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A Computational Method: Pre-emptive Goal Programming-A Review

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Abstract: In present scenario the modern world is progressively morecontingentwith computers and digital information and the blending of computer science with applied mathematics is calledComputational mathematics. it is use by many researchers in various field like in medical it use to predict the spread of disease and the long-term effects of immunization programs, engineers use it to develop automated control systems for cars, planes or industrial machinery. Businesses use it for strategic planning and many more. The Real World problems are multi-objectives rather than single-objective. Goal programming has been proven a valuable mathematical programming form in a number of venues. This paper presents a review and suggested Pre-emptive Goal Programming, Multiple Non-Linear Regression Model with Interaction effect.

Keywords: Pre-emptive Goal Programming; Multiple Regression; Least Square Method, TORA, SPSS

1. INTRODUCTION

Applied mathematics deals with the applications of mathematics in various fields. Pure math is a very precise that deals with many abstract math concepts. In general pure mathematics doesn't have as many applications as applied or computational mathematics. Computer science involves using computers to solve problems through the design and implementation of algorithms. Computational mathematics is a blend of all these. In other words Computational Mathematics is a hybrid program which is intersection of mathematics and computer science.

Many Computational models or mathematical models can be used to make predictions of the system's behavior under different conditions, particularly for those cases in which intuitive analytical solutions are not available.Computational Optimization and Applications covers a wide range of topics in optimization, including: large scale optimization, unconstrained optimization, constrained optimization, non-differentiable optimization, combinatorial optimization, stochastic optimization, multi-objective optimization, and network optimization. It also covers linear programming, complexity theory, automatic differentiation, approximations and error analysis, parametric programming and sensitivity analysis, management science and many more.

Many researchers were carried out with their research work and gave many significant conclusions. Arif S. Malik et al.[21] presented a new computational method for predicting the static cross-sectional thickness profile of rolled metal strip. Methods to model the strip profile and related flatness with improved efficiency and accuracy remain central for achieving high quality flat-rolled products. Zhang et al. [22] were proposed a computational method to identify MAs in ERVs. A divide and conquer technique was designed and applied to the conventional prediction model to acquire better results when dealing with gene sequences with various lengths. Initiation sites and termination sites were predicted separately and then combined according to their intervals.Jongkeun Lee et al. [23] were proposed a new CNV detection method, CNV_SS, which uses scale-space filtering. The scale-space filtering is evaluated by applying to the read coverage data the Gaussian convolution for various scales according to a given scaling parameter.

Many mathematical techniques deal for achieving the best possible outcomes of real world problems and prediction of uncertainties. In regression analysis multiple regression is used to predict or know the statistical dependence of one variable (dependent) on other variables (independent, may be in non linear form). Regression analysis is widely used predictive model in decision making in real world problems. It describes possible relationships between two or more variables. Legendre [2] and Gauss [5] published method of least squares which was most primitive form of regression. For the estimation of the regression parameters a number of methods are available. Weisberg, s. [13] include methods of minimizing the sum of absolute residuals, minimizing the maximum of absolute residuals and minimizing the sum of squares of residuals. Out of these methods least square methods is commonly used for minimizing the sum of squares of residuals popularly. Alp *et. al.* [17] explained that linear goal programming can be proposed as an alternative of the Least Square Method. Hassonpouret. al. [14] suggested a linear programming model which was based on goal programming for the estimation of the regression parameters. Saha [18] analyzed the school examination result (scores) of 1002 student by using the binary logistic regression model.

In regression analysis the magnitude of the effect of one independent variable on a dependent variable varies as a function of a second independent variable is also known as a moderation effect or interaction effect. Alken and West [1] analyzed moderation effect in regression analysis. Interaction effect was applied into various models by the researchers. Curran *et. al.* [6] applied interaction effect into hierarchical linear growth models.

Traditional mathematical programming models are based on the assumption that the decision making has a single objective. Often there are situation, where instead of posing a single objective, managers use multiple criteria in

decision-making. Thus, instead of setting only one objective, multiple goals may be set. An important technique that has been developed in 1960s to supplement linear programming is called goal programming. This technique is capable of handling decision problems involving multiple goals.
(Ijiri [10]; Lee [11]; Spronk [12]; Ignizio [9] and others) have been written many books on this topic over past years. This tool often represents a substantial improvement in the modeling and analysis of multi-objective problems (Charnes and Cooper [4]; Eiselt et al [7]; Ignizio [8]). Tamiz et. al. [15] presents the review of current literature on the branch of multi criteria decision making using goal programming. the goal programming model can create decision variable values (by minimizing deviation) that are the same as the beta values in some types of multiple re-gression models. Charnes et. al. [3] used goal programming in form of a constrained re-gression model that was first publication using GP. Machiel Kruger [16] proposed a goal programming approach to efficiently managing a bank's balance sheet while maximizing returns and at the same time taking into account the conflicting goals such as minimizing risk, subject to regulatory and managerial constraints.
Goal programming model is an important tool for studying various aspects in different areas and its extension to the findings. Sharma et. al. [19] [20], this paper suggested a Pre-emptive Goal Programming Multiple Non Linear Regression Model with two way Interaction Effect.

2. PRE-EMPTIVEGOAL PROGRAMMING

With 'm' goals, the general goal programming model may be stated as:

$$\text{Minimize } z = \sum_{i=1}^{m}\sum_{r=1}^{k} P_r\,(w_i^- d_i^- + w_i^+ d_i^+)$$

Subject to the goal constraints

$$\sum_{j=1}^{n} A_{ij}X_j + d_i^- - d_i^+ = b_i$$

Non-negativity constraint

$X_j \geq 0,$

$w_i^- \geq 0, \quad w_i^+ \geq 0,$

$d_i^- \geq 0, \quad d_i^+ \geq 0,$

Complementary constraints

$$d_i^- \times d_i^+ = 0$$

$i = 1,2,\dots,m \qquad r = 1,2,\dots,k \text{ and } j = 1,2,\dots,n$

The parameters w_i^- and w_i^+ represent weights to be assigned to the deviational variables d_i^- and d_i^+. These weights reflect the decision maker's preferences regarding the relative importance of each goal. These deviational variables d_i^- and d_i^+ represent underachievement and overachievement of goal respectively.
Since both underachievement and overachievement of goal cannot be achieved simultaneously, one or both of these deviational variables (d_i^- or d_i^+) be zero in the solution, i.e. $d_i^- \times d_i^+ = 0$.
In other words, at optimality, if one assumes a positive value in the solution, the other must be zero and vice versa. TheP_r , are the pre-emptive priorities assigned to the set of goals that are grouped together in the problem formulation. The "P" does not assume numerical value; they are simply a convenient way of indicating that one goal is more important than another. The A_{ij}, are constants attached to each decision variable X_j and theb_i, are the right-hand side values (i.e. goals) of each constraint, see, Jones and Tamiz [15].

3. SUGGESTED GOAL PROGRAMMING FORMULATION

Let Y_{iG} be the ith goal, d_i^+ be positive deviation from the ith goal and d_i^- be the negative deviation from the ith goal.

$$\text{Minimize } z = \sum_{i=1}^{m}\sum_{r=1}^{k} P_r\,(d_i^- + d_i^+)$$

Subject to:

$$a_0 + \sum_{j=1}^{n} a_j X_{1j} + d_1^- - d_1^+ = Y_{1G}$$

$$a_0 + \sum_{j=1}^{n} a_j X_{2j} + d_2^- - d_2^+ = Y_{2G}$$

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$$a_0 + \sum_{j=1}^{n} a_j X_{ij} + d_i^- - d_i^+ = Y_{iG}$$

Non-negativity constraint,

$X_{i1}, X_{i2}, \dots X_{ij} \geq 0,\ d_i^+ \geq 0,\ d_i^- \geq 0$

Complementary constraints

$d_i^+ \times d_i^- = 0 \qquad i = 1,2,\dots,m \quad j = 1, 2, \dots,n$

Where $a_0, a_1, a_2, \dots\dots a_j$ are the parameters to be estimated, decision variables $X_{i1}, X_{i2}, \dots X_{ij}$ respectively, excepta$_0$. Here $Y_{G1}Y_{G2}Y_{G3}\dots Y_{Gi}$.taken as dependent variable (n-goal) and $X_{i1}, X_{i2}, \dots X_{ij}$ are first, second and nth independent variable in linear form. Square of $X_{i1}, X_{i2}, \dots X_{ij}$ (nonlinear form) taken in linear form and product term of $X_{i1}, X_{i2}, \dots X_{ij}$ (representing interaction effect) taken in linear form respectively, TheP_r , are the pre-emptive priorities assigned to the set of goals. The "P" does not assume numerical value; they are simply a convenient way of indicating that one goal is more important than another.

P1>>>P2>>>P3>>>……>>>Pr

4. CONCLUSION

The pre-emptive goal programming pre-emptive suggested model provides the users with a better degree of estimates of the Multiple Non-Linear Regression parameters with two-way Interaction Effect. Various problems related to estimation in science and technologySolution may be obtained through presented goal programming modelby taking appropriate dependent and independent variables using various software packages like Microsoft Office Excel, SPSS and TORA or it may be programmed in various computer languages.

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