A New Mathematical Programming Method for Generating Non-linear discriminant Functions

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Abstract

Discriminant functions for separating observations or objects of known group or class membership into specified groups based on the values of variables or attributes associated with each observation or object can be generated by mathematical programming (MP) discriminant analysis models. Most MP discriminant analysis models produce linear discriminant functions. Non-linear discriminant functions can be generated by MP methods by first transforming the variables, although only a limited number of transformations can be considered in practice. Linear discriminant functions that are non-linear functions of the original variables can be obtained by forming dichotomous categorical variables from the original variables. MP methods have been proposed for categorical variable formation, but as with traditional ad hoc methods, information is lost in forming categorical variables. Mixed integer programming (MIP) models for generating piecewise-linear discriminant functions have also been developed, but the size of problems to which these MIP models for piecewise-linear discriminant analysis can be applied is restricted by the binary variable requirements. In this paper a new MP model for generating non-linear functions is described and the performance of this new MP model is compared with statistical discriminant analysis and standard MP discriminant analysis models using a real problem and a number of simulated problem sets.