Effective Programming Practices for Economists

Numerical Optimization

Derivative-Free Direct Search Algorithms

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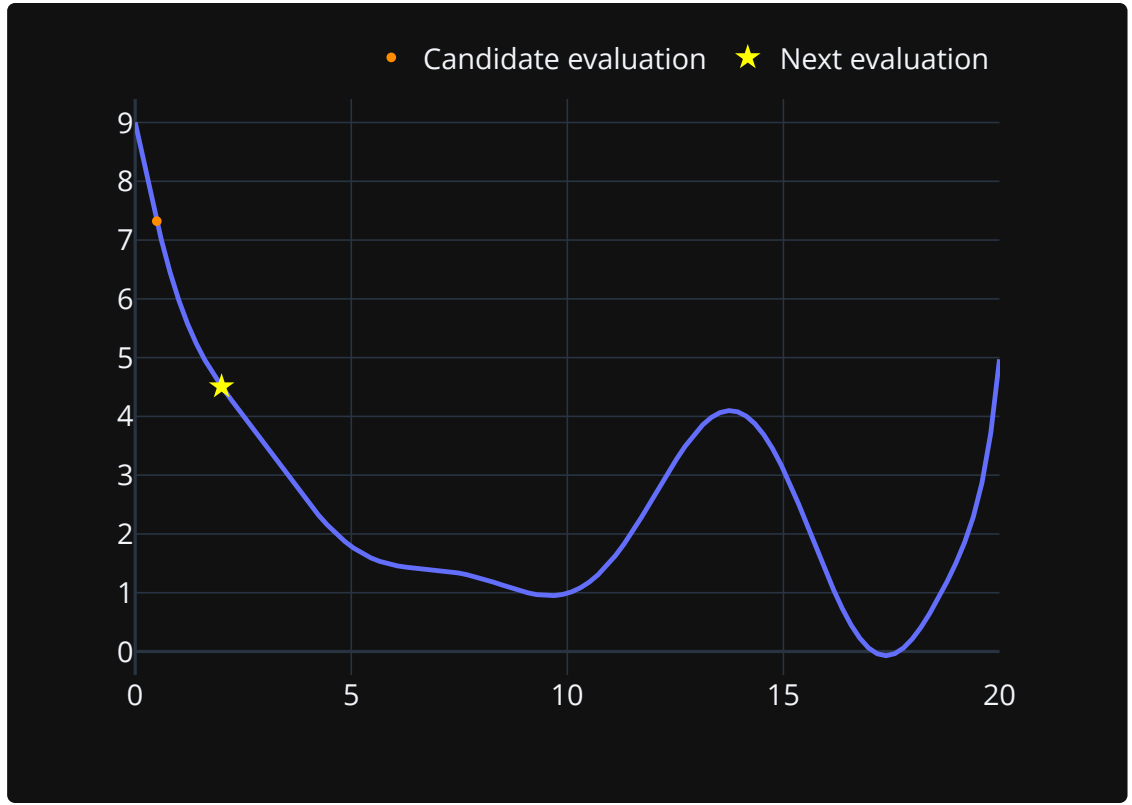
Basic Idea (optimagic docs)

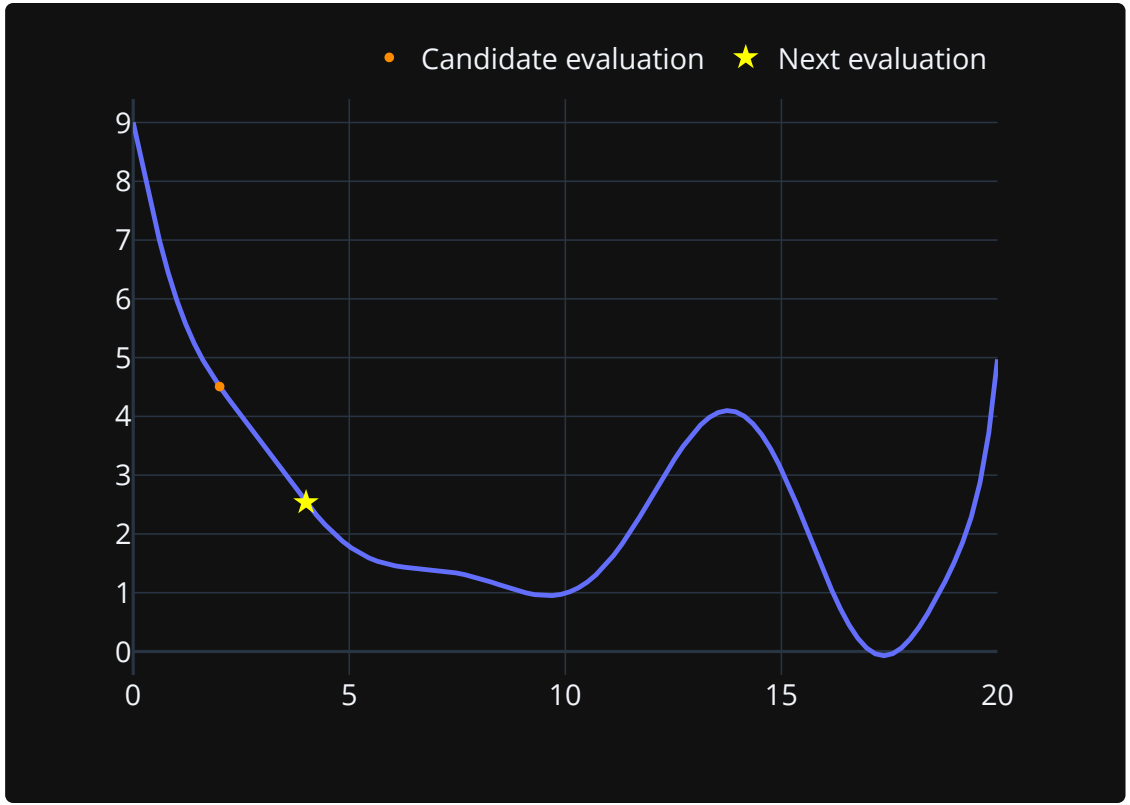
- Explore parameter space around current point systematically and accept the best value
- Also called pattern search because the points at which the function is evaluated form a pattern
- Easiest example for one dimensional problems:
  - Evaluate function at current point and one other point
  - Switch direction of other point if you got an increase in function value
  - Make steps larger after success
  - Make steps smaller after failure

Initial Evaluation



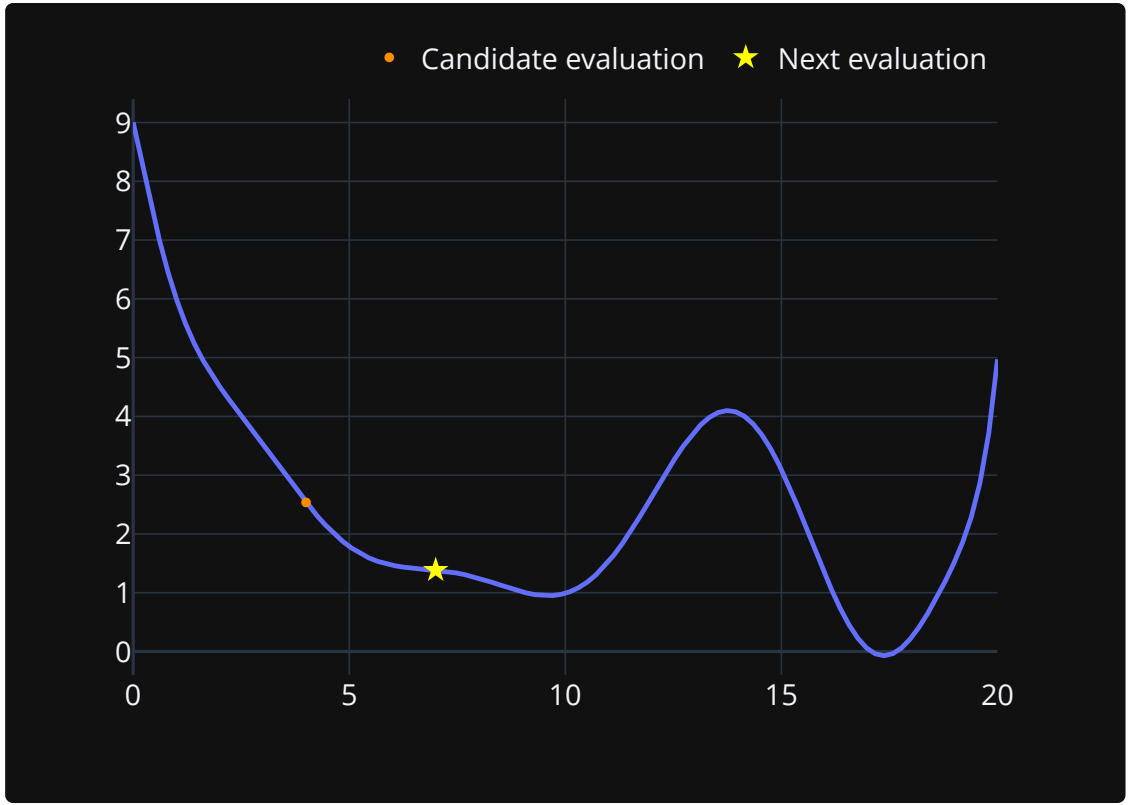
Candidate value $>$ initial value $\Rightarrow$ reject, reverse direction

Iteration 1



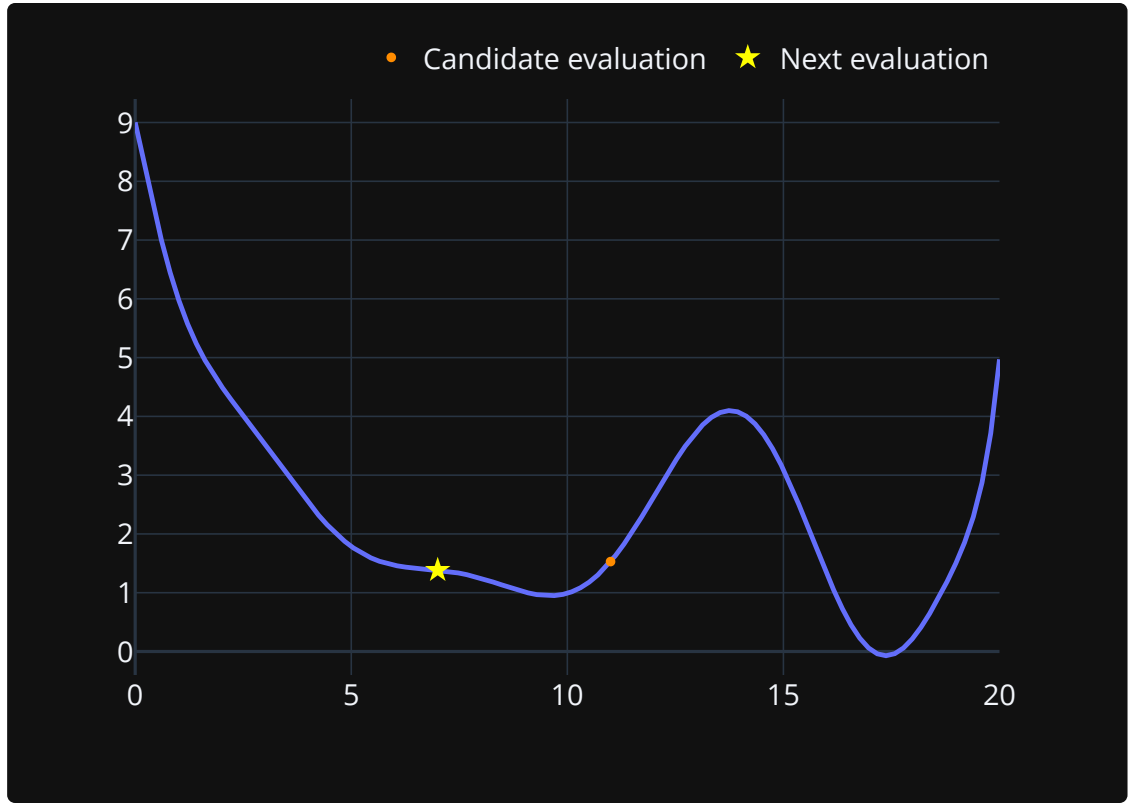
Candidate value $<$ initial value $\Rightarrow$ accept, increase step length.

Iteration 2



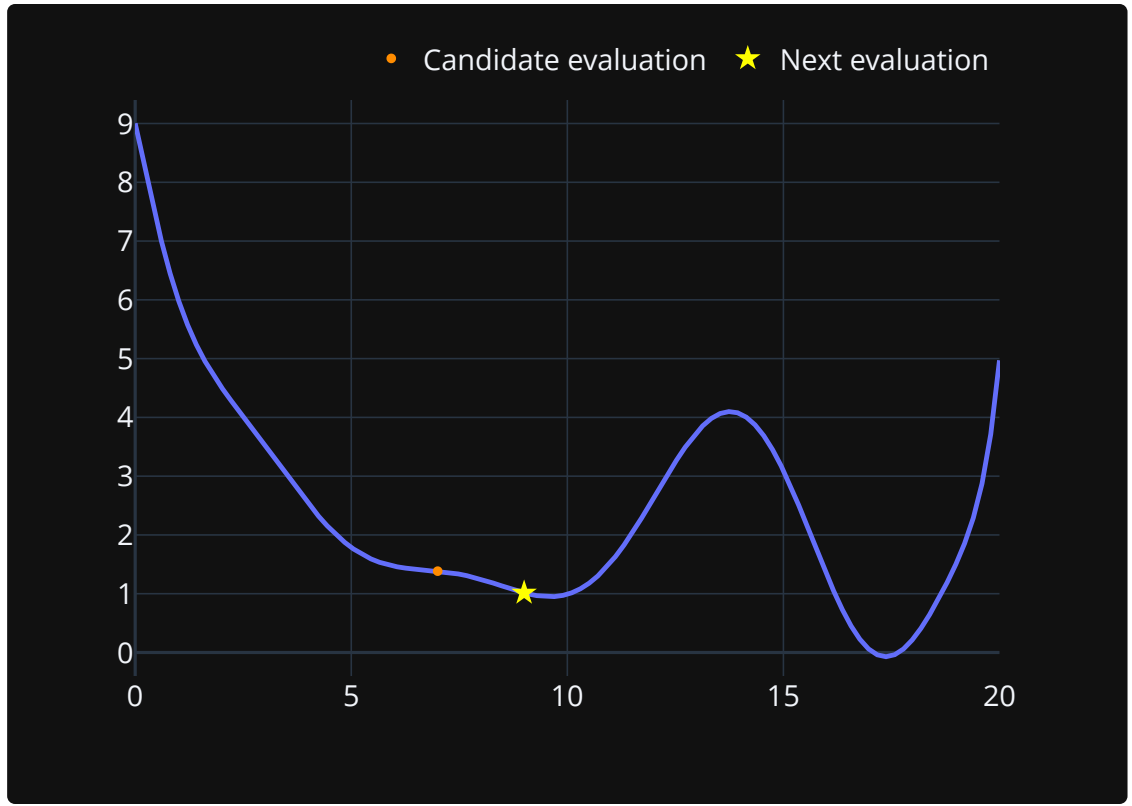
Candidate value $<$ initial value $\Rightarrow$ accept, increase step length.

Iteration 3



Candidate value $>$ initial value $\Rightarrow$ reject, decrease step length.

Iteration 4



Converge eventually (gets worse in both directions).

Some Remarks

- Adjusting the step size and switching to promising directions is complicated in real algorithms
- These algorithms only use the information which function value is smallest, not by how much
- Makes them slow but robust to small amounts of noise
- It does not help for large amounts of noise
- Most famous example is the Nelder-Mead algorithm
  - Very widely used
  - Very seldomly the best choice

A real algorithm: Nelder Mead