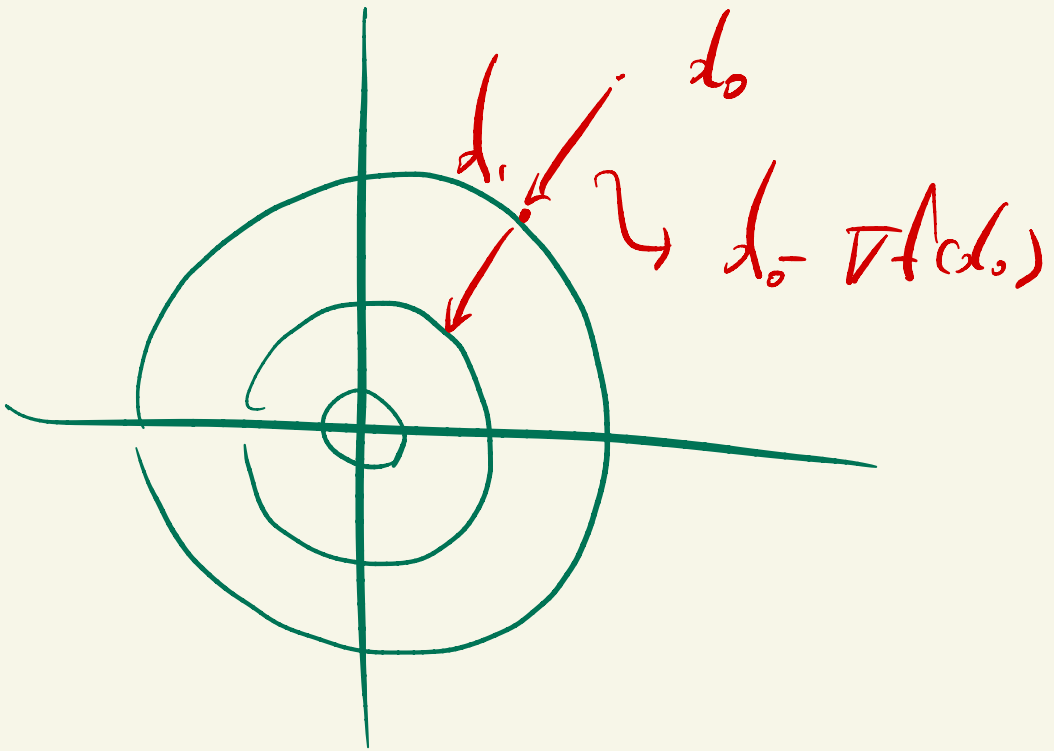


Optimization ( $\alpha \geq 0$  step length)

$\eta$  : Learning rate

Steepest Descent (Gradient)



# Pseudocode for Optimization Project

for  $i = 1, 2, \dots, \text{max\_iter}$

    Compute  $\nabla f(d_i)$

    Compute  $\|\nabla f(d_i)\|$

    if  $\|\nabla f(d_i)\| \leq \text{TOL\_GRAD}$

        BREAK

$d_{i+1} = d_i - \alpha \nabla f(d_i)$  ( $\alpha > 0$ )

    if  $|f(d_{i+1}) - f(d_i)| \leq \text{TOL\_FUN}$

        BREAK

Adapt Percent ( $f$ ,  $\nabla f$ ,  $d_0$ , max-iter,  
 $\alpha$ , tol, tol<sub>h</sub>)



return  $[d_0, d_1, \dots, d_{\text{opt}}]$

---

def f(x):  $\nabla f(\frac{\partial f}{\partial x_1}, \dots, \frac{\partial f}{\partial x_n})$   
 return ...  
 x = np.array  
 [1, 1, 1, 1, 1]