



# Cognitive technologies

## Applications to solve traditional business problems

By David Schatsky and Ragu Gurumurthy

**F**UTURISTIC artificial-intelligence scenarios may make for compelling reading. But heavy investment in startup companies that are developing or applying cognitive technologies suggests that established industries may find the biggest near-term opportunities in applying these technologies to traditional business issues.

### Signals

- Since 2011, venture-capital firms have invested over \$2.5 billion in cognitive technology startups developing applications for enterprise functions as marketing, sales, security, and analytics.
- Another \$2 billion has flowed to companies developing solutions for specific industries such as retail, advertising, education, and health care.
- Cognitive technology performance records continue to be shattered, with the accuracy of facial recognition and speech recognition reaching 100 percent and 92 percent, respectively.
- Applications are proliferating, with new examples in power generation, medical diagnostics, public health, financial risk management, and more.

## Better-than-human performance expands applications of cognitive technologies

The trend of relentlessly increasing performance in cognitive technologies has continued in recent months, with notable gains in face and image recognition, which can now outperform humans on some benchmarks, and speech recognition, with Google cutting errors by two-thirds.<sup>1</sup> As the performance of cognitive technologies such as computer vision, natural language processing, and speech recognition improves, the number and scope of applications continue to expand. For instance, IBM found its forecasts of the availability of sunlight and wind for energy production developed using machine learning to be up to 30 percent more accurate than those created using conventional approaches.<sup>2</sup> A machine learning-based analysis of brain images was shown to be 98 percent accurate in diagnosing Parkinson's disease, compared with 91 percent for conventional visual-analysis methods.<sup>3</sup> In just the last few months, researchers revealed projects in which neural networks can predict phenomena as diverse as bank failures,<sup>4</sup> rodent-borne disease outbreaks,<sup>5</sup> and clinical responses to anti-cancer drugs.<sup>6</sup> These are just a few examples of the many valuable applications of cognitive technologies being created to address today's opportunities and challenges.

A principal way that cognitive technologies can create value for companies is by intelligently automating tasks and surfacing insights that augment human decision making.

## Big opportunities for cognitive technologies in the enterprise

Continuing improvements in the power of cognitive technologies may make possible new classes of products, from intelligent virtual assistants to home robots, and will likely spawn entirely new industries. But a novel analysis of recent venture-capital investments suggests a large, nearer-term opportunity: serving

existing industries with products enhanced by cognitive technologies.

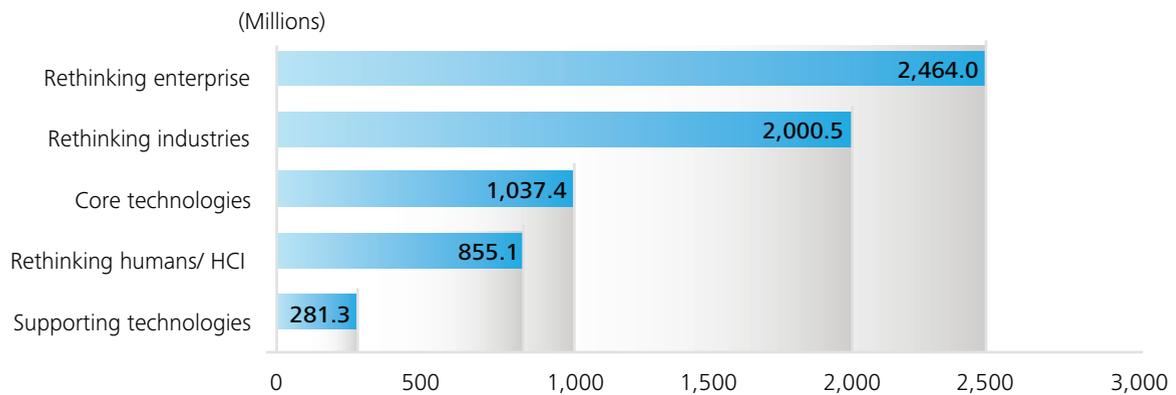
We can sense where the biggest opportunities may lie by analyzing venture-capital investments in startup companies that are developing or applying cognitive technologies. Our analysis is based on a schema created at the venture-capital firm Bloomberg Beta;<sup>7</sup> it divides cognitive technology startups into five broad categories based on the nature of their products:

**Core technologies:** broadly useful cognitive technology products such as machine learning platforms, natural language processing tools, and computer vision systems

**Supporting technologies:** hardware or software platforms supporting the development of applications of cognitive technologies

**Rethinking humans:** new human-computer interface tools such as augmented reality, gestural computing, and affective computing (recognizing or simulating emotions)

**Figure 1. VC investment since 2011 in US-based cognitive technology companies that have raised at least \$10M**



Source: Quid, Capital IQ, Deloitte analysis

Graphic: Deloitte University Press | DUPress.com

**Rethinking enterprise:** applications for typical enterprise functions such as sales, marketing, security, human resources, and intelligence/analytics

**Rethinking industries:** applications and tools designed for specific industry sectors such as retail, education, and health care

The biggest funding category by far is those companies building applications for traditional enterprise functions such as **marketing and sales**. Startups like these have raised nearly \$2.5 billion since 2011 (see figure 1), suggesting that the biggest near-term opportunity for cognitive technologies is in using them to enhance current business practices.

Indeed, startups are using cognitive technologies to develop valuable features and capabilities such as intelligent automation, ease of use, and insightful analytics that are superior to what can readily be achieved with conventional information technologies. In the Rethinking Enterprise category, for instance, marketing-focused startups have used machine learning to improve customer targeting<sup>8</sup> and website personalization,<sup>9</sup> natural language processing to understand what consumers are saying about television content on social media,<sup>10</sup>

and speech recognition to gauge the quality of inbound telephone leads.<sup>11</sup> The top segments in the enterprise category are **marketing, intelligence** (including **analytics solutions**), **security** and **authentication**, and **sales**.<sup>12</sup>

Companies developing applications tailored for specific sectors such as **retail, advertising** (“adtech”), **education, medical/diagnostics**, and **media** have also received major investments—over \$2 billion during the same period.<sup>13</sup> In the Rethinking Industry category, startups providing solutions aimed at the medical and diagnostics sectors are using natural language processing to automate the coding of medical charts for insurance reimbursement,<sup>14</sup> machine learning to power mobile care-management apps that tailor their content to better engage patients in their care regimen,<sup>15</sup> and computer vision and machine learning to power a simple, low-cost ultrasound device that can automatically diagnose disorders.<sup>16</sup> Top segments in this category include retail, adtech, medical and diagnostics, and education.<sup>17</sup>

This analysis suggests that the applications of cognitive technologies are broad; they can often resemble traditional enterprise applications—with advanced capabilities and performance—rather than specialized cognitive

computing products. A principal way that cognitive technologies can create value for companies is by intelligently automating tasks and surfacing insights that augment human decision making. The opportunities for this are huge, spanning all sectors and business functions.

## New platforms to expand adoption of cognitive technologies

Cognitive technologies present special opportunities in the technology sector itself. These include enabling customers' cognitive computing initiatives with platforms and tools to make it easier to build and deploy applications. Earlier this year, for instance, both Amazon and Microsoft introduced commercial cloud-based machine learning platforms.<sup>18</sup> Intel has released chips tuned for machine learning that vendors such as Dell, Hewlett-Packard, and Lenovo are incorporating into servers.<sup>19</sup> And Qualcomm has released processors aimed at deploying trained neural networks in mobile devices, from smartphones to consumer-oriented drones.<sup>20</sup> These developments highlight the potential for technology suppliers to meet growing demand for tools and platforms to support the development of cognitive technology applications.

## Implications

Vendors of enterprise software applications should consider how cognitive technologies can enhance their products. Startups may offer models of how to employ these technologies to make products easier to use, to automate functions intelligently, and to generate greater insight from data.

Corporate IT groups may want to build awareness of and skills in cognitive technologies such as machine learning and natural language processing. They can also begin to assess how to employ cognitive technologies to enhance existing corporate applications to provide greater usability and more valuable insights to users.

Buyers of enterprise software may find it worthwhile to ask their vendors to explain how they plan to take advantage of cognitive technologies to enhance their products' performance and utility.

## The biggest opportunities are under our noses

Cognitive technologies continue to improve and will likely give rise to entirely new product categories and even industries. In the near term, though, established industries can find significant opportunities in applying these technologies to conventional business functions, as the venture capital investment data suggests.

# Endnotes

1. See Derrick Harris, "Google: Our new system for recognizing faces is the best one ever," *Fortune*, March 17, 2015, <http://fortune.com/2015/03/17/google-facenet-artificial-intelligence/>; Andrew Moseman, "Computers now can recognize human faces from any angle," *Popular Mechanics*, February 17, 2015, [www.popularmechanics.com/technology/a14115/human-face-recognition-algorithm-yahoo/](http://www.popularmechanics.com/technology/a14115/human-face-recognition-algorithm-yahoo/); Aviva Rutkin, "Facebook can recognise you in photographs even if you're not looking," *Daily News*, June 22, 2015, [www.newscientist.com/article/dn27761-facebook-can-recognise-you-in-photos-even-if-youre-not-looking#](http://www.newscientist.com/article/dn27761-facebook-can-recognise-you-in-photos-even-if-youre-not-looking#.VYpQAPmqpBf); R. Colin Johnson, "Microsoft, Google beat humans at image recognition," *EE Times*, February 18, 2015, [www.eetimes.com/document.asp?doc\\_id=1325712](http://www.eetimes.com/document.asp?doc_id=1325712); Jordan Novet, "Google says its speech recognition technology now has only an 8% word error rate," *VentureBeat*, May 28, 2015, [venturebeat.com/2015/05/28/google-says-its-speech-recognition-technology-now-has-only-an-8-word-error-rate/](http://venturebeat.com/2015/05/28/google-says-its-speech-recognition-technology-now-has-only-an-8-word-error-rate/); and Susan Scutti, "IBM Watson, using speech analysis techniques, correctly identifies patients at-risk for psychosis," *Medical Daily*, August 26, 2015, [www.medicaldaily.com/ibm-watson-using-speech-analysis-techniques-correctly-identifies-patients-risk-349794](http://www.medicaldaily.com/ibm-watson-using-speech-analysis-techniques-correctly-identifies-patients-risk-349794), all accessed September 19, 2015.
2. Joanna Glasner, "IBM's machine learning tech takes on solar power's flakiness," *Data Center Knowledge*, July 22, 2015, [www.datacenterknowledge.com/archives/2015/07/22/ibms-machine-learning-tech-takes-on-solar-powers-flakiness/](http://www.datacenterknowledge.com/archives/2015/07/22/ibms-machine-learning-tech-takes-on-solar-powers-flakiness/), accessed September 19, 2015.
3. Jude Dineley, "Machine learning diagnoses Parkinson's," *MedicalPhysicsWeb*, April 9, 2015, <http://medicalphysicsweb.org/cws/article/research/60766>, accessed September 19, 2015.
4. Phys.org, "A neural network model predicts whether a bank can go bust," May 5, 2015, <http://m.phys.org/news/2015-05-neural-network-bank.html>, accessed September 19, 2015.
5. News-Medical.net, "Machine learning can predict emerging infectious diseases," May 19, 2015, [www.news-medical.net/news/20150519/Machine-learning-can-predict-emerging-infectious-diseases.aspx](http://www.news-medical.net/news/20150519/Machine-learning-can-predict-emerging-infectious-diseases.aspx), accessed September 19, 2015.
6. Rebecca Merrett, "Machine learning used to predict clinical response to anti-cancer drugs," *CIO*, March 2, 2015, [www.cio.com.au/article/569280/machine-learning-used-predict-clinical-response-anti-cancer-drugs/](http://www.cio.com.au/article/569280/machine-learning-used-predict-clinical-response-anti-cancer-drugs/), accessed September 19, 2015.
7. Shivon Zilis, "The current state of machine intelligence," [www.shivonzilis.com/machine-intelligence/](http://www.shivonzilis.com/machine-intelligence/), accessed September 15, 2015.
8. Derrick Harris, "Exclusive: Causata raises \$7.5M and steps up its game in targeted ads," *GigaOm*, February 6, 2013, <https://gigaom.com/2013/02/06/exclusive-causata-raises-7-5m-and-steps-up-its-game-in-targeted-ads/>, accessed September 19, 2015.
9. Jolie Katz, "Better recommendations are worth \$500M," *Rich Relevance*, March 31, 2015, [www.richrelevance.com/blog/2015/03/better-recommendations-worth-500m/](http://www.richrelevance.com/blog/2015/03/better-recommendations-worth-500m/), accessed September 19, 2015.
10. Mike Isaac, "Why Twitter dropped close to \$90 million on Bluefin Labs," *All Things D*, February 12, 2013, <http://allthingsd.com/20130212/why-twitter-dropped-close-to-90-million-on-bluefin-labs/>, accessed September 19, 2015.
11. Convirza, "Convirza closes \$20M of Series B funding for call analytics and automation," [www.convirza.com/press-releases/convirza-closes-20m-of-series-b-funding-for-call-analytics-and-automation/](http://www.convirza.com/press-releases/convirza-closes-20m-of-series-b-funding-for-call-analytics-and-automation/), accessed September 19, 2015.
12. Marketing vendors have attracted \$590 million; analytics and intelligence vendors: \$570 million; security and authentication startups: \$480 million; sales technology vendors: \$350 million.
13. Data from Capital IQ and Quid Inc., as of September 10, 2015. Investments in US-based companies that have raised at least \$10 million.
14. Apixio, [www.apixio.com/solutions/#](http://www.apixio.com/solutions/#), accessed September 19, 2015.
15. PRWeb, "Wellframe closes \$8.5 million in Series A financing," September 8, 2014, [www.prweb.com/releases/2014/09/prweb12149420.htm](http://www.prweb.com/releases/2014/09/prweb12149420.htm), accessed September 19, 2015.

16. Davey Alba, "The startup that's bringing AI to ultrasounds and MRIs," *Wired*, November 4, 2014, [www.wired.com/2014/11/butterfly-network/](http://www.wired.com/2014/11/butterfly-network/), accessed September 19, 2015.
17. Startups with solutions aimed at the retail sector have raised \$520 million; adtech startups have raised \$510 million; medical + diagnostics: \$440 million; education: \$270 million.
18. Ron Miller, "Microsoft officially launches Azure machine learning platform," *TechCrunch*, February 18, 2015, <http://techcrunch.com/2015/02/18/microsoft-officially-launches-azure-machine-learning-big-data-platform/> and Ron Miller, "AWS wants to put machine learning in reach of any developer," *TechCrunch*, April 9, 2015, <http://techcrunch.com/2015/04/09/aws-wants-to-put-machine-learning-in-reach-of-any-developer/>, both accessed September 19, 2015.
19. Agam Shah, "Intel's 18-core Xeon chips tuned for machine learning, analytics," *PC World*, May 5, 2015, [www.pcworld.com/article/2918852/intels-18core-xeon-chips-tuned-for-machine-learning-analytics.html](http://www.pcworld.com/article/2918852/intels-18core-xeon-chips-tuned-for-machine-learning-analytics.html), accessed September 19, 2015.
20. Agam Shah, "Qualcomm's Snapdragon 820 will pack a silicon brain with cognitive computing abilities," *PC World*, March 2, 2015, [www.pcworld.com/article/2891052/qualcomm-puts-silicon-brain-in-flagship-snapdragon-820-chip.html](http://www.pcworld.com/article/2891052/qualcomm-puts-silicon-brain-in-flagship-snapdragon-820-chip.html) and Qualcomm, "Qualcomm Zeroth is advancing deep learning in devices," March 2, 2015, [www.qualcomm.com/news/onq/2015/03/02/qualcomm-zeroth-advancing-deep-learning-devices-video](http://www.qualcomm.com/news/onq/2015/03/02/qualcomm-zeroth-advancing-deep-learning-devices-video), both accessed September 19, 2015.

# About the authors

**David Schatsky** is a senior manager at Deloitte LLP. He tracks and analyzes emerging technology and business trends, including the growing impact of cognitive technologies, for the firm's leaders and its clients.

**Ragu Gurumurthy** is chief innovation officer at Deloitte LLP, guiding overall innovation efforts across all Deloitte's business units. He advises clients in the technology and telecommunications sectors on a wide range of topics, including innovation, growth, and new business models.



Follow @DU\_Press

Sign up for Deloitte University Press updates at [DUPress.com](http://DUPress.com).

#### **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 in academia 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.

#### **About this publication**

This publication contains general information only, and none of Deloitte Touche Tohmatsu Limited, its member firms, or their related entities (collectively the "Deloitte Network") is, by means of this publication, rendering professional advice or services. Before making any decision or taking any action that may affect your finances or your business, you should consult a qualified professional adviser. No entity in the Deloitte Network shall be responsible for any loss whatsoever sustained by any person who relies on this publication.

#### **About Deloitte**

Deloitte refers to one or more of Deloitte Touche Tohmatsu Limited, a UK private company limited by guarantee ("DTTL"), its network of member firms, and their related entities. DTTL and each of its member firms are legally separate and independent entities. DTTL (also referred to as "Deloitte Global") does not provide services to clients. Please see [www.deloitte.com/about](http://www.deloitte.com/about) for a more detailed description of DTTL and its member firms.

Deloitte provides audit, tax, consulting, and financial advisory services to public and private clients spanning multiple industries. With a globally connected network of member firms in more than 150 countries and territories, Deloitte brings world-class capabilities and high-quality service to clients, delivering the insights they need to address their most complex business challenges. Deloitte's more than 200,000 professionals are committed to becoming the standard of excellence.

© 2015. For information, contact Deloitte Touche Tohmatsu Limited.