The Forrester Wave™: Multimodal Predictive Analytics And Machine Learning Solutions, Q3 2018

The 13 Providers That Matter Most And How They Stack Up

by Mike Gualtieri and Kjell Carlsson, Ph.D.
September 5, 2018

Why Read This Report

In our 24-criteria evaluation of multimodal predictive analytics and machine learning (PAML) providers, we identified the 13 most significant ones — Dataiku, Datawatch, FICO, IBM, KNIME, MathWorks, Microsoft, RapidMiner, Salford Systems (Minitab), SAP, SAS, TIBCO Software, and World Programming — and researched, analyzed, and scored them. This report shows how each provider measures up and helps enterprise application development and delivery (AD&D) leaders make the best choice.

Key Takeaways

SAS, IBM, And RapidMiner Lead The Pack
Our research uncovered a market in which SAS, IBM, and RapidMiner are Leaders; KNIME, SAP, Datawatch, TIBCO Software, and Dataiku are Strong Performers; FICO, MathWorks, and Microsoft are Contenders; and World Programming and Salford Systems (Minitab) are Challengers. All included vendors have unique sweet spots that continue to satisfy enterprise data science teams.

Data Science Teams Want To Shed Their Math Nerd Image
In 2012, Harvard Business Review asserted that data scientist is "The Sexiest Job Of The 21st Century." But being "sexy" without being "social" is to fritter away opportunity. Data scientists get this. That's why they want PAML solutions that also serve the many collaborators in an enterprise needed to bring their good work to production applications.

Multimodal PAML Solutions Are Flush With New Innovation
It was a very good year for multimodal PAML vendors. After years of incremental, ho-hum innovation, Forrester sees some bright lights: reimagined data science workbenches, collaborations tools designed for non-data scientist enterprise roles, hopped-up automation, and some enticing road maps for next year.

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Multimodal PAML Solutions Reimagine How Data Science Teams Work

Machine learning is an elemental core competency that every enterprise must have. The reasons are many. Machine learning gives enterprises the power to predict. It is a fundamental building block to AI. It can learn from data and find hidden insights. Most importantly, it can make even the hugest of enterprises gain the agility of disruptive upstarts by injecting scalable intelligence into hyperpersonalized customer experiences, business processes, operational applications, and employee decisions. None of this happens, though, without businesspeople, data scientists, data engineers, software developers, and AI engineers working together. That's where enterprise predictive analytics and machine learning solutions for data science teams and their friends are necessary. Forrester defines enterprise PAML as:

> *Software that provides enterprise data scientist teams and stakeholders with 1) tools to analyze data; 2) workbench tools to build predictive models using statistical and machine learning algorithms; 3) a platform to train, deploy, and manage analytical results and models; and 4) collaboration tools for extended enterprise teams, including businesspeople, data engineers, application developers, DevOps, and AI engineers.*[1]

"Multimodal" Is One Of Three PAML Segments Identified By Forrester

The focus of this Forrester Wave™ is on evaluating multimodal PAML solutions. This is one of three market segments identified in the "Now Tech: Predictive Analytics And Machine Learning Solutions, Q2 2018" Forrester report. We define these segments as follows:

› **Multimodal PAML solutions provide the widest breadth of workbench tools.** These solutions offer multiple user-interface paradigms and the broadest set of workbench tools, such as graphical user interfaces (GUIs), configuration wizards, automation, and coding environments. Many of these solutions also provide tools for non-data scientists to build data pipelines, create machine learning models, and collaborate with data science teams. This PAML market segment is what we have evaluated in this Forrester Wave.

› **Notebook-based PAML solutions favor a code-first approach.** Notebook-based PAML solutions provide workbench tools centered on coding in R, Python, and other programming languages using open source Jupyter or a proprietary interface that makes coding more efficient. The vendors in this segment add significant, differentiated features, such as environment provisioning, project management, deployment, model management, visualization tools, and more. Forrester has evaluated notebook-based PAML solutions in a separate Forrester Wave evaluation.[2]

› **Automation-focused PAML solutions help non-data scientists build models.** This segment focuses on tools to automate the steps in the model-building life cycle. Automation-focused solutions enable data scientists and non-data scientists to build models by configuration instead of coding and specifying each step in a data science pipeline. Some multimodal and notebook-based vendors offer automation as well, but they also offer other approaches to building models and thus

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are not exclusively included in this automation-focused segment. The vendors in this category focus specifically on an automation approach to machine learning. Forrester plans a separate Forrester Wave evaluation of this subsegment in 2019.

The Future Of PAML Is The Thousand-Model Vision

The importance of data science cannot be understated. It is the electricity of artificial intelligence, the butterfly effect of the insights-driven business, and the chemical reaction of scalable intelligence across the enterprise. Today, enterprises use machine learning models to identify customer churn, suggest upsell/cross-sell, reroute logistics bottlenecks, predict manufacturing machine failure, and make other predictions. A few models here and there are valuable and significant, but they are a mere drop in the bucket compared to what is possible. Enterprises have dozens, hundreds, and even thousands of applications and business processes that could, but do not currently, benefit from predictive models. That is the thousand-model vision that enterprise data science teams must rise to in the next two years. Multimodal PAML solutions vendors must help them get there by:

› **Supporting the needs of much larger teams and the larger community.** Most enterprise data science teams are small and organizationally dispersed. They often struggle to deliver data science initiatives on a repeated basis, especially for projects with new stakeholders or that involve new use cases.[3] To support the explosion of enterprise use cases, teams need to get bigger and, simultaneously, PAML tools need to support these teams as well as the larger community of businesspeople, data engineers, software developers, and AI engineers. In five years, we expect extended data science teams will become bigger than software development teams.

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› **Making automation the first step in the data science life cycle.** Today, only in our imaginations can data science teams churn out and maintain thousands of models. They need to in reality, though. The data science life cycle based on variations of the now decades-old CRISP-DM process is too sequential and too manually iterative to dramatically boost productivity. Massive machine learning automation is the future of data science because it will make data science teams exponentially more productive.[4] Automation-focused PAML vendors are leading the way, but multimodal and notebook-based vendors also provide varying degrees of automation. PAML vendors must make automation so good and natural that it becomes the first step that a data science team takes when working on a new project, rather than the novelty that it is today.

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› **Integrating with software development and continuous integration tools.** Data scientists regularly complain that their models are only sometimes or never deployed.[5] A big part of the problem is organizational chaos in understanding how to apply and design models into applications. But another big part of the problem is technology. Models aren't like software code, because they need model management. And models must make it into applications. Data science teams — and therefore PAML solutions — must play nicely with application development teams and the tools that they use to design, develop, and deploy applications.

› **Keeping up with open source innovation.** Data science teams need quick access to open source innovation, such as deep learning, that drives new enterprise use cases and delivers the thousand-model vision. Multimodal PAML vendors must make new open source libraries or newer versions of existing libraries available and abstracted within the workbench, almost as soon as they are released. Many teams that use multimodal PAML solutions are forced to also use a notebook-based solution to get quick access to these open source libraries. Switching tools and learning new programming languages is a productivity killer.

Multimodal PAML Solutions Evaluation Overview

To assess the state of the multimodal PAML solutions market and see how the vendors stack up against each other, Forrester evaluated the strengths and weaknesses of top vendors. After examining past research, user need assessments, and vendor and expert interviews, we developed a comprehensive set of 24 evaluation criteria, which we grouped into three high-level buckets:

› **Current offering.** Each vendor's position on the vertical axis of the Forrester Wave graphic indicates the strength of its current offering. Key criteria for these solutions include workbench, model operations, algorithms, architecture, and business solutions.

› **Strategy.** Placement on the horizontal axis indicates the strength of the vendors' strategies. We evaluated each vendor's ability to execute, solution road map, implementation support, pricing and acquisition, and partners.

› **Market presence.** Represented by the size of the markers on the graphic, our market presence scores reflect each vendor's customer adoption, evaluated product revenue, and market awareness.

Evaluated Vendors And Inclusion Criteria

Forrester included 13 vendors in this assessment: Dataiku, Datawatch, FICO, IBM, KNIME, MathWorks, Microsoft, RapidMiner, Salford Systems (Minitab), SAP, SAS, TIBCO Software, and World Programming. Each of these vendors (see Figure 1):

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› **Is identified as a multimodal PAML solution.** Forrester has determined that all evaluated vendors offer a multimodal PAML solution, as defined in the "Now Tech: Predictive Analytics And Machine Learning Solutions, Q2 2018" Forrester report.[6] Vendor solutions that we've identified as notebook-based PAML or automation-focused PAML solutions are not included. In some cases, vendors offer distinct PAML solutions that are included in more than one segment.

› **Offers a comprehensive, differentiated multimodal PAML solution.** Vendors included in this evaluation must offer a solution that can operate on large data sets; provide capabilities for data acquisition and preparation; and provide statistical and machine learning algorithms, a differentiated user interface to build models, and model management features. If a vendor offers a PAML based in whole or in part on open source, the vendor must have value-added differentiation; for example, a business intelligence (BI) or database vendor that includes the ability to run R scripts or Python is not included in this Forrester Wave.

› **Markets a standalone multimodal PAML solution at enterprise data science teams.** Forrester included only solutions that are marketed toward enterprise data science, AI engineers, and/or app development teams that use machine learning algorithms to analyze data and create predictive models. We did not include any PAML solutions that we deem are technologically embedded in any other particular application, such as a BI, data preparation, or ETL application, or a middleware stack.[7]

› **Meets our install base and revenue requirements.** Included vendors have at least four paying, named enterprise customers using the PAML solution. Vendors also provided Forrester with three customer references who agreed to fill out a confidential survey and/or a participate in a telephone interview. Included vendors also had a trailing 12-month revenue of at least $4 million.

› **Has sparked client inquiries and/or has market momentum.** Forrester clients often discuss the vendors and products through inquiries; alternatively, the vendor may, in Forrester's judgment, warrant inclusion or exclusion in this evaluation because of technology trends, market presence, or lack of client interest or vendor momentum.

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FIGURE 1 Evaluated Vendors And Product Information

Vendor	Product name	Version
Dataiku	Dataiku DSS	4.3
Datawatch	Angoss KnowledgeSTUDIO, KnowledgeSEEKER, KnowledgeENTERPRISE	10.7
FICO	Decision Management Suite 2018-2 (DMP 2.4.1 on AWS)	FICO Analytics Workbench 2.2 FICO Analytic Modeler Scorecard Pro 6.0.2 FICO Analytic Modeler Decision Tree Pro 2.0 FICO Blaze Advisor 7.5 FICO Decision Central 6.4 FICO DMP Streaming 3.5.1 FICO Model Builder 7.5.1
IBM	IBM Watson Studio	
KNIME	KNIME Analytics Platform and KNIME Server	V 3.5.3
MathWorks	MATLAB plus add-on products for predictive analytics	9.4
Microsoft	Azure Machine Learning Studio	
RapidMiner	RapidMiner Platform	
Salford Systems (Minitab)	Salford Systems	8.3
SAP	SAP Predictive Analytics 3.3 SAP HANA 2.0 SPS03 SAP Leonardo Machine Learning 1802	SAP Predictive Analytics 3.3 SAP HANA 2.0 SPS03 SAP Leonardo Machine Learning 1802
SAS	SAS Visual Data Mining and Machine Learning (VDMML) SAS Enterprise Miner (EM)	VDMML 8.3, EM 14.3
TIBCO Software	TIBCO Spotfire Data Science TIBCO Statistica TIBCO Enterprise Runtime for R (TERR)	TIBCO Spotfire Data Science 6.3.2 TIBCO Statistica 13.4 TIBCO Enterprise Runtime for R 4.4.1
World Programming	WPS Analytics	WPS Analytics 4.0

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Vendor Profiles

We intend this evaluation of the multimodal PAML solutions market to be a starting point only and encourage clients to view detailed product evaluations and adapt criteria weightings to fit their individual needs through the Forrester Wave Excel-based vendor comparison tool (see Figure 2 and see Figure 3). Click the link at the beginning of this report on Forrester.com to download the tool.

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FIGURE 2 Forrester Wave™: Multimodal Predictive Analytics And Machine Learning Solutions, Q3 2018

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*A gray marker indicates incomplete vendor participation.

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FIGURE 3 Forrester Wave™: Multimodal Predictive Analytics And Machine Learning Solutions Scorecard, Q3 2018

	Forrester's weighting	Dataiku	Datawatch	FICO	IBM	KNIME	MathWorks	Microsoft
Current offering	50%	2.68	2.47	2.62	4.01	3.05	2.44	1.93
Workbench	40%	3.50	2.60	2.60	4.20	3.30	1.60	2.00
Model operations (ModelOps)	15%	1.50	2.50	2.50	3.50	1.50	2.00	1.50
Algorithms	15%	2.00	2.00	1.00	4.00	4.00	3.00	2.00
Architecture	15%	2.00	2.00	3.00	4.00	2.00	2.00	2.00
Business solutions	15%	3.00	3.00	4.00	4.00	4.00	5.00	2.00
Strategy	50%	2.60	3.40	2.60	5.00	3.00	2.20	1.80
Ability to execute	20%	3.00	3.00	1.00	5.00	3.00	1.00	3.00
Solution road map	20%	3.00	3.00	3.00	5.00	3.00	1.00	1.00
Implementation support	20%	3.00	3.00	5.00	5.00	3.00	3.00	1.00
Pricing and acquisition	20%	1.00	3.00	3.00	5.00	5.00	3.00	1.00
Partners	20%	3.00	5.00	1.00	5.00	1.00	3.00	3.00
Market presence	0%	1.66	1.00	2.34	4.34	2.34	3.02	3.00
Customer adoption	34%	1.00	1.00	3.00	5.00	3.00	5.00	3.00
Evaluated product revenue	33%	1.00	1.00	3.00	3.00	1.00	3.00	1.00
Market awareness	33%	3.00	1.00	1.00	5.00	3.00	1.00	5.00

All scores are based on a scale of 0 (weak) to 5 (strong).

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FIGURE 3 Forrester Wave™: Multimodal Predictive Analytics And Machine Learning Solutions Scorecard, Q3 2018 (Cont.)

	Forrester's weighting	RapidMiner	Salford Systems (Minitab)*	SAP	SAS	TIBCO Software	World Programming
Current offering	50%	3.60	1.36	2.91	4.17	2.39	1.56
Workbench	40%	4.50	2.00	3.90	4.80	2.60	2.20
Model operations (ModelOps)	15%	1.00	1.25	2.00	3.00	2.00	1.50
Algorithms	15%	4.00	1.00	2.00	3.00	3.00	1.00
Architecture	15%	3.00	0.00	3.00	4.00	3.00	1.50
Business solutions	15%	4.00	1.50	2.00	5.00	1.00	0.50
Strategy	50%	3.80	1.00	3.00	5.00	3.40	1.60
Ability to execute	20%	3.00	1.00	3.00	5.00	1.00	1.00
Solution road map	20%	5.00	0.00	5.00	5.00	5.00	3.00
Implementation support	20%	3.00	3.00	3.00	5.00	3.00	3.00
Pricing and acquisition	20%	5.00	1.00	1.00	5.00	5.00	1.00
Partners	20%	3.00	0.00	3.00	5.00	3.00	0.00
Market presence	0%	1.66	1.00	2.34	5.00	3.02	1.68
Customer adoption	34%	1.00	1.00	3.00	5.00	5.00	3.00
Evaluated product revenue	33%	1.00	1.00	3.00	5.00	1.00	1.00
Market awareness	33%	3.00	1.00	1.00	5.00	3.00	1.00

All scores are based on a scale of 0 (weak) to 5 (strong).
*Indicates a nonparticipating vendor

Leaders

› **SAS builds the first truly multimodal PAML solution.** Use a wizard to automatically train a
model and generate a visual machine learning pipeline, convert it to code and edit it, then convert
it back to a visual pipeline. And do it all in a unified workbench. Impossible? Not for SAS. The
vendor's new Visual Data Mining and Machine Learning platform lets you go roundtrip between
visual machine learning pipelines and code and offers integrated features for automated machine

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learning. All of this is packaged in a slick, visual (veteran SAS users take note), *unified* environment that includes a growing set of well-thought-through visual tools for creating models — even deep neural networks. Data scientists who want to code using Python or R can embed snippets of code directly in their SAS programs.

› **IBM puts AI to work.** IBM Watson is a vast umbrella of technologies and solutions, one of which is Watson Studio, a PAML solution. Watson Studio was designed from the ground up to aesthetically blend SPSS-inspired workflow capabilities with open source machine learning libraries and notebook-based interfaces. It is designed for all collaborators — business stakeholders, data engineers, data scientists, and app developers — who are key to making machine learning models surface into production applications. Watson Studio offers easy integrated access to IBM Cloud pretrained machine learning models such as Visual Recognition, Watson Natural Language Classifier, and many others. It is a perfectly balanced PAML solution for enterprise data science teams that want the productivity of visual tools and access to the latest open source via a notebook-based coding interface.

› **RapidMiner helps 380,000 users do machine learning faster.** RapidMiner continues to live up to its name, building on its easy-to-use visual environment with the most productivity-enhancing, automated model creation features available. Rather than offer one-click features to create an opaque (and usually flawed) model, RapidMiner guides the user, suggests actions, and generates a host of models ranked by performance and transparency. Most importantly, each model is a standard workflow that the user can inspect, customize, and build on. Between features that enable a wide range of skill levels and its open-source-based business model, RapidMiner is a particularly good choice for organizations looking to scale the use of machine learning broadly. RapidMiner has long had the ability to run in Hadoop using Spark, and it recently added a host of features for enterprises — such as job scheduling and real-time scoring. Next step: revolutionize data prep?

Strong Performers

› **KNIME's model process factory is a productivity multiplier.** KNIME differentiates itself through its open source, community-driven innovation, which has contributed to more than 1,000 analytical, statistical, transformation, and machine learning methods. What could be better than that? The answer is reuse, recombination, and scaling of data science workflows. With its model process factory capability, KNIME has figured out how to make individual data scientists dramatically more productive — and teams of data scientists even more so. KNIME's position in the PAML market is solid because of its community of data scientists. With predictive analytics and machine learning taking off within enterprises, KNIME has a much larger opportunity to develop tools that are attractive to data engineers, business analysts, and the app developer community that will ultimately infuse KNIME models in enterprise applications.

› **SAP's solution is a critical component in its Intelligent Enterprise.** SAP's portfolio of enterprise applications and technology is breathtaking in its breadth and depth. That's the opportunity and impetus behind SAP Leonardo: to bring emerging technologies (including machine learning) to

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reimagined and redesigned applications, business processes, and customer experiences. Because of Leonardo, SAP's PAML solution should get a lot more attention. Enterprise data is the raw fuel of successful machine learning projects, so SAP has spiffed up its data management suite to serve the needs of data engineers and data science teams. Forrester has also recognized SAP Predictive Analytics as an automation-focused PAML solution, which is a hot market segment that Forrester will evaluate in 2019. SAP customers can leverage their unique data and the raw processing power of HANA to build predictive models that can make applications more intelligent and get smarter over time.

› **Datawatch's acquisition of Angoss may mean the best is yet to come.** Angoss has always been known for its features for building decision and strategy trees as well as scorecards, but it has long since evolved into a broad PAML solution. That evolution may be about to take another leap under Datawatch, with the potential for an integrated solution for data management, PAML, and BI. For example, financial firms may be interested in a solution that combines Angoss predictive analytics for financial applications with real-time visualizations from Datawatch's Panopticon solution. Angoss looks to be embracing the challenge with an impressive road map of features spanning BI integrations, simulations for sensitivity analysis, project management (including version control), and an algorithm marketplace. In the meantime, Angoss is particularly interesting for enterprises that can take advantage of its extensive tooling for tree models or its unique abilities to integrate SAS code.

› **TIBCO Software seamlessly integrates analytics and data science.** TIBCO offers enterprises two options for data science teams. The first, TIBCO Statistica, is the longstanding (founded in 1984), well-known PAML solution that the vendor acquired in 2017. It is targeted toward data science teams that need sophisticated analytical and machine learning methods to build industrial-class models and manage production deployments. The second is TIBCO Spotfire Data Science, which is targeted toward both BI and data science teams to collaborate on insights projects. For years, TIBCO's only PAML solution was TERR, a speed-optimized version of the open source R programming language. With TIBCO Statistica and TIBCO Spotfire Data Science, it now can satisfy a wide range of data science projects in close collaboration with BI professionals.

› **Dataiku is becoming the multimodal force majeure.** Dataiku is the only emerging vendor that Forrester has segmented as a multimodal PAML solution. All other up-and-comers are in the notebook-based or automation-focused PAML segments. Dataiku's solution is persona driven for the many stakeholders involved in scaling enterprise data science. While data scientists get both coding and visual pipeline tools for model building, data engineers, business decision makers, and data analysts can use Dataiku's visual interfaces and collaboration tools. Dataiku is well-VC-funded and is a disruptive challenger to long-time multimodal PAML solutions. To keep its product innovation momentum going, the vendor must stay focused on the collaborative roles that scale data science and ramp up model management capabilities.

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Contenders

› **FICO's focus is on high-value, automated decisions.** Predictive models are almost always used as components within a larger context of repeated, automated decisions in business process and customer experience applications.[8] FICO's unique value proposition is to offer an integrated set of tools for both PAML and decision management. This means that in addition to providing solid modeling capabilities, FICO offers sophisticated digital decisioning tools to author business logic and/or scorecards using models built within FICO's PAML solution or imported from other PAML solutions. Data science teams that focus exclusively on models may fail to recognize how digital decisioning tools such as FICO's can simultaneously spur smooth collaboration with business stakeholders and get models into production faster.

› **MathWorks' MATLAB is for specialist data scientists.** For anyone thinking that MATLAB is just for scientific computing, guess what? Machine learning is scientific computing. Though not often thought about as a PAML solution, MATLAB offers more machine learning algorithms — and more specialized modules for industry use cases — than you can shake a stick at. Indeed, it offers extensive features for deep learning, including the ability to import and export deep learning models with major open source frameworks (such as TensorFlow and Caffe). MATLAB is a good choice for enterprises whose machine learning needs span applied statistics, predictive analytics, and engineering or that need a fully supported environment and extensive modules focused on particular use cases. Keep it away from business users, though; while MATLAB has plenty of visual tools for specific use cases, it is a code-first environment.

› **Microsoft wants to help you manage machine learning like a tech giant.** Azure Machine Learning Studio is a streamlined visual tool that data scientists, developers, and non-data scientists alike can use to create simple data and machine learning pipelines. However, Microsoft has much larger plans for machine learning. In addition to promoting deep learning — such as its CNTK framework and the joint ONNX standard for neural networks — Microsoft wants to put the architecture it has built to deliver its own cognitive services into the hands of customers. This will involve a new set of tools to prepare data, build and train models, and deploy them at a scale that only tech giants can do today. Further, new services are coming to help enterprises provision resources, manage training jobs, and track project dependencies as well as deploy and manage models in production. Also, Microsoft is planning new features for automated machine learning, such as automated model selection and hyperparameter tuning.

Challengers

› **World Programming quietly satisfies an impressive list of world-class enterprises.** You probably haven't heard of World Programming and its WPS Analytics software. That's because its marketing budget is zero. A UK-based company founded in 2000 to develop analytics software, World Programming has developed a SAS compatible engine so enterprises can run their SAS language programs at a fraction of the cost of licensing software from SAS. Today, WPS Analytics offers a PAML solution that looks promising, although it lags in the breadth and depth of features

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of most other evaluated vendors. However, World Programming's WPS Analytics is compelling for enterprises that need a processing engine that can compile SAS code or mix SAS, Python, and R code. World Programming has the raw material to move from a niche player to a mainstream product if it is willing to invest in doing so.

› **Salford Systems disappears under its new owner, Minitab.** Salford Systems was acquired in 2017 by Minitab, a software company that provides software for statisticians. It is best known for its implementation of specific algorithms, including CART, MARS, Random Forests, and TreeNet. Most other vendor solutions have one or more of these methods, but Salford claims that its methods are the best because they are implemented by their inventors — including Jerome Friedman, a professor of statistics at Stanford University. Minitab has kept the Salford brand but has done nothing substantive to reinvigorate the brand or advance the overall product based on today's enterprise market demands. Forrester believes that Salford Systems' future depends on Minitab's investment in both the product and marketing. Salford Systems (Minitab) declined to participate in our research. Scores are based on Forrester estimates.

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Supplemental Material

Online Resource

The online version of Figure 2 is an Excel-based vendor comparison tool that provides detailed product evaluations and customizable rankings. Click the link at the beginning of this report on Forrester.com to download the tool.

Data Sources Used In This Forrester Wave

Forrester used a combination of three data sources to assess the strengths and weaknesses of each solution. We evaluated the vendors participating in this Forrester Wave, in part, using materials that they provided to us by June 6, 2018.

› **Vendor surveys.** Forrester surveyed vendors on their capabilities as they relate to the evaluation criteria. Once we analyzed the completed vendor surveys, we conducted vendor calls where necessary to gather details of vendor qualifications.

› **Product demos.** We asked vendors to conduct demonstrations of their products' functionality. We used findings from these product demos to validate details of each vendor's product capabilities.

› **Customer reference surveys.** To validate product and vendor qualifications, Forrester also fielded a reference survey with three of each vendor's current customers.

The Forrester Wave Methodology

We conduct primary research to develop a list of vendors that meet our criteria for evaluation in this market. From that initial pool of vendors, we narrow our final list. We choose these vendors based on 1) product fit; 2) customer success; and 3) Forrester client demand. We eliminate vendors that have limited customer references and products that don't fit the scope of our evaluation. Vendors marked as incomplete participants met our defined inclusion criteria but declined to participate or contributed only partially to the evaluation.

After examining past research, user need assessments, and vendor and expert interviews, we develop the initial evaluation criteria. To evaluate the vendors and their products against our set of criteria, we gather details of product qualifications through a combination of lab evaluations, questionnaires, demos, and/or discussions with client references. We send evaluations to the vendors for their review, and we adjust the evaluations to provide the most accurate view of vendor offerings and strategies.

We set default weightings to reflect our analysis of the needs of large user companies — and/or other scenarios as outlined in the Forrester Wave evaluation — and then score the vendors based on a clearly defined scale. We intend these default weightings to serve only as a starting point and encourage readers to adapt the weightings to fit their individual needs through the Excel-based tool. The final scores generate the graphical depiction of the market based on current offering, strategy, and

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market presence. Forrester intends to update vendor evaluations regularly as product capabilities and vendor strategies evolve. Vendors marked as incomplete participants met our defined inclusion criteria but declined to participate in or contributed only partially to the evaluation. For more information on the methodology that every Forrester Wave follows, please visit The Forrester Wave™ Methodology Guide on our website.

Integrity Policy

We conduct all our research, including Forrester Wave evaluations, in accordance with the Integrity Policy posted on our website.

Endnotes

[1] DevOps: development plus operations.

[2] See the Forrester report "The Forrester Wave™: Notebook-Based Predictive Analytics And Machine Learning Solutions, Q3 2018."

[3] See the Forrester report "Best Practices: Scaling Data Science Across The Enterprise."

[4] See the Forrester report "Massive Machine-Learning Automation Is The Future Of Data Science."

[5] See the Forrester report "Best Practices: Scaling Data Science Across The Enterprise."

[6] See the Forrester report "Now Tech: Predictive Analytics And Machine Learning Solutions, Q2 2018."

[7] ETL: extract, transform, load.

[8] See the Forrester report "The Dawn Of Digital Decisioning."

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