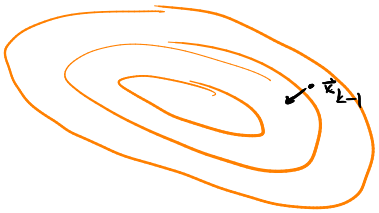
Unconstrained Local Optimization

$\vec{x} \in \mathbb{R}^n$ $f(x)$ is "smooth" differentiable to some degree

Strategy

choose $\vec{x}_0$
for $k \in 1..n$
  $\vec{x}_k \leftarrow$ update based on local information near $\vec{x}_{k-1}$
return $\vec{x}_n$ ← what direction?



$-\nabla f(\vec{x})$

Gradient Descent

for $k \in 1..n$
$\vec{x}_k \leftarrow \vec{x}_{k-1} - \alpha \nabla f(\vec{x}_{k-1})$

Two General Strategies

1. Line Search

Choose direction $\hat{d}$

Choose a step size
$\alpha^* = \underset{\alpha}{\text{argmin}}\, f(\vec{x} + \alpha \hat{d})$

$\vec{x}_k \leftarrow \vec{x}_{k-1} + \alpha^* \hat{d}$

2. Trust Region

Choose $\hat{f}$ + trust region for $\hat{f}$

$\vec{x}_k \leftarrow \underset{\vec{x}}{\text{argmin}}\, \hat{f}(\vec{x})$
subject to $d(\vec{x}, \vec{x}_{k-1}) \leq \delta$