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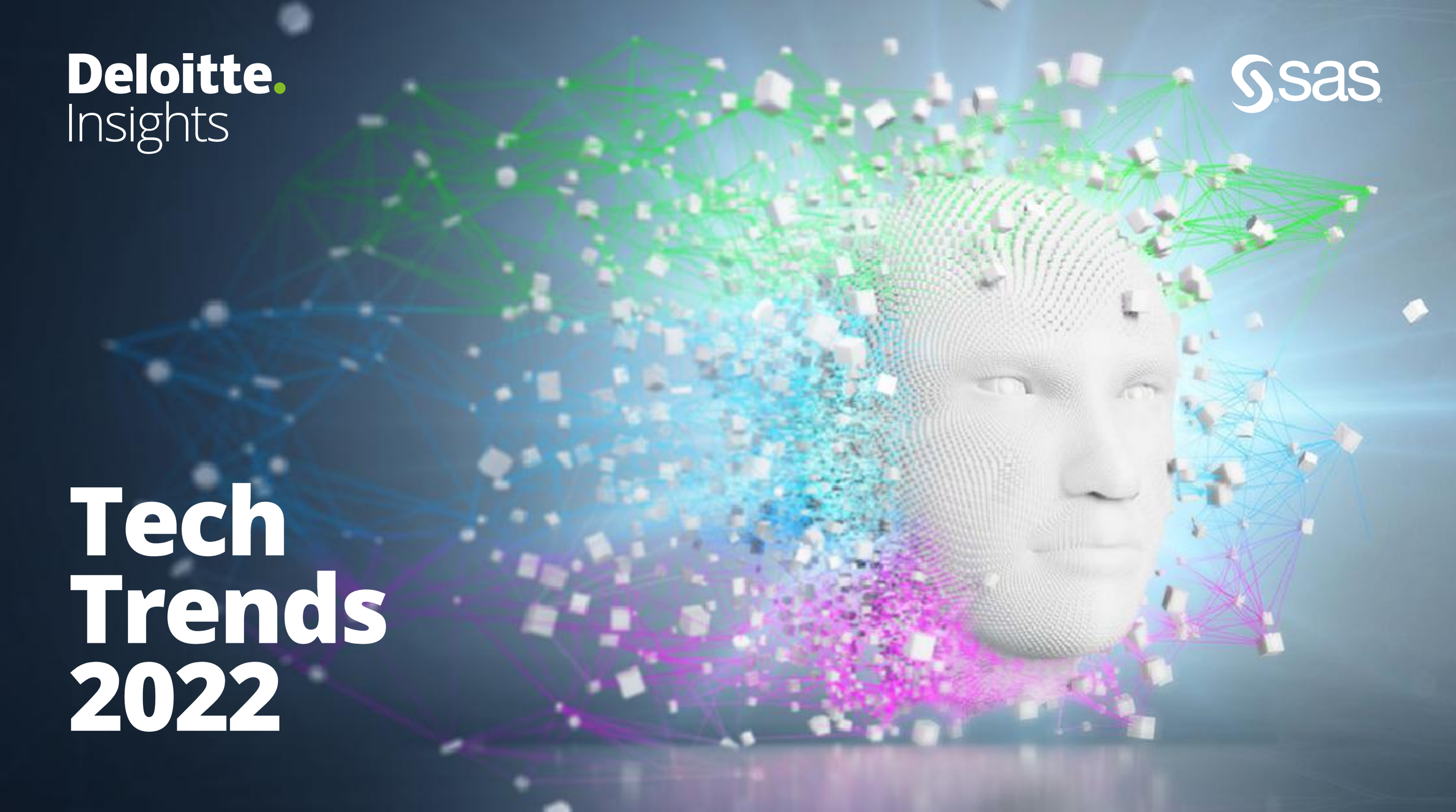

Tech Trends 2022

Explore the trends

Deloitte and SAS have been closely collaborating for decades to make emerging trends in technology and analytics a practical reality for clients around the world. The combination of Deloitte's hands-on, industry-level experience and SAS' world-leading analytics capabilities help deliver stronger outcomes for businesses everywhere. Each year, Deloitte's Tech Trends report sets the standard for forward-thinking insights on what's next in technology. Together, we put tomorrow's technology trends to work today. Explore them below.

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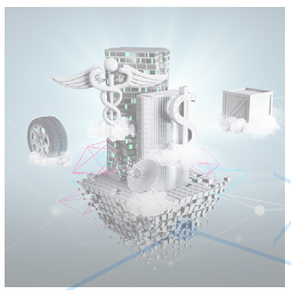

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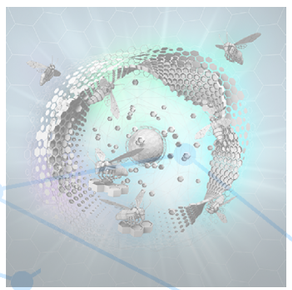

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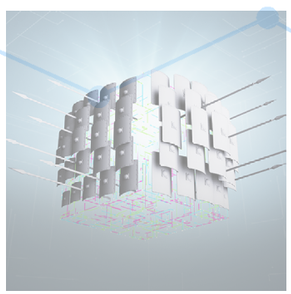

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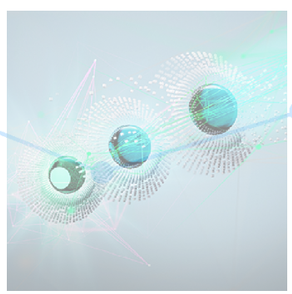


Wondering if all this will really happen?

Just watch.

If you're reading this, you already know why analytics is crucial to gleaning the full business value out of any technology implementation. Whether it qualifies as a trend or not, data is pulsing through these technologies at volumes that are – all hype aside – unprecedented. And the volume is only growing as more advances unfold.

Analytics is how organizations make connections between all this data, identify useful or insightful patterns, and apply the resulting insights into their business.

At least that's how it goes in theory.

In reality, a lot of leaders are struggling – not because they don't understand what analytics can deliver – because they're running into obstacles. Many leaders don't have the budgets or talent to deliver on existing analytics strategies, much less tackle more innovative, forward-looking opportunities.

Others are stuck in the data governance/data quality/data prep loop, making sure their data house is in order before inviting everyone into the big analytics and AI party.

These are real challenges that cannot and should not be ignored. But don't let them blind you to the possibilities presented by Deloitte's latest technology trends. Consider that only a few years ago, the idea of running analytics in the cloud qualified as an out-of-reach trend. Now, cloud services arrive with advanced analytics capabilities built in, requiring minimal coding or integration on the part of the user. It just works – because a wide range of providers saw the opportunity and made it happen.

Do all of these trends "just work" today? No – although aspects of them do. But we're working on that. Analytics capabilities delivered in a managed services model are already making it easy to bring some early phase aspects of these trends to life. As is the Deloitte-SAS Center of Excellence, where we facilitate important conversations about these trends between our two organizations in collaboration with our clients.

It's happening – and we're thrilled to be working together to translate these trends into business value and tangible outcomes.

Nat D'Ercole
Omnia AI Data Transformation and Ecocsystems & Alliances Leader
Partner, Deloitte

Data sharing made easy

Analytics and the trust imperative

The real barrier to large-scale data sharing among organizations – one of the key trends identified in Deloitte's most recent Deloitte Tech Trends report – isn't the technology required to enable such sharing. Nor is it finding enough useful data to feed this type of unprecedented collaboration.

The primary obstacle? Trust. Cultivating, managing and sustaining trust over the long term, enabling organizations with adjacent or even competitive aims to make use of shared stockpiles of data is the most important prerequisite to the type and level of strategic data sharing outlined by Deloitte. In fact, given rapid recent advances in analytics, AI, data management and other key technology enablers, an inability to create the conditions for trust is likely the only reason data sharing is considered a forward-looking trend rather than an everyday reality today.

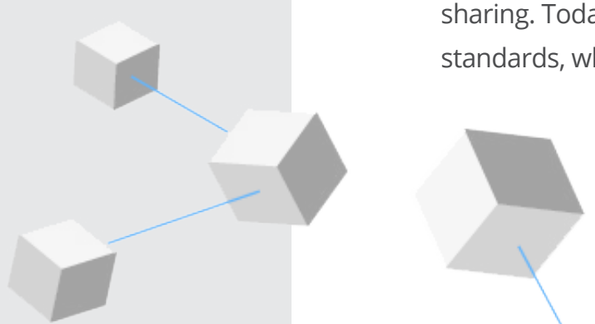
At the same time, data sharing is already happening in some important areas. In response to the emergence of COVID-19, an array of government agencies, pharmaceutical firms and medical care providers quickly mobilized to share data about the virus and its impact in order to inform vaccine development and to develop and launch prevention protocols. This type of collaboration was undertaken in the context of an unprecedented, society-level challenge – the normal rules of engagement changed in an instant. But data sharing can and should be happening in smaller, more focused ways across industries today.

While analytics capabilities have a clear role in making sense of shared data, there are some less obvious ways in which analytics principles and strategies can contribute directly to the trust

that is required for multiple organizations to share their data. Whether your organization is gearing up for a new data sharing arrangement or simply considering it, here are three ways in which your analytics infrastructure can directly contribute to the trust that is needed to move ahead with confidence.

Model sharing

Imagine a scenario in which a research hospital quickly develops a promising analytical model for oncology treatment, but doesn't have the capacity to run the model at the scale required to show the desired results. Other organizations in the research community could provide that scale, with the hopes of uncovering insights that could improve patient outcomes faster. Can the hospital share the model? Can they trust the results of others' model deployments – and can the other institutions trust the model itself? Models developed with analytics systems that come with built-in due diligence – that are validated and certified to be reliable and trustworthy – make it easier to facilitate efficient model sharing among different organizations, each of which can see how the model was constructed and why it is generating certain outcomes. This combination of data ops and model ops is likely to become the standard as model sharing becomes a more widespread practice.



Metadata

When was this data set created? Based on what inputs? Is it the right type of data for my purposes, and can I trust it? When two or more organizations agree to share data, these are the types of questions that each partner is likely first to ask about the data they've been provided. They're the same questions they ask about their own data – but it can be difficult to assess data quality and relevance without ownership. In these scenarios, metadata attributes can be built into the analytics approach, giving each partner valuable insights into large volumes of data that would otherwise present a daunting, time- and resource-intensive challenge in vetting it to determine whether it is trustworthy. Metadata strategies also make it easier for partners to quickly assess which tranches of data are useful for their purposes – and which are irrelevant – using a common language shared between partners and their systems.

By developing their own metadata standards, individual industries can accelerate the application of metadata as well as create the condition of trust that is required for successful data sharing. Today, industries such as healthcare are awash in such standards, while others are lagging far behind.

Synthetic data creation

Sometimes potential data-sharing partners encounter obstacles that may at first seem insurmountable. The data they need may be unavailable, for example. Maybe it's available, but too costly to acquire. Or it's so private and sensitive that partners are unwilling to share. Sometimes the available data is full of gaps – underrepresented segments or conditions.

Data-sharing partners using synthetic data are able to use the essential attributes of real data without compromising security or confidentiality, as long as the synthetic data is representative of reality, and was not generated in a use-case-specific manner. The original data remains in the original data centers, while partners are free to use the synthetic versions to feed a range of analytical models. At an aggregate level, the resulting insights are accurate and useful.

Advanced analytics tools will increasingly come with the ability to generate and analyze synthetic data in a way that generates valuable insights without compromising data security.

TRANSFORMATION TAKES TRUST

Data sharing has the potential to usher in a new era of more powerful, rapid advances across industries. But this transformation is not likely to take hold at a massive scale, all at once – it will more likely unfold in a piecemeal fashion, led by industries and sectors where there is a strong, sometimes unavoidable imperative for change. This is exactly the scenario that led governments, public health agencies, universities and medical providers to collaborate at the data level in response to the onset of COVID-19, in ways that were unthinkable beforehand.

This trust-enabled transformation will not happen without the active, focused efforts of technology providers who understand the value of data sharing to their users and begin building data sharing tools and capabilities into their solutions. For those that have not already begun doing so, now is the time.

Cloud goes vertical

Analytics implications of an industry-focused cloud

In its 2022 Tech Trends report, Deloitte identifies the rise of clouds tailored to specific industry verticals as a development likely to shape the future of business and technology.

Here at SAS, we see plenty of evidence of this trend already at work. We've been coordinating with the leading cloud providers to develop and deploy industry-focused analytics and AI capabilities for years. Today we are finally seeing some of these capabilities reach the marketplace as cloud adoption further expands.

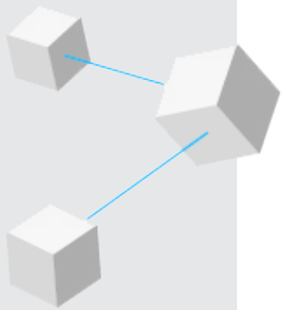
The implications of this development on data and analytics practices are significant. The impact on industry solutions is equally powerful, as organizations are now able to take advantage of industry-tailored analytics that are delivered as part of a broader cloud package. This gives users the ability to accelerate the deployment of analytics capabilities while avoiding many of the technical challenges that might otherwise stand in their way.

Several data- and analytics-related developments are likely to unfold on the way to industry clouds. Here's what to prepare for in the coming years.

Open data standards

Industry clouds will reach their full potential only when industries are operating with a shared set of data standards – a development that is already unfolding in pockets of the financial services and health care industries. In health care, these standards – Fast Healthcare Interoperability Resources, or FHIR standards – are emerging from broader industry trends pushing in the direction of standardization, and are managed by an independent industry organization. With disparate health care organizations adhering to the same data standards, it's easier for cloud providers to develop and deploy analytics models in their cloud environments. These models can then be adopted and further customized by a wide range of organizations in the same industry – an obvious benefit.

But these standards introduce a host of less obvious benefits as well. For example, FHIR standards allow users to securely access only the specific information they need, when they need it. While a health payer has multiple clinical and operational data systems, with FHIR their analytics teams can select the specific patient or claims data needed for business insight without having to bring in all the data – saving time and resources.



As-needed (rather than always-on) access to analytics capabilities

For many business processes, constant monitoring and analysis is not required to produce useful business insight. But many organizations rely on expansive data environments that require them to constantly host, monitor and analyze all the data – not just the parts they need – in order to answer focused questions. Their data environments are neither modularized nor particularly efficient – all the data must be up and running all the time to accommodate queries.

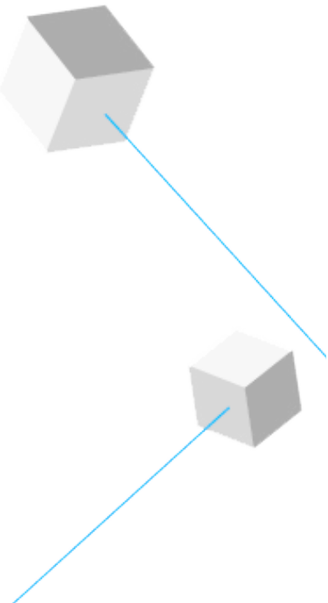
Industry cloud environments, developed in a way that distinguishes between large-scale, mission-critical, always-on insight requirements and more focused, intermittent insight needs, are able to provide users with a richer set of options. Just as important, a modularized, cloud-based approach can reduce costs, since the organization isn't using compute services around the clock, like living in a house where the lights are never left on in unoccupied rooms.

Standardized/off-the-shelf analytics algorithms

At the industry level, organizations share many of the same or similar needs for insights. For example, all hospitals need the ability to anticipate resource needs in the short and long term – a relatively simple analytics task that can easily be adapted to individual organizations using a generic cloud-based capability. Industry-oriented clouds will serve these types of needs with foundation-level analytics tools that make it possible for the organization to flex its analytics muscles in other, higher-value areas. Expect industry clouds to have the greatest early impact in operational areas such as workflow management before taking hold in more specialized, complex parts of the organization.

The scramble for innovation and competitive differentiation

As organizations within industries benefit from a shared set of analytics tools, they will face new pressure to distinguish themselves on their ability to generate unique insights. The organizations most likely to succeed are those able to devote resources to analytics innovation and go beyond simply monitoring and managing the baseline analytics tools embedded in industry cloud solutions. Operationalization is also a big part of the appeal of industry clouds in terms of innovation. Too often, after teams develop a successful innovation, they struggle to roll it out more broadly across the organization. The reasons are technical and related to resource allocation. But the more modular



the analytics tools, the easier they are to operationalize in other parts of the organization. The most successful are lightweight and ready to be dropped into different initiatives.

Early boon for "challenger" organizations

As industry clouds become the norm, midtier and "challenger" organizations are likely to see the most benefit. Industry leaders will typically have advanced analytics capabilities in place, so they are less likely to see upside in off-the-shelf analytics capabilities. At the same time, however, these more mature organizations are likely to benefit by selling versions of their analytics tools and models in the marketplace. In this scenario, everyone benefits – mature organizations create a new revenue stream from existing IP, and up-and-comers get the benefit of their more advanced peers' hands-on experiences and insights. "Model marts" may become the norm in some industries.

Among industries that have less mature analytics capabilities overall, compared with their peers in retail and banking, industry clouds could set off a rush of insight, because industry leaders and up-and-comers alike will avail themselves of these tools.

THE TRUST IMPERATIVE

Ask technology and business leaders across industries for their thoughts on new industry cloud offerings, and you're likely to find that they are bullish on the opportunity but hesitant to adopt. This is understandable. Whether the organization already has sophisticated analytics capabilities or is earlier in their journey, technology leaders are skeptical of implementing any off-the-shelf analytical model, even those designed specifically for their industry. Large organizations are especially hesitant after working years to develop and improve their own data centers. Even if those data centers have problems, they are known problems.

Model transparency is critically important for overcoming any trust deficit in new industry cloud-based analytics capabilities. Models should come pre-validated, and organizations should be able to replicate results.

Emerging vertical cloud offerings should give industry users the confidence they need to adopt and operationalize industry cloud analytics capabilities as industry clouds become more widely available.

Blockchain: ready for business

Using analytics to make blockchain a practical reality

As blockchain continues to evolve out of the hype cycle and into its role as a practical business enabler, leaders across industries need to find ways to square blockchain's exotic reputation with its practical, everyday potential. That can be difficult given blockchain's strong connections to the emergence of NFTs, cryptocurrencies and other headline-grabbing technology developments that can make blockchain appear unsuited to more traditional environments and challenges. But blockchain has significant potential to transform more traditional business realms. This is especially true, as Deloitte notes, as organizations are actively reimagining "how they make and manage identity, data, brand, provenance, professional certifications, copyrights, and other tangible and digital assets."

Analytics-based approaches are likely to be one of the most effective ways to connect blockchain's high-flying potential with day-to-day business needs. Plus, in some industries, analytics are likely to be required by regulators looking to ensure security. In 2022, the New York Department of Financial Services (DFS) issued guidance recommending that all digital currency companies operating under New York banking law adopt blockchain analytics to trace transactions. As a "blockchain bellwether," the financial services industry offers a glimpse of the future awaiting other industries experimenting with blockchain.

Here are three of the most likely ways analytics will be deployed alongside blockchain capabilities to make them a true force in business.

Focus on fraud first

Much of the appeal of blockchain comes from the anonymity it provides to users. Anonymity is perhaps the core feature of blockchain – and it opens the door to a host of possibilities to organizations in terms of security and privacy. It also presents a tantalizing target for those wishing to commit fraud.

Today, this is one of the most significant barriers to the mainstream adoption of blockchain. How can organizations monitor, detect and prevent fraud in an environment created specifically to deliver anonymity, using anonymized registers and data sources? By using the same tested, proven analytical approaches to fraud prevention they've used for years elsewhere in their organizations. Blockchain represents a potentially transformative break from the mainstream – and for mainstream users to adopt and apply it in a meaningful way, they need the confidence of knowing that they can keep fraud in check. Analytics tools offer the most powerful way to deliver order and confidence in a blockchain environment.

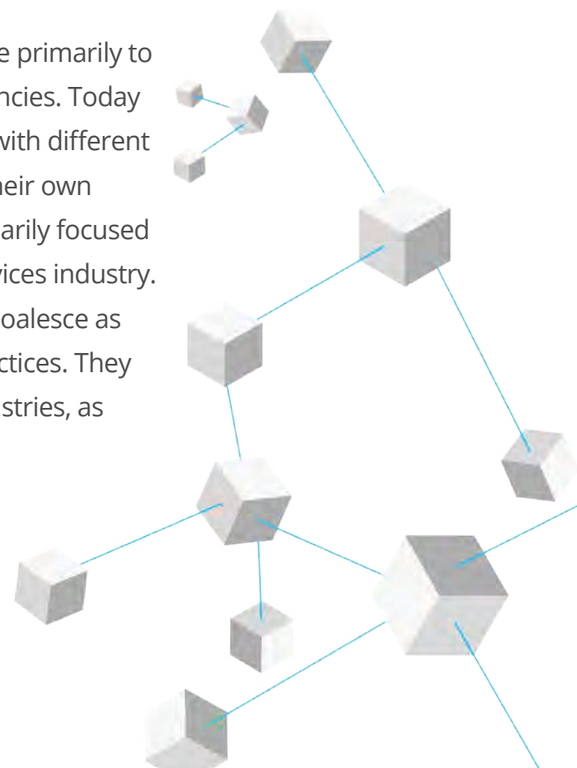
Lean on third parties

Who's going to run analytics on our blockchain activities? This can be a difficult question to answer in organizations where analytics talent is already stretched thin, and there are already a host of other pressing insight needs in other parts of the business. But without a good answer, it is impossible for business and technology leaders to move ahead with adoption to take advantage of blockchain's powerful capabilities.

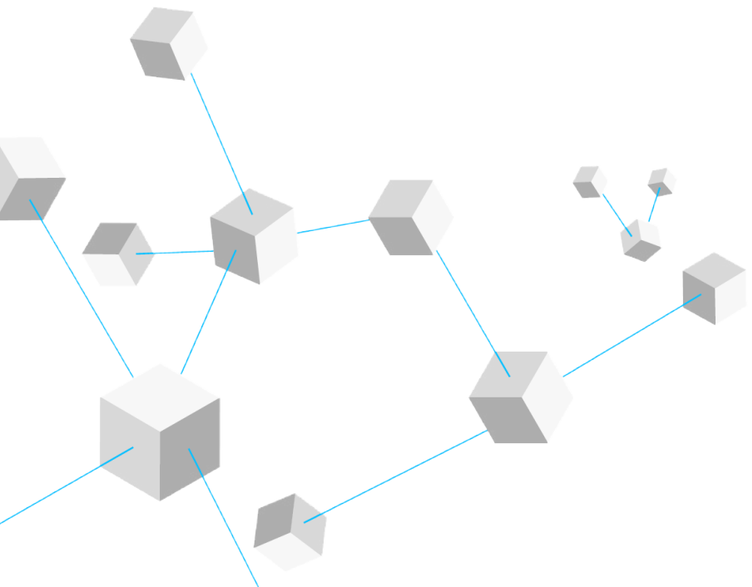
In the short term, many will conclude that support from third parties offers the most direct, practical, accelerated path forward. Already, the number of blockchain-focused technology and analytics service providers has begun to grow rapidly, building on experiences gained in cryptocurrency markets and other early-phase staging areas for blockchain.

Build a bridge to regulators with analytics

Blockchain is already on the regulatory radar, due primarily to the explosion of blockchain-enabled cryptocurrencies. Today the regulatory environment is highly splintered, with different regions, countries and jurisdictions all bringing their own different approaches to regulation. It is also primarily focused on applications of blockchain in the financial services industry. In coming years, these approaches will begin to coalesce as regulatory experiences point the way to best practices. They will also expand to address a wider range of industries, as blockchain continues its march into other areas.



Along the way, regulators will demand more information on organizations' risk exposure due to blockchain activities. In that regard, regulators are seeking essentially the same information as the organizations themselves – they want to know exactly where and how blockchain is being used, which threats the organization faces as a result, and how the organization is responding. This is exactly the type of information analytics systems should be configured to address. Forward-thinking organizations (and the third parties who support them) can implement these systems in ways that enable data-sharing with regulators, smoothing the path to compliance as regulators pursue enforcement of new blockchain-focused laws as they emerge.



BLOCKCHAIN ANALYTICS: BEYOND FRAUD

Analytics has a role to play anywhere there is data – and blockchain activities generate massive volumes of it. As technology and business leaders begin to experiment with blockchain, analytics should be part of the plan. The most pressing reason to incorporate analytics practices into the blockchain strategy is to satisfy existing or upcoming regulatory requirements in fighting fraud. As New York's DFS has shown, regulatory interest in blockchain analytics is already significant in some quarters, and this will continue as blockchain adoption expands.

However, using analytics solely to satisfy fraud-related regulatory requirements in blockchain would be a mistake. How are an organization's employees, customers, partners and others using blockchain to engage? What patterns are already in place – and what future patterns are likely to emerge? Where is blockchain working well – and where is it falling short of expectations? What are the most immediate opportunities to use blockchain to transform other parts of the organization? These are the types of questions that analytics can help leaders answer as they expand their focus beyond regulatory compliance and take advantage of the full value of the data generated by blockchain. Security first – but don't plan on stopping there.

Automating at scale: 3 key analytics questions

Analytics implications and practical insights for moving ahead

Is it any surprise that Deloitte has identified large-scale automation as one of the key technology trends expected to shape the future? The events of the past few years have led business and technology leaders alike to redouble their efforts to embrace transformative technologies – and automation tops the list for many, given its ability to provide continuity under challenging conditions, as well as its ability to support human operators who are stretched thin in the face of a talent shortage.

Just as important, foundational automation capabilities are proven and tested in the real world. Automation is happening – and it's been underway for years. The main difference today, as Deloitte notes, is that the tide is turning: Automation is reaching a phase of critical mass, momentum and scale that will make it an unavoidable force across industries.

All of which brings us to analytics. Given the amount of data required to inform the creation of automation tools and operate them over time, not to mention the volumes

of data automation generates, analytics plays a predictably large role in automation at scale.

Which repeatable processes are generating the most data?

Repeatability is an obvious consideration for anyone looking for processes that could be automated. But from an analytics perspective, some processes are more "data-immersive" than others – and those are the ones that present the most opportunity in terms of the organization's ability to replicate them with analytics and automation, and to do so quickly.

Many organizations have focused their first automation efforts on internal processes, as a way to minimize risk and gain skills

and insights before they expand their automation strategies to include customer-, partner- and public-facing processes. Internally, human resources processes provide a data-rich environment full of repeatable processes, many of which already rely heavily on a self-service approach. Adding a layer of automation to these processes, where embedded solutions are already creating and capturing a significant amount of data, can be a productive starting point for large-scale automation ambitions.

Do we have enough of the right people to ingest, understand and act on the data?

Automation generates a significant amount of data, which in turn informs the development of insights – about how effectively automated processes are running, the outcomes they're generating, where processes can be improved, and much more. Because automation requires ongoing human oversight in order to deliver its full value, it's important to ensure that automated processes are supported by enough human operators to ensure that the analytics-derived insights they are generating are being acted on appropriately.

While this sort of activity was once the sole domain of business analysts and data scientists, advances in the delivery and presentation of analytics insights mean that a wider range of people in the organization can play a role in this aspect of analytics in automation. That's important, since data scientists and those in similar roles are in short supply for the foreseeable future.

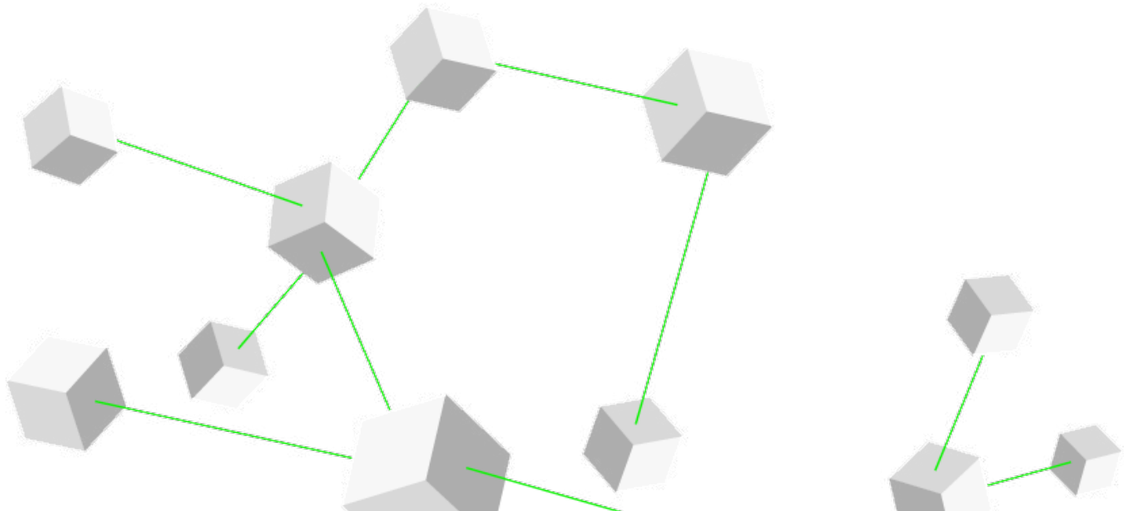
SAS' Jonathan Tottman has spent his career at the intersection of analytics and law enforcement, and has observed a growing disconnect: While a steadily increasing number of dynamic analytical tools are available to support more effective enforcement practices, the profession's rigid attachment to traditional staffing models and policing patterns means that these tools remain underutilized in practice. "***When I talk to police leaders today, I often ask them 'of the 1,000 people in your organization, how many are police officers?'***" says Tottman. ***"When they reply that all 1,000 are police officers, I tell them that today half should be analysts, using analytics tools to help their departments become more effective in anticipating, preventing and mitigating crime."*** This will only become more important as the nature of crime itself evolves to become more digital, with technology-driven crime emerging as a dominant trend.

Which analytics capabilities are already available in our commercial solutions?

Many providers of commercial solutions, anticipating a boom in demand for AI, have been building analytics and AI capabilities

into their solutions. Much like new features that are embedded in commercial technologies such as phones and televisions, these additions may be underutilized or even unknown to those who own them.

Cloud offerings are a prime example of this phenomenon. Each of the leading cloud providers is working with partners to deliver fully integrated, advanced analytics capabilities as part of their service packages. Similarly, analytics providers like SAS have launched cloud-native and cloud-ready solutions that are designed to sync with commercial cloud offerings. This is the case for virtually every enterprise-level solution available today. Before embarking on any AI and analytics journey, no matter what size, IT and business leaders should take stock of the potentially underused or overlooked capabilities already available to them.



THE MOST IMPORTANT BARRIER REMAINING

As with many technology advances, as the technical barriers to adoption fall away, they reveal a more persistent obstacle: cultural change. Just as analytics requires a level of openness to insights that are sometimes uncomfortable or unexpected, successful AI adoption requires a significant mindshift. Executives and front-line workers alike can be expected to resist ceding aspects of their work to automation, and to question the efficacy and accuracy of tasks and decision-making activities that have been automated.

Analytics insights may have a higher-order role to play here as well. How is automation really performing? What is the impact on our efficiency, and on the quality of our decision making? What is the scale and nature of improved business outcomes resulting from our automation initiatives? Good answers to questions like these can help mitigate the cultural barriers that stand in the way of automation – and an analytics-driven approach can help provide employees at every level with the insights they need to quickly adapt to an automation-enabled environment.

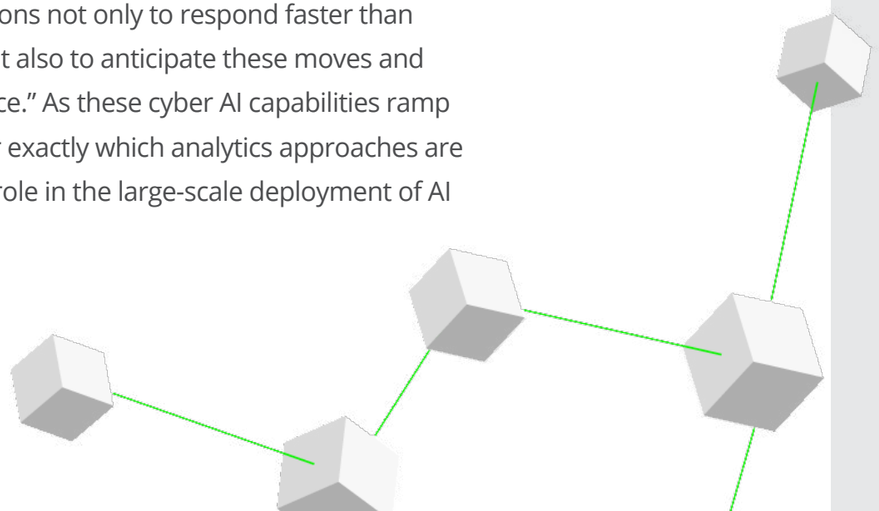
Cyber AI: real defense

Force multiplier that is cyber AI + analytics

Cybercrime isn't new. But the scale of cybercrime continues to explode, leaving business and technology leaders alike scrambling to find effective strategies for defending against criminals who are using more sophisticated techniques at every turn.

The stakes are high. As Deloitte notes in its Tech Trends 2022 report, the cost of cybercrime is expected to grow to US$10.5 trillion by 2025, compared to an estimated $6 trillion by the end of 2021. Deloitte also cites insurer AIG's report that ransomware claims alone have grown 150% since 2018.

Deloitte is right to note that "cyber AI can be a force multiplier that enables organizations not only to respond faster than attackers can move, but also to anticipate these moves and react to them in advance." As these cyber AI capabilities ramp up, it's time to consider exactly which analytics approaches are likely to play a leading role in the large-scale deployment of AI in fighting cybercrime.



Fortunately, a host of analytics strategies and capabilities have already been tested on the cybercrime battlefield. Most were not deployed in an extensive AI context – but that may be about to change quickly. Here are some of the analytics approaches that, depending on the industry in which they are applied, are poised to create a "force multiplier" effect with AI.

Comparison analytics

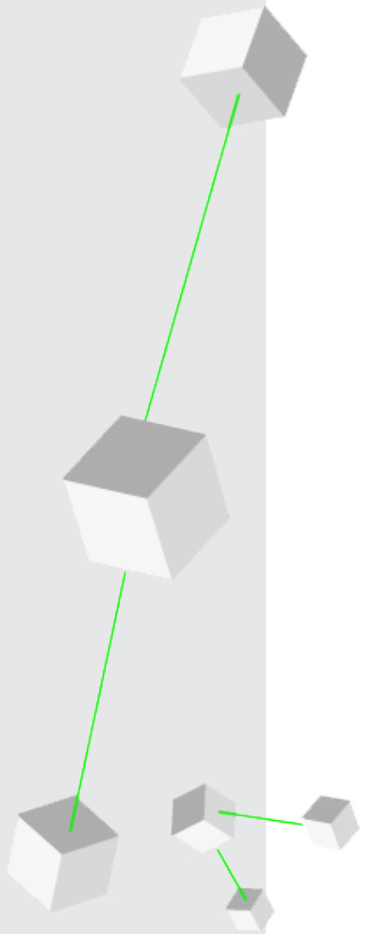
When a network-connected machine or device suddenly operates differently, is this the result of suspicious activity, or simply the result of something harmless and explainable?

Comparison analytics is a strategy for identifying anomalies and patterns and zeroing in on those that may signal criminal activity.

For example, a user may engage in the same activities day after day – sending 10-25 emails before 10 a.m., going quiet for several hours, scanning emails intermittently throughout the day, and logging into the same three systems. When that predictable pattern is disrupted – when the user accesses an entirely different system or taps into non-routine processes and data within systems – it could be for good reasons, or that activity could signify that the machine has been compromised.

Comparison analytics tools can help identify these types of signals and flag potential risk markers using peer grouping strategies, clustering algorithms and other widely deployed approaches. But this strategy can only succeed when the organization has established baseline patterns of "normal" activities. That's no small feat, which is why this approach can be so difficult to get off the ground.

It can be expensive and time-consuming to map digital asset activities, identify when and how individual employees and departments typically use various systems – especially when the systems themselves often don't interface with one another. Regulatory constraints can also make establishing a baseline a daunting task.



Technology advances are making this effort more straightforward. After all, digital systems generate data at every turn. This data can be loaded directly into monitoring systems equipped with pattern recognition tools, deep learning and other analytics-driven features. Such capabilities can help identify patterns and make connections beyond the grasp of human analysts due to the scale and volume of data involved. Technology leaders should start by determining which of their systems are most susceptible to being compromised, then expand from system to system as their organizations gain proficiency.

Rarity analytics

When network or digital asset users do something completely out of the ordinary, they could have a legitimate reason for doing so, or they could be introducing cyber risk to the organization. Meanwhile, relatively rare or uncommon events such as monthly maintenance updates present opportunities for cyber criminals to exploit networks. Both circumstances should be closely monitored for breaches. Rarity analytics

capabilities help identify risk-significant rare events as well as more closely monitor user behaviors during routine-but-uncommon events such as system updates.

The SolarWinds hack of 2020, in which hundreds of large organizations worldwide (including many US government departments and agencies) suffered extensive data breaches, underscores the role that rarity analytics can play in defending against attacks. During that attack, organizations with rarity analytics capabilities in place suddenly began producing thousands of alerts each hour. These procedures generated alerts to spur defensive actions for identifying and mitigating threats.

Temporal analytics

Imagine you're a cybercriminal seeking to exfiltrate 200 terabytes of customer data. Attempt to do it all at once, and you're likely to trip the alarms of even the most basic systems. But if you're patient and siphon off a single megabyte or two each day over time, you may fly under the radar and get all the data you want.

Slow-and-steady attacks of this nature are extremely difficult to detect without the help of temporal analytics, which analyzes network traffic and all digital assets on the network over time. Be it a week, three weeks, six months, a year, temporal analytics capabilities seek discreet patterns that would otherwise go undetected or be uncovered long after the damage was done.

RISING TO MEET THE CHALLENGES OF SCALE WITH AI

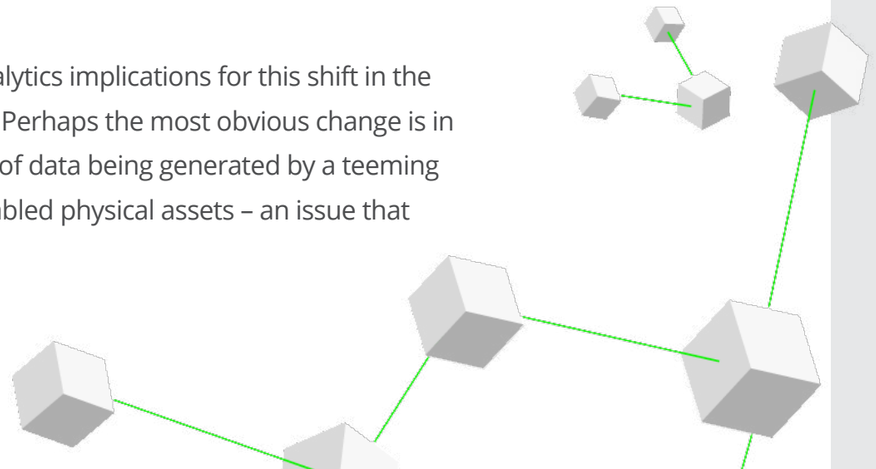
Any of the analytics capabilities described here can have a powerful impact on their own. But when paired with AI, they can help organizations rise to the meet the challenges of scale, in an environment in which cybersecurity threats are more complex and growing in number. Given the scarcity of both cybersecurity and analytics talent today, which shows no sign of relenting in the near future, AI is even more important as a tool for meeting the growing scale of cyber threats. As Deloitte says, "it's time to call for AI backup." Organizations should be actively exploring opportunities for developing their AI acumen by combining AI and analytics capabilities to make sure they're ready for what's next.

The tech stack goes physical

Managing physical assets

According to Deloitte's Tech Trends 2022 report, IT leaders have one more important, emerging category of technology infrastructure to manage: Physical assets. That's because the proliferation of smart devices and other sensor-enabled physical objects, from smart factory equipment and inspection drones to health monitors and many more, has expanded the reach of IT far beyond the realm of digital-only solutions and technologies. For CIOs, it won't be enough to ensure that digital systems are properly implemented, integrated, and functioning as expected on behalf of the enterprise. They'll also need to consider how digital technologies are integrated with a physical tech stack that is spread across geographies – and how they are operating in often-challenging environments over time.

There are a host of analytics implications for this shift in the technology landscape. Perhaps the most obvious change is in the range and volume of data being generated by a teeming portfolio of sensor-enabled physical assets – an issue that many companies are already grappling with as they pursue IoT-based strategies. In short, a lot more data can mean a lot more opportunity for insight – if you have the right tools to make sense of it.

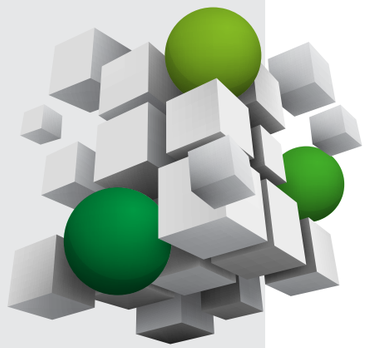


But there is an equally important application of analytics in this context: Monitoring and managing all those physical assets. Because without maintaining tight control over which assets are in place, what they are responsible for doing, how they are performing, and when and how they are degrading over time, the data they are generating may not be particularly useful to end users.

Early progress in analytics

Analytics approaches are already delivering strong capabilities in this arena. Where only a few years ago it was considered a victory to be able to anticipate when classes or types of devices would likely need to be replaced or repaired, allowing organizations to preemptively pull devices out of commission for predictive maintenance, today it is possible to track the performance of individual assets in the physical tech stack. Think of it as a specific predictability rather than generic predictability. That's a new level of power and insight for any organization.

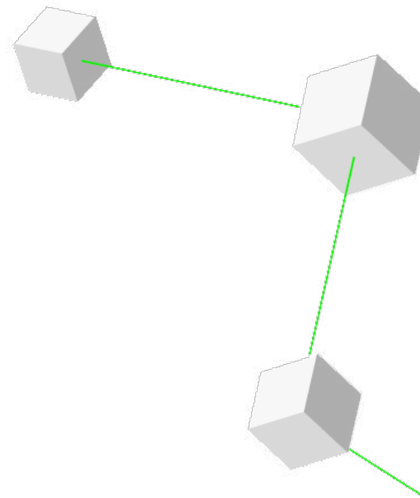
For example, in response to changing weather patterns and other impacts of climate change, some national, state, and municipal governments have launched strategies for using an army of inexpensive sensors to track rising water levels that may help more accurately predict flooding. With so many sensors generating data, this presents new analytics challenges and opportunities. Just as important, though, it creates a new class of physical assets that must be managed in order to ensure the overall success of the strategy, which hinges on accurate, reliable, consistent data from low-cost sensors.



In one US municipality pursuing this strategy, the IT team responsible for operating the sensors identified a number of concerns after the sensors were set in place, including:

- Too many false positives and false negatives.
- Identical sensors exhibited different behavior.
- Field sensors were often offline.
- Intermittent, inconsistent data.
- Unanticipated environmental challenges contributed to sensor calibration issues.

For the CIO responsible for managing this sensor-based flood prediction strategy, these issues suggested infrastructure-level problems. Plus, while the sensors were relatively inexpensive to purchase, dispatching a team to examine the status of so many of them, many of which were placed in difficult-to-reach, even dangerous locations, would be cost-prohibitive over time. Was a sensor simply blocked by a blade of grass or spider web that would eventually move and cease to present a problem, or did it exhibit technical malfunctioning requiring repair or replacement?



Without better tools for monitoring the sensors, human intervention would be the only way to find out – a time-consuming, resource-intensive proposition.

How analytics can help

Analytics-enabled "intelligent monitoring" capabilities can provide a much more focused, effective and efficient way to monitor the health of data-generating physical assets, across several different critical aspects:

- Operations and process performance.
- Asset and equipment health.
- Sensor and connectivity issues.

With intelligent monitoring, technology teams can also develop asset hierarchies that distinguish between different types of remote physical assets and create a map of each – a water pump with four sensors for tracking everything from temperature to vibrations is managed differently than a single-purpose sensor designed to track water depth, for example. These profiles can be used by field engineers and others to assess how well or poorly the system is working, all the way down to the level of individual sensors.

INTELLIGENT MONITORING: ENABLING SCALE AND ENSURING PERFORMANCE

Intelligent monitoring is only one of many ways in which analytics capabilities will be used to better manage the large-scale emergence of the physical tech stack that is anticipated by Deloitte.

But it is an important analytics-based strategy, because it can help establish a sturdy foundation for future efforts. It can also guard against unintended consequences, especially in cases where IT leaders may be eager to take advantage of inexpensive new capabilities with little regard for the cost and effort of the ongoing management of those capabilities.

When planning your strategy for managing the emerging physical tech stack, don't just focus on how analytics can help make sense of the data these physical assets are generating. You also must consider ways in which analytics tools can help maintain the high performance levels of the assets themselves, delivering consistent, high-quality data from the front lines, wherever they are stationed.

Field notes from the future

Quantum computing for optimization

In a world where data streams continue to multiply and computational problems become more sophisticated, we need every solution possible to handle the compounding growth in data and complexity.

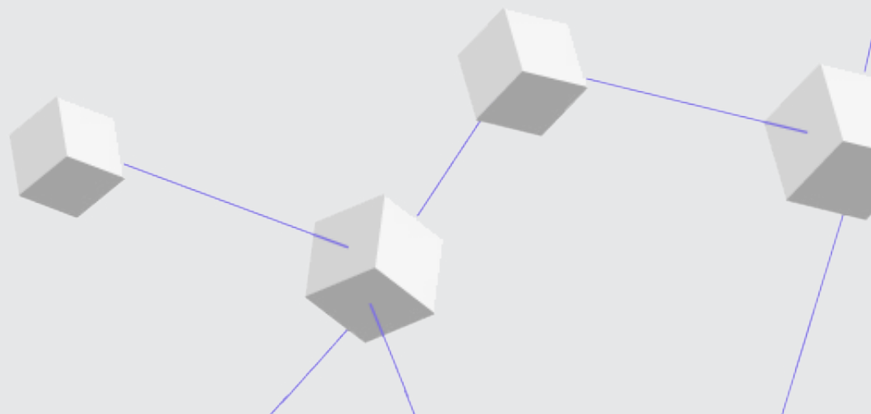
While quantum computing has been discussed for decades as a possibility, we are only just starting to see some exciting implementations in areas like cybersecurity, drug development and climate change.

While quantum computing has important applications, its usefulness may be limited to those who can afford it and to a particular set of problems that fit its unique criteria.

In the analytics realm, optimization problems are the most likely to be paired with the unique capabilities of quantum computing. Classic optimization problems include flight patterns and delivery schedules. But many complex world problems like poverty, clean energy and clean water could someday benefit from the combination of optimization and quantum computing.

Exponential intelligence requires responsible AI

The goal for analytics, machine learning and AI is to scale human observation and decision making. It benefits us all to realize that human experiences and opinions naturally influence human observation and decision making. Our feelings, opinions and emotions can influence the way we go about solving problems. Our own biases can even influence the data we collect and use to solve a particular problem.



Applying ethical considerations to analytics, machine learning and AI means we work to make sure technology does not harm people but instead helps people thrive. We refer to this as trustworthy AI or responsible innovation. This requires a greater level of oversight and awareness of potential issues throughout the AI development cycle, not just the operational aspects of AI.

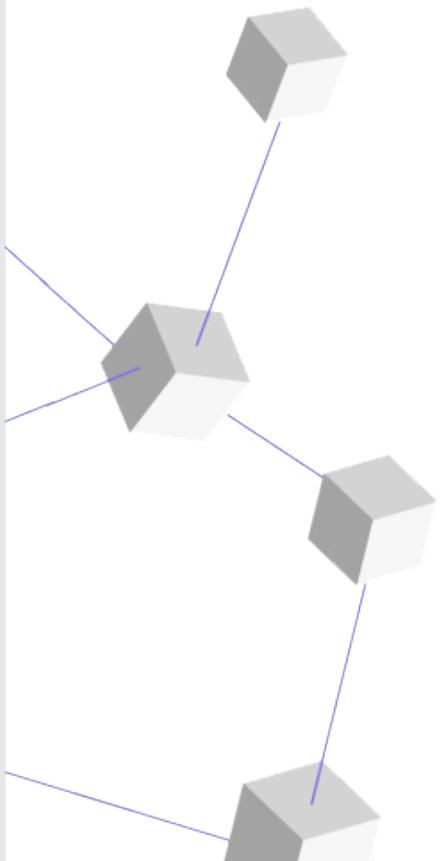
If the promise of exponential intelligence comes to fruition, with computers developing uniquely human insights like compassion and emotion, the importance of responsible innovation will become even more crucial.

Ambient analytics will power ambient experiences

As described in the report, ambient computing will offer a frictionless, proactive, intuitive "life beyond the glass." In this world, our technologies anticipate our needs before we do. With ambient computing, even before you can say "Siri" or "Alexa," your ambient computing devices will adjust settings, make plans and provide answers.

SAS has long had an interest in ambient analytics, where data is used in the background ubiquitously to make decisions without human intervention.

Already, there are analytical decision points that happen around us without our knowledge or input, including spot cloud computing purchases, thermostat adjustments, traffic light changes and online advertising displays.

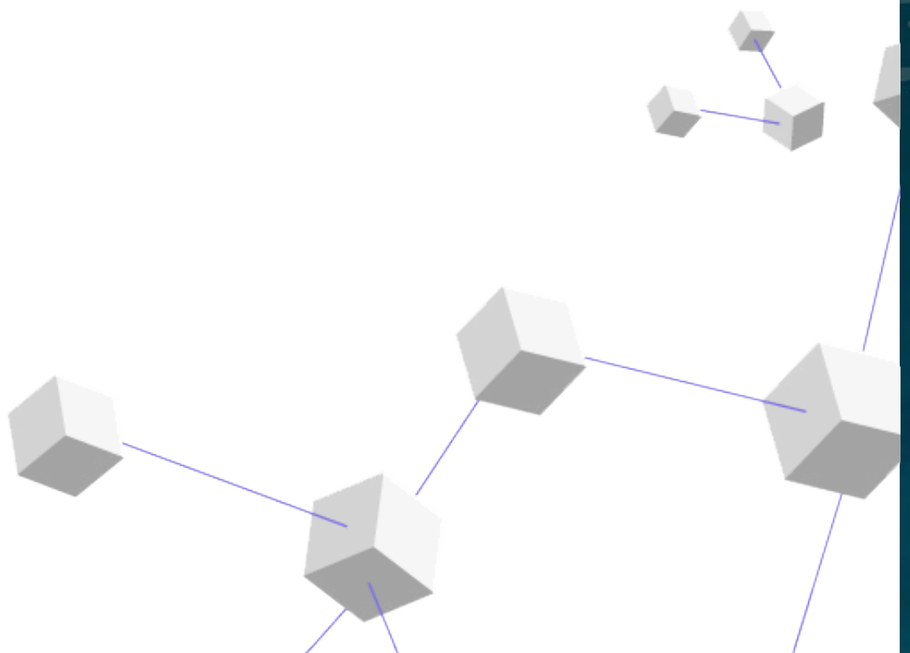


"The mission of SAS is to bring analytics everywhere, to make it ambient."

Jim Goodnight
CEO, SAS

Ambient analytics becomes even more feasible when you bring analytics to the data by cleansing, transforming, filtering and analyzing data at its source. When data has intelligence as it's issued, it can be directed from its source to use automatically. If data is clean, relevant and has specific merit as it's generated, it becomes easier for preprogrammed and intuitive uses.

Data is everywhere. And with ambient analytics, analytics will be everywhere that data exists.



CONVERGING FUTURE TECHNOLOGIES

Will quantum computing solve our most complex problems? Will exponential intelligence help AI reach a level of acumen that's even smarter and more ethical than human decisions? Will we find ourselves, through ambient experiences, surrounded by problem-solving computers that predict our needs before we speak to them?

These types of optimistic scenarios sound enticing – and each of these technologies intersect with analytics in powerful ways that could shape the future.

Often, though, it's not a single technology that changes our lives but a convergence of multiple technologies. Look at the way IoT, blockchain and online banking are converging today. Individually, the technologies in this report each sound intriguing, but it will likely be a combination of two or three of these technologies that usher in the biggest changes.

Combining exponential intelligence with ambient analytics could expand our interactions with analytics and lead to a broader acceptance of data-fueled decisions in the world around us. As you look into the future, we encourage you to explore combinations of technologies from this report and elsewhere.

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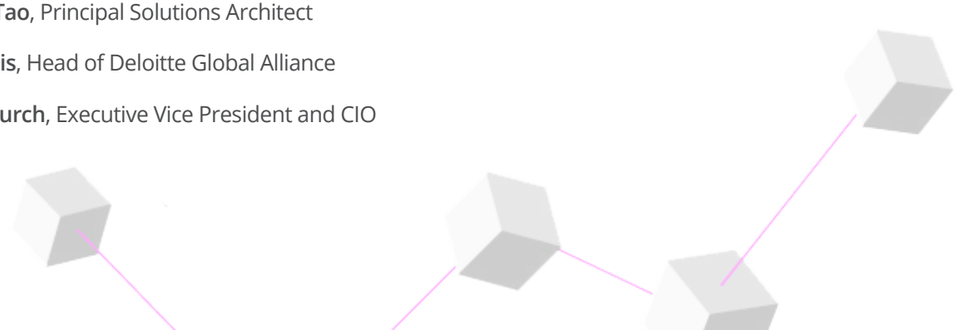

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