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34  **Computing Semiparametric Bounds on the Expected Payments of Insurance Instruments via Column Generation**

   by Robert Howley, Robert H. Storer, Juan C. Vera, and Luis F. Zuluaga

   It has been recently shown that numerical semiparametric bounds on the expected payoff of financial or actuarial instruments can be computed using semidefinite programming. However, this approach has practical limitations. Here we use column generation, a classical optimization technique, to address these limitations. From column generation, it follows that practical univariate semiparametric bounds can be found by solving a series of linear programs. In addition to moment information, the column generation approach allows the inclusion of extra information about the random variable, for instance, unimodality and continuity, as well as the construction of corresponding worst/best-case distributions in a simple way.

51  **Rating Endorsements Using Generalized Linear Models**

   by Edward W. Frees and Gee Lee

   Insurance policies often contain optional insurance coverages known as endorsements. Because these additional coverages are typically inexpensive relative to primary coverages and data can be sparse (coverages are optional), rating of endorsements is often done in an ad hoc manner after a primary analysis has been conducted. This paper describes a study of the Wisconsin Local Government Property Insurance Fund where it is desirable to have a formal mechanism for rating endorsements. Our goal is to provide prediction algorithms that are transparent and that promote equity among policyholders by determining rates that reflect the appropriate level and amount of uncertainty of each risk. To accommodate potentially conflicting goals of data complexity and algorithmic transparency, we utilize shrinkage techniques to moderate the effects of endorsements with penalized likelihoods. We find that the rating algorithms using shrinkage techniques have a predictive accuracy that are comparable to unbiased generalized linear model techniques and provide relativities for endorsements that are consistent with sound economic, risk management, and actuarial practice.
An Empirical Investigation of the Value of Claim Closure Count Information to Loss Reserving by Greg Taylor and Jing Xu

The purpose of the present paper has been to test whether loss reserving models that rely on claim count data can produce better forecasts than the chain ladder model (which does not rely on counts); better in the sense of being subject to a lesser prediction error. The question at issue has been tested empirically by reference to the Meyers-Shi data set. Conclusions are drawn on the basis of the emerging numerical evidence. The chain ladder is seen as susceptible to forecast error when applied to a portfolio characterized by material changes over time in rates of claim closure. For this reason, emphasis has been placed here on the selection of such portfolios for testing. The chain ladder model is applied to a number of portfolios, and so are two other models, the Payments Per Claim Incurred (PPCI) and Payments Per Claim Finalized (PPCF), that rely on claim count data. The latter model in particular is intended to control for changes in claim closure rates. Each model is used to estimate loss reserve and the associated prediction error. A compelling narrative emerges. For the selected data sets, the success of the chain ladder is limited. Either PPCI or PPCF model produces, or both produce, at least equal performance, in terms of prediction error, 80% of the time, and positively superior performance two-thirds of the time. When the chain ladder produces the best performance of the three models, this appears to be accounted for by either erratic count data or rates of claim closure that show comparatively little variation over time.

Projection for Claims Triangles by Affine Age-to-Age Development by Thomas Müller

Actuaries have always had the impression that the chain-ladder reserving method applied to real data has some kind of “upward” bias. This bias will be explained by the newly reported claims (true IBNR) and taken into account with an additive part in the age-to-age development. The multiplicative part in the development is understood to be restricted to the changes in the already reported claims (IBNER, “incurred but not enough reserved”). Based on regression theory the reserve as well as error formulae are generalized from the purely multiplicative chain-ladder model to our considerably more stable “affine” models.

What Actuaries Should Know about Nonparametric Regression with Missing Data by Sam Efromovich

To predict one variable, called the response, given another variable, called the predictor, nonparametric regression solves this problem without any assumption about the relationship between these two random variables. Traditional data, used in nonparametric regression, is a sample from the two variables; that is, it is a matrix with two complete columns. In practical applications some observations in that matrix may be missed, and what can be done in this case is the subject of this paper. Three possible scenarios are considered. First, if the probability of missing an observation depends on its value, then no consistent estimation is possible. Second, if all predictors are available and the probability of missing the response depends on value of the predictor, then a nonparametric regression, based on complete cases, is optimal. Third, if all responses are available and the probability of missing the predictor depends on value of the response, then a special estimation procedure, based on all available observations, is optimal. The results are illustrated via examples, and possible extensions are discussed.
Moment-Based Approximation with Mixed Erlang Distributions

by Hélène Cossette, David Landriault, Etienne Marceau, and Khouzeima Moutanabbir

Moment-based approximations have been extensively analyzed over the years (see, e.g., Osogami and Harchol-Balter 2006 and references therein). A number of specific phase-type (and non phase-type) distributions have been considered to tackle the moment-matching problem (see, for instance, Johnson and Taaffe 1989). Motivated by the development of more flexible moment-based approximation methods, we develop and examine the use of finite mixture of Erlangs with a common rate parameter for the moment-matching problem. This is primarily motivated by Tijms (1994) who shows that this class of distributions can approximate any continuous positive distribution to an arbitrary level of accuracy, as well as the tractability of this class of distributions for various problems of interest in quantitative risk management. We consider separately situations where the rate parameter is either known or unknown. For the former case, a direct connection with a discrete moment-matching problem is established. A parallel to the s-convex stochastic order (e.g., Denuit et al. 1998) is also drawn. Numerical examples are considered throughout.
Hidden in Plain Sight: Unexpected Nuggets of Wisdom

At some point during the review and editing process, I have generally read each paper that appears in a new issue of *Variance*. Nevertheless, when I first receive that new issue, I enjoy thumbing through the pages and occasionally letting my eyes fall on random sentences or paragraphs. Sometimes, those isolated excerpts have little to do with the core idea, or *raison d’etre*, underlying the paper – but they nevertheless are frequently thought-provoking, causing my mind to wander through the universe of actuarial concepts and experiences.

The seven papers included in this issue are all excellent, and some of them should have great relevance to many readers, as you will see from the abstracts in the Table of Contents. But I thought it might be fun to share with you what turned up when I randomly dipped into each paper. These are in no way meant to be selective or authoritative excerpts – just thoughts on what one person found by pulling a largely arbitrary sentence out of each article…

A Comprehensive, Non-Aggregated, Stochastic Approach to Loss Development by Uri Korn:

“Combining frequency and severity information can often mask important patterns in the data, while separating them out usually yields better predictions.”

Modeling aggregate data versus modeling the individual components: we are all confronted regularly with this essential question, in numerous contexts.

Computing Semiparametric Bounds on the Expected Payments of Insurance Instruments via Column Generation by Robert Howley, Robert H. Storer, Juan C. Vera, and Luis F. Zuluaga:

“Many financial and insurance instruments protect against underlying losses for which it is difficult to make exact distributional assumptions.”

This is the very first (post-abstract) sentence of the paper. A truth that clearly and succinctly encapsulates a major challenge associated with actuarial work.

Rating Endorsements Using Generalized Linear Models by Edward W. Frees and Gee Lee:

“For the actuary who uses generalized linear model (GLM) techniques and is charged with developing an associated set of rates, how does one determine surcharges associated with endorsements?”
A very good question, and the kind of consideration that might not occur to many young actuaries unless they are specifically involved with the types of risks that commonly utilize insurance policy endorsements.

**An Empirical Investigation of the Value of Claim Closure Count Information to Loss Reserving** by Greg Taylor and Jing Xu:

“The evident question of relevance is whether any reduction in uncertainty in the claim payment model by conditioning on the count data is more than, or less than, offset by the additional uncertainty induced by the modelling and forecasting of the counts themselves.”

While referring to a specific issue in a particular context, this sentence alludes to an important and pervasive consideration in modeling with which actuaries are constantly confronted: the tradeoffs associated with including or excluding different elements, or with using or not using certain data or techniques.

**Projection for Claims Triangles** by Affine Age-to-Age Development by Thomas Müller:

“When applying rigorous and apparently objective mathematical methods in an economic setting, one should always keep in mind how much the corresponding results depend on the choice of models and of the parameters involved.”

Absolutely. Well said.

**What Actuaries Should Know about Nonparametric Regression with Missing Data** by Sam Efromovich:

“To predict one variable, called the response, given another variable, called the predictor, nonparametric regression solves this problem without any assumption about the relationship between these two random variables.”

Following immediately upon the previous two sentences, this one alludes to a possible statistical solution to the tradeoff between assuming or not assuming a certain parametric structure.

**Moment-Based Approximation with Mixed Erlang Distributions** by Hélène Cossette, David Landriault, Etienne Marceau, and Khouzeima Moutanabibir:

“Mixed Erlang distributions are known to yield analytic solutions to many risk management problems of interest.”

Sentences such as this one can lead practicing actuaries to important discoveries, causing us to read further and discover just which “problems” have been addressed, and whether they are similar or relevant to any of the actuarial issues we personally face.
What are the lessons from the above personal indulgence? I'd suggest the following takeaways regarding our professional CAS literature:

- **Value**: If even the most cursory reading of our papers can provoke contemplation, how much more valuable will be in-depth reading?
- **Relevance**: Even the most esoteric papers can provide some non-technical, thought-provoking nuggets.
- **Research**: Good research ideas can emerge from contemplating even simple and innocuous-looking statements buried within our literature.

Enjoy these papers and their hidden treasures!

Rick Gorvett, editor in chief, *Variance*
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