WHITE PAPER

Combining Robotic Process Automation and Machine Learning

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Robotic process automation (RPA) and machine learning (ML) are among the most popular and exciting technologies available today. These two technologies are often included as components of artificial intelligence (AI), but they have usually been viewed as separate. In the Deloitte 2018 State of AI in the Enterprise survey, 63 percent of respondents said they were already using ML, and another 32 percent said they were planning to use the technology. In the case of RPA, 48 percent were already using it and an additional 40 percent had plans to employ it. In other words, these are among the most pervasive of AI technologies within the enterprise.

Each of these technologies brings business value on its own, but their combination is particularly useful. Some organizations are beginning to combine them for automated, intelligent decision making. The combined capabilities are sometimes called "intelligent automation" or "robotic and cognitive automation." Many firms are beginning to realize that ML can make RPA smarter and that RPA can help to embed machine learning-based decisions into business processes. In this paper, I'll describe each individually, then discuss why combining them can provide substantial additional value.

Robotic process automation

This technology performs structured digital tasks – i.e., those involving information systems – as if it were a human user following a script or rules. There is justifiable debate about whether RPA belongs in a collection of AI technologies because on its own it's not terribly intelligent. However, the fact that it is frequently combined with other AI technologies – not only RPA but tasks like AI-based optical character recognition – makes its classification in the AI category appropriate.

Some refer to RPA as "digital labor," and compared to other forms of AI it is relatively inexpensive, easy to program and transparent in its actions. If a user can point and click, understand graphical models of process flows, and identify some if/then business rules, he or she can understand and perhaps even develop RPA. These systems are also much easier to configure and implement than alternative approaches like developing your own programs in a programming language. Its greatest benefit is to free up humans from performing repetitive and tedious tasks.

RPA doesn't really involve actual robots – only computer programs on servers. It relies on a combination of workflow, business rules and "presentation layer" integration with information systems to act like a semi-intelligent user of the systems. The underlying systems usually don't need to be changed to interface with RPA. Some compare RPA to spreadsheet macros, but RPA can perform substantially more complex tasks. It is also compared to business process management (BPM) tools, which may have some workflow capabilities but are generally designed to document and analyze a business process, not actually automate it.

The greatest shortcoming of RPA alone is its lack of ability to use data or analytical models to make accurate and fast decisions. If RPA needs to make a decision in a process, it can do so only through the use of rules. These are typically adequate for simple, structured decisions, but often break down as decisions become more complex and data-intensive. And while RPA systems are typically quite capable of extracting information from various information systems, they are not able to analyze the information in order to decide or act upon it.

About the author

Tom Davenport is the President's Distinguished Professor of Information Technology and Management at Babson College, the co-founder of the International Institute for Analytics, a Fellow of the MIT Initiative for the Digital Economy, and a Senior Adviser to Deloitte Analytics. He has written or edited 20 books and over 250 print or digital articles for the Harvard Business Review, Sloan Management Review, the Financial Times and many other publications.

Machine learning

ML is a powerful method in its own right and a strong complement to RPA. It is a set of techniques for making sense of data and "learning" by training models with data. ML allows predictions of outcomes that are not known and is a way to make decisions based on data and probabilistic reasoning. It is a broad technique at the core of many approaches to artificial intelligence and is perhaps the most powerful form of AI. The explosion of data within and outside firms – and particularly external data – has made it both feasible and necessary for them to adopt ML to understand it all.

There are many different algorithms and versions used in machine learning. A relatively complex form of machine learning is the neural network – a technology that has been available since the 1960s and has been used for categorization applications like determining whether a credit transaction is fraudulent. It views problems in terms of inputs, outputs, and weights of variables or "features" that associate inputs with outputs. The most complex forms of ML involve "deep learning," or neural network models with many levels of features or variables that predict outcomes. Unlike earlier forms of statistical analysis, each feature in a deep learning model typically has little meaning to a human observer. As a result, the models are difficult or impossible to interpret.

Once an ML model has been trained (through a process called "supervised learning" – the most common ML approach in business by far), the resulting model can be converted into code – sometimes called "scoring code." That code can be used to predict or classify new data. If new training data is available and analyzed, ML models can learn from that new data. New learning is usually episodic and initiated by humans, rather than continuous and automated.

Modern forms of ML attempt to automate aspects of the model development and scoring process. That can greatly increase the speed and productivity of ML-based analysis, although some interventions by human analysts or data scientists are usually necessary.

Why RPA and ML make sense in combination

RPA and ML are highly complementary technologies that provide significant value to each other. RPA systems are good at structuring and managing the flow of digital work in transactional business processes. ML allows RPA to handle more complex decisions with greater accuracy. Certain forms of machine learning allow RPA to deal with unstructured data – images, text and so forth. ML also allows RPA-based systems to make large-scale decisions (such as whether to extend credit to a large sample of customers) much faster and more accurately than basic RPA alone. Together, the two technologies are more likely to support intelligent end-to-end process automation.

How the combination of the two technologies would normally work is as follows. The role of RPA would be to structure and manage workflow for a process, extract needed information from multiple information systems, and perhaps make some simple decisions using rules. The RPA system would typically interact with a previously-created ML scoring application through the use of an API. The machine learning model, which would have been trained on data for which the outcomes are known, would use data that the RPA system pulled from transactional systems. Over time, the ML model could be retrained with new data.

Examples of combined RPA and ML

Some examples of ML and RPA in combination:

- Companies using RPA for accounts receivable collections processes could focus their efforts on higher value past-due customers as identified by ML models.
- In an RPA-based claims processing application within an insurance company, ML could be used to score claims on the likelihood of fraud, or to identify possible patterns of fraud in "fraud rings."
- Banks or insurance firms could make ML-based credit or insurance underwriting decisions within the context of an RPA-based credit application process.
- ML models could identify images (using deep learning) within the context of an RPA-based marketing or customer relationship management process, e.g., customer photos in social media contributions.
- An employee fraud or malfeasance application could identify possible problematic employee communications through RPA-based extraction of content and ML-based analysis of emails, messages, etc.
- ML-based models could learn from past patterns of customer behavior to make intelligent next-best-offer recommendations, driven by an RPA system, for customers in real time.
- Machine learning could be used to identify government grants or contracts that have not been drawn down after a specified time, and are thus eligible for deobligation. An RPA system could then prepare the deobligation document for human review, and then execute the deobligation in financial systems.

Some firms or government agencies already employ most of these applications, and there are many other possible uses. Anytime a company needs RPA to manage a set of tasks with workflow and also needs to interpret information or make decisions within that process, the two technologies in combination are highly relevant.

What to look for in each technology

It is not guaranteed that the marriage between RPA and ML will be a smooth one. In selecting each of the two technologies, it's important to look for attributes that will make combining them easier and more productive. In terms of ML, organizations should seek ML tools (or more appropriately, broad "platforms") that have the following attributes:

- A wide variety of algorithms, so that the best model to fit the training data can be achieved.
- The ability to easily create an API or scoring code to easily connect the RPA system to the ML model.
- Capabilities that support the entire life cycle of machine learning, from data preparation to model deployment.
- The ability to model and deploy as either on-premises or cloud-based platforms.
- The ability to generate models quickly, even at large scale, with some sort of parallel processing.
- Some degree of automation in the algorithm selection and broader machine learning process (known as "automated machine learning"), unless an organization has plenty of highly skilled data scientists to spare.

The RPA system that an organization selects should have the following capabilities:

- It should have an open architecture that allows for the easy integration of ML services when needed for decision making and end-to-end automation.
- The system would ideally have some approach to process discovery in which the existing workflow can be mapped somewhat autonomously.
- The system should have enterprise-level features like security, scheduling, reporting, log-based analytics, etc.
- A library of reusable process templates for common processes can help ease the development of new applications.
- For a large-scale enterprise application, the RPA system should be scalable up to hundreds of robots.

Several vendors provide the RPA capabilities listed; the ML offerings with the needed capabilities are somewhat less common (see sidebar below about SAS ML features). There are both ML and RPA offerings that are open source, but they don't generally incorporate all of the features described above. Eventually, it seems likely that RPA vendors will provide common ML capabilities and vice versa. For the moment, however, a company will need to use multiple tools and vendors to get the desired features.

This combination may seem exotic to some organizations, but it is rapidly becoming mainstream. Most organizations can benefit from technologies that can both automate digital work tasks and make intelligent decisions within those tasks. Consultants and system integrators are increasingly offering help with the combined solutions, and are often working in partnership. SAS and Deloitte, for example, are offering their experience in machine learning and RPA implementation, respectively, for both private sector and government clients. The combination of RPA and ML is likely to be a substantial growth area for many years to come.

Machine learning capabilities from SAS

SAS® Viya®, introduced in 2017, provides a visual, open and modular approach to machine learning. It includes all the features described above as desirable for machine learning and others, including the following features:

- Visual modeling of the machine learning process.
- Many (16) algorithm types, including neural networks and deep learning.
- Multiple approaches to data preparation and management.
- Automated model tuning and feature engineering.
- In-memory parallel processing in the cloud or on-premises.
- Deployment of scoring code via RESTful APIs.

Many SAS customers are using these ML capabilities in combination with their RPA tools.

SAS® Viya®

Machine learning and Intel technology

Want to benefit from the full business value of machine learning? It will require access to large amounts of diverse data sets, optimized data platforms, powerful data analysis and visualization tools. In short, it will have a big impact on your IT environment. That's where Intel comes in.

Intel Xeon processors:

- Servers equipped with Intel Xeon processors help keep costs in check while delivering exceptional performance, agility, reliability and security.
- Machine-learning workloads that are optimized for the latest generation of Intel Xeon processors can execute much faster than unoptimized code.

Additional high-performance Intel technologies:

- **Memory and storage.** As model sizes increase, it is important to keep data close to memory to reduce latency while processing large data sets. Intel 3D XPoint technology, Intel Optane technology and more can help.
- **Network.** Effective machine-learning solutions require a high-performance, low-latency fabric like Intel Omni-Path Architecture to maximize memory capacity and floating-point performance – and to accelerate results.
- **Scalable data and analytics platforms.** New Intel Scalable System Framework hardware and software, in combination with code modernization, have delivered significant machine-learning performance improvements.

These are only a few of the Intel technologies used by leading global organizations at the very center of their machine learning infrastructures every day.

Robotic process automation capabilities from Deloitte

Deloitte is helping transform competitive organizations with new capabilities, like robotics and cognitive automation, that can reduce costs, enhance customer experience and boost employee engagement. Robotics tools, such as RPA and intelligent virtual assistants, are lightweight and quick to implement, with little to no impact on the underlying systems. As an introductory automation capability on the path to true AI, robotics is a critical investment in helping businesses thrive in our disruptive digital world.

Implementing robotics effectively requires a clear understanding of the business strategy and processes to be automated, as well as the technical skills to implement. Deloitte has supported 30 defense, security, justice, civil, health and education clients in reallocating over 160,000 labor hours to agencies at the state, local and federal levels. Leveraging its deep industry experience and extensive alliances with leading robotics and intelligent automation technologies, Deloitte has supported the deployment of over 100 automations from proof of concepts to pilots to enterprise at scale.

Deloitte's Robotic and Intelligent Automation offering includes the following services:

- RPA strategy (operating model, business case, road map).
- Vendor selection.
- Implementation support.
- Opportunity identification.
- Proof of concept/pilot advisory.
- RPA execution support.
- Sustainment model design and operation.
- Managed service.

Artificial intelligence and machine learning from SAS

Artificial intelligence and machine learning capabilities are embedded throughout the SAS Platform, which connects all analytic life cycle activities. SAS offers a cloud-enabled, in-memory analytics engine that provides quick, accurate and reliable analytical insights. Elastic, scalable and multithreaded parallel processing addresses the complex analytical challenges of today while effortlessly scaling for the future.

SAS and robotic process automation (RPA) can communicate with each other via API calls. RPA can feed information to SAS either by moving files into a directory monitored by SAS and via REST calls. SAS can send data back to RPA/Chat via REST calls/API. Output can be stored within data-table variables that a bot is trained to unpack.

SAS and Deloitte are working together to deliver robotic and intelligent automation capabilities to our joint clients to capitalize on the highly complementary technologies of RPA and ML. These efforts leverage RPA and SAS artificial intelligence capabilities such as natural-language processing and machine learning to enable more complex automation through the use of analytics.

The SAS Platform delivers flexibility that drives innovation and creativity while maintaining appropriate control over data, machine learning models and processes. SAS addresses all analytical needs, including:

- **Data management:** SAS helps access, profile, cleanse and transform data from an intuitive interface while securing assets with features such as authentication, authorization and encryption.
- **Analytic techniques:** A single, visual web interface supports iterative model building using a variety of techniques, including classical and modern machine learning, deep learning, natural language processing, computer vision, forecasting and optimization.
- **Model governance:** Quickly register champion and challenger models in a shared, centrally managed inventory with lineage traceability across the entire analytical life cycle.
- **Open:** Access the power of SAS for data manipulation, interactive data interrogations and advanced analytics through REST APIs and a variety of programming languages, including Python, R, Java, Lua and Scala.
- **Deployment:** Develop models once and deploy them in batch, in database, in stream and via APIs with just a few clicks to any infrastructure or application ecosystem, without rewriting code.

SAS combines comprehensive data management, machine learning, business rules management, decision processing, real-time event detection and decision governance. With SAS, you can automate and manage decisions with AI across your organization to transform data into intelligence.

Learn more

For more information about how Deloitte and SAS can help you, visit sas.com/ai or contact one of the representatives below:

Contacts

Chris Rose
Principal, US Government, Deloitte Consulting LLP
christopherrose@deloitte.com

John Houston
Principal, US Data Science Offering Leader,
Deloitte Consulting LLP
jhouston@deloitte.com

Rick Joplin
Global Alliances Director, SAS
rick.joplin@sas.com