Hooke and Jeeves Search

1. Choose a *starting point* using common sense or the *shotgun* approach[1]. Evaluate the objective function $f(\mathbf{x})$. Choose a suitably-sized increment for each variable $x_1, x_2, \ldots, x_n$.

2. Record the current point as the *base point.*

3. For each variable in turn:

   • Increase it by its increment, i.e. $x_i + \delta_i$.

   • If this reduces the value of the objective function, retain the change, otherwise reverse it $(x_i - \delta_i)$ and re-evaluate. If this produces no improvement either, leave the variable at its original value x_i.

4. If step 3 resulted in a change of position, go to step 5. Otherwise, *stop* if each increment is smaller than the required tolerance. If some are not, reduce them and go back to step 2.

5. Record the current point as the new base point, and perform a *pattern move* by repeating the vector from the last base point. If this reduces the value of the objective function, retain it, otherwise discard it.
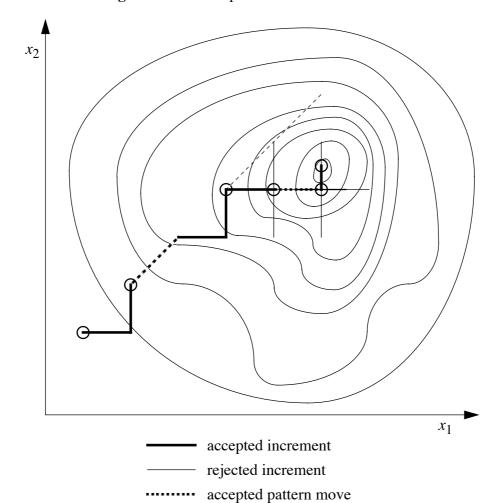
6. Return to step 3.

Note that there are several variants on this algorithm, e.g. with repeated pattern moves etc.

Reference

Hooke, R., and T.A. Jeeves (1961) "'Direct Search' Solution of Numerical and Statistical Problems", *Journal of the ACM* **8**, 212-229.

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1. The shotgun approach consists of randomly sampling the search space a few times and choosing the combination which gives the lowest objective.

Figure 1: An Example of Hooke and Jeeves Search.

Legend:
- accepted increment
- rejected increment
- accepted pattern move
- rejected pattern move
- ◯ successive base points