J. A. Nelder, R. Mead, "A Simplex Method for Function Minimization",
Computer Journal, vol. 7, pp. 308-313, 1965

Nelder-Mead Simplex Method

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with thanks to:
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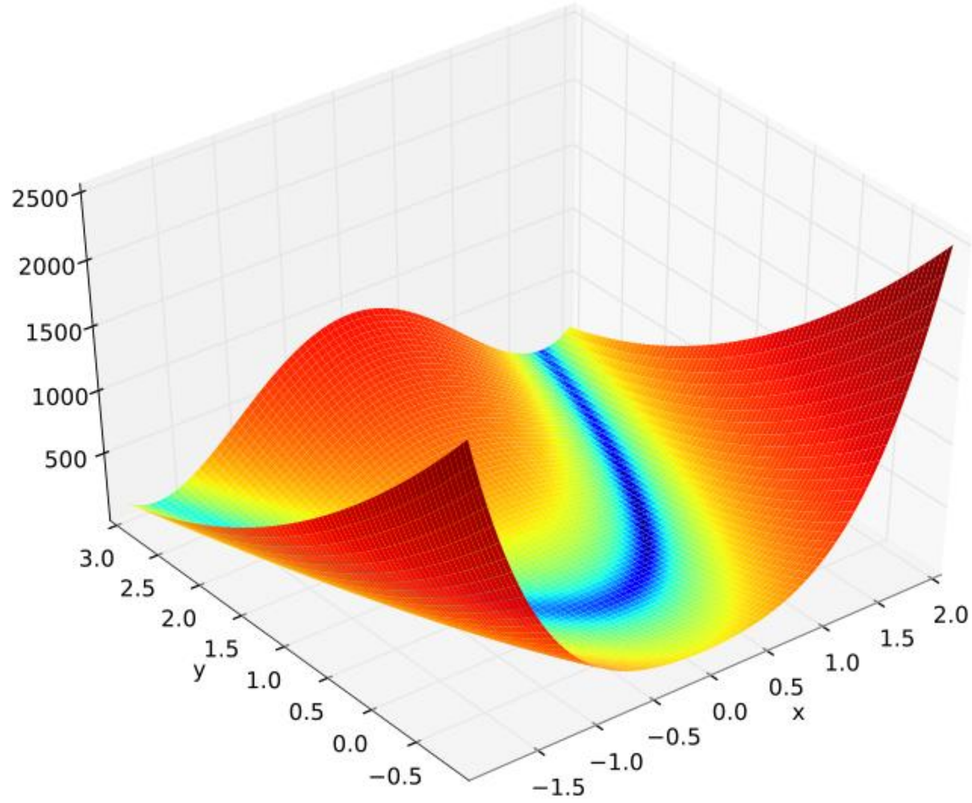
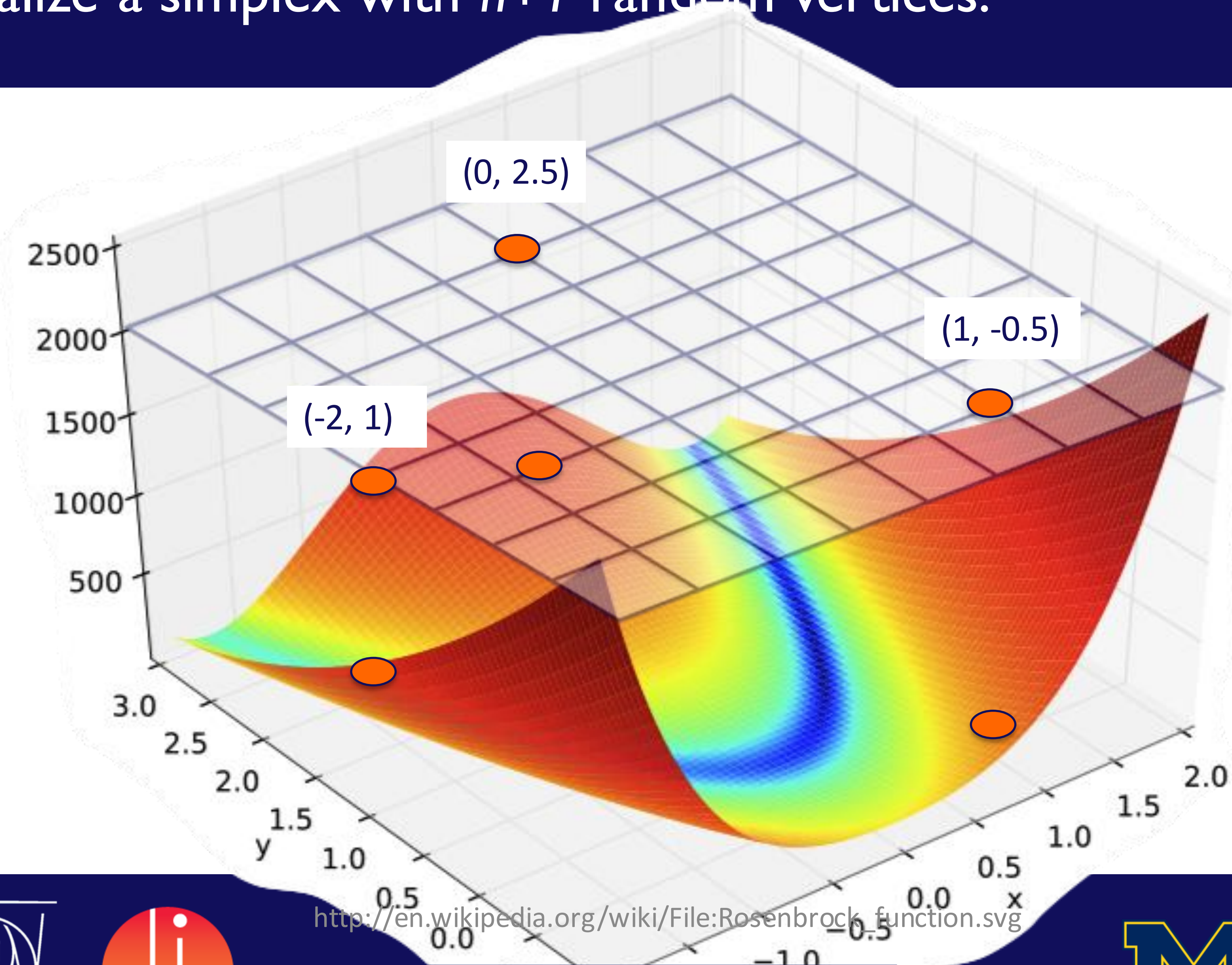
Nelder Mead Simplex Method is a simple minimization algorithm.

Start with an n-dimensional function you want to minimize.

Let's take Rosenbock's parabolic valley, a.k.a the banana function.

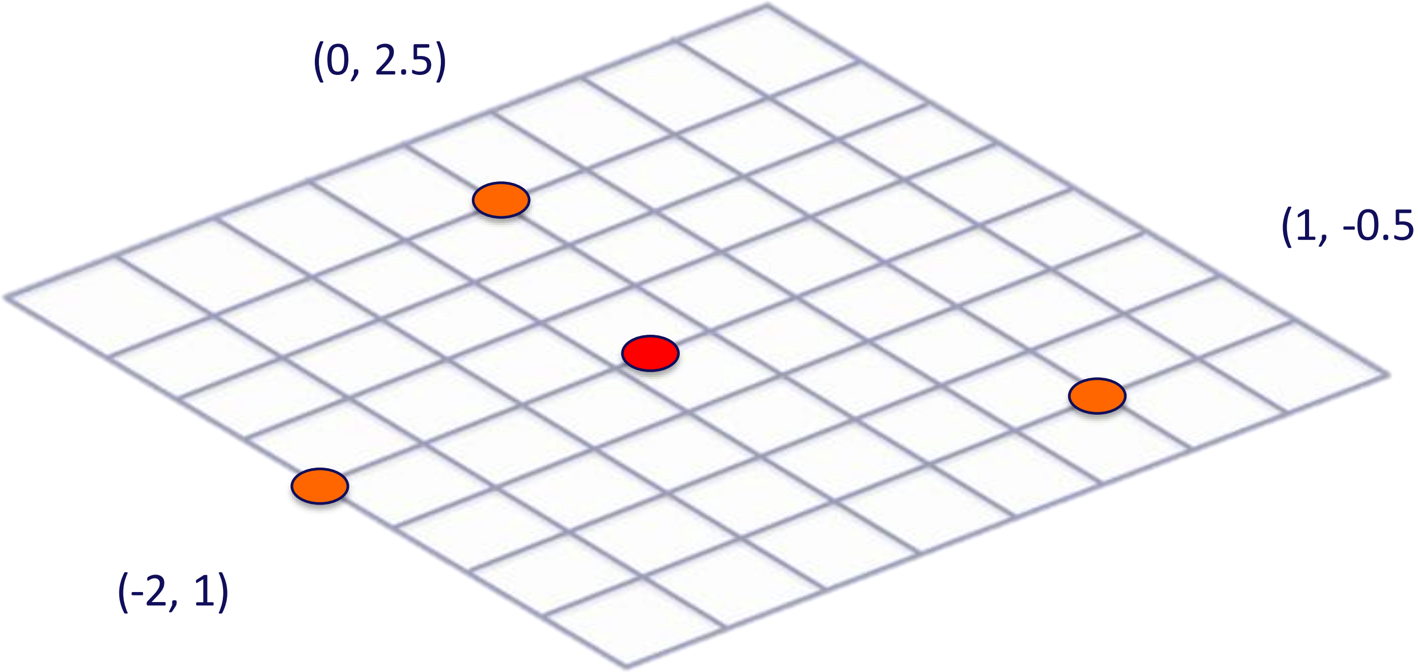


Initialize a simplex with $n+1$ random vertices.

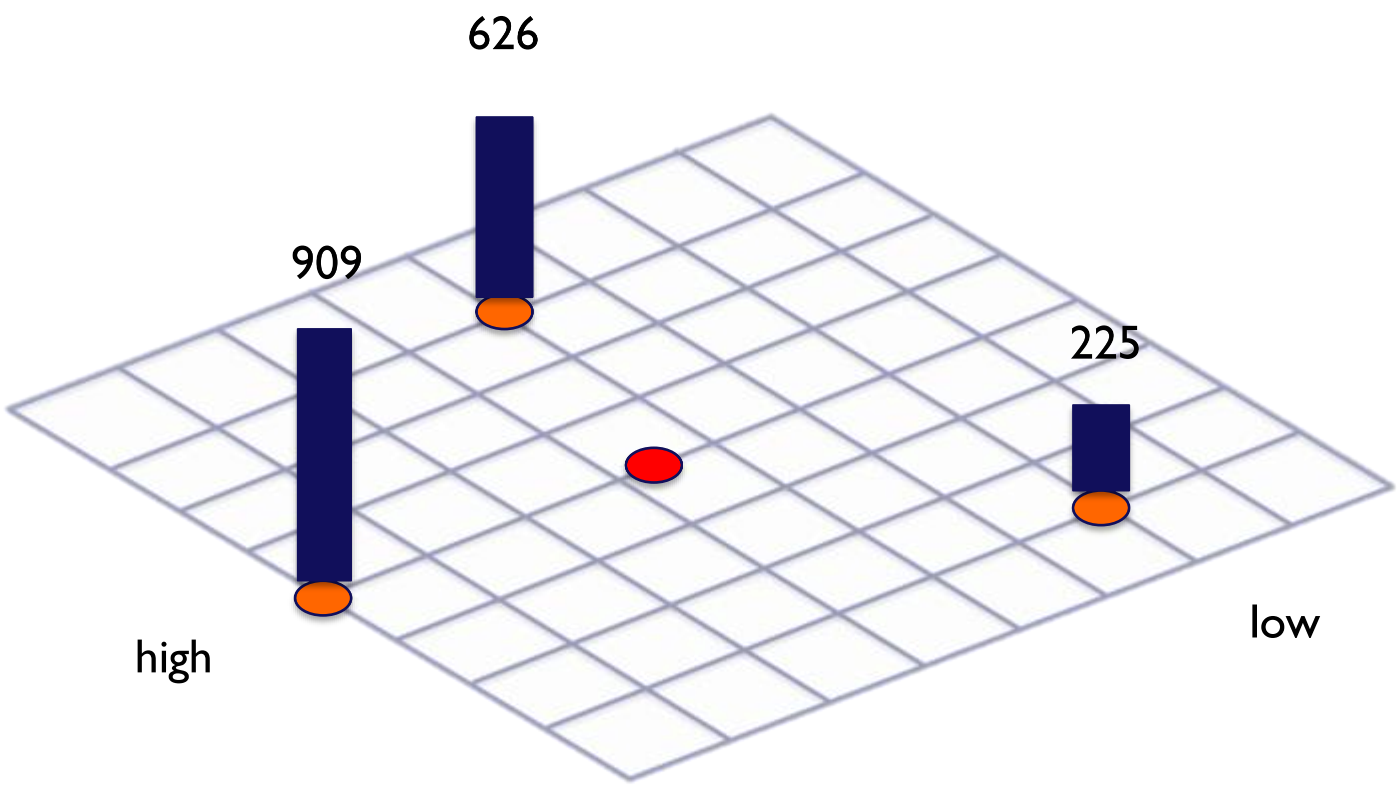


http://en.wikipedia.org/wiki/File:Rosenbrock_function.svg

Calculate the centroid of the simplex



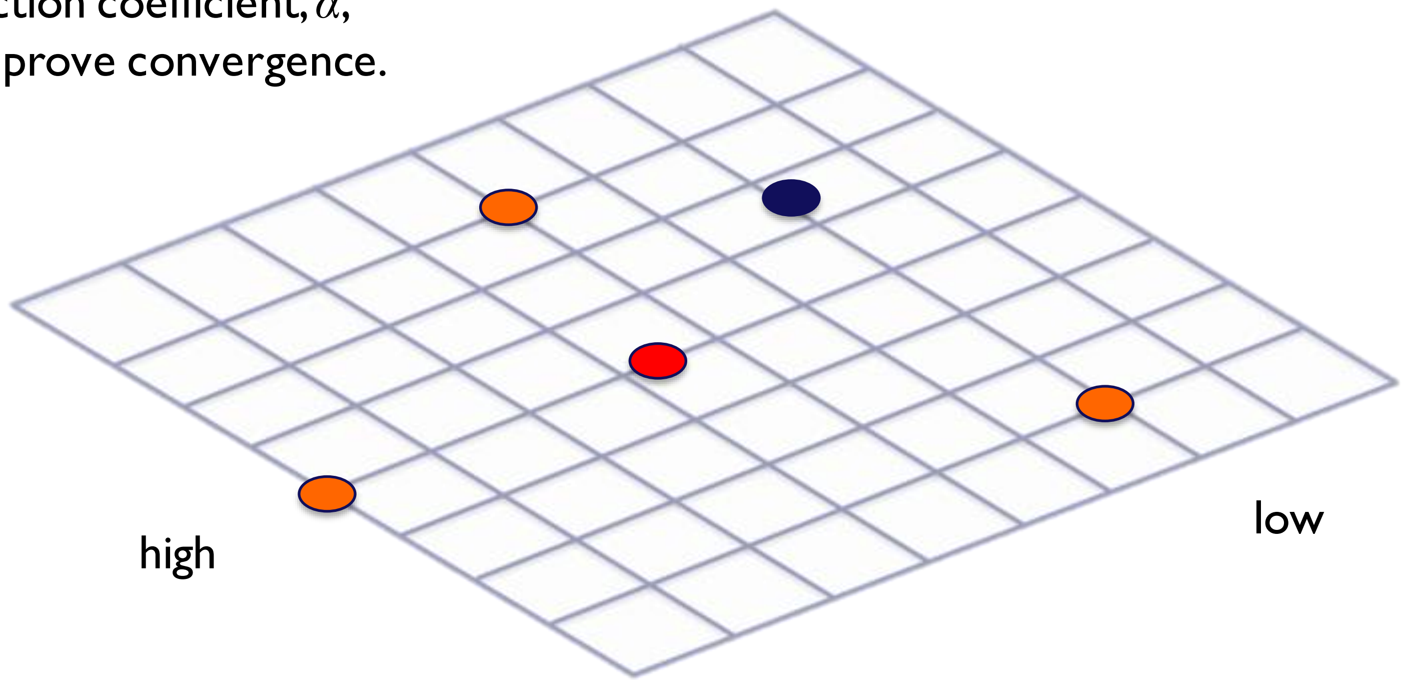
Order the points from highest to lowest



Reflect the highest point across the centroid

You can change the reflection coefficient, α, to improve convergence.

Here, $a = 1$



Evaluate the new point

- Is it better than the best point? EXPANSION
  - if so, keep looking in that direction and replace worst point
- Is it in the middle?
  - replace the worst point
- Is it worse than the worst point? CONTRACTION
  - move entire simplex closer to the best point

This is not ideal

3 coefficients must be chosen: for reflection, expansion, and contraction.

An initial simplex must be chosen (or an initial point and 1-D increments).

There is no pre-evaluation of the search direction.

So let's improve it

Put your starting vertices in a matrix from low to high

$$\begin{bmatrix} 1 & -0.5 \\ 0 & 2.5 \\ -2 & 1 \end{bmatrix}$$

"Step 1: Initialize a simplex with *(n+1)* random vertices $x_1, x_2, \ldots, x_n$."

The diagonal defines your extra point, *xs*.

Calculate pseudo-gradients and refine reflection

best point

Calculated reflected point as $R' = B - \sigma * G$??

step size

If mod (i, 2) == 0

$$g_i = \frac{\partial f}{\partial x_i} = \frac{f(i-1) - f(xs)}{x_{i-1,i} - xs_i}$$

Else

$$g_i = \frac{\partial f}{\partial x_i} = \frac{f(i+1) - f(xs)}{x_{i+1,i} - xs_i}$$

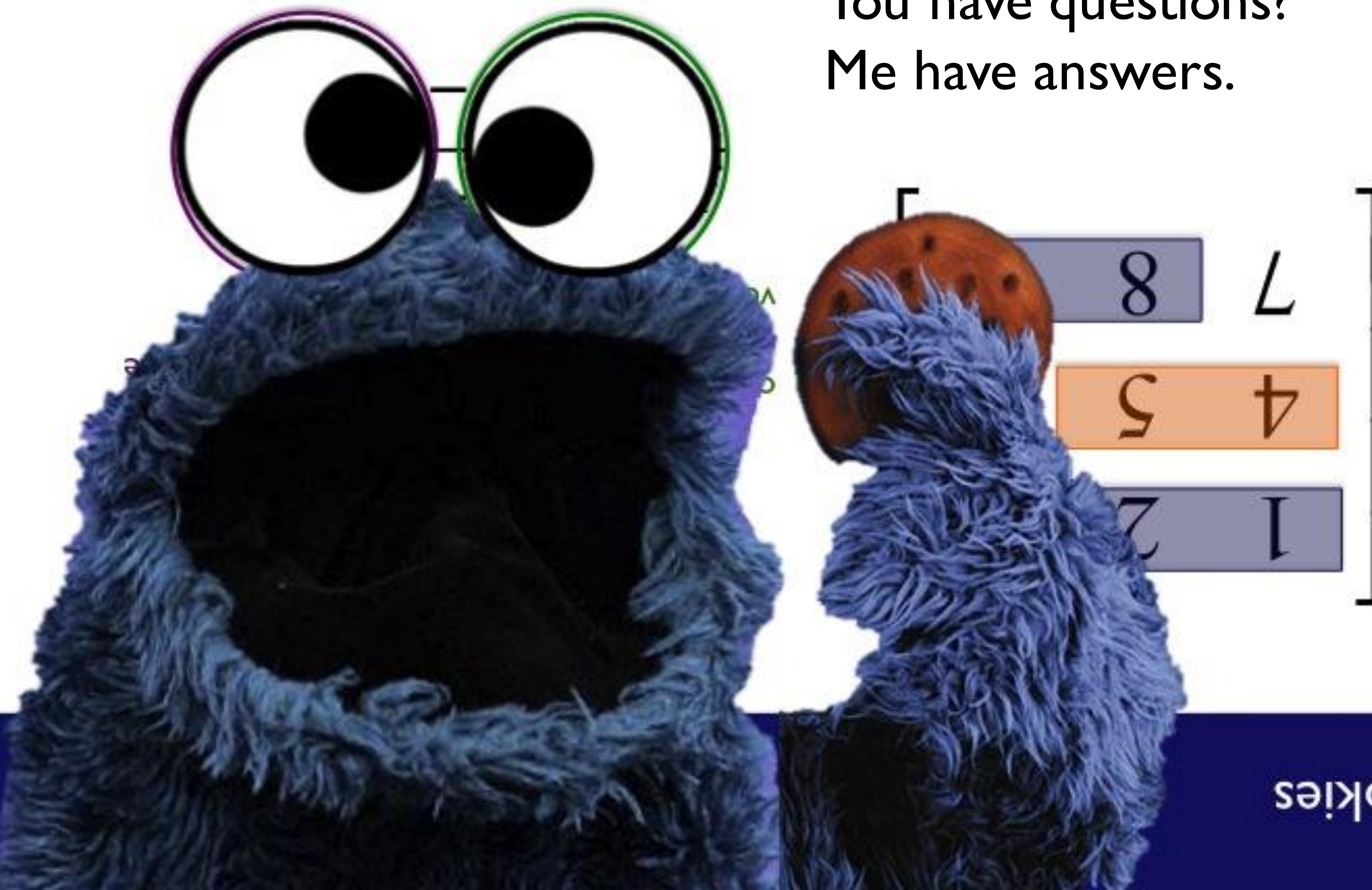
End

End

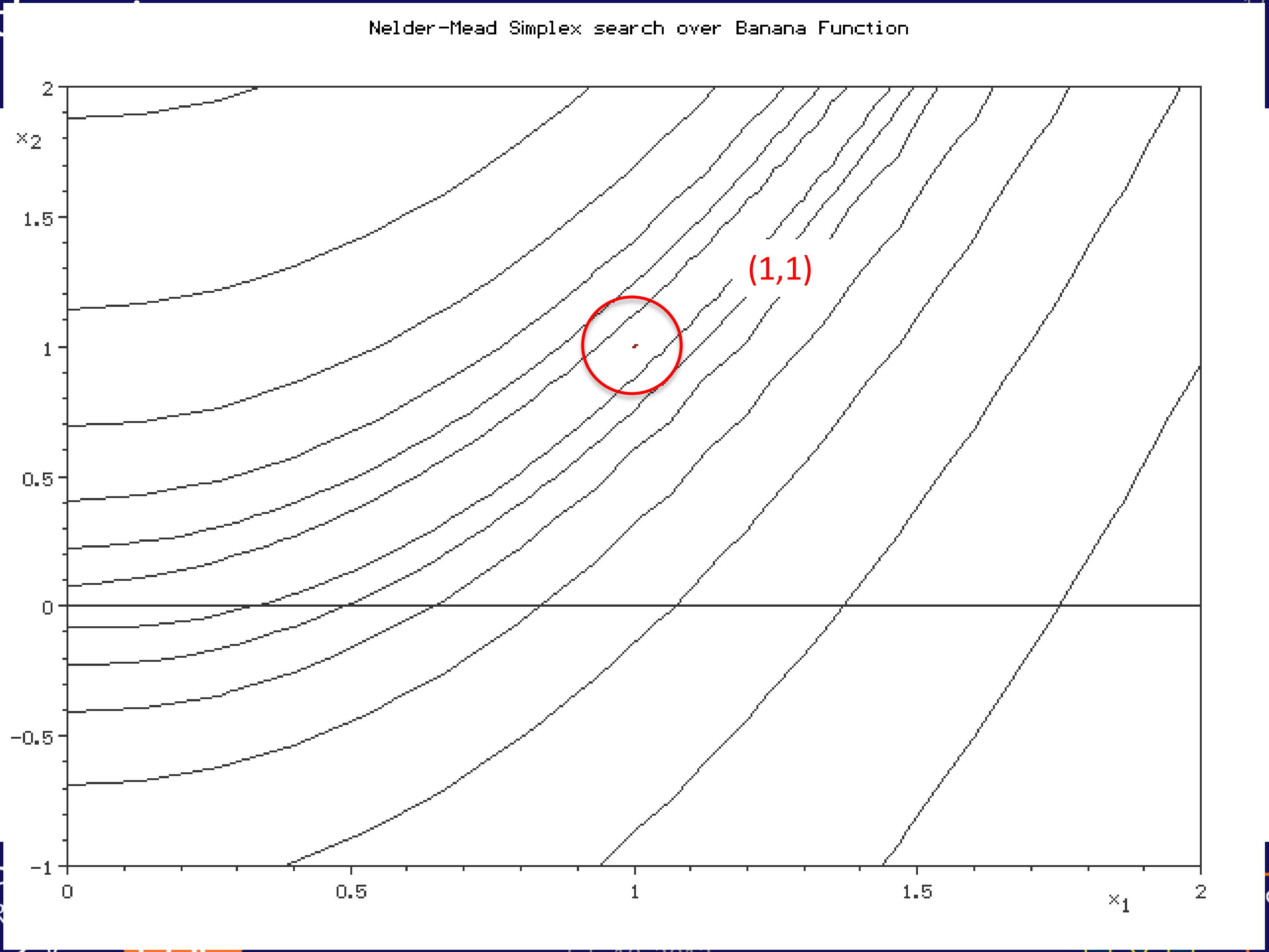
Previously, *G* referred to a 'good' point. Presumably, they mean the vector '*g*' containing the pseudo-gradients.

Cookies

You have questions?
Me have answers.



Let


Nelder-Mead Simplex search over Banana Function
2
1.5
1
0.5
0
-0.5
-1
x2
0
0.5
1
1.5
2
x1
(1,1)