

## Goal Programming Technique for Correcting Multicollinearity Problem in Multinomial Logistic Regression

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### Abstract

The multinomial logistic models are used to estimate a relationship between a polytomous (multi-category) response variable and a set of explanatory variables. These models usually suffer from multicollinearity problem that causes lack of prediction power, wider confidence intervals, and incorrect decisions for testing hypotheses for the regression parameters. In this paper, two methods (ridge regression and Stein estimators) are extended for correcting multicollinearity in multinomial logistic regression, and the multinomial logistic generalized ridge regression method is suggested accompanying with a goal programming model to determine the optimal values of ridge parameters. These optimal values achieve two objectives: 1) multinomial logistic generalized ridge regression estimates have smaller variances than the maximum likelihood estimates; 2) multinomial logistic generalized ridge regression estimates have minimum sum of squared residuals. Comparing results of applying these methods (multinomial logistic ridge regression, Stein estimators and generalized ridge regression) using a numerical example, show that the suggested method is superior to other methods in terms of a reduction in parameter estimates, its standard errors and in the mean squared errors of responses and mean absolute errors of responses.

**Key words:** Goal programming, multicollinearity, multinomial logistic regression, multinomial Stien estimates, multinomial ridge regression, optimization