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Statistical Modeling of Data Breaches and Its Application in Cyber Insurance

Abstract

Data breach incidents result in severe financial loss and reputational damage, which raises the importance of using insurance to manage cyber-related risks and protect industries exposed to such risks. Different from traditional loss distribution approach that treats claims frequency and severity separately and compound their fitted distributions by convolution, we study statistical models for records of data breaches due to cyber security incidents since 2005 collected by Privacy Rights Clearinghouse. Specifically, an ordinal response variable is introduced representing different ordered severity levels based on the number of records exposed due to data breaches. The corresponding spatial location and types of breach and organization are taken into consideration as continuous and nominal categorical explanatory variables. Ordered probit regression modeling techniques and Bayesian approach are adopted to investigate the relationship between these variables. Predictions and applications of the proposed model in cyber insurance are discussed.