www.youvaworld.com

Date : 21/06/2022 Page :

Topic :

Student Name: Vyankat shankar udase

College Name: Shrikrishna Mahavidyalaya, Gunjoti

Class: M. sc. second year

Project Name: Operation Research I I

Titel of the Project: Quadratic Programming

PRN Number: 2015015200600311

Seat Number: CTD401582

16/20

Head
Department of Mathematics,
Shrikrishna Mahavidyalaya, Gunjoti.
Tq.Omerga Dist.Osmanabad
(M.S.)-413606

Date : Page : 01

Topic : Quadratic programming

* Name: Vyankat Shankar Udase

Project name: Operation Research - II

Tital of the project: Quadratic programming

Quadratic programming is the process of solving certain mathematical optimization problems involving quadratic functions. specifically, one seeks to optimize a multivariate quadratic function subject to linear constraints on the variables. Quadratic programming is a type of nonlinear programming.

"programming" in this context refers to a formal procedure for solving mathematical problems. This usage dates on the 1940s and is not specifically tied to the more recent notion of "computer programming". To avoid confusion, some practitioners prefer the term "optimization" — e.g. "quadratic optimization."

problem formulation:

The quadratic programming problems with n variables and m constraints can be formulated as follow. Given.

- A real valued, n-dimensional vector C,
- An $n \times n$ dimensional real symmetric matrix Q,
- An $m \times n$- dimensional real matrix ~~A~~ A, and
- An m- dimensional real vector b,

The objective of quadratic programming is to find and n-dimensional vector x, that will

$$\text{minimize } \frac{1}{2} x^T Q x + C^T x$$

$$\text{subject to } Ax \le b,$$

Where x^T denotes the vector transpose of x, and the notation $Ax \leq b$ means that every entry of vector Ax is less than or equal to the corresponding entry of vector b (component-wise inequality).

Least squares

As a special case when Q is symmetric positive-definite, the cost function reduces to least squares:

$$\text{minimize } \frac{1}{2} \|Rx - d\|^2$$

$$\text{subject to } Ax \leq b,$$

Where $Q = R^T R$ follows from the Cholesky decomposition of Q and $c = -R^T d$.

Conversely, and such constrained least squares program can be equivalently framed as a QP, even for generic non-square R matrix.

Topic : Quadratic Programming

When minimizing a function f in the neighborhood of some references point x_0, Q is set to its Hessian matrix $H(f(x_0))$ and c is set to its gradient $\nabla f(x_0)$. A related programming problem, quadratically constrained quadratic programming, can be posed by adding quadratic constraints on the variables.

Solution methods

For general problems a variety of methods are commonly used, including

- interior point,
- active set,
- augmented Lagrangian,
- Conjugate gradient,
- gradient projection,
- extensions of the Simplex algorithm.

in the case in which Q is positive definite, the problem is a special cases of the more general field of convex optimization.

Equality constraints

Quadratic programming is particularly simple when Q is positive definite and there are only equality constraints; specifically the solution process is linear. By using Lagrange multipliers and seeking the extremum of the multipliers and seeking, Lagrangian, it may be readily shown that the solution to the equality constrained problem.

$$\text{minimize} \quad \frac{1}{2} x^T Q x + c^T x$$

$$\text{subject to} \quad Ex = d$$

is given by the linear system

$$\begin{bmatrix} Q & E^T \\ E & 0 \end{bmatrix} \begin{bmatrix} x \\ \lambda \end{bmatrix} = \begin{bmatrix} -c \\ d \end{bmatrix}$$