Statistical learning techniques for insurance data in relation to new crises

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Scientific project

Over a fixed time period, an insurance company experiences a random number of claims called the *claim frequency*, and each claim requires the payment of a randomly sized compensation called the *claim severity*. The claim frequency is a counting random variable while the claim sizes form a sequence of non-negative random variables. For a sequence of time periods $s = 1, \dots, t$, we have the number of claims n_s and the claim sizes $\mathbf{u}_s := (u_{s,1}, u_{s,2}, \dots, u_{s,n_t})$.

We propose to study and compare novel modeling strategies to go beyond the classical settings that assume for instance (i) independency between the claim sizes and frequency, (ii) independency among the claim sizes, (iii) stationarity of the claim data over time, and (iv) independency between the lines of business. We believe that the classical assumptions need to be challenged, especially in the context of the current COVID19 crisis.

The successful PhD applicant will help in developping new inferential and model selection tools based on recent advances on

- Orthogonal projections of the probability distributions of the claim count and the claim amounts to provide non parametric estimates and compare the empirical distributions, see Goffard et al. [5], Goffard and Laub [4], and Doukhan et al. [2].

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- Approximate Bayesian Computations, see Sisson et al. [7], is a statistical learning technique that allows to handle sophisticated models for which the likelihood is not tractable and to circumvent incomplete or aggregated data situations see the 2020 actuarial science colloquium recorded session https://youtu.be/rLyI0Phc3O8.

- Minimum distance estimation and goodnesss of fit testing, based for instance on the Wasserstein distance, see Bernton et al. [1] or on a dissimilarity measure based on the Laplace transform, see Goffard et al. [3] or based on the coefficients of an orthogonal function expansion, see Milhaud et al. [6].

Keywords: ABC method; Bayesian choice; (Chaos) polynomials; Compound distribution; Goodness-of-fit test; Mixture of distributions; Non parametric inference; Parametric Inference

Position description

We are looking for a Master level (university or *Grande Ecole*) student in applied mathematics, statistics and probability with a strong appeal toward computational and coding optimization problems. The successful candidate will join the research team of the *Laboratoire de Sciences Actuarielles et Financières* hosted by l'*Institut de Sciences Financière et d'Assurance* which is a graduate school (Grande Ecole) specialized en actuarial and data science based in Lyon, France. The PhD candidate will have light teaching duty (student research project and sections (Travaux Dirigés) supervision). He will be offered the possibility to follow some courses at ISFA in order to get the french actuary diploma. The PhD candidate will have to learn how to write a scientific document in latex and how to collaborate using versioning softwares like git.

We require the PhD applicant to have

- coding skills in a statistical programming language such as R or Python

- professional proficiency in communicating in english

To apply please send a resume and a cover letter to both Pierre-Olivier Goffard (pierre-olivier.goffard@univ-lyon1.fr) and Denys Pommeret (denys.pommeret@univ-amu.fr).

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