Randomization and informed censoring for loss estimation

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Abstract

We consider the introduction of exogenous random variables into the loss modeling framework. The first aim is to show that such a setting can produce robust estimators in case of few or heterogeneous data, and in that case, the exogenous variables will be fully independent and regarded as a smoothing mechanism. The second aim is to incorporate expert information into maximum likelihood estimation through informed randomization. This mechanism allows incorporating expert guesses into a loss function even before any observation has been made, or when only partial information is present. The latter method has the potential to bridge statistical rigor with certain actuarial traditions, by casting both into the same framework and outputting a balanced result.

We provide conditions for recovering the asymptotic distribution of the presented estimators, generalizing Donsker-type results for the independent case, and M- and Z- estimator-type asymptotics for the informed case. We construct and analyze realistic scenarios under which insight can be drawn, and apply the methodology to real-life insurance loss data. Potential extensions and limitations are briefly discussed. The results are not limited to actuarial applications and may be used whenever exogeneous information requires to be taken into account in statistical analysis.

Keywords: Randomization, expert information, smoothed distributions, informed estimation.

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