# 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

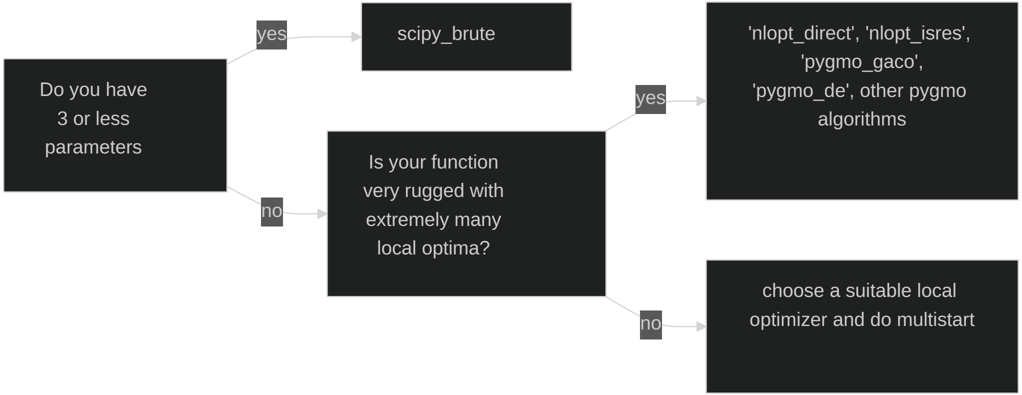
$\rightarrow$ Properties guide selection but experimentation is important

$\rightarrow$ 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 a global approach




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