Application of Goal Programming in Linear Regression with Imprecise Data

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Abstract

Regression is a popular methodology for expressing the functional relationship between two or more related variables. The remarkable applicability of regression analysis makes this to one of the most useful techniques in many areas including: engineering, chemistry, biology, business, economics etc.

In our approach we suppose the given inputs are positive crisp numbers x_{ij} and observed responses are imprecise data which can be represented by trapezoidal fuzzy numbers $\tilde{y}_i = (y_{il}, y_{iu}, l_i, r_i), i = 1, 2, ..., n, j = 1, 2, ..., p$ where n is the number of observations and p is the number of independent variables.

The purpose of this presentation is to fit a linear relation, based on goal programming, to the given data as follows:

$$\tilde{Y} = \tilde{A}_0 + \tilde{A}_1 \ x_1 + \cdots + \tilde{A}_p \ x_p = \sum_{j=0}^{p} \tilde{A}_j \ x_j,$$

where $x_0 = 1$. In our method to estimate $\tilde{A}_j$, we try to determine the lower middle points, upper middle points, left spreads, and right spreads of the observed response $\tilde{y}_i$ as close as possible to those of the estimated response $\tilde{Y}_i = \sum_{j=0}^{p} \tilde{A}_j \ x_{ij}$, for each i.

The results of some numerical examples and simulation studies showed that the proposed approach is better than several previous methods, according to some criterion of goodness [2].

Keywords. goal programming, linear regression, imprecise data, trapezoidal fuzzy number.

References

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