

CASE BRIEFS

Automotive finance firm looking to optimize loan offers

An automotive finance company required an application for validating and optimizing loan terms and suggesting alternative terms. NAG provided its robust numerical components with additional VBA code to deliver an Excel-based solution.

A Financial Services company, that employs 3,300 associates with managed assets in excess of \$80 billion, was looking to implement a finance optimization solution. The company provided retail and wholesale financing, retail leasing, vehicle protection plans and other similar financial services.

One of its wholesale finance products involves individual motor dealerships gathering customer details for prospective car loans. The dealers then put together a possible finance package and then pass all the information to the central office for processing.

NAG helped by developing techniques, for optimization with constraints, as part of a new back-end process to find the best finance package that would meet various internal criteria. NAG routines for finding roots of transcendental equations were used as part of the solution.

NAG also worked with the client to provide an Excel interface to access the advanced optimization algorithms provided for this project.

At the end of the work the client had a specification for a new system that they could use to enable dealers to return prospective customer data to the central office together with a simple initial model proposal. The central service could then run optimization algorithms on the initial model and respond to the dealer with an 'accept or refuse' answer. Alternative acceptable finance packages/products could also be provided for the dealer to discuss with the prospective car loan purchaser.



Pharmaceutical company looking to forecast product lifecycle

NAG helped a pharmaceutical company deliver a new analysis tool. The solution allowed them to forecast and run scenario analysis on complete product lifecycles. They chose NAG because they needed robust and well tested methods.

A business team who are responsible for a line of chronic illness products, within a multinational pharmaceutical company, needed to consider a range of possible product lifecycle scenarios in order to plan investment returns and to avoid riskier financial strategies.

The team already had an Excel based solution and had started to develop new business based modelling approaches. These models needed to take into account both incremental growth and decline as well as allow for more sudden changes, such as delays in type approvals, loss of patents through legal dispute and unexpected epidemiological results.

They were looking for a partner who could provide guidance for the existing mathematical models and one who they could rely on as the business grew and modelling needs became more sophisticated.

NAG advised on the numerical detail of how best to incorporate the various data sets into the initial overall model and then to design and build new algorithms combined with existing NAG solvers.

The initial model worked successfully and there have been further iterations to refine and extend the techniques implemented, whilst maintaining the original user interface.

NAG routines were used to solve systems of nonlinear equations, to provide probability distributions and to perform optimization.



Trading firm wanted new strategies for portfolio optimization

A proprietary trading firm chose NAG software to create a new strategy for portfolio optimization. The client adopted NAG optimization solvers and used novel heuristics to enforce real-world constraints; the solvers were accessed using the NAG R package.

This mid size trading firm has used NAG consulting services, over a number of years, to develop portfolio management tools. They had a particularly difficult problem to address due to the structure of some real world constraints. The problem was exacerbated because, for legal and confidentiality reasons, the numerical model of the portfolio needed to be described without access to the actual core model.

NAG worked on techniques for mapping from the trading firm's domain, without uncovering its details, to another domain in which the new approach, using linear algebra, sorting, optimization, Cholesky factorization and other routines, could work effectively. NAG also helped to develop the details of the overall optimization strategy.

For the optimization a small set of well focused approaches were investigated. A number of initial approaches, including Nonlinear Programming (NLP) solver, turned out to be slow when applied to the specific problem type. Further investigation resulted in the use of a combination of a Quadratic Programming (QP) solver together with an NLP solver to greatly improve performance. Finally heuristics, drawn from recent past events, were also incorporated into the optimization process to manage the various constraints.

The resulting overall approach to optimization is working successfully and has made a significant difference to how the client manages their complex finance portfolios.



CASE BRIEFS

Retail analytics firm needed new regression methods

A retail and consumer products firm, with a focus on pricing models, needed access to some sophisticated regression techniques. NAG provided special new implementations quickly, with APIs to meet the client's specification.

The client, a specialist retail analytics company, provides planning and analysis tools to retailers and vendors. These tools help to evaluate possible price changes in relation to criteria such as promotions and offers, range assortments, deal sizes, lifecycle stages, amongst others. They needed to quickly implement advanced regression algorithms, in order to maintain their commercial position, as another technology supplier indicated that they were about to move into the same market.

A particular approach to regression analysis was identified by the client. They then looked for an organisation that could deliver correct software and make sure that the new routines would work efficiently on their hardware platform configuration.

NAG was chosen because of the excellent understanding of the regression topics and because of their proven ability to deliver very accurate code. In this case the NAG was also able to provide some further added value by suggesting platform specific tuning advice so the client could get even more performance out of the new routines.

Subsequently this client was purchased by a major global technology and software vendor who put a high value on the ability to realise competitive advantage through the use of applied numerics.



CASE BRIEFS

An organisation that provides banking analysis and pricing services needed help improving the speed of its computational engine

When an analysis and pricing firm, in the banking sector, needed help improving the speed of its applications, NAG consulting services were able to provide a speed-up of more than 10 times.

The client was an organisation that focuses on pricing and profitability management for financial services companies by utilizing predictive analytics based on resilient modelling and statistical techniques.

NAG was engaged to find ways to improve performance by looking into a specific domain problem which required multiple iterations of solvers. NAG worked on a number of client test datasets and found that the method of function evaluation was a key factor that impacted on run-time performance.

The consulting work resulted in a speed-up, with no loss of accuracy, of 12 times for some of the datasets. NAG also developed an optimal tuning approach for the most typical client data.

The optimal solution needed to be deployed to a well defined production architecture. So NAG created a custom build of the routines which were tuned to perform well in that environment.

During the work NAG remained in close contact with business's CTO and also promoted knowledge sharing to help the client's development team produce more efficient solutions for their future products and services.



CASE BRIEFS

Financial Systems firm looking to add new functionality for regression-based models

The financial systems division of a leading software and technology services company needed to enhance some of its key statistical models. NAG developed new methods for the proposed approach, collaborated with the company to verify the methods, and re-engineered legacy code for deployment in a new computing environment.

The client wanted to extend their range of regression-based models by incorporating new ways to handle data and additional statistical methods. The solution was presented in a Library structure for use within an internal application developed in the Microsoft Visual Studio environment. NAG studied the proposed statistical approaches to verify the accuracy of the methods for the target application, involving benchmark tests for a range of distributional regression assumptions.

When the best approach had been found, the next step was to re-engineer the software structure to fit the client's application development tools and their product environment. NAG used the most appropriate compiler tools and options to enable fast execution within the Microsoft .NET environment running under both 32 and 64-bit Windows.

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Financial regulation consultancy looking for faster optimization

A leading strategic innovation, intellectual asset and financial regulation consultancy turned to NAG to help verify some details of an economic model for a central bank and to provide complied code for improved performance.

The client needed to speed up specific optimization functions called from a generic modelling tool.

NAG initially verified that the optimization approach selected was the most appropriate for the problem before looking into ways of improving performance. Once it was verified NAG went on to investigate possible improvements.

It was quickly clear that some customization in the use of the routine would yield useful benefits. Alternative options for this approach were presented to the client together with a NAG recommendation. The NAG consultant then confirmed the validity of the selected approach against the client's data.

NAG built and verified a custom implementation, now as compiled code specifically for the target processor, operating system and memory configuration used in production environment on which the economic model was run.

In addition to this NAG was able to offer further advice about potential issues with planned choice of optimization approach to be applied to other areas of the model. The client was able to independently confirm this advice and as a consequence ensure that they, in turn, were giving the best advice to their own clients.



CASE BRIEFS

A precision engineering firm needed confirmation of an in-house approach

A precision engineering business wanted NAG to verify their in-house algorithms. Routines from the NAG Library were shown to give more exact results. The work enabled the client to offer their customers a more accurate service.

The client was a precision engineering company who provide alignment and measurement services for complex manufactured components and for production equipment. They needed to use numerics to verify properties of physical components and machines. This is done by using applications that work on data points actually measured from metal surfaces.

They came to NAG for expert help to verify that the software that they had created correctly translated and rotated surface points thus enabling them to test properties including moments of inertia. NAG found that they had developed an adequate solution but that it could be made more accurate.

NAG was able to use existing routines from the NAG Library, providing singular value decomposition and optimization techniques, together with a little additional code, to provide more exact results in the required formats to fit with the rest of the client's processes. This allowed the client to offer a more valuable service.

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