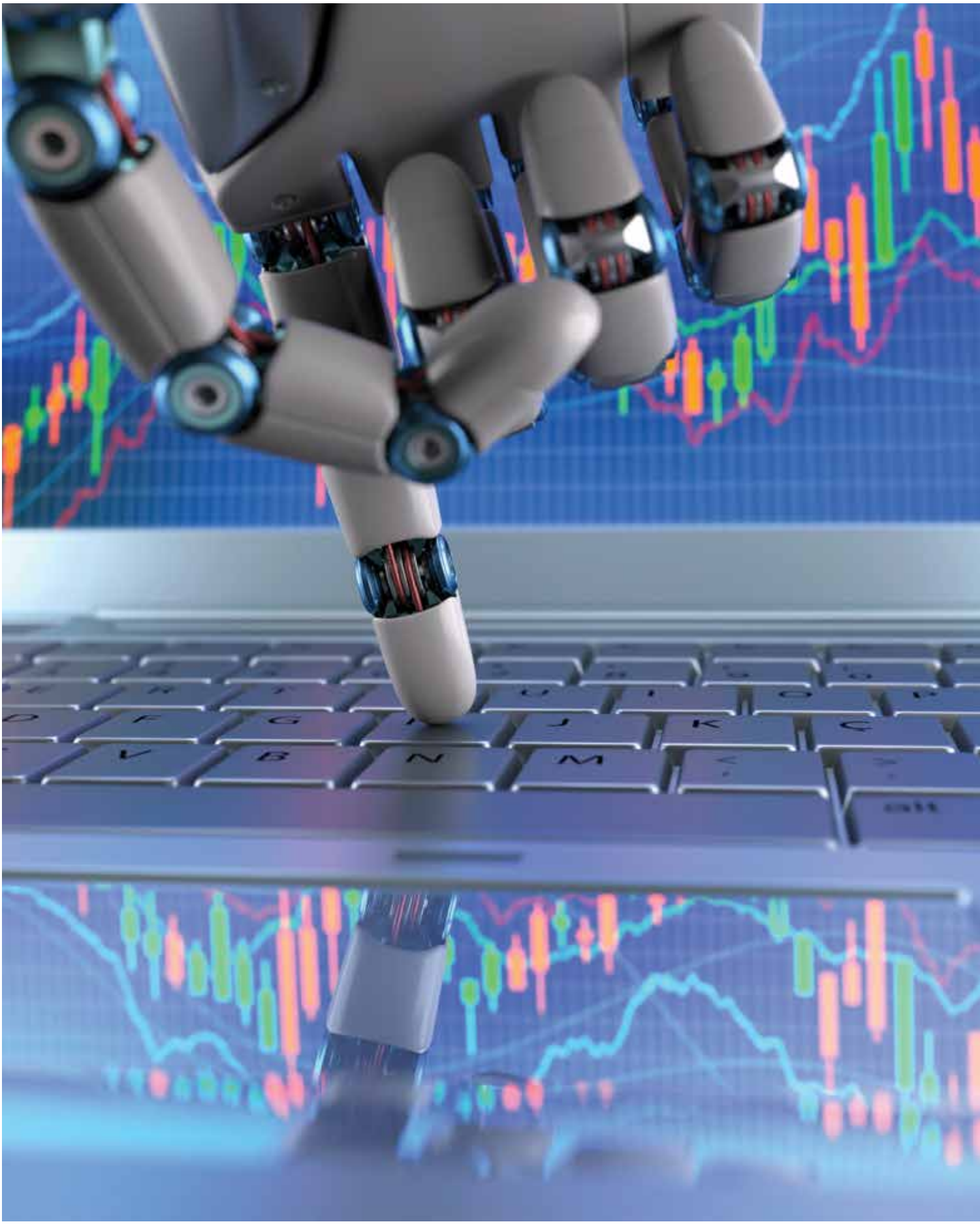

Cognitive Intelligence

When intelligent machines learn to venture into the business world

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Cognitive intelligence is a booming technologic trend. This new concept might very well be the next revolution that improves revenue growth, operational efficiency, and risk management.

AI is becoming an increasing part of companies' investments and fundamental research, which in turn is spurring a significant activity of development.

Introduction

Artificial Intelligence, Cognitive Intelligence, and Machine Learning are areas that tend to make machine processing more akin to human reasoning. Algorithms hidden behind these "smart machines" are rational agents that solve problems, thanks to the sheer amount of computing power available that the human mind has difficulties processing. Unlike classical algorithms, they mimic cognitive human functions in that they understand, reason, and learn. Areas of computer science like Artificial Intelligence, Cognitive Intelligence, and Machine Learning could change our vision on business, the way we operate in it, and how we make decisions.

Nevertheless, Artificial Intelligence is a topic that the majority of actors mature enough to activate cognitive capabilities still need to get familiar with. Indeed, notions like "Intelligence," "Cognition," or "Learning" as applied to machines are still in their infancy; intelligent machines are able to reason, plan, and process natural language based on computational, logical, and statistical methods, but all of these abilities are limited to the algorithms' specific features.

These cognitive abilities can contribute to the autonomous processing of huge amounts of data and the identification of real-time patterns to make predictions. In doing so, they actively decrease the risk of human error. In providing efficient solutions to certain specific tasks, machines can improve workplace operations, giving companies the ability to optimize their operations, reduce their costs, and optimize customer experience. No further explanation is needed as to why this subject is branding itself as the future of business tools.

1. Artificial Intelligence as a top priority in technology investments for the next years[1]

Artificial Intelligence is a booming area revealing a growing interest from companies, fueled by the steady and frequent introduction of new use cases. AI is becoming an increasing part of companies' investments and fundamental research, which in turn is spurring a significant activity of development.

For the mature companies that have a clear view of their business model, and would like to optimize their operations and make decisions with a reduced risk of human errors, leveraging AI algorithms is a smart choice. We see data-driven companies promoting a culture of using analytics for business decisions, investing in predictive software based on machine learning concepts to improve operations and to provide a better insight into how their customer population is evolving. Take for instance Gartner's example of a food concession provider at sporting events that used an intelligent BPM (Business Process Management) system to monitor oversupply of snacks and waiting times at different stands. This tool helped to redirect customers to where they would be served more quickly, providing a better customer experience. Similar systems can also be used to implement more critical tasks, like assisting strategic corporate decisions through advanced analytics and complex mathematical predictive models. Cognitive intelligence is not only adopted by sectors with a high analytic maturity level; it is also applied by mass retail companies like the aforementioned food supplier as well as Amazon.

This is not the only way in which companies make use of AI. One of the trends in which we have seen a real boom is bots used directly for customer service that are programmed to seem human. In a relatively short time, these have evolved from basic planning assistants to natural language processors, actively helping people out with their web requests. E-commerce is one of the sectors in particular in which this application is successfully deployed, implementing bots to help customers in choosing their products. The customer

1 http://www.information-management.com/news/data-management/machine-learning-and-ai-in-the-workplace-the-future-of-business-tools-10029379-1.html

describes the aspects of the product they want to buy and the context in which they will use it, and the machine will figure out the best fit (providing for instance a selection of insulating gear in response to the request "I need a jacket for a skiing trip in February"). Moreover, machine learning also provides deeper insights into customer behavior, and can anticipate the next trends in their purchases.

One of the other major areas in which machine learning and other cognitive algorithms can be particularly relevant is cyber security. These algorithms are designed to discern even the smallest of suspicious patterns in enormous amounts of data—an impossible task for the human eye and mind. Monitoring takes place in real time, and uses learning mechanisms to detect every threat or attack as soon as possible to minimize the harm it can do, making customers' data safer.
These varied business needs have prompted a surge in AI software development. From powerful code libraries (some of which are available in different programming languages like Java, C, and Python, enabling custom developments of predictive algorithms based on fundamental functions of resolution like regression, neural networks, and decision trees) to complete software stacks, an ecosystem with a wide variety of tools has been developed over the past few years in order to implement cognitive functions. And this is only the beginning. Software suites offer the complete stack of cognitive data analysis as well, from data collection and integration to advanced cognitive analysis with data transformation and exploration features. These tools are often integrated into the cloud, allow ng the use of open data.

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IBM Watson is a particular example of how these different tools are applying machine learning concepts; it understands natural language and can be trained to solve problems specific to a given industry. After having trained Watson on what is called a data "training set," it can then be asked to answer questions related to that field, or even predict new behavior given new input data. A major area of expertise here is oncology, where Watson is used to assist oncologists in making more informed treatment decisions. First, Watson is "trained" by uploading and analyzing structured and unstructured data in clinical notes and reports that assemble key patient information written in plain English. By combining data from patient files with external sources, like scientific articles, Watson is able to identify potential treatments. The doctor can then consider the treatment options provided by Watson when making decisions for individual patients.

2. Artificial Intelligence's autonomy is limited; these technologies still rely on human action

AI algorithms are bound by the cognitive functions through which they are implemented. As there is currently not one instance of artificial intelligence that can fully imitate every cognitive function of a human being, AI architectures are unable to act without a human touch. The level of human involvement generally depends on what you wish to obtain from the machine. Prediction expression of an output variable given some input variables will differ in that sense, for instance, from correlation between variables, which in turn will require yet another level of involvement compared to other applications etc.

Machine learning illustrates these different levels of human involvement by dividing its algorithms into two groups: supervised and unsupervised learning. Let us illustrate the supervised learning approach with a classification problem: a retailer wants to determine if its clients are going to buy its newly released product, and does so by analyzing their age, behavior, and the products they previously bought from its catalog. The retailer can then use a suitable model for classification problems, like logistic regression, to predict whether its clients are going to buy the new product or not. The model is fed ("trained," as it were) with data obtained from the first sales of the new product, yielding a predictive function aimed at describing whether or not a client will continue to be part of the future purchasers based on predictor variables like age, behavior, or bought products. Data generated from further sales can then be used to iterate on the resolution model to improve the prediction: this is why the machine is said to "learn"—it improves with experience. In the area of information management, the learning step is generally associated with an increase of the data set volume, enabling a more accurate resolution of the predictive system.

For unsupervised learning, on the other hand, humans only need to provide a set of variables, and the chosen algorithm will work on finding correlations between them, i.e., without being based on an initial "training set."

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A good example is the correlation of pixels in a numeric picture: application of neural network algorithms on the set of pixel intensities can be useful to determine the expression of some pixels as a function of the surrounding ones, which helps compress pictures by reducing the number of stored individual pixels.

Tools embedding natural language processing, like Watson, need to be trained as well. Watson can answer questions about a specific problem or area of interest, if you train it to do so. The first step is to define a training set of documents (HTML, PDFs, etc.) that will be fed into Watson, which must contain the answers to the expected questions specific to the use case. Then a question/answer management tool is needed to train the machine: for each question entered, an ideal answer to that question must be chosen. Each new question can either be matched to the answer of a previously answered question or can be provided with a full new answer. In that way, Watson will be able to answer the questions related to your specific business case in an increasingly better manner.

3. Implementation of cognitive technologies: taking the first steps

Depending on your specific needs as well as your existing infrastructure, AI can be implemented in multiple ways. Before any investments take place, a thorough understanding of your business's specific needs is crucial to establish what kind of tool is necessary to activate the cognitive functions that can solve your problem. If your problem needs perception skills, your architecture will require a system incorporating image recognition or natural language processing. If you need to perform predictive analyses on large data sets, you might need a complete software suite handling data integration, transformation, and analysis. When you already have a data lake in place, chances are that you only need to integrate a predictive tool or that you can even develop your own machine learning algorithms based on code libraries. Evaluating your own application portfolio is a necessary step in efficiently integrating cognitive functions in your IT landscape. Cognitive intelligence indeed requires a high level of maturity in terms of enterprise data management practices and analytics capabilities. Considering the importance of human actions in the configuration process of cognitive machines, companies with a low level of information management maturity might run the risk of failing to effectively leverage these kinds of advanced analytics technologies. Indeed, insufficient knowledge, poor quality, or lack of proper integration of one's own data in the target BI system will lead to inaccurate implementations of cognitive functions. Patterns detected through cognitive analysis might be wrongly influenced by unmanaged noise in the data, which could finally produce inappropriate predictions.
Therefore, the implementation of Cognitive technologies might need a significant digital transformation of the enterprise to enable artificial functions to effectively and efficiently leverage massive data sets coming from almost fully automated processes (think for instance of robotics, or the Internet of Things). It is essential, then, that large amounts of data are handled through appropriate big data platforms—the hardware and software technologies of which are able to support cognitive computing capabilities.

Deloitte believes that when humans rely on their own experiences and knowledge, augmented by a stream of analytics-driven insights, the impact on value can be exponential. We have seen achievement of this impact as the rule, rather than exception, in insight-driven organizations.

Through the effective use of technology, including leading analytics technologies from IBM, Deloitte helps our clients become insight-driven organizations. Specifically, we help them ask the right questions first, and then apply advanced analytical and machine learning techniques to make their decision-making processes more efficient. Through Deloitte's strategic alliance with IBM, we can provide capabilities spanning the range of "right questions," from tactical to operational to strategic—all backed by IBM's deep stack of analytics technology.

The following are just a few examples of our analytics teaming priorities:

- Watson Analytics: This cloud service combines the power of IBM's Watson cognitive computing technology with Big Blue's predictive analytics capabilities and puts them in the hands of business users. Watson Analytics provides a unified experience that brings together a complete set of self-service enterprise data and analytics capabilities in the cloud. Leveraging Watson Analytics as a shared common platform with clients, Deloitte can guide them in identifying their most valuable insights, predicting outcomes, visualizing results, and then creating reports or dashboards to share these new insights.
- Sales Performance Management: IBM Cognos ICM offers an enterprise application that leading organizations use to streamline compensation processes, reduce errors, meet compliance requirements, and drive improved sales performance. Organizations are able to design and manage highly complex compensation programs, including sales commissions, MBOs, and noncash rewards. Deloitte helps deliver on this solution, providing deep technical capabilities, a long history with Varicent, and the know-how to match technical solutions to the strategic goals of the enterprise.
- Automated External Reporting (AER) for Finance: Though companies have made significant investments in technology to improve their accounting and reporting processes, much of this effort has focused on improving the "close" and "consolidate" processes. In conjunction, the processes to prepare and submit financial statements and other external reports (i.e., statutory, tax, regulatory, and other) continue to be operationally inefficient and, in some cases, ineffective. AER is Deloitte's approach to assisting companies in moving past these challenges, providing an efficient, sustainable and technology-enabled process to optimize external reporting and overcome operational inefficiencies while enabling financial analytics. And, Deloitte's most significant AER reference is IBM Finance and Tax, who have been very successful in deploying AER, with Deloitte's help.

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Watson

Deloitte was the only professional services organization selected for the inaugural IBM Watson Ecosystem Board of Advisors, which shapes the direction and strategy of the ecosystem by offering external views on the marketplace and potential opportunities for ecosystem partners. "We chose Deloitte because of its experience at the intersection of business and technology, its knowledge of the Watson product, and the value we've realized from our strategic and longstanding relationship," says Mike Rhodin, SVP, IBM Watson Group. We were also pleased to have IBM Watson featured in Deloitte's 2015 Global Report, acknowledging the broader impact our two companies can have when we work together.
Cognitive computing is emerging as a very real opportunity, as well as a threat, for many businesses. It is a component of the broader trend around big data, but it is particularly important because cognitive computing focuses on the realm of unstructured data, which is clearly dominant in volume over that of structured data. Given Deloitte and IBM's already strong client and alliance relationship, our collaboration around Watson is a natural extension, enabled by the emergence of powerful cognitive computing and analytics technologies. Deloitte is proud to have been the first global systems integrator to join IBM in investing time, money, and people toward applying Watson technologies to solve business problems. Deloitte is also a member of the Watson Partner Program, giving us access to many resources, including the Watson Developer Cloud, which provides an expansive sandbox for our professionals to gain hands-on experience.

Watson Health

In April of 2014, IBM announced the Watson Health unit, which will provide patients, physicians, researchers, and insurers secure access to individualized insights and a more complete picture of the many factors that affect people's health. Watson Health draws on IBM's collaborative relationships with leaders across the healthcare ecosystem, and builds on IBM's strengths in cognitive computing, analytics, security, and cloud, to improve the ability of doctors, researchers, and insurers to innovate by surfacing new insights from the massive amount of personal health data created daily. As the number one ranked Life Sciences & Healthcare consulting firm globally (based on both revenue and capabilities), Deloitte is embracing cognitive computing, and specifically IBM Watson Health's offerings, as a potential path forward for our healthcare provider, health plan, and life sciences clients who are challenged with the rapidly shifting landscapes of their business environments.

Conclusion

- Cognitive intelligence refers to software programmed to augment human cognitive functions. These technologies are becoming better through machine learning and a continued human feedback throughout all interactions.
- Cognitive machines can be used to automate predictions and help make decisions or optimize operational processes.
- Certain artificial intelligence programs understand natural language and can provide an enhanced customer experience when responding directly to clients' needs.
- Cognitive technologies are just beginning to emerge: underlying algorithms need a substantial configuration phase to work efficiently.
- Implementation of cognitive technologies depends on your specific needs, existing infrastructure, and IM maturity level.It could also hide future showstoppers to the launch of the offering.