In a thought experiment, imagine (3) strategies for finding the deepest area of a graded sandpit.

I. Simple

Arbitrary

II. Steepest Descent

Use the Jacobian with an aggression parameter — for how big each step is.

$$\delta x = -\gamma J$$

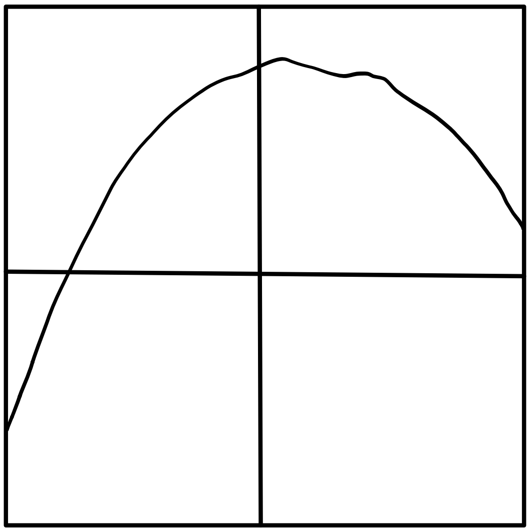
III. Hessian — Approach (second derivative matrix).

It is difficult to know how large to set γ (gamma). Setting the parameter innapropriately will either prevent the gradient descent from converging (when γ is too small) or entirely skipping over the gradient (if too large).

The Hessian can be used to set the γ-value applied to the Jacobian.

$$\delta x = -H^{-1} J.$$ where δx is a small step on the x-axis.

(*) liable to find maxima or minima! Changes direction and size.



$f(x) = -x^2 + 10$

$f'(x) = -2x$, Jacobian $_{1\times1}$

$f''(x) = -2.$, Hessian $_{1\times1}$

The hessian expresses the rate of change which the rates change relative to a variable(s).

By inversing the rate of change which the rates change relative to a variable, and applying it to the Jacobian the jacobian's gradient is transformed to an inverse - what Jacobian (i.e the gradient) would have been before being influenced by the Hessian (i.e the underlying 2nd-order characteristic of the polynomial).

Does this just normalize/linearize the steps.

Is the change in direction due to too big of a step function?

IV. Hybrid Approach

use hessian and gradient descent.

if hessian step is too big/wrong direction use gradient descent.

- too big = when $-H^{-1}J(-J) \leq 0$ or $\|-H^{-1}J\| > 2$.