QR Preconditioner

Govind Chari

Univeristy of Washington

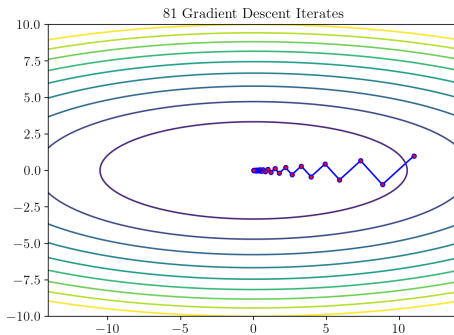May 2023

Preconditioning

Definition

Transforming a given problem into an equivalent problem that is more numerically stable or can be solved quicker

Example

$$\min_x x_1^2 + 10x_2^2$$

$$x_{k+1} = x_k - \gamma_k \nabla f(x_k)$$

$$\gamma_k = \frac{\nabla f(x_k)^\top \nabla f(x_k)}{\nabla f(x_k)^\top P \nabla f(x_k)}$$

81 Gradient Descent Iterates

Example

$$z_1 = x_1$$
$$z_2 = \sqrt{10x_1}$$
$$\min_z z_1^2 + z_2^2$$

1 Gradient Descent Iterate