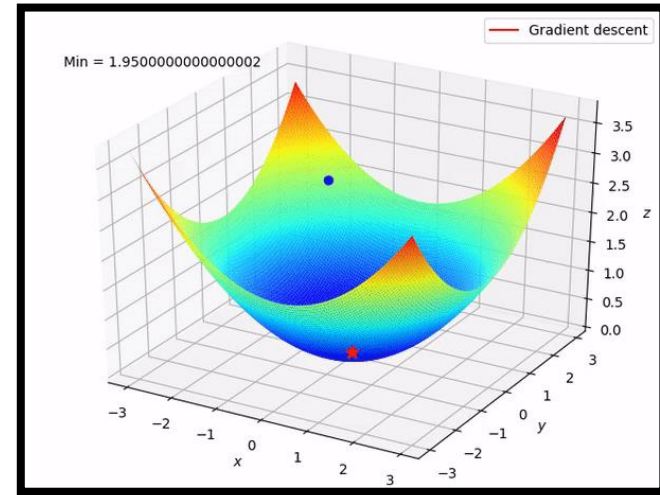
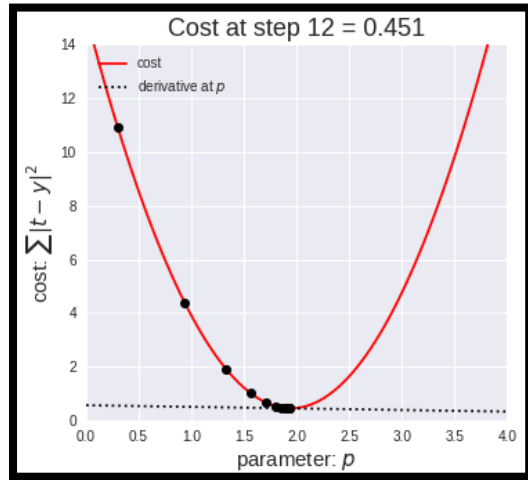


MATLAB Tutorial 14

ENME 303 Computational Methods for Engineers

Parham Oveissi

Gradient Descent



$$x_{k+1} = x_k - \alpha \left. \frac{\partial f}{\partial x} \right|_{x_k}$$

Example

$$f = 101x_1^2 + 83x_2^2 + 142x_1x_2 - 2x_1 - 3x_2 + 5$$

Solution 1:

$$\frac{\partial f}{\partial x} = \left[\frac{\partial f}{\partial x_1} \quad \frac{\partial f}{\partial x_2} \right]$$

$$x_{k+1} = x_k - \alpha \left. \frac{\partial f}{\partial x} \right|_{x_k}$$

$$\begin{bmatrix} x_{1k+1} \\ x_{2k+1} \end{bmatrix} = \begin{bmatrix} x_{1k} \\ x_{2k} \end{bmatrix} - \alpha \begin{bmatrix} \frac{\partial f}{\partial x_{1k}} & \frac{\partial f}{\partial x_{2k}} \end{bmatrix}^T$$

Example

$$f = 101x_1^2 + 83x_2^2 + 142x_1x_2 - 2x_1 - 3x_2 + 5$$

Solution 2:

$$f = \frac{1}{2}x^T Ax + b^T x + c$$

$$\frac{\partial f}{\partial x} = x^T A + b^T = 0 \rightarrow x = -A^{-1}b$$

$$x_{k+1} = x_k - \alpha(Ax_k + b)$$

Thanks!