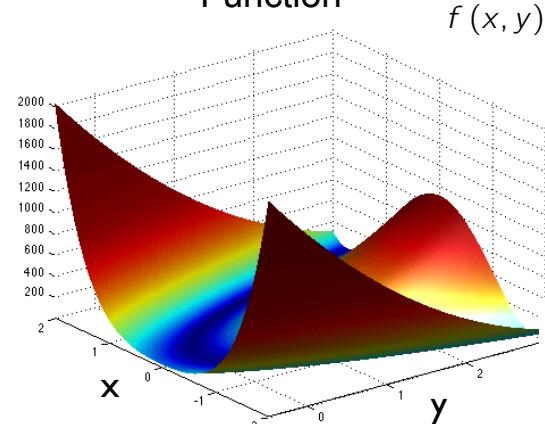
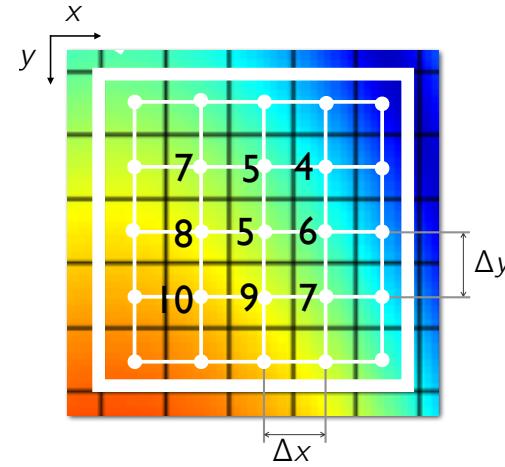
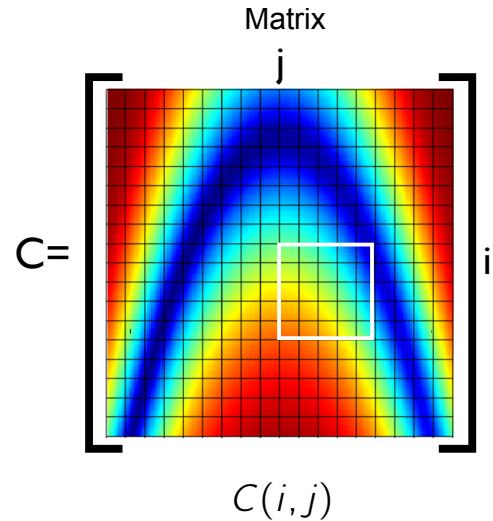


Function

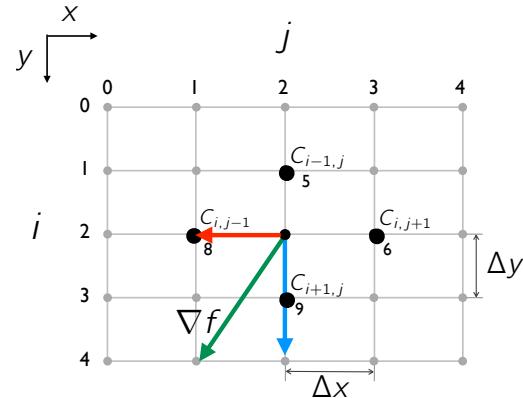


Matrix



Calculating the gradient of a function on a discrete grid

$$\nabla f(x, y) = \begin{bmatrix} \frac{\partial f(x, y)}{\partial x} \\ \frac{\partial f(x, y)}{\partial y} \end{bmatrix} \approx \begin{bmatrix} \frac{\Delta f}{\Delta x} \\ \frac{\Delta f}{\Delta y} \end{bmatrix}$$



$$\Delta x = \Delta y = 1$$

$$\frac{\partial f(x, y)}{\partial x} \approx \frac{\Delta f}{\Delta x} = \frac{f(x + \Delta x) - f(x - \Delta x)}{2\Delta x} = \frac{C_{i, j+1} - C_{i, j-1}}{2} = \frac{6 - 8}{2} = -1$$

$$\frac{\partial f(x, y)}{\partial y} \approx \frac{\Delta f}{\Delta y} = \frac{f(y + \Delta y) - f(y - \Delta y)}{2\Delta y} = \frac{C_{i+1, j} - C_{i-1, j}}{2} = \frac{9 - 5}{2} = 2$$

