

# The Fast Gradient Sign Method

$$J(\tilde{\mathbf{x}}, \boldsymbol{\theta}) \approx J(\mathbf{x}, \boldsymbol{\theta}) + (\tilde{\mathbf{x}} - \mathbf{x})^\top \nabla_{\mathbf{x}} J(\mathbf{x}).$$

Maximize

$$J(\mathbf{x}, \boldsymbol{\theta}) + (\tilde{\mathbf{x}} - \mathbf{x})^\top \nabla_{\mathbf{x}} J(\mathbf{x})$$

subject to

$$\|\tilde{\mathbf{x}} - \mathbf{x}\|_\infty \leq \epsilon$$

$$\Rightarrow \tilde{\mathbf{x}} = \mathbf{x} + \epsilon \text{sign}(\nabla_{\mathbf{x}} J(\mathbf{x})).$$