collection of animations of search path in optimization

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Contents

These are animations[1] showing the search path u^k on top of a contour plot from different starting point u^0 toward a minimizer u^* for different objective functions using different algorithms. More animations will be added.

The animation run once and stop. To re-start the animation, please force reload the HTML page (using shift-reload).

[1] Made during taking course ECE 719 optimal systems at University Wisconsin, Madison. Course given by Professor B Ross Barmish in spring 2016

1 First example $f(u) = (11 - u_1 - u_2)^2 + (1 + u_1 + 10u_2 - u_1u_2)^2$

1.1 compare steepest descent optimal step with conjugate gradient

The objective function is $f(u) = (11 - u_1 - u_2)^2 + (1 + u_1 + 10u_2 - u_1u_2)^2$ Starting from $u^0 = \{14; 23.59\}$.

1.2 compare steepest descent optimal step with conjugate gradient, larger range

The objective function is $f(u) = (11 - u_1 - u_2)^2 + (1 + u_1 + 10u_2 - u_1u_2)^2$

This is the same as the earlier animation but uses larger range. Starting from $u^0 = \{14; 23.59\}$.

1.3 compare steepest descent optimal step with fixed step h=0.25

The objective function is $f(u) = (11 - u_1 - u_2)^2 + (1 + u_1 + 10u_2 - u_1u_2)^2$

Starting from $u^0 = \{14; 23.59\}$.

THe search using optimal step size is slower (due to performing line search at each step) and consumes more CPU time, but it does converge. While the search using fixed step is faster (since it does not perform line search) but it failed to converge when it u^k was very close to u^* due to oscillation around u^* as the step size was relatively large.

1.4 compare steepest descent optimal step with fixed step h=0.1

The objective function is $f(u) = (11 - u_1 - u_2)^2 + (1 + u_1 + 10u_2 - u_1u_2)^2$

Starting from $u^0 = \{0.4; 4.3\}$.

2 second example, Rosenbrock's banana function $f(u) = 100 * (u_2 - u_1^2)^2 + (1 - u_1)^2$

2.1 compare steepest descent optimal step with fixed step h=0.1

The objective function is $f(u) = 100 * (u_2 - u_1^2)^2 + (1 - u_1)^2$

Starting from $u^0 = \{1.828, -1.878\}$.