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Research Article

OPTIMIZATION ALGORITHM OF REFLECTIVE AND CONTRACTION VARIABLE FUNCTION

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ABSTRACT

Optimization technique is a mathematical approach to solve for the best solution to problem. It is a science designed to provide quantitative tools to help in decision making procedures. The Simplex method provides the optimum solution of the function. Linear programming being the most prominent optimization technique is applicable for the solution of real world problems in which the objective function and constraints appear as linear functions of the decision variables. The paper will discuss on the function optimization algorithm. There will be consider an n- dimensional space and use the operation equation of reflection, contraction and expansion.

INTRODUCTION

The computational procedure requires at most m non zero variables in the solution in the at any step. In case of less than m non zero variables at any stage of computations the degeneracy arises in LP problem. Operations Research has gained significance in applications like world-class Manufacturing systems (WCM), Lean production, Six-sigma quality management, Benchmarking, Just-in-time (JIT) inventory techniques. The growth of global markets and the resulting increase in competition have highlighted the need for Operation Research. One of the essential managerial skills is ability to allocate and utilize resources appropriately in the efforts of achieving the optimal performance efficiently. In some cases such as small-scale low complexity environment, decision based on intuition with minimal quantitative basis may be reasonably acceptable and practical in achieving the goal of the organization. (Agarwal & Subraminiam, May 2010)[1] described that managerial skills is ability to allocate and utilize resources appropriately in the efforts of achieving the optimal performance efficiently. In some cases such as small-scale low complexity environment, decision based on intuition with minimal quantitative basis may be reasonably acceptable and practical in achieving the goal of the organization. However, for a large-scale system, both quantitative and qualitative analyses are required to make the most economical decisions. (Sawik, 2005)[2] presented an integer programming approach to make a production scheduling in make to order environment with various due date related performance measures. (E.E & A, 2020)[3] presented a methodology for solving fully rough integer linear programming problems and found rough value optimal solutions and decision rough integer variables, where all parameters and decision variables in the constraints and the objective functions are rough intervals. In this process obtained N suggested solutions in order to enable the decision maker to take the best decision. Here got satisfactory solutions by lower approximation interval and upper approximations interval respectively. The results are in the form of intervals and the interval method does not ignore any part of solution area. It is thought that the rough intervals are useful new tools to tackle the uncertainty, vague and imprecise data in decision making problems. Also, a flowchart of the steps to solve the problem is provided for more clarification. (Jain & Saxena, 2017)[4] optimize (maximize) the profit of a pharma company (MASCOT HERBALS PVT. LTD. and ASHWINI HERBAL PHARMACY) in the area of manufacturing of O. Porosys Powder and minimize the cost of transportation of Cough syrup to transport from different plants of company situated at different location to different markets (customers) situated at different locations. In this method applied. linear programming technique to maximize profit and minimize transportation cost. (Bhavesh & Patel, 2017)[5] developed the buoyant matrix of met forming by the direct compression method by using mixture design as an optimize techniques. (Kumar, 2017)[6] attempted to get an insight about the various application of optimization techniques in business. It is a conceptual research based on various literatures available. Linear programming problem started in Military field, its vast application in portfolio management, fund allocation, product mix, advertising mix or media mix, resource allocations and many other areas made it one of the most popular decision making tool. (Velino & Gicev, Aug 2018)[7] solved

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optimization problems with constraints and used the simplex method f or finding a maximum o f an objective function. They used the "linprog" function in MatLab for problem solving.. Finally investigated the complexity of the method via variation of the computer time versus the number of control variables. (Cosmis & Leeno, 2012) [8] present some possible applications and use in Operations Research and Mathematical Programming. In particular, we will show how the use be beneficial in anti–cycling procedure for the well–known simplex method for solving Linear Programming Problems and in defining exact differentiable Penalty Functions in Nonlinear Programming. (Sharma & Kumar, 2020)[9] focus on the two strategies to take care of the TSP issue of a book shop. The TSP issue arrangement finds the ideal course which advances the course and cost. The client characterized work is associated with AMPL to take care of progressively muddled issue. This shows the better outcome between the both. The motivation behind the paper is to discover the figuring by AMPL programming and approach for ideal course. The AMPL writing computer programs is utilized for the arrangement of Linear and Non direct conditions. Right now we are examining the issue of book retailer who needs to visit the five urban areas to satisfy the interest. [5] developed the buoyant matrices of met forming by the direct compression method using mixture design as an optimization technique. The simplex Centroid design was practiced as an optimization technique by modifying the quantity of three elements simultaneously and holding back their total concentration constant. The Simplex method is the most popular and successful method for solving linear programs. The objective function of linear programming problem (LPP) involves in the maximization and minimization problem with the set of linear equalities and inequalities constraints. There are different methods to solve LPP, such as simplex, dual-simplex, Big-M and two phase method. (Hussain & oayyam, 2019) [10] presented solve LPP with new seven steps process by choosing "key element rule" which is still widely used and remains important in practice. We propose a new technique i.e. seven step process in LPP for the simplex, dual-simplex, Big-M and two phase methods to get the solution with complexity reduction. The complexity reduction is done by eliminating the number of elementary row transformation operation in simplex tableau of identity matrix. (Farhaousi, 2016)[11] studied water treatment operators with methods and practices that enable to attain the most effective use of the facility and in consequence optimize the cubic meter price of the treated water. This paper proposes a review on optimization of drinking water treatment process by analyzing all of the water treatment units and gives some solutions in order to maximize the water treatment performances without compromising the water quality standards. Some practical solutions and methods are performed in the water treatment plant located in the middle of Morocco.

A method is described for minimization of a function of n variables which depends on the comparison of function values at the (n+1) vertices of general simplex method. The paper will discussed about simplex method for function linear system optimization and estimate the extreme value with hessian matrix. The Hessian matrix is provide a estimation of the neighborhood of the minimum.

Consider the minimization of function of n variables without constraints $a_0, a_1, a_2 \ldots\ldots\ldots\ldots . a_n$ are (n+1) points in n-dimensional space. Here take $y_{h=miny_i}$. At each stage in the process p_h is replaced by a new point. There are used three operation :- reflection, contraction, and expansion.

If P^* is the reflection of $P_h = \ 1 + \alpha \ \ P^- - \alpha P_h$ ……..(1)

Where α is a positive constant, the reflection coefficient. Thus $P^*$is on line joining P_h and P^- as

$P^* P^- \ = \alpha[P_h P^-]$.

If y^* lies between y_h and y_l.

$P^{**} = \gamma P^* + \ \ 1 - \gamma \ P^-$ ……..(2)

Here γ is expansion coefficient . if on reflecting P to P^* we find that $y^* > y_i$ for all $i \neq$ ⍰ i.e that replacing P by P^* leaves y^* the maximum then we define P_h.

$P^{**} = \ \beta P_h + (1 - \beta)P^-$

The contraction coefficient β lies between 0 and 1 and is the ratio of the distance $(P^{**}P^-)$ to (PP^-). We accept P^{**} for P_h and restart, unless $y^{**} >$ min $y_{h,} y^*$ $i.e$ the contraction point is worse than the better of P_h and P^*.

The coefficient α, β, γ give the factor by which the volume of simplex is changed by the operations of reflection, contraction or expansion respectively. A final point concern the criterion used for reflecting the procedure. The success of criterion depends on the simplex not becoming too small in relation to the curvature of the surface until final minimum is reached. The reasoning behind the criterion is that in statistical problems where one is concerned with finding the minimum of a negative surface, the curvature near the minimum gives the information available on the unknown parameters.

One of the x_i must be non-negative in a minimization problem, then our method may be adapted in one of two ways. The scale of the x concerned can be transformed by using the logarithmic so that negative values are included. The programming table is below which may be used for find the function minimization.

Enter
Calculate initial $P_i and y_i$
Determine h, calculate P^-
From $P = \ \ 1 + \alpha \ \ \ P^-$
Calculate

Is $y^* < y_1$ $\rightarrow No$ $\rightarrow is\, y^* > y_i,\ i \neq h \rightarrow yes \rightarrow is\, y^* > y_h \rightarrow No$

$p^{**} = \ \ 1 + \gamma \ p^* - \gamma p^-$
Yes $replace\ P_h\ by\ P^*$
$is\, y^{**} < y_1$ $from\ P^{**} = \ \beta P_h + (1 - \beta)P^-$
$calculate\ y^{**}$ is $> y_h$ $\rightarrow$
yes
$replace\ p_h\ by\ p^{**}$
$replace\ p_h\ by\ p^{**}$ $(p_i + p_j)$/2

$Has\ maximum\ been\ reac⍰ed \rightarrow \ \ yes \rightarrow exit$

RESULT

Three function, all of which have been used before for testing minimization procedure were used to test method. The function all of which have a minimum of zero, were

1. Rosenbrock's parabolic valley
   $y = \ 100 \ x_2 - x_1^2 \ 2 + \ \ 1 - x_1 \ 2$ starting points $(-1{,}2{,}1)$

2. Powell's quartic function

$$y = x_1 + 10x_2{}^2 + 5\ x_3 - x_4{}^2 + \ x_2 - 2x_3{}^4 + 10\ x_1 - x_4{}^4 \quad staarting\ point\ \ 3, -1,0,1$$

3. Fletch and Powell helica

$$y = 100[x_3 - 10\theta(x_1 - x_2]^2 + [\ \overline{x_1{}^2 + x_2{}^2} - 1]^2 + x_3^2$$

$starting\ point$ $(-1,0,0)$

Given a function f : Rn → R the Fletcher-Powell-Davidon method belongs to a group of methods variously called quasi-Newton methods, matrix updating methods, or variable metric methods which attempt to locate a local minimum of f. The Fletcher-Powell-Davidon method is also refered to as the Davidon-Fletcher-Powell method or sometimes more simply as the Fletcher-Powell method. A difficulty encountered in testing the procedure was that the size and orientation of the initial. An initial trial with function used all combination of α, β, γ and initial length. The low value of $\alpha,\ and\ \beta$ provide slower convergence. The result which we get Powell's method cannot be compare. We used the same convergence criterion; smaller value of the criterion would be justifiable. Given a point x0 ∈ Rn, Newton-Raphson's method generates the search direction $d_o = H_o grad f(x_o)$, where $H(f(x_o)$is the Hessian of f at x0. The quasi-Newton methods avoid the need for calculating the Hessian directly and then inverting it by successively estimating the inverse of the Hessian using only the gradient, $grad f(x_{o)}$.

In general the quasi-Newton methods proceed as follows:

1. Initialization: Choose a point, x_o, which approximates the location of a local minimum. Set H0 = I, the identity matrix, and calculate $d_0 = H_o grad f(x_o)$.
2. Determine the Displacement Vector Δ xk: Given xk and dk, let λk be the value of λ which minimizes f (xk - λ dk). Then set Δ xk = λk dk.
3. Update the estimate for the location of a local minimum: Set xk+1 = xk + Δ xk.

Check if the stopping criterion is satisfied: The conventional stopping rules are Stop if || g || < ε for either the max-norm It has a global minimum the function is symmetric and the minimum is at the origin.

CONCLUSION

The paper found the algorithm to solve the optimization of function. In this paper discussed the three equation Rosenbrok's parabolic valley, Powell,s quartic function, fletch and powell hellica. A simple problem can be solved by all minimization methods is that of false convergence at a point other than minimum. This difficulty has been found in using Simplex method on a four – dimensional surface having a long curved valley wth extremely steep sides: along the valley bottom the function varies considerably compared with the accuracy to which the minimization function value is required.

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