



Contribution ID: 8

Type: **not specified**

## Seasonal Warranty Prediction Based on Recurrent Event Data

*Wednesday, 30 September 2020 15:15 (45 minutes)*

Warranty return data from repairable systems, such as home appliances, lawn mowers, computers, and automobiles, result in recurrent event data. The non-homogeneous Poisson process (NHPP) model is used widely to describe such data. Seasonality in the repair frequencies and other variabilities, however, complicate the modeling of recurrent event data. Not much work has been done to address the seasonality, and this paper provides a general approach for the application of NHPP models with dynamic covariates to predict seasonal warranty returns. The methods presented here, however, can be applied to other applications that result in seasonal recurrent event data. A hierarchical clustering method is used to stratify the population into groups that are more homogeneous than the overall population. The stratification facilitates modeling the recurrent event data with both time-varying and time-constant covariates. We demonstrate and validate the models using warranty claims data for two different types of products. The results show that our approach provides important improvements in the predictive power of monthly events compared with models that do not take the seasonality and covariates into account. This talk is based on joint work with Qianqian Shan (Amazon) and Yili Hong (Virginia Tech).

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**Session Classification:** Awards and Challenges