrary parameters from the modeler, and the estimated cumulative intensity function can be used to generate a point process for simulation by inversion. The details associated with the estimation technique are given in [1].

The estimation procedure is based on the fact that the cumulative intensity function for an NHPP is the expected cumulative number of events. An asymptotically exact confidence interval for the cumulative intensity function is given, and verified by Monte Carlo simulation.

Three examples illustrate the use of the estimator. First, arrivals to a lunch wagon between 10:00 AM and 2:30 PM illustrate the effect of overlapping intervals and test the difference between the stated and actual coverage of the confidence interval for the cumulative intensity function. The second example examines a data set consisting of failure times for a group of 20 copy machines [2]. The final example considers a data set consisting of failure times of heat pump compressors located in five buildings [3].

Keywords
Input modeling, nonstationary stochastic processes, probability models, reliability.

Acknowledgements
The author gratefully acknowledges NSF support providing funding for an Educational Innovation Grant CDA9712718 “Undergraduate Modeling and Simulation Analysis.”

References