Perluasan Model Kredibilitas Buhlmann dalam Memprediksi Frekuensi Klaim Menggunakan Kerangka Generalized Linear Mixed Model : Extension of Buhlmann Credibility Model in Predicting Claim Frequency Using Generalized Linear Mixed Model

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Abstrak

Model kredibilitas mengestimasi frekuensi klaim tahun berikutnya dengan menggunakan data klaim masa lalu. Model kredibilitas Buhlmann dapat dinyatakan sebagai kasus khusus dari Linear Mixed Models (LMM) dengan asumsi banyak klaim dan random effect berdistribusi normal. Namun, banyak klaim lebih tepat dimodelkan dengan distribusi diskrit sehingga LMM perlu diperluas ke Generalized Linear Mixed Models (GLMM) yang dapat mencakup variabel respons mengikuti keluarga eksponensial. Pada tugas akhir ini, dikonstruksi model kredibilitas Buhlmann untuk frekuensi klaim yang diperluas berdasarkan kerangka GLMM dengan variabel respon berdistribusi Poisson dan binomial negatif. Parameter dari model kredibilitas Buhlmann yang diperluas berdasarkan kerangka GLMM diestimasi menggunakan metode numerik adaptive Gaussian quadrature. Data yang digunakan untuk penerapan model adalah data frekuensi klaim yang dibangkitkan dengan menggunakan software R. Pada akhir tulisan, performa model kredibilitas Buhlmann yang diperluas berdasarkan kerangka GLMM dibandingkan terhadap model kredibilitas Buhlmann menggunakan nilai Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) serta Mean Squared Prediction Error (MSPE). Berdasarkan kriteria model terbaik serta nilai MSPE, model kredibilitas Buhlmann yang diperluas berdasarkan kerangka GLMM memiliki performa yang lebih baik dibanding model kredibilitas Buhlmann dalam memprediksi frekuensi klaim.
.....The credibility model estimates claim frequency in the following year by using past claims data. Buhlmann credibility model can be expressed as a special case of Linear Mixed Model (LMM) assuming claim frequency and random effects are normally distributed. However, claim frequency is more precisely modelled with discrete distributions so that LMM needs to be extended to Generalized Linear Mixed Model (GLMM) which can include response variables following an exponential family. In this final project, extended Buhlmann credibility model is constructed for predicting claim frequency based on the Generalized Linear Mixed Model (GLMM) framework with response variables following Poisson distribution and negative binomial distribution. The parameters of the extended Buhlmann credibility model based on the GLMM framework were estimated using the adaptive Gaussian quadrature numerical method. The data used for application of the model is claim frequency data generated using R software. At the end of this paper, the performance of extended Buhlmann credibility model based on the GLMM framework is compared to Buhlmann credibility model using AIC (Akaike Information Criterion), BIC (Bayesian Information Criterion), and MSPE (Mean Squared Prediction Error) values. Based on the criteria of the best model and the MSPE value, the extended Buhlmann credibility model based on the GLMM framework has better performance than Buhlmann credibility model in predicting claim frequency.