

Effective Programming Practices for Economists

Scientific Computing

Choosing optimization algorithms

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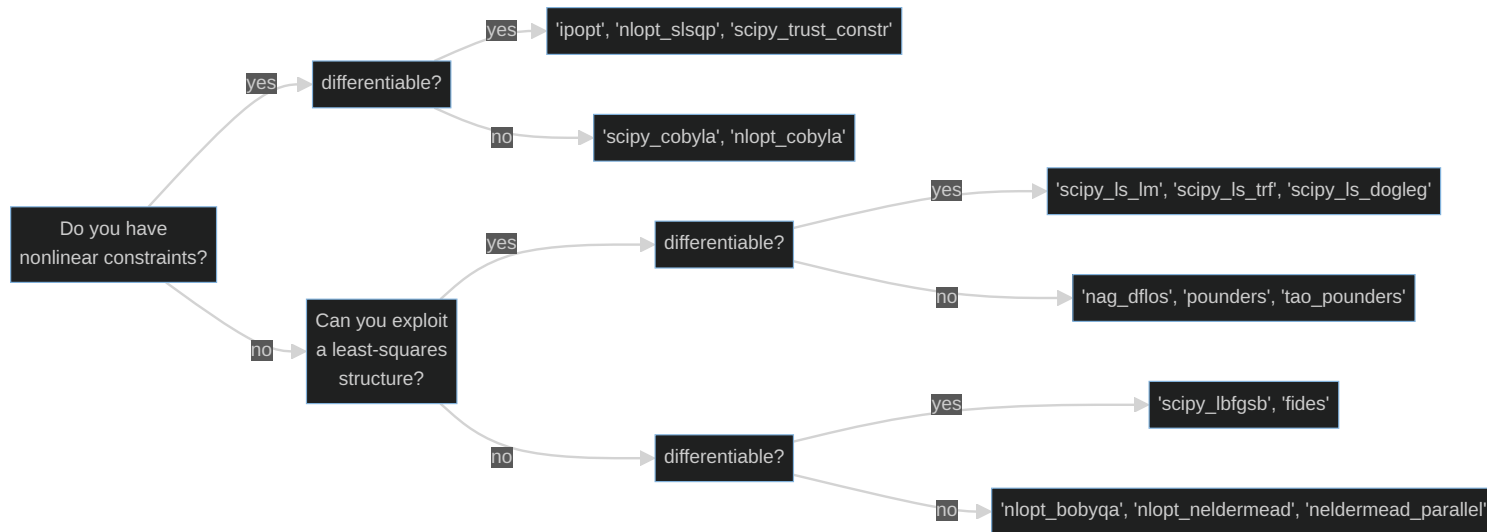
Relevant problem properties

- **Smoothness:** Differentiable? Kinks? Discontinuities? Stochastic?
 - **Convexity:** Are there local optima?
 - **Goal:** Do you need a global solution? How precise?
 - **Size:** 2 parameters? 10? 100? 1000? More?
 - **Constraints:** Bounds? Linear constraints? Nonlinear constraints?
 - **Structure:** Nonlinear least-squares, Log-likelihood function
- Properties guide selection but experimentation is important
- Always compare multiple algorithms in a criterion plot

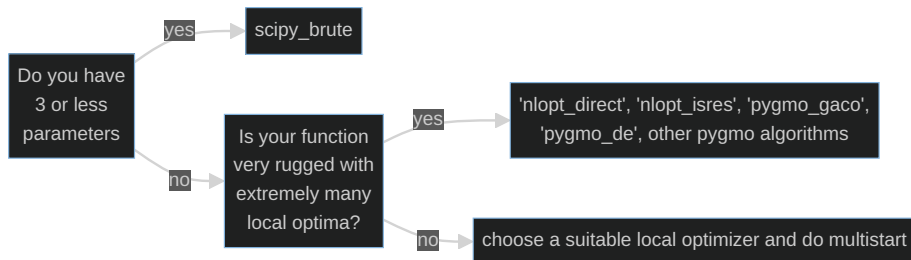
Try to make your problem simpler

- Get derivatives using automatic differentiation (JAX, pytorch)
- Make your function faster
- Make your function more stable
- Try to make your function smooth

Choosing local optimizers



Choosing a global approach



Always refine the result of a global optimizer with a local one