Advanced Machine and Deep Learning Helps Digitization of IT

More use of data mining and advanced machine learning helps Cisco IT improve operational efficiency, service performance, and user experience

Until recently, IT organizations used machine learning technology primarily for log analysis or trending to extract meaningful information from data collected in a network or system. Now, machine learning and deep learning are increasingly used to make pattern-based decisions and predictions that help reduce, simplify, and speed up IT service enablement as well as reduce service outages and operational costs.

Machine learning technology can also help IT organizations adapt to three current challenges that mean big changes and new opportunities for IT operations and services.

The first challenge comes with the opportunity to extract value from the exponential growth of unstructured data in the enterprise environment, including data from the Internet of Things and the network and IT infrastructure. These technologies produce enormous amounts of data to monitor and process for the business, which in turn will impact every facet of IT operations and infrastructure.

The second challenge comes from the knowledge that every successful business of the future will be digital. As enterprises pursue this digital transformation, information technologies (IT) and operational technologies (OT) will integrate, which means enabling new business models will be fast and simple. Machine learning will help IT serve as an enabler for these integrations by automating service delivery.

Finally, the principles of the shared economy will extend even deeper into IT organizations. As the cloud has already proven, many IT departments recognize that it is simply too expensive to own most network, computing, and storage assets over the long term. The move away from enterprise-owned infrastructure will mean a redefinition of IT roles, activities, expertise, and services.

WHAT IS MACHINE LEARNING?
A widely quoted definition of machine learning is provided by Professor Tom M. Mitchell of Carnegie Mellon University:
A computer program is said to …
Learn from experience E
With respect to some class of tasks T and performance measure P …
If its performance at tasks in T …
As measured by P …
Improves with experience E

"Machine/Deep learning and automation are 'must-do' next steps to increasing our value to Cisco," says John Manville, Cisco, Senior Vice President, Global Infrastructure Services. "As more and more of Cisco's IT infrastructure are digitized and deploying analytics tools, the boost we get from embedded machine/deep learning is impossible to ignore. After very successful test-programs, we are now planning expanded deployment of ML/DL in every place we can increase our value to the business."

Within Cisco IT, we recognize that making more use of machine learning technology is one answer to these challenges. We have identified six categories of business-impacting use cases for machine learning, as well as the associated infrastructure and process changes we will need to make. We're also getting vital knowledge from two machine learning deployments, for protecting intellectual property and improving wireless LAN coverage.

Machine Learning Use Cases for IT

Cisco IT plans machine learning deployments to generate positive business outcomes in six categories of use cases. These categories reflect mission-critical operations for Cisco, often with an impact that reaches across the company.

Foundational Services. Focusing on the cloud and network infrastructure, the foundational services use case brings a data layer to the physical and virtual IT infrastructure. Machine learning algorithms process that data to improve event correlation, impact analysis, and root-cause analysis in order to reduce mean time to discovery (MTTD) and mean time to resolution (MTTR) of problems. Machine learning programs also help predict outages and reduce overall downtime. For example, our use of machine learning in Cisco® Tetration Analytics gives us pervasive visibility into network activity and a reduced security risk, all with 70 percent lower time and cost for monitoring.

IT Operating Services. Machine learning gives us a predictive capability that reduced escalation rates of IT operations cases by 60 percent. Additionally, machine learning improves our automated case routing for a 30 percent reduction in MTTR.

Experience Services. Bots and advisers support services that deliver personalized experiences for employees, customers, and other users. For example, machine learning guides the output of our learning and development engine, which provides personalized training recommendations to employees.

Security, Identity, and Privacy. Machine learning helps us better identify network anomalies and increase automation of threat intelligence awareness and protection of Cisco's intellectual property.

Adaptive Capabilities. Machine learning helps us understand how to adapt products and services to reflect customer activity. One example here is digital listening, where machine learning classifies telemetry data to analyze the service features used or preferred by customers. For example, by reviewing analytics on subscriber use of Cisco WebEx® services, machine learning helps us retain customers and identify new revenue opportunities.

Large-Scale Services. By applying machine learning to functions with a broad impact on our business, we are positioned to gain substantial business outcomes. For example, machine learning helps us use supply-chain data to predict and prevent avoidable product returns.

The benefits of machine learning will compound in the future as we add more IT services and business functions to these use cases.

Machine Learning Success Stories

Two Cisco IT projects show successful use of machine learning in IT operations.

Protecting Intellectual Property

Cisco IT and the Cisco Security Incident Response Team (CSIRT) work together to detect and prevent inappropriate storage, handling, or disclosure of the company's confidential information and intellectual property.. To support this work, Cisco IT developed the Intelligent Context and Content Aware Monitoring (iCAM) software, which analyzes abnormal user behavior, generates alerts, and applies machine learning technologies to improve the monitoring activity and automated remedies over time. (Figure 1)

With iCAM, fewer than one percent of disclosure incidents require human support, which is a significant cost-savings benefit for Cisco. Additionally, our median time of detection is 2.9 minutes, less than half the industry-standard time of 6 minutes. We are able to accomplish these results by orchestrating an ensemble of machine learning algorithms to detect intellectual property loss while also reducing rates of false-positive alerts.

As the machine learning capabilities improve to detect any risky user behavior, we will create predictive analytics for proactively monitoring and detecting when an unauthorized action may occur. The ultimate goal with iCAM is to predict and prevent disclosure of sensitive information and intellectual property before it happens.

Figure 1.   iCAM Process for Analyzing and Generating Alerts Based on User Behavior and Context
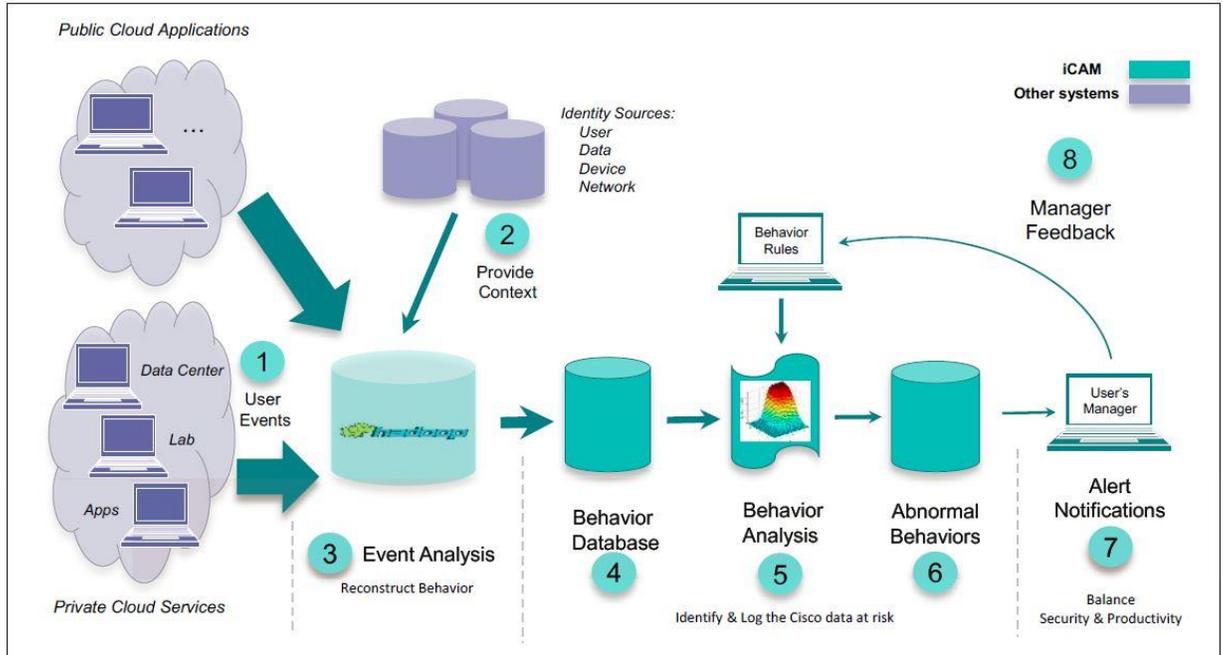
Improving Wireless Coverage

The new Cisco cloud-based analytics solution for wireless and wired networks (called KAIROS) collects network data in the cloud then applies multiple advanced machine learning algorithms to provide an excellent user experience and improve the network coverage and performance. The solution can produce a behavioral analysis of the wired network as well as the wireless access points, controller, and clients, then apply predictive analytics to identify the impact of issues on the user experience. For example, when Kairos detects a problem, it displays the impact on users and recommends network changes to solve the issue. (Figure 2)

Figure 2.   Example Issue Alert in Cisco Kairos

"Cisco has been working for years on the use of Machine Learning/AI architectures and technologies for the network," say JP Vasseur, Cisco Fellow, Engineering. "Without a doubt, we see such technologies playing an increasing role in making the network scalable, secure, providing high quality of service to most demanding applications and truly become intuitive and self-healing. Machine Learning is currently used in many of our products, for both Security, Cognitive Analytics (extracting insights from vast amount of raw data) and Predictive Analytics (capable of forecasting issues, providing root cause and fixing issues before they happen. Such technologies are used in the context of Security and Networking for Enterprise (Wireless & Wired), SP and IoT".

Key Strategies for Maximizing Machine Learning Value

From our experience in applying machine learning technologies to Cisco IT operations and services, we recommend two key strategies for maximizing their business value.

First, focus on data gathering and data quality in order to avoid the "garbage in, garbage out" phenomenon. IT infrastructure organizations can start by building a data platform and adding e-discovery and machine learning capabilities for analyzing data already collected from networks, applications, and systems. Apply mining tools to the data collected, keeping in mind that the infrastructure and applications need to work together to define a common model that will extract useful and relevant data.

Second, define the key metrics for measuring success. Example metrics include operational simplicity, faster time to deliver IT capabilities, excellence of the user experience, reduced manual work, and automated decision-making for IT services, infrastructure investments, and applications.

"The digital transformation of business changes the role of data from being the post-production result of IT operations to a major source of value," says Plamen Nedeltchev, distinguished engineer, Cisco IT. "This change also allows IT to use machine learning for pattern-based decisions and predictions that can increase the value of IT, enable new services quickly, and increase the profit margin for products and services."

For More Information

[Using Machine Learning Technologies to Drive Digital Transformation](#) - (Spanish)

[How Cisco Automates Protection of Intellectual Property](#)

[Cisco Tetration Analytics: Initial Implementation](#)

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