

# **Effective Programming Practices for Economists**

## **Scientific Computing**

### **Choosing optimization algorithms**

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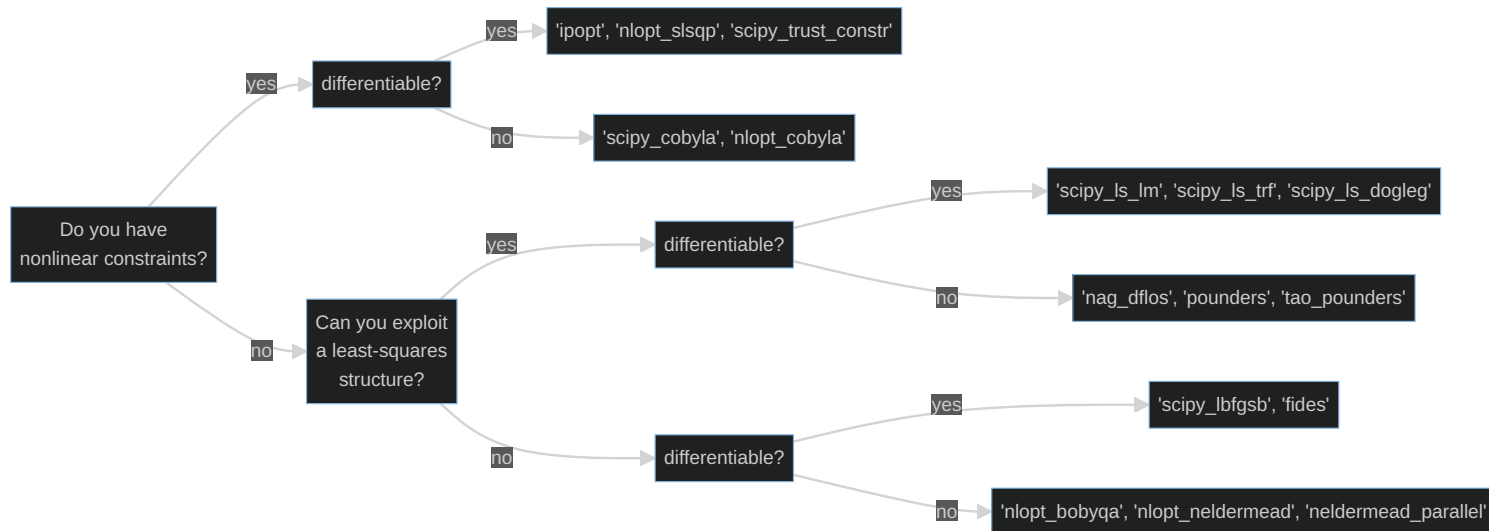
# Relevant problem properties

- **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

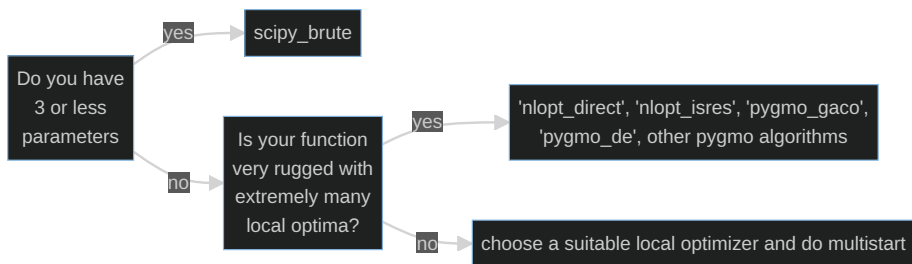
# Try to make your problem simpler

- 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