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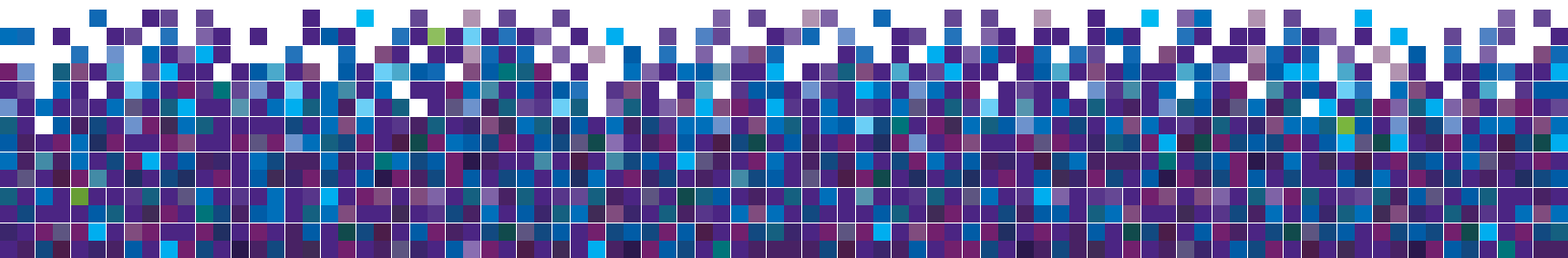
Predictive analytics in government

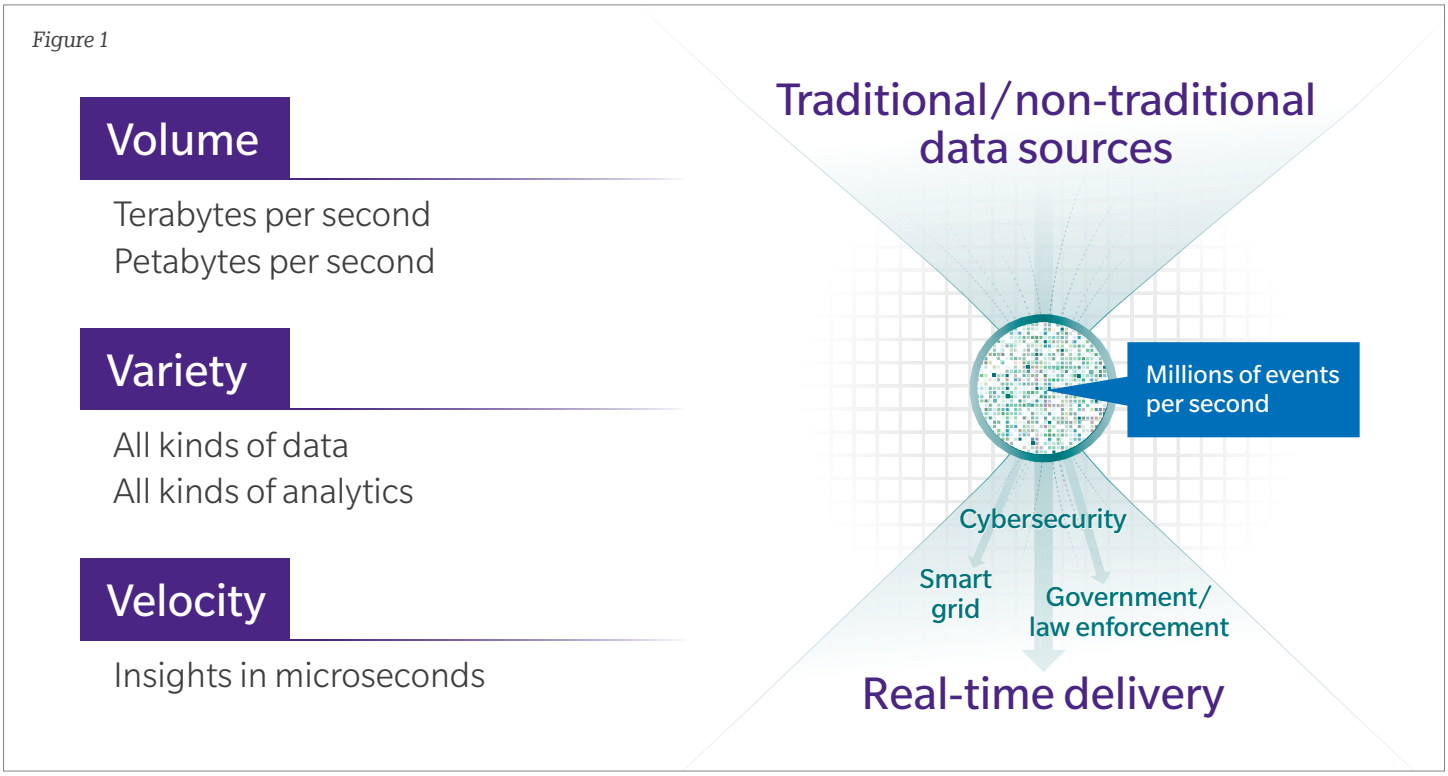
Leveraging past operational data to meet future mission objectives



Today, federal agencies are being asked to do even more with fewer resources. The need to deliver more services and benefits to a growing number of constituents — while simultaneously meeting increasing expectations around transparency, privacy, and fraud prevention — can be daunting.

Fortunately, most agencies already possess a key asset to aid in future mission delivery: their own data, which typically describe how their programmatic objectives were accomplished in the past. Through predictive analytics, agencies can harness these data and gain authoritative insights at scale and speed, hundreds or thousands of times a day (Figure 1). These insights can inform agency policy and improve program effectiveness by showing agencies which approaches work well, where the greatest risks lie, where to set performance targets, and where to focus their efforts to provide maximum benefit and meet the greatest needs.

Figure 1



These high-volume, high-velocity information assets are characteristic of "big data," a term that describes data sets that are multisource, multidisciplinary, generally distributed among multiple physical sites, and often multi-database.[1]

Effective interpretation and application of big data can help federal agencies enhance healthcare delivery, public safety, national security, fiscal management, compliance with regulation, and environmental health.

What is predictive analytics?

Predictive analytics is a scientific discipline that allows decision makers to make better choices. It uses data mining, modeling, and mathematical analysis to make forecasts, calculate probabilities, and anticipate future trends and behaviors. When properly implemented, a predictive analytics solution can inform an automated and repeatable process that reaches an unbiased conclusion free of human subjectivity.

1 Cox, M., & Ellsworth, D. (1997, May 1). Managing big data for scientific visualization. Retrieved February 19, 2016, from https://www.researchgate.net/publication/238704525_Managing_big_data_for_scientific_visualization

Using predictive analytics effectively

Several federal agencies are already using predictive analytics to accomplish their respective missions. The following programs demonstrate successful implementation of predictive analytics.

Center for Medicare and Medicaid Services (CMS)

The Department of Health and Human Services (HHS) Center for Medicare & Medicaid Services (CMS) established the CMS Program Integrity Command Center in 2012 with a mandate to stop criminals from defrauding Medicare and Medicaid.[2] Within the Command Center, CMS employees share resources and expertise with members of the law enforcement community from the HHS Office of the Inspector General and from the Federal Bureau of Investigation. The Command Center has harnessed the predictive analytics capabilities of the HHS Fraud Prevention System (FPS) to identify or prevent $820M in inappropriate payments since it went online in 2011.[3] The HHS FPS identifies troublesome billing patterns and outlier claims for action, similar to systems used by credit card companies.[4] By applying models of fraudulent behavior to Medicare claims data, the HHS FPS can prioritize specific claims and providers for enhanced surveillance or investigative action.[5] FPS represents a major improvement upon HHS' traditional analytics approach: instead of validating claims data with one fraudulent behavior model at a time, FPS applies several concurrently. As a result, healthcare claims that exhibit a single aberrant behavior or multiple aberrant behaviors are flagged earlier in the process.[6]

Defense Finance and Accounting Service (DFAS)

The Defense Finance and Accounting Service (DFAS) has operated the Business Activity Monitoring (BAM) tool since 2008.[7] The tool evaluates payments based on criteria including matching Procurement Instrument Identification Numbers (PIINs), invoice numbers, and invoice gross amounts. The predictive analytics engine driving BAM has prevented $2.3B in improper payments since it was brought online.[8]

Office of the Inspector General (OIG), Department of Education

The Department of Education's Office of the Inspector General (OIG) also fights fraudulent payments with a predictive analytics solution. The OIG Data Analytic System (ODAS) identifies patterns of fraud and areas of risk within the Education Department and within Federal Student Aid (FSA) systems. ODAS, housed in the Department's Information Technology Audits and Computer Crime Investigations (ITACCI) lab, uses predictive analytics to identify audit and investigative targets.[9] ODAS enables Education OIG to apply its investigative resources more effectively in pursuit of fraudulent loan applications.

2 Budetti, P. (2012, July 31). Command Center Speeds Up Anti-Fraud Efforts [Web log post]. Retrieved February 19, 2016, from https://blog.cms.gov/2012/07/31/command-center-speeds-up-anti-fraud-efforts/

3 "Report to Congress: Fraud Prevention System Third Implementation Year – July 2015," https://www.cms.gov/About-CMS/Components/CPI/Center-for-program-integrity.html, retrieved February 5, 2016

4 Centers for Medicare & Medicaid Services, U.S. Department of Health and Human Services. (2015, July 14). CMS cutting-edge technology identifies and prevents $820M in improper Medicare payments in first three years [Press release]. Retrieved February 5, 2016, from https://www.cms.gov/Newsroom/MediaReleaseDatabase/Press-releases/2015-Press-releases-items/2015-07-14.html

5 U.S. Government Accountability Office. (2012, October). Medicare Fraud Prevention: CMS Has Implemented a Predictive Analytics System, but Needs to Define Measures to Determine Its Effectiveness. (Publication No. GAO-13-104). Retrieved from Government Accountability Office Reports Online via GPO Access: http://www.gao.gov/assets/650/649537.pdf, retrieved February 5, 2016

6 "Report to Congress: Fraud Prevention System – Second Implementation Year" https://www.stopmedicarefraud.gov/fraud-rtc06242014.pdf, retrieved February 5, 2016

7 United States Congress. House Committee on Oversight and Government Reform, Subcommittee on Government Operations. Hearing on the Actions of the Department of Defense to reduce Improper Payments and to achieve sustained compliance with the Improper Payments Elimination and Recovery Act of 2012. July 9, 2014. 113th Cong. 2nd sess. Washington: GPO, 2014 (Statement of Mark Easton, Deputy Chief Financial Officer, Department of Defense). https://oversight.house.gov/wp-content/uploads/2014/07/Easton-Testimony-Bio.pdf

8 "Success Stories." (no date). Retrieved February 5, 2016, from https://paymentaccuracy.gov/content/success-stories

9 "Privacy Impact Assessment for the Office of the Inspector General Data Analytics System (ODAS)," https://www2.ed.gov/notices/pia/oig-das.pdf

Office of the Inspector General (OIG), U.S. Postal Service

The Postal Service's Office of the Inspector General (OIG) also uses predictive analytics to focus its investigative resources more effectively. The Risk Assessment Data Repository (RADR) (Figure 2), built by the Counter Measures and Performance Evaluation (CAPE) team, scores all USPS contracts and healthcare claims for their likelihood of fraud, waste, and abuse based on a set of risk indicators.[10] Investigators use RADR's web-based interface to identify potential fraud cases with a visual heat map showing the geographic location of potential fraudulent activity within the USPS enterprise. RADR went online in 2011[11] and has even attracted attention from private sector organizations like Netflix, which was interested in identifying where lost packages were going.[12]

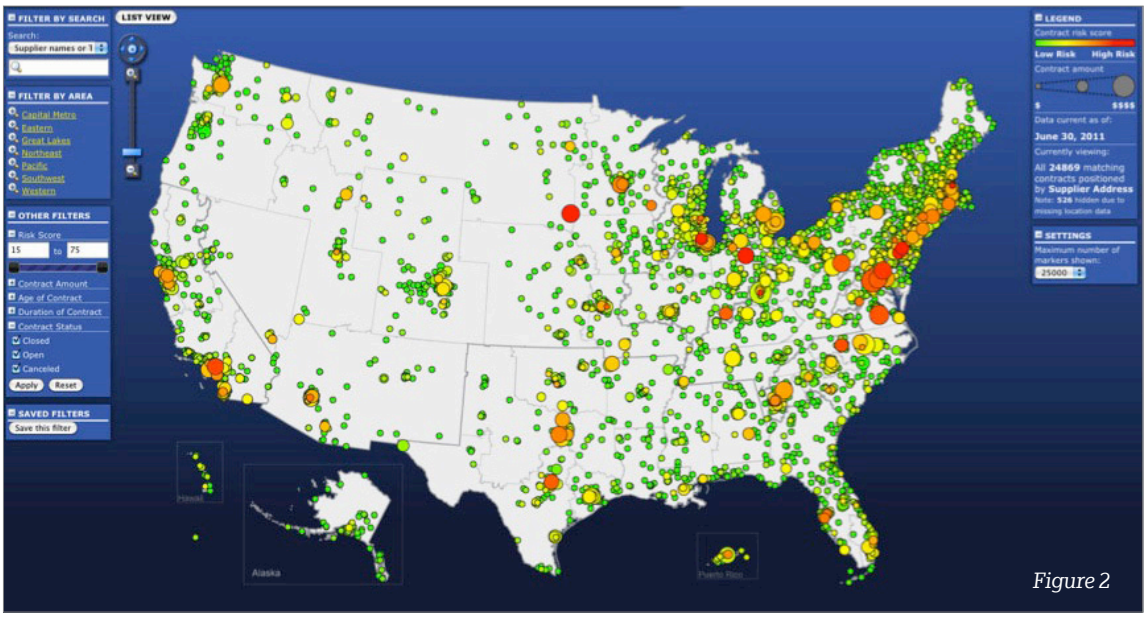


Figure 2

UNITED STATES POSTAL SERVICE

Implementing a predictive analytics solution

Implementing a predictive analytics solution requires a significant investment, one that may face extreme scrutiny in the present fiscal climate where an agency's budget growth has been flat or negative year-over-year.[13] To mitigate the risk of cost overruns, agency leadership must approach a predictive analytics implementation with an iterative mindset. The basic steps to a successful implementation are as follows:

i. Define the objective – The first step in any analysis process is defining the objective you wish to achieve.

ii. Gather the data – Accurate and accessible data are vital to the success of any analytics model.

iii. Prepare the data – Data often need to be converted, cleansed, translated, depersonalized, or otherwise normalized before they can be reliably and securely analyzed.

iv. Define the variables – It is critical to identify dependent and independent data points. Without understanding the variables, it is difficult to apply an appropriate model.

v. Create the model – Various modeling techniques and approaches can be applied to predictive analytics. Before analysis can occur, you must define and create a model that supports the objective.

vi. Validate the model – A model must be tested before it can be implemented. A good test of a model is to apply normalized data sets from multiple sources, ensuring the model performs uniformly regardless of the data source.

vii. Implement the model – Effective implementation of a model consists of several steps, including the use of business intelligence tools, well-designed and repeatable procedures, and a go-forward plan that defines how the model will be maintained and refined.

10 "RADR System," http://datamininglab.com/fraud-detection/89-radr-system , retrieved February 5, 2016
11 "In-house analytics tool maps fraud at USPS," https://gcn.com/Articles/2014/05/20/USPS-RADR-fraud-detection.aspx?Page=2, retrieved February 5, 2016
12 "How the Post Office's 'Eye in the Sky' fights fraud," http://datamininglab.com/fraud-detection/89-radr-system, retrieved February 5, 2016
13 Smarter, Better, Faster: The Potential for Predictive Analytics and Rapid-Cycle Evaluation to Improve Program Development and Outcomes. The Hamilton Project. Retrieved February 5, 2016, from http://www.brookings.edu/~/media/research/files/papers/2014/06/19_hamilton_policies_addressing_poverty/predictive_analytics_rapid_cycle_evaluation_cody_asher.pdf

What to consider when implementing a predictive analytics model

For an agency willing to leverage its data in pursuit of operational savings and greater insight into its own processes, the programs outlined above demonstrate the potential of predictive analytics. However, the decision to implement a predictive analytics solution must be an informed one. Program executives can and should apply the expertise of their operational support staff, or those whose work will be most affected by the introduction of a predictive analytics tool. Following are five themes an agency should explore before investing in predictive analytics.

a. Measuring success: Model success is easiest to quantify by comparing model output with actual results. Back-testing model output over time against actual results can provide a baseline of model variance. When a model's forecasts are consistent with actual results (within an acceptable tolerance range defined by the agency), the model can be deemed a success.

b. Implementation time: When estimating how long it will take to implement a predictive analytics solution, there are several factors to consider, including output significance and model objective. The quality and quantity of inputs must be taken into consideration, in addition to the model's complexity. Other major factors in implementation timelines are the integrity of data used to develop the model, the accessibility of the data, and the data format. Lastly, ensuring a robust and thorough quality check and validation process is important and could significantly increase implementation time, depending on model significance and potential regulatory oversight of the model and its outputs.

c. Unique model vs. "off the shelf" solutions: In looking at the model type, its objective, and the significance of the drivers from internal and external sources, an agency must decide if it needs a unique solution or one that is generic and off the shelf. It can be very beneficial to customize and extend your model output across the agency and incorporate the results into divisions or subagencies. When a model's results already perform within predetermined tolerance levels, investments in customizing the model may outweigh the benefits of incremental performance. In those cases, it would be better to develop a new model than to customize an existing one.

d. Flexibility to improve the model over time: Models use historical data to predict future results, so they should improve over time. Agencies should maintain and update their models as the environment changes. For example: over time, external factors and the impact of macroeconomics on model results can be correlated, creating opportunities for additional inputs that can improve model performance.

e. Communicating the predictions to stakeholders: Models are developed to help stakeholders better anticipate future results and to better understand the drivers of those results. Model owners must be able to illustrate and articulate driver impacts on model results to stakeholders. This enables stakeholders to make adjustments that will move the agency toward its desired results.

Conclusion: Predictive analytics can help your agency evolve and thrive

With pressures increasing on agencies' C-suites to adapt to regulatory change — and with a growing volume of government mandates overwhelming resource-stretched agency risk and compliance teams — predictive analytics provides a toolkit for more efficient transaction/operational processing for the federal enterprise. By leveraging their agencies' indigenous operational data, CIOs can transform their system data into a solution that mitigates risk, enhances efficiency, and bolsters compliance.

Navient's predictive analytics capabilities

Navient brings data, analytics, visualization, compliance, and risk management together in a repeatable and sustainable way that transforms risk and compliance initiatives and obligations, enabling agency and IT leaders to work side by side for enterprise mission success.

Navient uses predictive analytics every day to guide our loan management, loan servicing, and asset recovery clients. Our models help us identify individuals and entities most likely to service or repay their debt and contribute to the health of our clients' loan portfolios. Navient predictive models draw data from a vast array of borrower attributes. The most common attributes include individual income, individual payment history, contact history, delinquency age, credit score, assets, homeownership status, and employment status. For a tax amnesty engagement for a Midwestern state, Navient models also drew from data sets of unemployment rates (at county and ZIP code level) and average household incomes.

Navient is a nationwide leader in loan management and servicing, asset recovery, and business services. In our capacity as the nation's largest student loan servicer, we have access to customer attributes such as loan payment history and credit bureau data. We use an enterprise data warehouse (EDW) that retains and tracks all account activity, including program use, payments, and delinquency. We have access to a wide variety of data sources that assist with measuring, understanding, and implementing model overlays based on current and future economic conditions (e.g., unemployment rates, GDP, and household income). We leverage data to help our customers achieve their educational goals and help our clients achieve their financial goals. We can help your agency accomplish:

Data management: Navient takes in, integrates, and cleanses vast volumes of data from a variety of sources before loading it into a cohesive and comprehensive data platform, consisting of a traditional EDW and highly scalable big data. Clean data is the fuel on which our predictive analytics solutions run.

Increased operational efficiency: Navient's competitive advantage in the student loan industry lies in our ability to realize efficiencies and execute effective engagement through predictive analytics. We leverage our extensive historical data to help develop models of borrowers who may struggle to meet their financial obligations. These predictive scoring models help us focus our efforts and prevent thousands of borrowers from becoming delinquent or defaulting. In part because of these efforts, our borrowers default 38% less often than student loan borrowers serviced by other organizations.

Balance sheet management: Using a variety of internal and external data sources, Navient has developed predictive underwriting, segmentation, and loss models. To assist high-risk borrowers entering repayment, we can compare the distribution of inventory by risk tiers to Navient's existing segmentation models. Navient's life-of-loan default rates can serve as a proxy for a like-kind population and/or be augmented with additional external data to improve model effectiveness.

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For more information about how Navient can help your organization implement a predictive analytics solution, please contact:

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