Cayuga Research

Optimization | Computation | Applications

Cayuga Research™ is a consulting company focused on the development and implementation of advanced optimization methods. We work with clients to develop complete optimization solutions to industrial problems. These target industries vary widely, from financial services, mortgage and default services and insurance, to logistics and transportation, and engineering design. Our clients include leading Wall Street investment banks, engineering and manufacturing companies, and major shipping/port operators. Cayuga Research operates internationally, with active clients and partners in New York, Toronto, the Middle East, and Asia.

Our specialty is developing sophisticated optimization solutions to complex modeling problems that occur across various industries. We are experts in the design and application of optimization strategies that increase process efficiency. We provide predictive analytic tools to help in both decision making and the identification of unusual, perhaps fraudulent, patterns of activity. We are accomplished in designing complex optimization systems, and we are experienced in increasing the efficiency and accuracy of current optimization procedures.

Cayuga Research also builds optimization tools and environments primarily designed to work in the MATLAB setting, to aid in the design of a complete optimization system. Current optimization tools developed by Cayuga Research include:

> **ADMAT™** (**A**lgorithmic **D**ifferentiator for **MATLAB** codes). ADMAT enables the automatic, efficient, and accurate computation of first and second derivatives of differentiable multi-dimensional functions (expressed as M-files in MATLAB). ADMAT is freely available under license.
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> **CGO™** (**C**ayuga **G**lobal **O**ptimizer for global minimization in MATLAB). CGO searches for a global minimizer of a multi-dimensional function, using smoothing and simulated annealing techniques. CGO employs MATLAB local minimizers in its global search. CGO is freely available under license.
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> **PANDA™** (**P**redictive **A**dvanced **N**onlinear **D**iagnostic **A**nalyzer). PANDA is a sophisticated machine learning system, employing advanced nonlinear minimization techniques, to solve classification, prediction, and feature selection problems. Currently PANDA is for Cayuga application use only. [NOTE: PANDA ranked in top ten in the Heritage Health Provider Network Competition https://www.heritagehealthprize.com/, out of 1600 competitors world-wide.]

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About Cayuga Research

Our firm is composed of experienced research analysts and developers based in Waterloo, Ontario. We have broad experience in basic applied optimization research with over 100 research publications and several published software packages, as well as years of experience in industrial consulting and collaboration.

Our industry collaboration work has spanned many industries - from computational finance to engineering design to port optimization. Typically our work involves developing more efficient and reliable optimization methods, and implementations, to solve complex and practical optimization problems.

We are optimization experts - experts in the design and application of optimization strategies to increase process efficiency, and provide predictive analytic tools to help both in decision making and identification of unusual, perhaps fraudulent, patterns of activity. We have high-performance computing experience including work with GPUs for numerical acceleration. Typically we develop our codes in MATLAB; however, we also have bench strength in C, C++, C#, and Fortran.

Cayuga Research leadership

Thomas F. Coleman, PhD., is the senior research analyst at Cayuga Research. Coleman is a former faculty member at Cornell University (24 years in Computer Science, Applied Mathematics), former director of the Cornell Theory Center, and former dean of the Faculty of Mathematics, University of Waterloo. Currently Coleman is a Senior Research Advisor to the Global Risk Institute in Toronto and holds the Ophelia Lazaridis University Research Chair at the University of Waterloo. Coleman is the author of over 70 published research papers in optimization and applications, computational finance, high-performance computing, and algorithmic differentiation. Coleman has extensive consulting experience in finance, logistics, and engineering design.