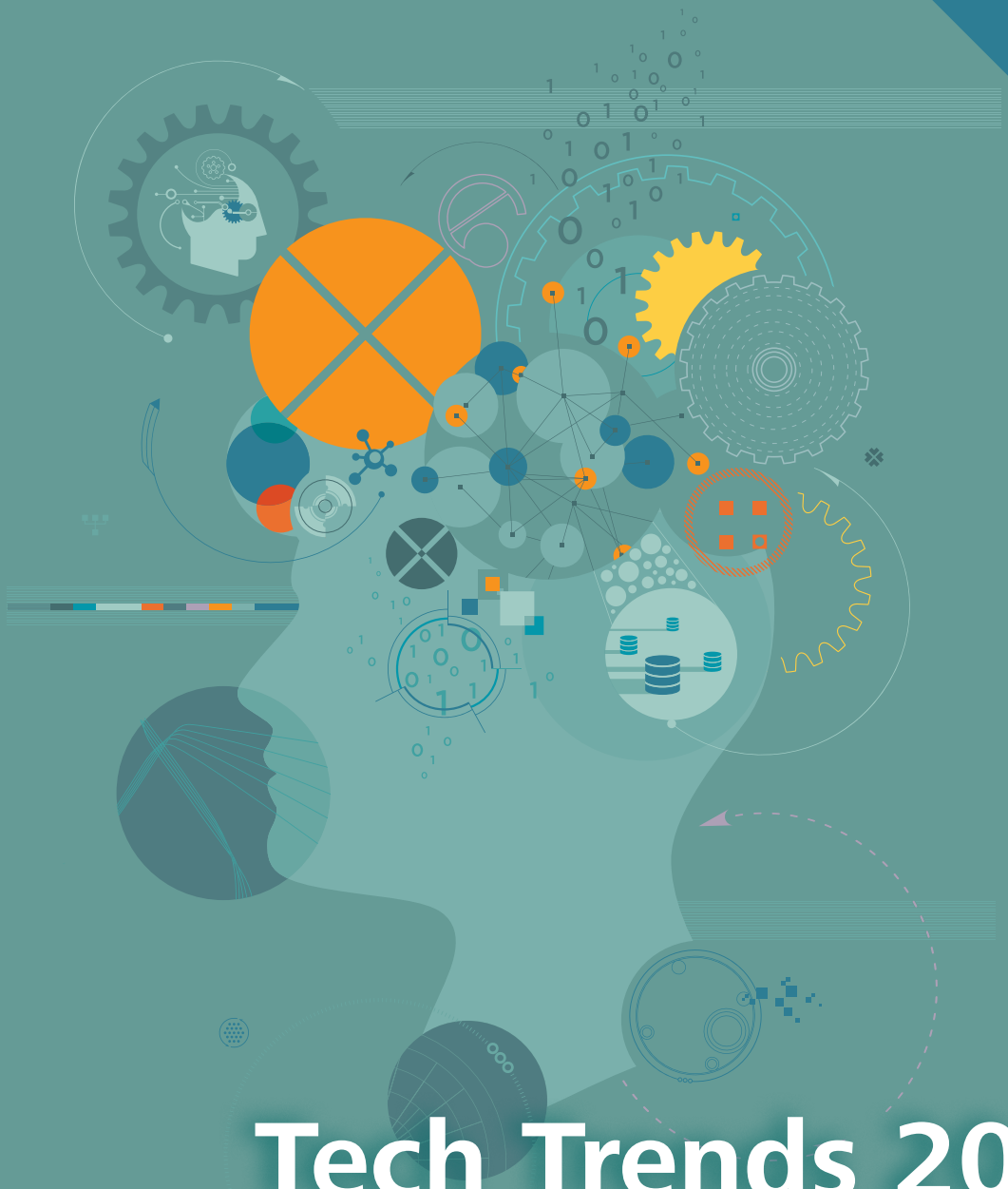
UK Edition
Chapter Extract



Tech Trends 2014

Cognitive analytics

Download the full report at **www.deloitte.co.uk/techtrends**

Deloitte University Press

Cognitive analytics

Wow me with blinding insights, HAL

Artificial intelligence, machine learning, and natural language processing have moved from experimental concepts to potential business disruptors – harnessing Internet speed, cloud scale, and adaptive mastery of business processes to drive insights that aid real-time decision making. For organisations that want to improve their ability to sense and respond, cognitive analytics can be a powerful way to bridge the gap between the intent of big data and the reality of practical decision making.

FOR decades, companies have dealt with information in a familiar way – deliberately exploring known data sets to gain insights. Whether by queries, reports, or advanced analytical models, explicit rules have been applied to universes of data to answer questions and guide decision making. The underlying technologies for storage, visualisation, statistical modeling, and business intelligence have continued to evolve, and we're far from reaching the limits of these traditional techniques.

Today, analytical systems that enable better data-driven decisions are at a crossroads with respect to where the work gets done. While they leverage technology for data-handling and number-crunching, the hard work of forming and testing hypotheses, tuning models, and tweaking data structures is still reliant on people. Much of the grunt work is carried out by computers, while much of the thinking is dependent on specific human beings with specific skills and experience that are hard to replace and hard to scale.

A new approach to information discovery and decision making

For the first time in computing history, it's possible for machines to learn from experience and penetrate the complexity of data to identify associations. The field is called *cognitive analytics*™ – inspired by how the human brain processes information, draws conclusions, and codifies instincts and experience into learning. Instead of depending on predefined rules and structured queries to uncover answers, cognitive analytics relies on technology systems to generate hypotheses, drawing from a wide variety of potentially relevant information and connections. Possible answers are expressed as recommendations, along with the system's self-assessed ranking of how confident it is in the accuracy of the response. Unlike in traditional analysis, the more data fed to a machine learning system, the more it can learn, resulting in higher-quality insights.

Cognitive analytics can push past the limitations of human cognition, allowing us to process and understand big data in real time, undaunted by exploding volumes of data or wild fluctuations in form, structure, and quality.

Context-based hypotheses can be formed by exploring massive numbers of permutations of potential relationships of influence and causality – leading to conclusions unconstrained by organisational biases. In academia, the techniques have been applied to the study of reading, learning, and language development. The Boltzmann machine[1] and the Never-Ending Language Learning (NELL)[2] projects are popular examples. In the consumer world, pieces of cognitive analytics form the core of artificial personal assistants such as Apple's Siri[3] voice recognition software[4] and the Google Now service, as well as the backbone for the Xbox® video game system's verbal command interface in Kinect®.

Even more interesting use cases exist in the commercial realm. Early instances of cognitive analytics can be found in health care, where systems are being used to improve the quality of patient outcomes. A wide range of structured inputs, such as claims records, patient files, and outbreak statistics, are coupled with unstructured inputs such as medical journals and textbooks, clinician notes, and social media feeds. Patient diagnoses can incorporate new medical evidence and individual patient histories, removing economic and geographic constraints that can prevent access to leading medical knowledge.

In financial services, cognitive analytics is being used to advise and execute trading, as well as for advanced fraud detection and risk underwriting. In retail, cognitive systems operate as customer service agents, in-store kiosks, and digital store clerks – providing answers to customers' questions about products, trends, recommendations, and support. Another promising area for cognitive analytics involves the concept of "tuning" complex global systems such as supply chains and cloud networks.

Getting practical

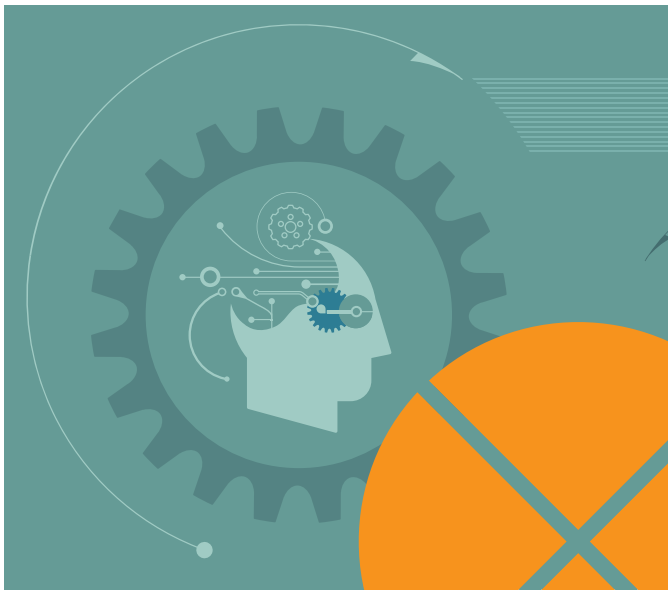
In practical terms, cognitive analytics is an extension of cognitive computing, which is made up of three main components: machine learning, natural language processing, and advancements in the enabling infrastructure.

Machine learning, or deep learning,[5] is an artificial intelligence[6] technique modelled after characteristics of the human brain. A machine learning system explores many divergent concepts for possible connections, expresses potential new ideas with relative confidence or certainty in their "correctness," and adjusts the strength of heuristics, intuition, or decision frameworks based on direct feedback to those ideas. Many of today's implementations represent supervised learning, where the machine needs to be trained or taught by humans. User feedback is given on the quality of the conclusions, which the system uses to tune its "thought process" and refine future hypotheses.

Another important component of cognitive computing is natural language processing (NLP), or the ability to parse and understand unstructured data and conversational requests. NLP allows more data from more sources to be included in an analysis – allowing raw text, handwritten content, email, blog posts, mobile and sensor data, voice transcriptions, and more to be included as part of the learning. This is essential, especially because the volume of unstructured data is growing by 62 percent each year[7] and is expected to reach nine times the volume of structured data by 2020.[8] Instead of demanding that all information be scrubbed, interpreted, and translated into a common format, the hypothesis and confidence engines actively learn associations and the relative merits of various sources.

NLP can also simplify a person's ability to interact with cognitive systems. Instead of forcing end users to learn querying or programming languages, cognitive computing allows spoken, natural exploration. Users can ask, "What are the sales projections for this quarter?" instead of writing complicated lookups and joins against databases and schemas.

Finally, cognitive computing depends on increased processing power and storage networks delivered at low costs. That's because it requires massively parallel processing, which allows exploration of different sets of data from different sources at the same time. It also requires places where the massive amounts of data can be continuously collected and analysed. Options include the cloud, large appliances and high-end servers, and distributed architectures that allow work to be reduced and mapped to a large collection of lower-end hardware.



All together now

Cognitive analytics is the application of these technologies to enhance human decisions. It takes advantage of cognitive computing's vast data-processing power and adds channels for data collection (such as sensing applications) and environmental context to provide practical business insights. If cognitive *computing* has changed the way in which information is processed, cognitive *analytics* is changing the way information is applied.

The breakthrough could not have come at a better time. As more human activity is being expressed digitally, data forms continue to evolve. Highly structured financial and transactional data remain at the forefront of many business applications, but the rise of unstructured information in voice, images, social channels, and video has created new opportunities for businesses to understand the world around them.

For companies that want to use this information for real-time decision making, cognitive analytics is moving to centre stage. It is both a complement to inventorying, cleansing, and curating ever-growing decision sources and a means for machine learning at Internet speed and cloud scale to automatically discover new correlations and patterns.

Cognitive analytics is still in its early stages, and it is by no means a replacement for traditional information and analytics programs. However, industries wrestling with massive amounts of unstructured data or struggling to meet growing demand for real-time visibility should consider taking a look.

Wellpoint: Changing the world of health care

In 2011, WellPoint, one of the USA's largest health benefits companies, set out to design a world-class, integrated health care ecosystem that would link data on physical, financial, worksite, behavioural, and community health. By establishing a singular platform, WellPoint could enhance its ability to collaborate, share information, automate processes, and manage analytics. To do this, WellPoint needed an advanced solution, and therefore teamed with IBM to use the capabilities of Watson – IBM's cognitive computing system.

"We decided to integrate our health care ecosystem to help our care management associates administer member benefits, while providing a seamless member experience and working to reduce costs," said Gail Borgatti Croall, SVP of Care Management at WellPoint. "Cognitive analytics was important in creating a system that could drive effectiveness and efficiencies throughout our business."

Today, WellPoint uses cognitive analytics as a tool for utilisation management:[9] specifically, in reviewing pre-authorisation treatment requests – decisions that require knowledge of medical science, patient history, and the prescribing doctor's rationale, among other factors. With its ability to read free-form textual information, Watson can synthesise huge amounts of data and create hypotheses on how to respond to case requests. In fact, WellPoint already has "taught" its cognitive engine to recognise medical policies and guidelines representing 54 percent of outpatient requests.

"It took us about a year to train our solution on our business, and the more we taught the faster the Watson cognitive platform learned," said Croall. "Now it's familiar with a huge volume of clinical information and professional literature. This reduces a significant amount of time needed for nurses to track down and assess the variables when making a well-informed decision on an authorisation request."

For each case reviewed, the system provides nurses with a recommendation and an overall confidence and accuracy rating for that recommendation. In some outpatient cases, the system already can auto-approve requests, reducing the timeframe for patient treatment recommendations from 72 hours to near-real time. As the cognitive system develops its knowledge database, the accuracy and confidence ratings will continue to rise, and the ability to approve greater numbers and types of cases in real time becomes a reality.

Furthermore, nurses have experienced a 20 percent improvement in efficiency in specific work flows due to the one-stop-shop nature of the integrated platform. The integrated platform will create not only efficiency savings but also enable improvement in speed of response to provider requests.

WellPoint's use of cognitive analytics for utilisation management represents the tip of the iceberg. Its integrated health care ecosystem is a multiyear journey that the company approaches with iterative, small releases, keeping the effort on time and on budget. In the future, WellPoint may look into how the system can support identification and stratification for clinical programmes or many other applications.

"We'd like to see how our system can support a more holistic, longitudinal patient record – for example, integrating electronic medical record (EMR) data with claims, lab, and pharmacy data," said Croall. "We also see opportunities on the consumer side. Imagine using cognitive insights to create an online, interactive model that helps you, as a patient, understand treatment options and costs. We've barely scratched the surface with our cognitive analytics capabilities. It truly will change the way we perform utilisation management and case management services."

Where do you start?

RATHER than having a team of data scientists creating algorithms to understand a particular business issue, cognitive analytics seeks to extract content, embed it into semantic models, discover hypotheses and interpret evidence, provide potential insights – and then continuously improve them. The data scientist's job is to empower the cognitive tool, providing guidance, coaching, feedback, and new inputs along the way.

As a tool moves closer to being able to replicate the human thought process, answers come more promptly and with greater consistency. Here are a few ways to get started:

- **Start small** It's possible to pilot and prototype a cognitive analytics platform at low cost and low risk of abandonment using the cloud and open-source tools. A few early successes and valuable insights can make the learning phase also a launch phase.

- **Plant seeds** Analytics talent shortages are exacerbated in the cognitive world. The good news? Because the techniques are so new, your competitors are likely facing similar hurdles. Now is a good time to invest in your next-generation data scientists, anchored in refining and harnessing cognitive techniques. And remember, business domain experience is as critical as data science. Cast a wide net, and invest in developing the players from each of the disciplines. Consider crowdsourcing talent options for initial forays.[10]

- **Tools second** The tools are improving and evolving at a rapid pace, so don't agonise over choices, and don't overcommit to a single vendor. Start with what you have, supplement with open-source tools during the early days, and continue to explore the state of the possible as tools evolve and consolidate.

- **Context is king** Quick answers and consistency depend on more than processing power. They also depend on context. By starting with deep information for a particular sector, a cognitive analytics platform can short-circuit the learning curve and get to high-confidence hypotheses quickly. That's why the machinery of cognitive computing – such as Watson from IBM – is rolling out sector by sector. Early applications involve health care management and customer service in banking and insurance. Decide which domains to target and begin working through a concept map – part entity and explicit relationship exercise, part understanding of influence and subtle interactions.

- **Don't scuttle your analytics ship** Far from making traditional approaches obsolete, cognitive analytics simply provides another layer – a potentially more powerful layer – for understanding complexity and driving real-time decisions. By tapping into broader sets of unstructured data such as social monitoring, deep demographics, and economic indicators, cognitive analytics can supplement traditional analytics with ever-increasing accuracy and speed.

- **Divide and conquer** Cognitive analytics initiatives can be broken into smaller, more accessible projects. Natural language processing can be an extension of visualisation and other human-computer interaction efforts. Unstructured data can be tapped as a new signal in traditional analytics efforts. Distributed computing and cloud options for parallel processing of big data don't require machine learning to yield new insights.

- **Know which questions you're asking** Even modest initiatives need to be grounded in a business "so what." An analytics journey should begin with questions, and the application of cognitive analytics is no exception. The difference, however, lies in the kinds of answers you're looking for. When you need forward-looking insights that enable confident responses, cognitive analytics may be your best bet.
- **Explore ideas from others** Look outside your company and industry at what others are doing to explore the state of the possible. Interpret it in your own business context to identify the state of the practical and valuable.

Bottom line

As the demand for real-time support in business decision making intensifies, cognitive analytics will likely move to the forefront in high-stakes sectors and functions: health care, financial services, supply chain, customer relationship management, telecommunications, and cyber security. In some of these areas, lagging response times can be a matter of life and death. In others, they simply represent missed opportunities.

Cognitive analytics can help address some key challenges. It can improve prediction accuracy, provide augmentation and scale to human cognition, and allow tasks to be performed more efficiently (and automatically) via context-based suggestions. For organisations that want to improve their ability to sense and respond, cognitive analytics offers a powerful way to bridge the gap between the promise of big data and the reality of practical decision making.

Authors
Rajeev Ronanki, principal, Deloitte Consulting LLP
David Steier, director, Deloitte Consulting LLP

1 Sam Roweis, "Boltzmann machines," lecture notes, 1995, http://www.cs.nyu.edu/~roweis/notes/boltz.pdf, accessed December 19, 2013.
2 Andrew Carlson, Justin Betteridge, Bryan Kisiel, Burr Settles, Estevam R. Hruschka Jr., and Tom M. Mitchell, "Toward an architecture for never-ending language learning," http://www.cs.cmu.edu/~acarlson/papers/carlson-aaai10.pdf, accessed December 19, 2013.
3 Siri is a trademark of Apple Inc., registered in the U.S. and other countries.
4 Tech Trends 2014 is an independent publication and has not been authorised, sponsored, or otherwise approved by Apple Inc.
5 Robert D. Hof, "Deep learning," MIT Technology Review, April 23, 2013, http://www.technologyreview.com/featuredstory/513696/deep-learning/, accessed December 19, 2013.
6 For more information on AI, see Deloitte Consulting LLP, Tech Trends 2014: Inspiring disruption, 2014, "Exponentials."
7 HP Autonomy, Transitioning to a new era of human information, 2013, http://www.autonomy.com/html/power/sem/index-human_information.html, accessed December 19, 2013.
8 Steven Hagan, "Big data, cloud computing, spatial databases," Geospatial World Forum, Amsterdam, The Netherlands, April 25, 2012.
9 Utilisation management is the case-by-case assessment of the appropriateness of medical services against evidence-based quality guidelines.
10 Deloitte Consulting LLP, Tech Trends 2014: Inspiring disruption, 2014, chapter 3.

Contacts

Carl Bates
Partner, Analytics
Deloitte MCS Limited
020 7007 7590
carbates@deloitte.co.uk

Kevin Walsh
Head of Technology Consulting
Deloitte MCS Limited
020 7303 7059
kwalsh@deloitte.co.uk

About Deloitte University Press
Deloitte University Press publishes original articles, reports and periodicals that provide insights for businesses, the public sector and NGOs. Our goal is to draw upon research and experience from throughout our professional services organization, and that of coauthors inacademia and business, to advance the conversation on a broad spectrum of topics of interest to executives and government leaders.

Deloitte University Press is an imprint of Deloitte Development LLC.

Designed and produced by The Creative Studio at Deloitte, London. 32430A