

CS 268 Intro to Optimization HW4

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Chosen Software:

Specific-Domain: Matlab

API callable from a general purpose programming language: Scipy.optimize

My choice: AMPL

1. Read the specifications or documentation.

Qualitatively (not quantitatively) compare and contrast the specifications and claims of your three code bases in these areas:

1) mathematical optimizations capabilities (types of problems; types of algorithms - much as we have been studying in class) ?

Matlab

Matlab has a comprehensive library for optimization, include nonlinear optimization, linear and quadratic programming and so forth. For nonlinear optimization, it supports Quasi-Newton method, Nelder-Mead algorithm and trust-region algorithm which we haven't cover yet. It also include global optimization methods such as genetic method, simulated annealing method and so forth.

Scipy.optimize

Scipy supports BFGS, Nelder-Mead simplex, Newton Conjugate Gradient, Brent's method, bound method and so forth. It also supports method we don't cover in class such as hybrid Powell, Levenberg-Marquardt or large-scale methods.

AMPL

AMPL has various kinds of solvers to solve different kinds of optimization. CPLEX is used for Linear and quadratic optimization, Gurobi support Linear and convex quadratic optimization in continuous and integer variables and so forth.

2) computational scaling (problem sizes and running speeds)

Matlab

Matlab has a Parallel Computing Toolbox working together with the Optimization Toolbox to provide parallel computing capabilities. Also, Matlab has a comprehensive solution for GPU computing and cloud computing.

Scipy.optimize

Scipy is designed to handle large data sets as long as it can fit into memory. However it does not have distributed or parallel computing solutions.

AMPL

Its scalability depends on the kind of solver.

3) known application base (extent and problem domains)

Matlab

Matlab can be used in general optimization problems including nonlinear optimization, linear and quadratic programming, mixed-integer linear programming, multi-objective optimization, nonlinear least squares, data fitting, and nonlinear equations and global optimization problems.

Scipy.optimize

Scipy can be used in general optimization problems. Based on python, which is a very popular and powerful language, scipy can be used in machine learning, computer vision and all kinds of different data science project

AMPL

The solver of AMPL covers linear and quadratic programming, nonlinear convex problem, .nonlinear global optimization problem. It also support integer programming problem. AMPL can be used to solve both industry and academic optimization problems.

4) ancillary code needed or available eg plotting, visualization, scientific notebooks

Matlab

Matlab has its own plotting library and script files. So it is highly self-contained.

Scipy.optimize

Scipy is specialized in scientific computing in the python data science stack. Python has many other libraries for visualization such as matplotlib or pandas. Also, we can use ipython notebook to present the optimization process and results.

AMPL

AMPL is specialized for optimization problems, it does not support visualization. We may need python or other general purpose programming for this purpose.

2. List the documents you read for each of the three packages, in bibliography format.

Matlab

1. http://www.mathworks.com/products/optimization/index.html?s_tid=gn_loc_drop
2. <http://www.mathworks.com/products/global-optimization/features.html#key-features>

Scipy.optimize

1. <http://docs.scipy.org/doc/scipy/reference/optimize.html#module-scipy.optimize>
2. <http://stackoverflow.com/questions/6853923/python-handling-a-large-set-of-data-scipy-or-rpy-and-how>

AMPL

1. <http://ampl.com/products/solvers/all-solvers-for-ampl/>