

# GENO – GENeric Optimization for Classical Machine Learning

[www.geno-project.org](http://www.geno-project.org)

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- formulate machine learning problem as optimization problem
- generate code using GENO website
- run solver on your problem
- deploy solver if needed

- one algorithm for everything a lot
- can solve constrained, non-smooth problems
- easy to use
- no parameter tuning needed
- quasi-Newton solver with Augmented Lagrangian

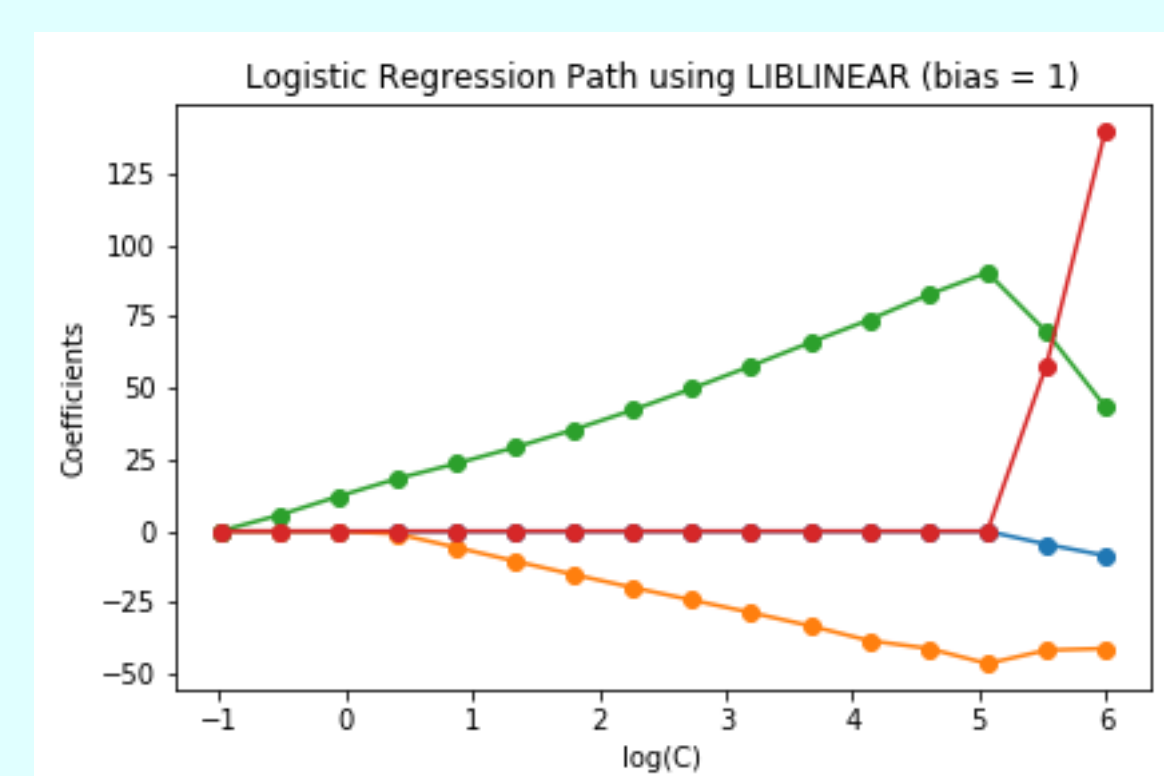
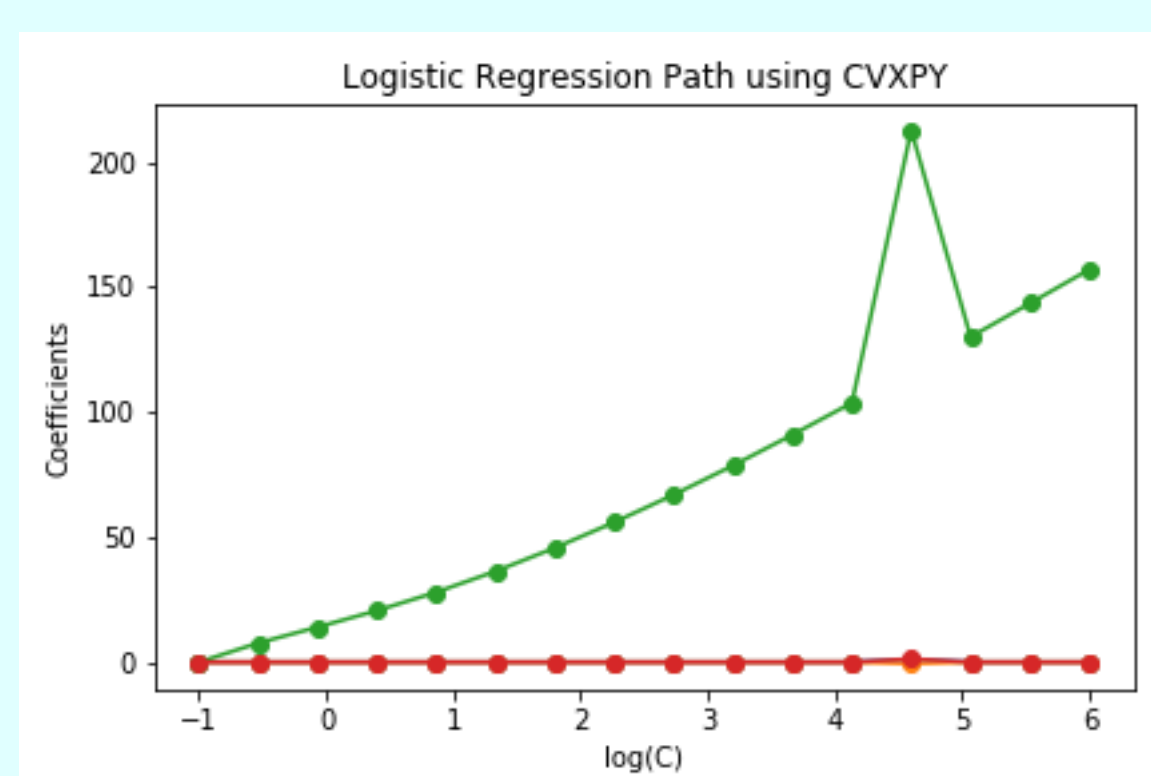
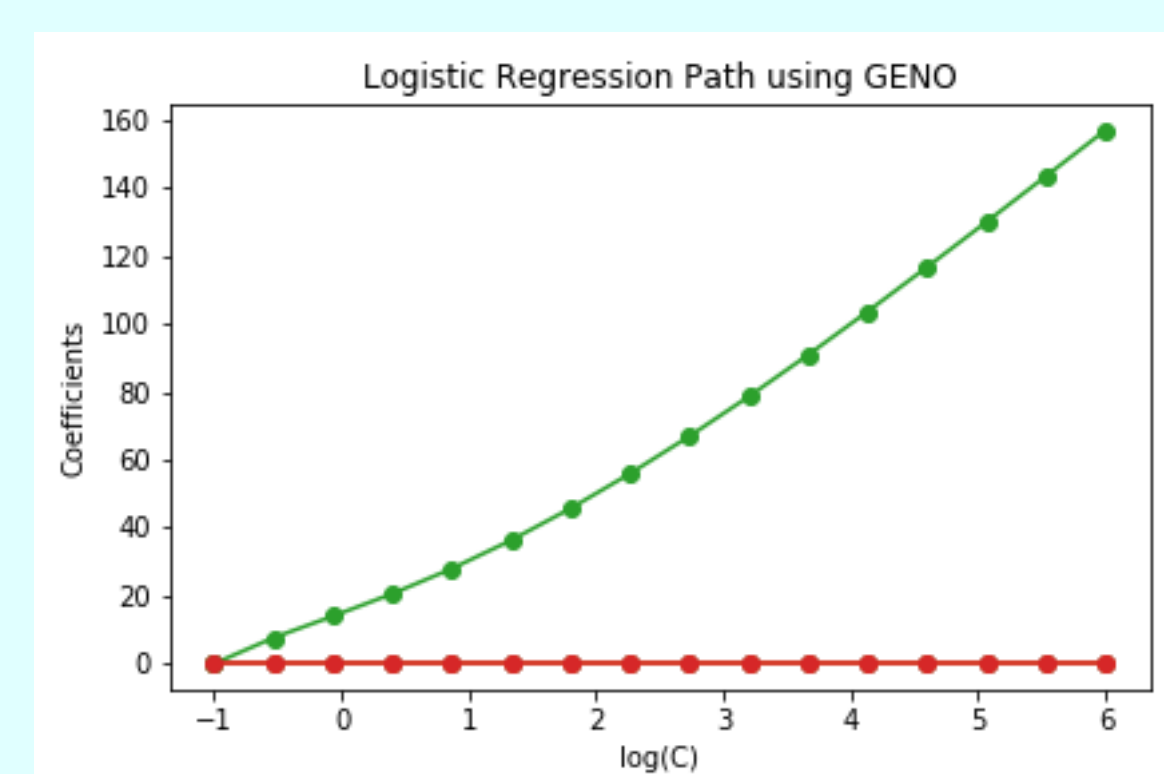
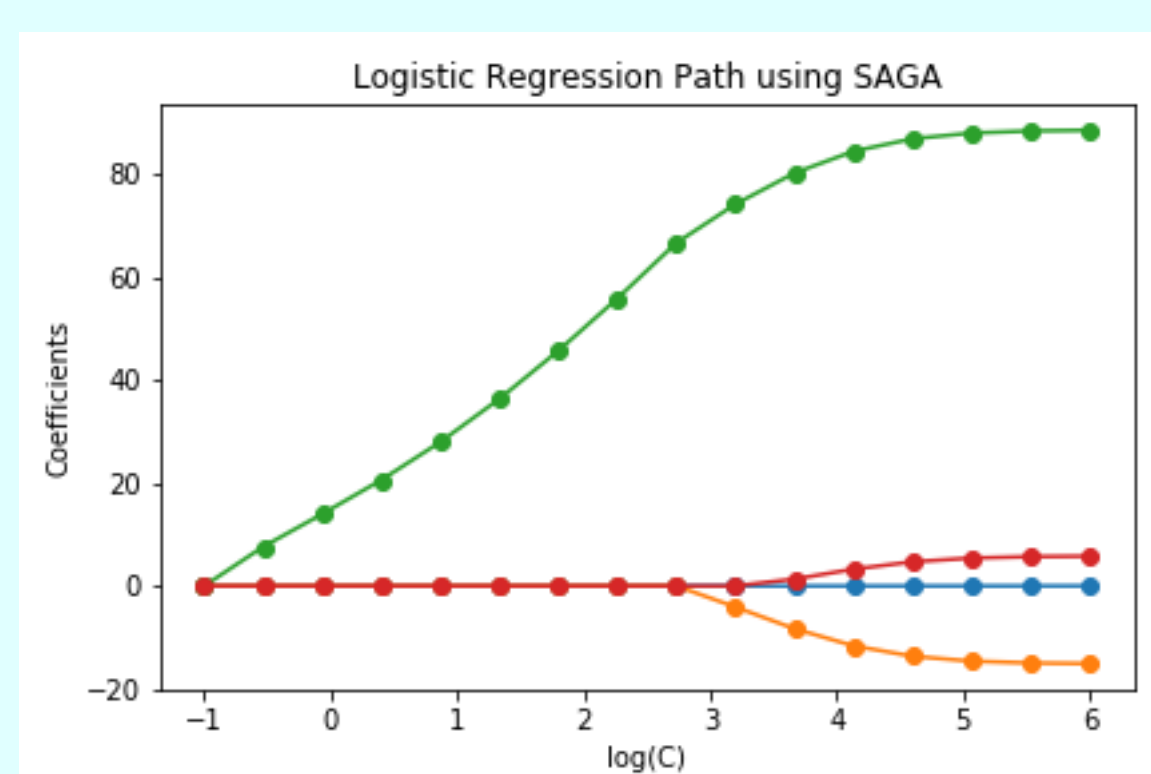
## Results

- as fast as well-engineered, well-established, specialized solvers
- faster than recently published, state-of-the-art specialized solvers by a decent margin
- orders of magnitude faster than classical modeling language plus solver approaches (CVXPY + Gurobi, CPLEX, Mosek, ...)

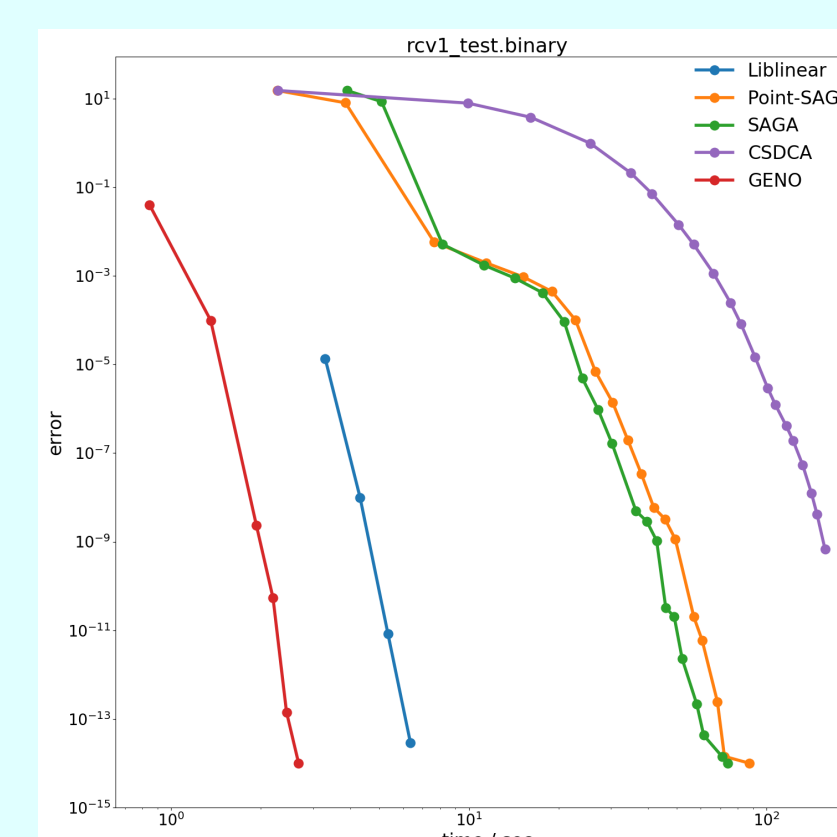
	handwritten solver	TensorFlow, PyTorch	Weka, Scikit-learn	CVXPY	GENO
flexible	✗	✓	✗	✓	✓
efficient	✓	✓	✓	✗	✓
deployable / stand-alone	✓	✗	✗	✗	✓
can accommodate constraints	✓	✗	✓	✓	✓
parameter free (learning rate, ...)	✗/✓	✗	✓	✓	✓
allows non-convex problems	✓	✓	✓	✗	✓

## Logistic Regression Path

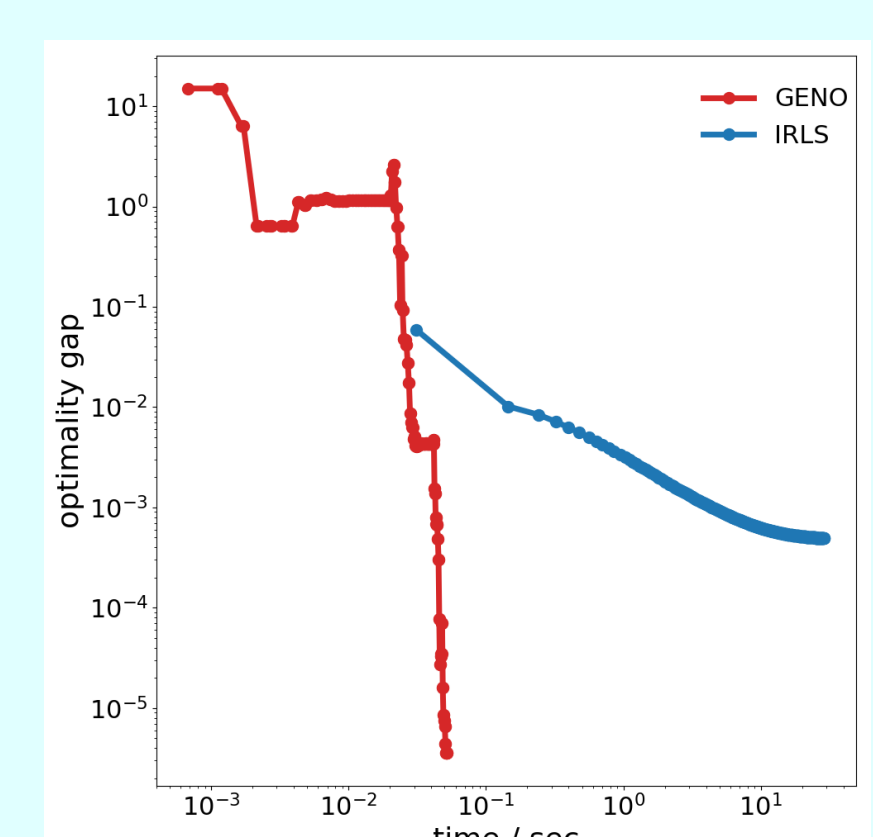
$\ell_1$ -regularized logistic regression



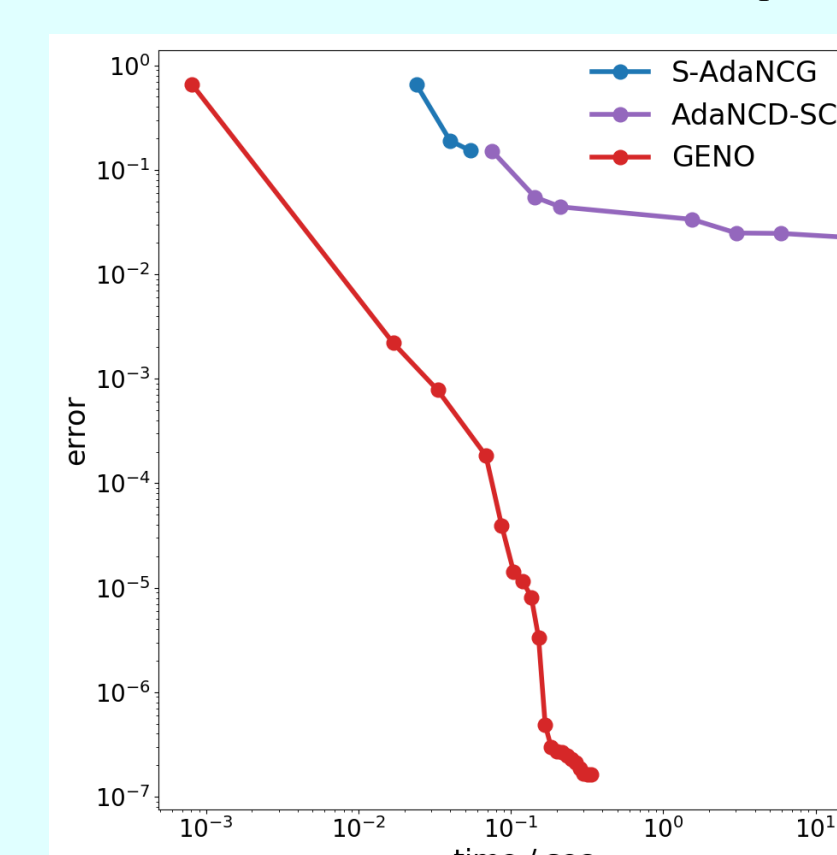
## Logistic Regression



## Compressed Sensing



## Nonlinear Least Squares



## Symmetric Nonnegative Matrix Factorization

