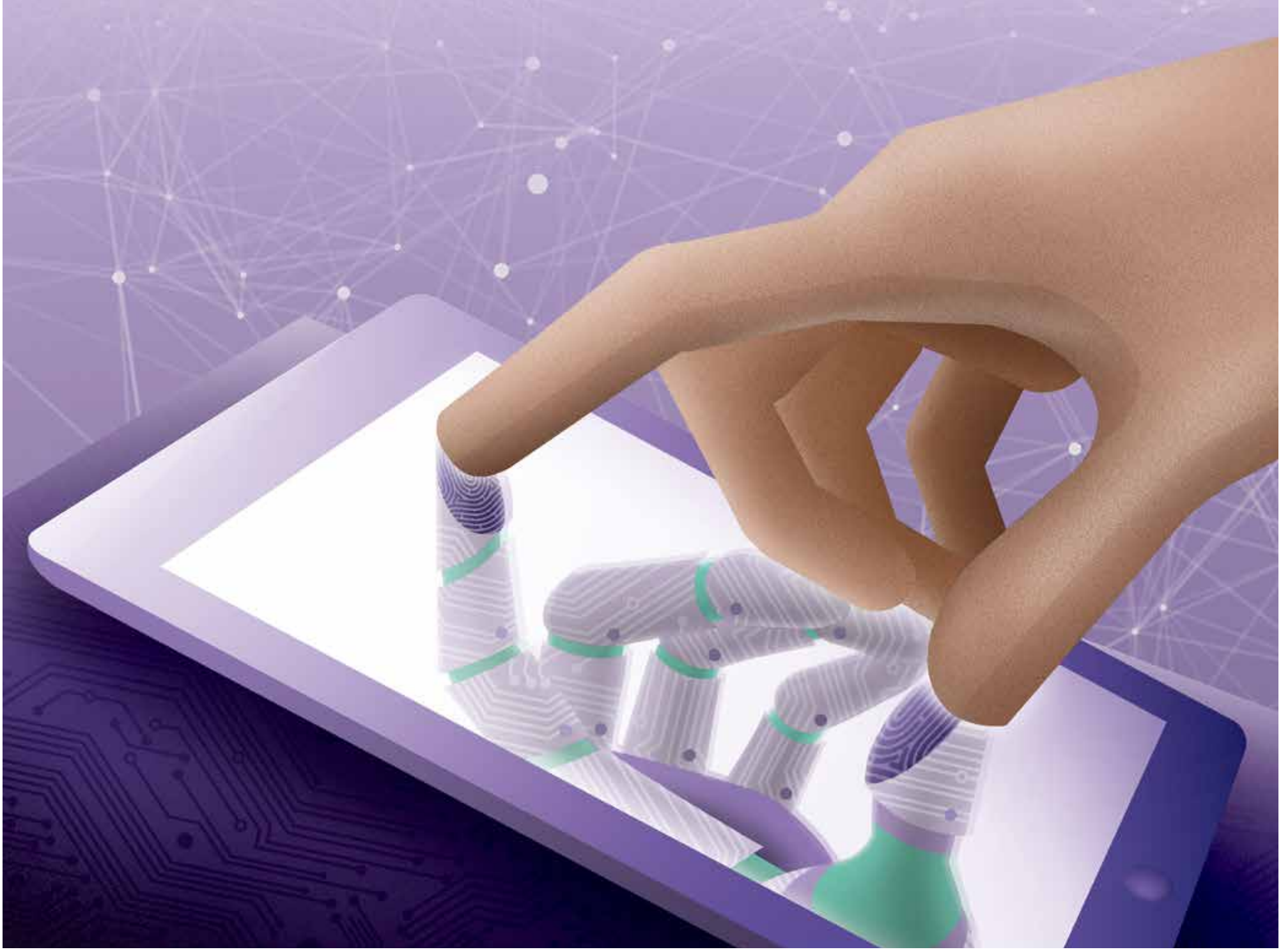
ARTIFICIAL INTELLIGENCE FOR BUSINESS



AI SHOULDN'T MEAN "ARTIFICIALLY INFLATED"

We Make AI Work for Your Industry.

TRUSTED
AI that is transparent, explainable, and auditable. It augments human experience and builds trust by providing users with the right advice, at the right time, with the right evidence.

PROVEN
Used by multiple global Fortune 1000 brands, including the world's largest department store, the world's largest cancer center, the world's largest non-profit health system, and the world's most valuable bank.

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CognitiveScale builds industry optimized augmented intelligence software for financial services, healthcare, and commerce markets. The company's products, ENGAGE and AMPLIFY, are built on its open and extensible AI foundation, CORTEX, to help large enterprises increase user engagement, improve decision-making, and deliver self- learning and self-assuring business processes.

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OVERVIEW

Building machines to be more like us

Artificial intelligence is at the tipping point of becoming emotionally sensitive, believably naturalistic and humanly imperfect

ADRIAN BRIDGWATER

The role of artificial intelligence or AI in business has progressed from initial sci-fi notions of movie robots and talking doors. In a world where human-machine interface technologies are evolving at quantum speed and one where talking doors are very much a reality, the more imperfect and almost human the next generation of AI can be, the more "perfect" it becomes.

We can now use emerging AI tools to deduce whether social media outputs – tweets, Flickr images, Instagram posts and more – are being generated by so-called software bots programmed by malicious hackers or whether they indeed are being made by genuine humans. The central notion here is that computers are still slightly too perfect when they perform any task that mimics human behaviour.

Even when programmed to incorporate common misspellings and the idioms of local language, AI is still too flawless. Humans are more interactive, more colloquial, more context-aware and often altogether more imperfectly entertaining. Programming in sarcasm, humour and the traits of real human personality are still a big ask, it seems.

"Medical advancements such as robots taking over dangerous jobs and the automation of mundane tasks are some of the key benefits that AI can bring to people in all walks of life," says Martin Moran, international managing director at InsideSales, a company that specialises in a self-learning engine for sales acceleration. Mr Moran points to engineering, administration and customer service as three areas set for AI growth.

"Essentially, it is the admin-heavy departments that stand to benefit most from AI today. We have taken AI out of the movies and reached the tangible 2.0 generation of cognitive intelligence," he says.

"The next phase of AI will mimic humans more closely and be built on the back of massive processing power, access to vast amounts data and hugely complex algorithmic logic, just like our own brains. Equally, the true and lasting impact on business will only happen if this AI intelligence is deeply embedded in the workflow process itself."

The point at which we can interplay the nuances of natural language understanding with human behavioural trends in their appropriate contextual environment takes us to a higher level of AI machine control. Being able to build AI with the idiomatic peculiarities of real people could allow us to use AI in real business workshops, factories and offices. So how do we build machines to be more like us?


Buyenlarge / Contributor / Getty Images

Poster of the 1927 German sci-fi film *Metropolis*, which featured one of the first robots depicted in cinema

Operational intelligence company Splunk says the answer to perfectly imperfecting AI is there in the machines, not in any study of humans in the first instance. "The bedrock of machine-learning is in the insights that can be found through the analysis of humans interacting with machines by the residue data left on those machines, says Guillaume Ayme, IT operations evangelist at Splunk.

"Every human action with a machine leaves a trace of 'machine data'. Harnessing this data gives us a categorical record of our exact human behaviour, from our activity on an online store to who we communicate with or where we travel through the geolocation settings on a device."

Mr Ayme points out that most of this kind of data is only partially captured by the majority of organisations and some of it is not tracked at all. When we start to digitise and track the world around us to a more granular level, then we can start to build more human-like AI that has a closer appreciation of our behaviour.

The point AI needs to get to next is one where it fits more naturally into what we might call the narrative of human interaction. AI intelligence needs to be intrinsically embedded in the fabric of the way firms operate. Only then can the AI brain start to learn about the imperfect world around it. Humans need to get used to a future where we have to interact with and work alongside computer brains on a daily basis.

A new report by the Project Literacy campaign, overseen and convened by learning services company Pearson, predicts that at the current rate of technological progress, devices and machines powered by AI and voice recognition software will surpass the literacy level of more than one in twenty British adults within the next ten years.

"Machine-reading is not close to mastering the full nuances of human language and intelligence, despite this idea capturing the imagination of popular culture in movies. However, advances in technology mean that it is likely 'machines' will achieve literacy abilities exceeding those of 16 per cent of British people within the next decade," says Professor Brendan O'Connor of the University of Massachusetts Amherst.

What happens next with AI is emotional. That is to say AI will start to be able to understand, classify and then act upon human emotions. Initially, this work has been straightforward enough. An image of a person showing their teeth is probably smiling and happy. A person has furrowed eyebrows might be angry or frustrated and so on. Latterly, we have started to add extra contextual information about what the user might be doing or where they might be located, then a more accurate picture of mood and emotions is built up.

Natural language interaction company Artificial Solutions says it is working on the next generation of AI cognizance. By creating a world of computer "conversations" that are a world away from what we might consider to be textbook English, Artificial Solutions is working to create AI that understands human bad habits and can appreciate our unpredictable colloquial nuances. AI today is just at the tipping point of becoming emotionally sensitive, believably naturalistic and humanly imperfect. Be nice to your computer, it's just about to get closer to you.

Economist Intelligence Unit 2016/Accenture 2016

CUSTOMER SERVICE

Chatbots can now learn what you like

The next frontier for customer service is being driven by artificial intelligence so brands can target consumers with products based on their personal taste

Luke Sharrett/Bloomberg / Getty Images

01

NICK EASEN

It sounds absurd to think artificial intelligence could be used to generate a more human-like customer experience. But that's exactly how it's now being used. AI analyses huge amounts of behavioural and emotional data in a bid to communicate with us and deliver brand experiences that are more personalised and predictive.

When Unilever turns to an AI bot to boost Lipton tea sales, GlaxoSmithKline uses machine-learning to dispense flu advice through interactive ads and Dutch airline KLM trials machine-learning in its social media chatbot for flyers, you know times are a changing.

"AI is offering retailers new ways to make shopping hassle free. Modern cognitive systems can understand, reason, learn and interact in similar ways to a human being. This is a very fast-moving area," says Tony Maile, European retail leader at IBM Cognitive Solutions.

IBM Watson, the company's cognitive computing service, is now employed by North Face, an outdoor clothing brand, to power their virtual shopping assistant. AI helps people shop online for the right jacket, based on questions relating to where they will use it and when, say the Himalayas in December.

While US department store chain Macy's has developed a shopping companion for smartphones, powered by machine-learning, so customers can shop and navigate the store they're in and ask questions, such as where a brand is located or whether an item is in stock.

"AI will increasingly be used to solve problems for customers, rather than just selling products," says Mr Maile. "Advertisers can target spend more effectively. Retailers can look at past behaviour patterns and tailor offers accordingly. We are in an era where cognitive systems can be taught by the most experienced employees and this knowledge can be made available to all staff and customers directly."

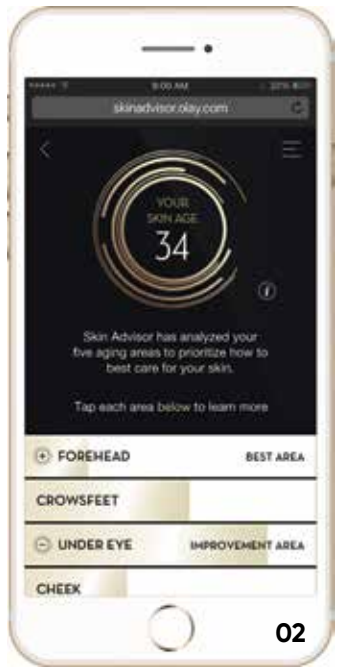
A few trends have driven recent changes. Firstly, there's been an exponential rise in the amount of data relating to consumer behaviour. Secondly, there's more affordable computational power to drive AI. Thirdly, there's been a huge advance in core AI techniques and machine-learning algorithms.

"And on the organisational side, we're also seeing a sea-change in how companies view the role of AI in developing customer experiences. While corporations once felt that AI conflicted with the human design of experiences, they now realise that it enhances efforts instead," says Jonathan Epstein, international senior vice president at Sentient Technologies.

It's working well for subscription services such as Stitch Fix and Birchbox, which sell and curate clothes and beauty products respectively. These e-commerce stores have embedded state-of-the-art AI to act as virtual personal shoppers that work on behalf of customers who don't have the time or inclination to shop.

In a similar vein, US beauty brand CoverGirl is serving up the world's first influencer chatbot based on AI, called the KalaniBot, featuring American reality TV star Kalani Hilliker.

"Customers prefer KalaniBot to the real thing and she has 14 times more conversations than the average [social media] post by the star," says Michelle Du-Prât, strategy director at Household. "KalaniBot will get smarter with use and is designed to interact in a conversational way like the real person, learning more about fans, asking them questions and then driving CoverGirl coupon downloads."



02

> We are now in an arms race and the weapons are learning algorithms

There's no doubt that AI is enabling companies to craft tailored experiences that can accurately predict what will motivate consumers across the globe. "Technologists can anticipate the customer's needs on a scale unimaginable a few years ago," says Gurjeet Singh, co-founder of Ayasdi.

A great example is look-alike modelling, where companies automatically detect the characteristics of existing customers and build an online profile for a lookalike set of new prospects. Harley-Davidson has used this AI technique to boost motorcycle sales by 40 per cent.

"Using similarity metrics, we can also micro-segment customers by identifying subtle patterns in behaviour that tie them together. These segments each get an experience tailored to them, which can feel very personal," Mr Singh explains.

01
Outdoor clothing brand North Face uses IBM Watson to power its virtual shopping assistant, helping customers shop online

02
Olay's Skin Adviser uses deep-learning technology to help customers find the products best suited to their personal skincare needs

This is now creating a whole new playing field when it comes to customer service because bespoke experiences are no longer the domain of high-end or well-funded retailers. If you have superior data and you can act on it with intelligence, smaller and savvy online retailers can make the grade as well.

"We are now in an arms race and the weapons are learning algorithms. These algorithms, their application, their transparency, and the actions brands and businesses take based on their recommendations will define the competitive landscape going forwards," says Mr Singh. "AI is board-level stuff. It's an existential threat and the businesses that fail to scale up artificial intelligence will simply go extinct."

The next frontier for AI is focused on personalisation, where brands are looking to merchandise products based on personal taste. For instance, Procter & Gamble are using it for their skincare brand Olay, where an AI-powered platform is designed to help women better understand their skin type.

"Retailers have been talking about personalisation for years, but it's been an aspiration. Now, however, with the ability to implement AI at scale, it's within reach. And, paradoxically, AI can personalise experiences without needing necessarily to know any personal information at all, merely by looking at online behavioural patterns," says Sentient Technologies' Mr Epstein. Now there's a thought.

COMMERCIAL FEATURE

Q&A: Can computers have 'conversations' with humans?

Artificial Solutions chief strategy officer **Andy Peart** explains how, through the use of the Teneo Analytics suite, computer brains are being taught to flow and thread sentences together to understand and successfully emulate human conversation interaction

ARTIFICIAL SOLUTIONS

Computers have become a lot smarter; we can take that as read. What actually matters now in terms of the way computers react with us, perform speech recognition and exhibit forms of artificial intelligence is not as straightforward as our machines simply being able to "hear" us or react to our commands. We now expect computers to actually understand us and develop a level of contextual awareness related to what we are talking about. It's as if we actually expect to have "conversations" with our devices. At natural language interaction specialist Artificial Solutions, we have created a new bridge in the conversational conduit between humans and machines.

Why is computer speech recognition such a big ask in the first place?

Human languages are riddled with colloquial nuances, changeable dialects and a multiplicity of accents. Then there is the challenge with homonyms – words spoken the same way but with different meanings – so it's tough for a machine to know the difference between site, sight and cite, for example. Cricket is a game, but it's also an insect and so on. We have built a level of contextual analytics into speech recognition so machines will logically reason that sports cricketers seldom talk about insects, unless they are in Asia perhaps, but then we can program that location awareness in too. Think about how many ways we humans say yes: yep, yeah, exactly, OK, affirmative, righto and ten-four. This is tough IT engineering.

Why is it so difficult to give computers conversation power?

As clever as it is, plain old automated speech recognition technology is ultimately starting to become commoditised and in some cases made free. What we are doing is breaking sentences up into blocks and providing contextual conversation memory so, for example, a virtual assistant can thread one request to the user's previous question or comment. We have built our Indigo virtual assistant to showcase this power. If I ask "tell me how to get to Liverpool", then Indigo will offer map directions. If I then restrict my request to "and now Bristol", then Indigo knows I am still having a conversation about directions and so offers more route options. It does not treat it as a new topic and offer Wikipedia pages on Bristol. It is at this crucial point that we start to give computers conversation power.

So will Artificial Solutions make computer conversations more human-like?

It's not just a question of them being more human-like, although we have created a new level of informal realism that is more tangible and can even be chatty if you want. What we are actually building with Teneo is a computer brain that's smarter – one that can automatically tailor communication based on each unique interaction, one that can track historical interactions, such as human memory power, and one that has "meta-level" awareness of the rest of the world, albeit if that awareness is drawn from the internet. The free-format unstructured content in most human conversations makes it hard for computers to understand a user's true intent. We use a hybrid combination of machine-learning and a rules-based software engine to achieve this. Machine-learning is all about software being able to crunch through a corpus of information, so it provides massive breadth to the machine brain. Rules-based engines allow us to be much more specific about decisions based on defined intelligence, so that gives us precision. When you mix breadth of knowledge with precision intelligence, then you get smart people or smart machines.

Who uses this kind of conversational intelligence technology?

The implementation of this kind of technology in the real world works particularly well where clients have large customer bases and need to automate conversations between customers and companies – think telecoms, financial firms and the modern web-connected retail business. It also works effectively in the travel and leisure business, and utilities. These are the types of firms that can benefit from automated intelligence to handle customer, and often employee, requests at a more sophisticated level. Essentially they tend to be enterprises with a need for multiple language solutions. This is why we have built Teneo with a specific integration element so firms can use our software in a sort of white label or "vanilla" format. This means they can use it to drive the front end of their own user interface depending on the industry, use case and the firm. We think natural language technologies will be as fundamental to company business by 2020 as a firm's website is today.

Are humans ready and welcoming the idea of talking to machines?

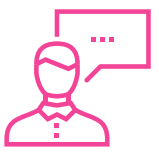
A recent global research study has suggested that 68 per cent of people are already using a voice assistant service such as Apple Siri, Microsoft Cortana, Amazon Alexa, Google Now and our own Indigo. At this stage of human acceptance of these technologies, 90 per cent of us say we want to know if we are speaking to a virtual assistant or a human because disclosure is vital. In the next five to ten years, we anticipate people actually won't mind.

Are we in danger of our computers becoming self-aware and taking over the world?

We are already building computer intelligence with all the worst-case scenarios in mind. Firms who use these types of systems don't want their conversation engines suddenly starting to recommend another competitor's product. So while we keep the doorway open for the computer brain to learn, we also define the parameters of knowledge within which it is allowed to educate itself. While we may allow for an element of humour, we can program against any suggestion of sexism, racism or any other inappropriate behaviour or sensitivity. We, as humans, like to think we're the smartest things on the planet. For now I think we're all happy to keep it that way.

ANDY PEART
CHIEF STRATEGY OFFICER
ARTIFICIAL SOLUTIONS

> "While we keep the doorway open for the computer brain to learn, we also define the parameters of knowledge within which it is allowed to educate itself



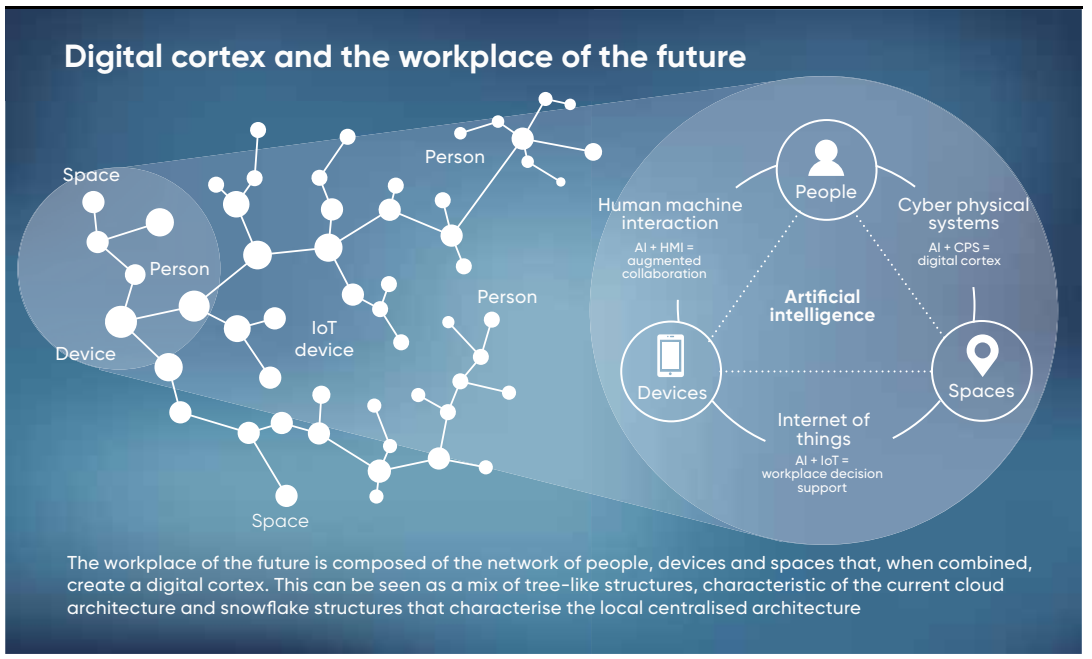
68%
of people are already using a voice assistant service

90%
of us say we want to know if we are speaking to a virtual assistant or a human

81%
say they would engage with an intelligent virtual assistant

For more information please visit www.artificial-solutions.com

COMMERCIAL FEATURE



Cognitive Hub: the future of work

As organisations and individuals struggle to manage a tidal wave of information and a growing range of devices, **Konica Minolta** offers a new approach to effective decision-making based on artificial intelligence and the internet of things

KONICA MINOLTA

It's 10am on a Monday and Ada, a marketing executive, is working with her colleagues to put together a presentation for a new business pitch. The client is a large multinational and the pressure is on to win the account.

Liaising with teams in other locations, Ada has information coming in by e-mail, text, WhatsApp, through instant messaging and by phone. Meanwhile, she's searching online for useful facts and data for her project.

The global population is expected to reach 7.6 billion in 2020 with the number of internet of things (IoT) connected devices expected to grow to between 20 and 30 billion by the same year. How can Ada and hundreds of millions of others, manage these information sources, identify what's important and make the right decisions?

"Add together this growing number of people and devices and you can see an exponential increase of available data and ubiquitous information that are already causing what is known as 'infoxication'," says Dennis Curry, a senior director at Konica Minolta. The company has recently developed a new platform called Workplace Hub, which will meet the needs of the growing number of people who find themselves in Ada's position.

"Artificial intelligence looks likely to solve this problem by providing a system of technologies that can help manage information, identify reliable data sources, take informed decisions and above all take advantage of enhanced cognition," he says.

Shoei Yamana, president and chief executive of Konica Minolta, says: "Workplace Hub is centred on the office and, more importantly, the workplace of the future. It unifies all of an organisation's technology via a single centralised platform, as well as driving efficiencies by reducing the overall costs of IT management and service provision. It provides real-time data-driven insights that help to improve business processes."

But Konica Minolta is already planning the next stage of this transformation. By integrating AI and IoT systems, Workplace Hub will evolve within the next five years or so to become what the company calls Cognitive Hub. This new platform will apply intelligent edge computing to AI and augmented human intelligence to extend the network of human interfaces, and enhance collaboration between individuals and teams.

"Cognitive Hub will become a nexus for a company's information flows within the digital workplace and provide augmented intelligence-based services that anyone can use easily," says Mr Curry

"It will also be able to connect with the devices of the future, such as augmented reality glasses, smart-walls and flexible screens," he says. "Cognitive Hub blends collective company wisdom with AI to gather and process data to make life easier for individuals, teams and companies, large and small, helping them to work more efficiently."

Konica Minolta describes digital activity – the digital objects we engage with such as documents, the people we interact with, and the places and events we visit – as a "digital self". Usually this information is dispersed around different devices and in various locations, but by applying semantic technologies and identifying relationships, it's possible to co-ordinate the information and create a meta-information layer that is manageable and scalable.

"Some believe that cloud computing is coming to an end. However, we believe that it won't die," explains Christian Mastrodonato, chief technologist for the Konica Minolta Workplace Hub.

"Instead it will diverge and evolve into a cortex-like structure made of complex three-dimensional tree-like substructures. In this new world, Konica Minolta sees itself as the glue between cognitive computing, intelligent automation and other disciplines related to AI, the use of IoT devices and wearables that deploy services and solutions for a more efficient working environment."

Mr Curry concludes: "Cognitive Hub is currently at the prototype stage, but it represents the next generation of Workplace Hub devices. We still have a lot of work to do to deliver it, but Workplace Hub is already set to revolutionise the way in which we work by helping us to manage the rapid increase in devices, connections and information that we're all presented with in the modern workplace."

For more information please visit workplacehub.konicaminolta.com

OPINION COLUMN

'Vendors are building the AI train while the enterprise drivers are gearing up for their next journey'

GEORGIOS KIPOUROS
Research director
AI Business

Artificial intelligence is poised to be the biggest technological hype of 2017. Conversations around the renaissance of AI technologies and their impact in the world of work have dominated events, articles and reviews. The dominant angle has been the impact on employment, with automation of jobs a pivotal theme.

There is an acute need for a pragmatic, facts-based approach to how AI is tangibly transforming business and how it will evolve in the future. AI Business set out to research the UK and Europe's 300 largest businesses, surveying C-suite executives about how they see AI impacting their organisations, understanding their current and future AI projects, concerns and overall strategy.

More than 95 per cent of corporate leaders surveyed recognise AI as a big deal. They agree it will transform their industry; 98 per cent perceive it as essential for their organisation. Over 80 per cent compare the impact of AI to that of the internet. What does AI mean practically to their organisation? "Increased productivity, process efficiencies and optimisation of activity are the three key areas of impact," according to Periklies Antoniou of Diageo. Moreover, 92 per cent of respondents see AI bringing improved efficiency across their board, 77 per cent expect to see a reduction in overall costs, while 66 per cent also anticipate enhanced accuracy in their operations.

Machine and deep-learning dominates current investment in AI with more than 80 per cent of Europe's leading organisations investing in the technology. Natural language processing is also popular with 56 per cent engaged in this sector. An average of €4 million per AI project is expected to be spent within the next two years, soaring to over €30 million in a five-year term. Is return on investment (ROI) visible on the horizon? While less than 30 per cent are already seeing some ROI on their investments, particularly in areas where AI has been used in customer experience management and customer relationship management, more than half expect to see stronger results within the next three years.

Internal transformation is also happening across organisations. "Artificial intelligence will change everything," says Neil Pearce, group chief information officer at Travis Perkins. A plethora of new roles and hierarchies are appearing, from board-level chief AI officers to enhanced chief data officers. However, more than 79 per cent of senior executives highlight the lack of available talent as one of the main obstacles in implementing AI. Data scientists and machine-learning experts are in short supply and highly sought after. A broader, all-encompassing conversation on talent in the era of AI is pivotal as organisations will be forced to address the skills gap sooner rather than later.

There are a number of further bumps in the road to adopting AI. The nebulous regulatory framework is one that concerns more than half of respondents. Who regulates and what kind of rules should we expect? The ethical challenges and risks of using AI are also on the corporate executive agenda. Interestingly, the single biggest obstacle to AI adoption highlighted by 67 per cent of respondents is the lack of understanding about AI's capabilities and limitations. Despite the hype, knowledge of the opportunity around AI is still rather limited.

"We think the technology isn't completely mature yet, but that we have to get on the AI train now," Marion Aubert, working on IT innovation at Burberry, concludes. Indeed, vendors are building the AI train and its wagons while the enterprise drivers are gearing up for their next journey.

Michael Natusch, newly appointed as global head of AI for Prudential, believes AI will have a revolutionary impact in their organisation. AI Business's own research confirms that the hype is based on solid foundations and enterprise executives recognise the opportunity in place. AI is still work in progress, but the fourth industrial revolution is happening now and transforming the future of business.

ETHICS AND REGULATION

Making sure the machines don't take over

Preparing economic players for the impact of artificial intelligence is a work in progress which requires careful handling


Krisztian Bocsi/Bloomberg / Getty Images

01


Ibrahim Yozoglu / Anadolu Agency / Getty Images

02


Michael Gottschalk / Photothek via Getty Images

03

MARK FRARY

When Stephen Hawking warns about the implications of a particular technology, you sit up and take notice. In 2014, the Nobel-winning astrophysicist said AI "could spell the end of the human race".

Yet what received less coverage was an open letter Professor Hawking signed just a month later along with entrepreneur Elon Musk and dozens of AI experts which focused instead on the positive benefits of AI.

"The potential benefits are huge, since everything that civilisation has to offer is a product of human intelligence; we cannot predict what we might achieve when this intelligence is magnified by the tools AI may provide, but the eradication of disease and poverty are not unfathomable," the letter said.

Humanity's possible death at the hands of machines is a long way off and even the much-discussed concern of robots replacing huge swathes of the workforce has a silver lining.

In PwC's March 2017 *UK Economic Outlook* report, for example, the consultancy forecasts that around 30 per cent of UK jobs could be automated by 2030, with workers in the transportation, storage, manufacturing, wholesale and retail sectors most likely to be at risk.

> Jobs could be very different in the future – you could be working alongside a robot or teaching them

Despite PwC's chilling outlook, other commentators are more bullish about the effect that AI will have. In its 2017 report *Why Artificial Intelligence is the Future of Growth*, Accenture predicts that AI technologies will give the UK economy in 2035 an additional $814 billion boost.

Co-author Mark Purdy says: "There have been many scare stories about AI and a number of studies have focused heavily on the job displacement effect. We feel that it is too simplistic a view."

The traditional levers of economic growth – investments in capital and labour – are no longer working to boost GDP, argues Mr Purdy, but AI provides a new hope.

"Our argument is that AI, to the extent that it can be a new kind of virtual labour, can effectively be a new factor of production that can change that growth picture," he says.

AI will drive both intelligent automation and augmentation, he says. "Intelligent automation is different from the automation we have seen in the past. It is about using data to provide services and undertake tasks in a more intelligent way. There is also a huge element of augmentation. Taking the things we already do and allowing us to do them more productively – the surgeon using an AI system to help with an operation, for example."

What has unleashed AI in the business world is the plummeting cost of computer power and the rise of cloud availability, says Peter Reeve of Ayasdi, a company founded by three Stanford University mathematicians in 2008.

Its cloud-based platform, which uses AI to analyse the shape of networks of data in near-real time, is used by companies and governments around the world, including Johnson & Johnson, the US Department of Homeland Security and Citi.

"You can store every bit of data you come across and you can use that data coupled with these algorithms to present an opportunity where it didn't exist before," says Mr Reeve.

"If you need a professor of mathematics to interpret what happens with AI and machine-learning algorithms, then you can't convince regulators in the regulated industries and you can't convince your senior executives to go ahead with it."

Ayasdi has done this by building applications based on the underlying technology, but aimed at specific business problems, such as helping hospitals identify best practice in healthcare from their own data so they can deliver better quality care at lower cost.

AI providers are already helping companies become more efficient and smart. Accenture's Mr Purdy says: "We know there is tremendous economic potential from AI technologies, but how do we develop people and infrastructure so we actually get the economic benefit?

"Jobs could be very different in the future – you could be working alongside a robot or teaching them. How do we educate people now so they are equipped to deal with that?".

01 German and Japanese leaders Angela Merkel and Shinzo Abe watch a robotic arm serving sushi at the CeBIT 2017 tech fair in March

02 Vehicles move along a robot-controlled production line at a Toyota assembly plant in Turkey

03 Microsoft's Bill Gates has spoken in favour of a robot tax to offset the expected decline in income tax revenues

CASE STUDY

TAXING QUESTION OF ROBOTS

The rise of AI will present governments with thorny problems, particularly around legislation and taxation. If humans are replaced by robots, how will governments fund public spending?

"People haven't appreciated the importance of tax policy in automation yet," says Ryan Abbott, a law professor at the University of Surrey. "Taxes artificially incentivise machines; when businesses replace a person with a machine they save an enormous amount of money."

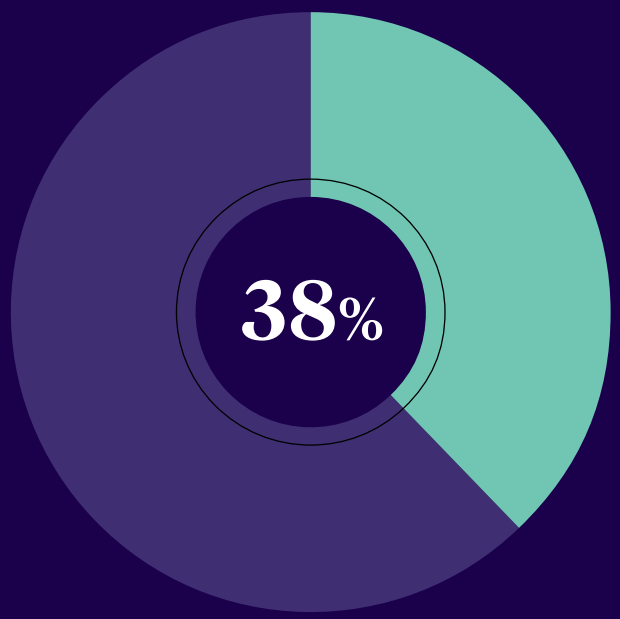
One idea that has gained traction – Bill Gates is a supporter – is a "robot tax" to offset the expected decline in income tax revenues. French presidential candidate Benoît Hamon has pledged to introduce such a tax to help "create as many new jobs as will disappear and to finance the training of employees in new trades".

Martin Ford, author of *Rise of the Robots*, doesn't believe robot taxes will work. "How do you define a robot? If you go to a factory and there is an industrial robot, that is obvious, but most of it really is just software integrated into enterprises. Will the government review all this software and figure out what needs to be taxed? It sounds completely impractical," he says.

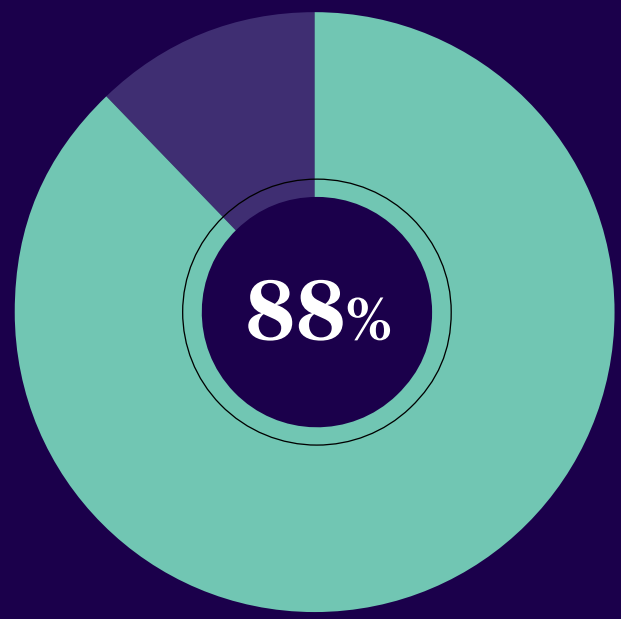
The UK government is rising to the challenge. It appointed Liam Maxwell as digital tsar in 2016 to lead government efforts in driving forward the government's work on emerging technologies, including AI. Then in February, culture secretary Karen Bradley announced an AI review to consider the core challenges, such as skills and access to talent, access to data, and access to finance and investment.

ARTIFICIALLY INTELLIGENT BUSINESS

Artificial intelligence is already extensively used by enterprises, both directly and indirectly, and has had a profound effect on how many major industries operate. Here is an overview of AI adoption levels and surveyed opinions of senior decision-makers and technology executives to show its impact on organisations

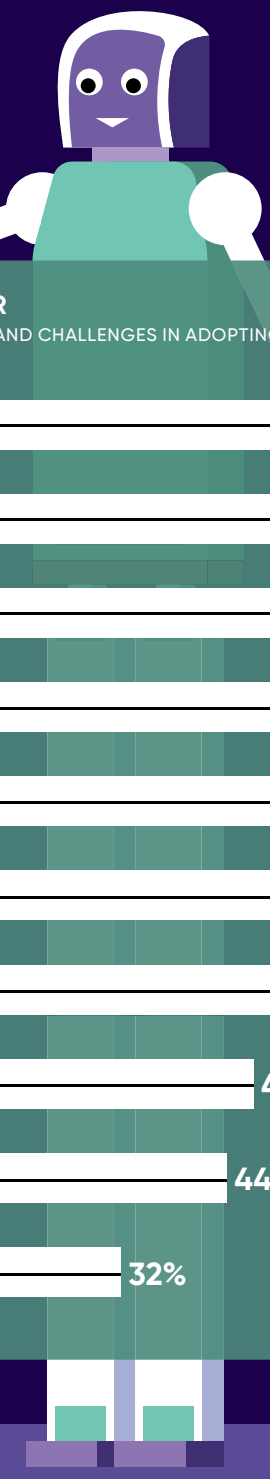


of businesses are using AI technologies in the workplace



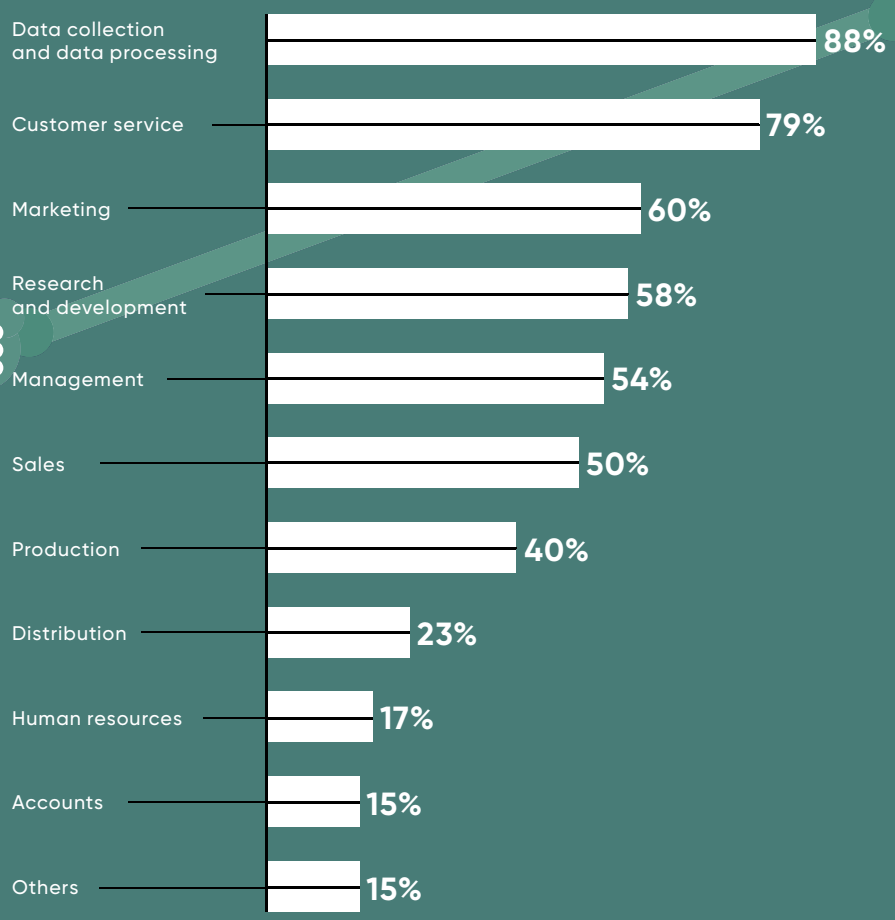
of those that don't use AI said they are using technologies which rely on AI

Narrative Science 2016



AREAS OF THE BUSINESS PLANNING TO INVEST IN AI

BUSINESS LEADERS LISTED THEIR TOP FIVE CHOICES



AI Business 2017

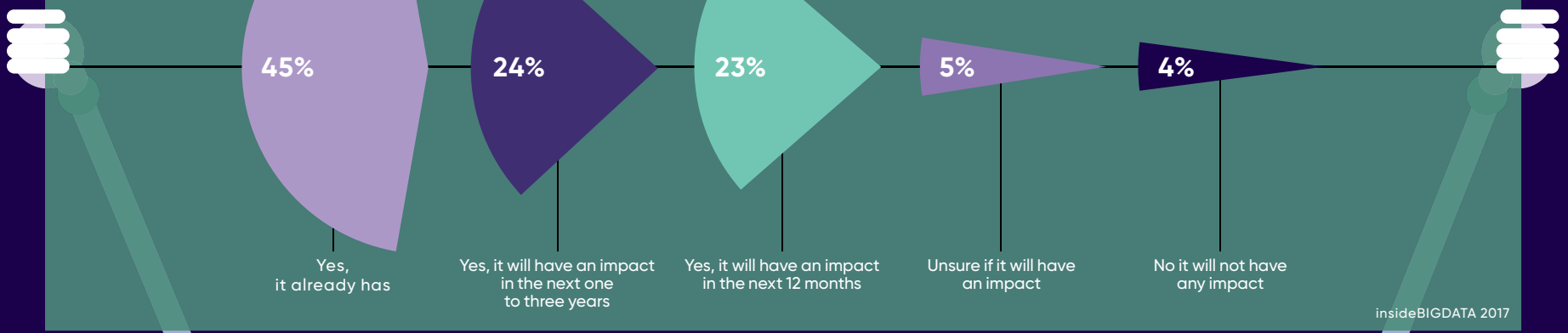
AI MATURITY LEVELS BY SECTOR

SECTORS WERE RANKED ON OPPORTUNITIES AND CHALLENGES IN ADOPTING AI, AND GIVEN A SCORE OF ZERO TO 100 PER CENT

Infosys 2017

BUSINESS IMPACT OF AI

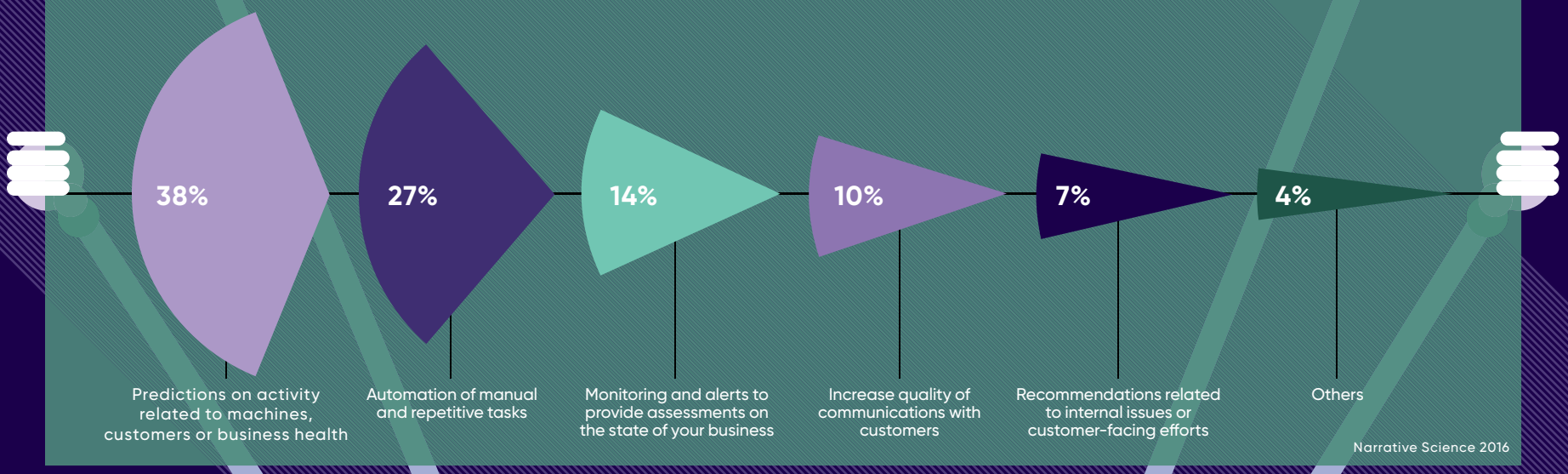
WILL AI/MACHINE-LEARNING/DEEP-LEARNING HAVE AN IMPACT ON THE WORK YOU ARE DOING?



insideBIGDATA 2017

MOST IMPORTANT BENEFIT THAT AI SHOULD PROVIDE BUSINESSES

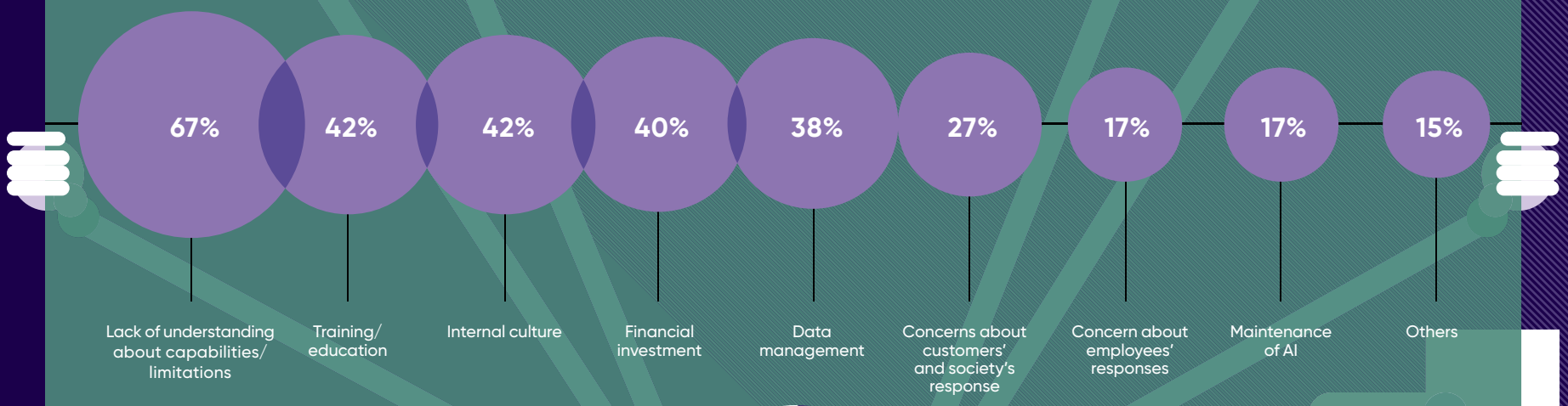
TOP CHOICE OF BUSINESS AND TECHNOLOGY EXECUTIVES



Narrative Science 2016

BIGGEST CHALLENGES/BARRIERS TO CHOOSING AND IMPLEMENTING AI

PERCENTAGE OF BUSINESS LEADERS THAT RATED THE FOLLOWING A CHALLENGE OR BARRIER



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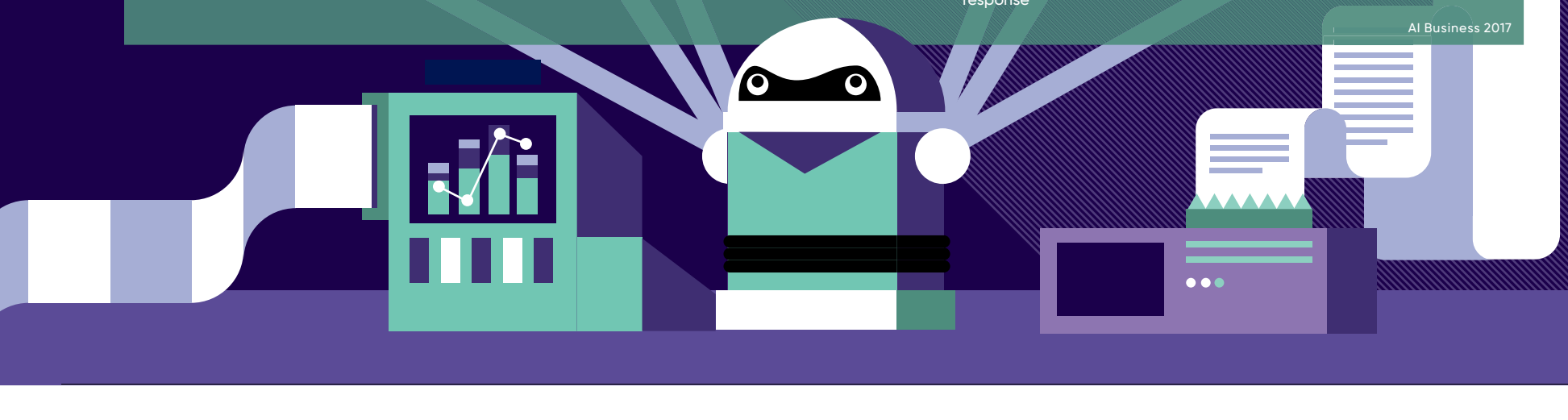


COMMERCIAL FEATURE

The real luxury experience begins with artificial intelligence

Artificial intelligence is empowering businesses to deliver lifelike interactions for five-star service

Luxury may be synonymous with exclusivity and rarity. However, as many of today's high-end brands fall behind in an era of global e-commerce, the question is how can they not only catch up, but also get ahead to deliver those special experiences on the scale they need to survive?

Organisations in other markets are deploying chatbots, computer programs that allow customers to converse with an automated system, responding with set messages based on pre-defined rules, such as keywords in their text. Some are taking things a step further and offering a live chat function on their website.

But luxe products – with price tags to match – must be sold online with the same tailored approach a shopper would expect in store. It's an approach that chatbots simply cannot provide. On the other hand, live chat is expensive to maintain, governed in part by the emotions of the agent behind the screen, and almost impossible to run all day, 365 days a year. A different tactic is needed to lure the affluent out of shops and on to their devices.

That's where artificial intelligence (AI) comes in. The industry's pioneers are already injecting their web presence with AI and the future-savvy are following suit. In fact, Forrester predicts that across all businesses, there will be a greater than 300 per cent increase in investment in the methodology this year.

The analyst firm has not only identified an imminent rise in AI spend, but also one of its interestingly predominant use cases; it says that 57 per cent of businesses expect it to help improve customer experience and support.

As consumers demand choice, convenience and personal attention – an expectation born from the instant gratification our smartphones, wearables and the internet of things provide – is this the new way to supply it?

Global customer experience company Volume certainly believes so. Chris Sykes, chief executive and head of AI and robotics, says: "What we're seeing now is that price, ease of purchase, consistency of service and on-demand support are the key drivers for loyalty and spend. You can have the coolest bricks-and-mortar store at the most popular shopping centre, but standing out doesn't necessarily mean profitable trading.

"By deploying a conversational AI platform, you can create that wow factor while also giving customers what they need, when they need it, whenever and wherever they want."

A conversational AI platform is, in layman's terms, an online chat service with a virtual brain. It asks for your name and requirements when you log on, using these details throughout the conversation It answers almost any question you may have for it, on any topic, with little training and it learns from every interaction, constantly offering up better, more personalised responses.

Unlike a rep, though, it's available from anywhere, at any time, 24/7 – and it doesn't have bad days. With no mood or feeling, and a personality that you can develop and control, it'll always speak in your brand tone of voice, politely, consistently. It's no wonder that another analyst firm, IDC, says that by 2018, 20 per cent of major retailers will use AI to personalise the brand experience from awareness through to purchase.

> You'd be forgiven for believing that AI platforms are expensive to build and implement. It's true that they require investment, but most of the time, our clients are surprised at how affordable they are

Volume has not only developed conversational AI platforms for some of the world's biggest brands already, with more luxury clients on the waiting list, but it also replaced its own traditional web presence with one six months ago.

Volume's platform, its aptly named Digital Concierge® application, is called LUSY. She can tell visitors all about the company, put them in touch with staff where relevant and direct them to collateral, such as white papers and videos, for more information.

Mr Sykes' team is currently investigating ways they can develop LUSY further, and say that soon she'll be able to recognise faces to establish mood and produce content that complements this.

"We're even looking into technologies that will allow LUSY to pick up on personality," he says. "She can then provide information in a format that appeals based on the way users communicate. For example, if a user is more outgoing and talkative, they might prefer friendlier interaction; if they're more subdued, they'd probably rather receive just the facts than conversation loaded with wit and banter."

As well as offering the tailored experience shoppers want and the sales acceleration businesses need, AI solutions such as LUSY bring myriad other benefits for companies, employees and customers alike.

Mr Sykes explains: "You'd be forgiven for believing that AI platforms are expensive to build and implement. It's true that they require investment, but most of the time our clients are surprised at how affordable they are.

"Part of this is because they can dramatically reduce the cost to serve, negating the need for you to hire, develop and train staff to perform tasks that are, in all honesty, mundane. Removing this element of service roles also enables your people to focus on strategy and innovation. So you become more profitable, your employees become more productive and your customers feel more cared for online. It's win-win-win."

Though there's been talk of AI taking jobs, Mr Sykes is right about employees' shift, not replacement. According to a survey conducted by technology enterprise Narrative Science, 80 per cent of executives say AI boosts productivity and creates new positions, while IDC estimates that by 2018 at least 20 per cent of all workers will use automated assistance technologies to make decisions and get work done.

If your business is looking for a pioneering way to meet the needs of the truly modern consumer, there's no doubt about it, it's time to move towards AI. There's never been a better time – new AI vendors are emerging fast. By combining services from several, you can build a platform that can deliver the service benefits you'd like today and continue to exceed expectation tomorrow.

Mr Sykes' final word of advice? "Think big, but start small. By beginning your AI journey now, you can make a head-start and earn that coveted loyalty luxury brands require."

Chat with LUSY at volume.ai to learn more

300% increase in investment in AI methodology this year across all businesses

57% of businesses expect it to help improve customer experience and support

20% of major retailers will use AI to personalise the brand experience from awareness through purchase

20% of all workers will use automated assistance technologies to make decisions and get work done

80% of executives say AI boosts productivity and creates new positions

Forrester/IDC/Narrative Science

GENDER

Gender options for popular virtual assistant voices

AI 'victims' of sexism answer back

Does gender matter in artificial intelligence? Does the fact that most virtual assistants default to female characters reflect outdated social norms and prejudices? Do developers and brands need a gender agenda?

JOANNA GOODMAN

Last year saw conversational artificial intelligence agents facilitating personal and business interactions, and providing real-time customer service and business support. Most of these "assistants" default to a female voice, although users sometimes have a choice. You can change the settings on Apple's Siri, while Google Assistant may be gender neutral with no name but comes with a default female voice. Microsoft describes Cortana as gender neutral, but the name comes from the AI in the game *Halo* which is represented as a female hologram. Amazon's Alexa describes herself as "female in character".

This gender bias is not down to sexism by predominantly male developers. Rather, it is a reflection of outdated social norms and the gender imbalance in the work force that many big tech players are working to redress. It also mirrors ingrained human perceptions.

As AI agents combine natural language processing (NLP) with machine-learning, they need to be monitored and guided to ensure that they learn from positive examples and do not take on prejudices that may be inherent in the data they use. This was illustrated by Microsoft's ill-fated Tay experiment, which "learnt" racist and other inflammatory statements, and it is particularly important when the outcome involves a human decision, such as in recruitment.

Ben Taylor, founder and chief executive at Rainbird, an AI platform that models cognitive reasoning processes, highlights the main challenge around AI and prejudice as unconscious bias. He says: "Rainbird works with expertise, so its analyses are transparent and auditable, but when AI applications analyse big data and machine-learning adjusts the algorithm on which decisions are made, it is impossible to know what features it is basing its decisions on. And we have an unequal society."

As voice becomes the default interface, tech giants and brands are refining NLP to make AI agents sound more human. Tacotron, a text-to-speech synthesis model, changes its intonation in response to punctuation, emphasising capitalised words and lifting the pitch if there is a question mark at the end of a sentence. But how human can the user interface get before it reaches "uncanny valley" or the point at which people feel uncomfortable with things that appear nearly human? And to engage us and provide a natural, effortless interface, do AI agents need a gender?

IPSoft's cognitive knowledge worker Amelia that handles customer service and internal business support appears online as a blonde, female avatar. However, as Mr Taylor observes, some people find gender stereotyping off-putting.

In March, Capital One launched Eno, a gender-neutral chatbot that responds to natural language text messages, showing customers their account balance or paying credit card bills. Eno describes its gender as "binary", but the banking bot still has "personality". Its favourite colour is green.

Dennis Mortensen, founder and chief executive of x.ai whose AI assistants organise meetings via e-mail, disagrees. "Some people prefer working with a female assistant, while others prefer a male," he says. Consequently, x.ai users can choose Amy Ingram or Andrew Ingram that have different identities, but identical personalities.

Although gender makes Amy and Andrew more engaging, and therefore more efficient as their human qualities encourage people to respond quickly to their e-mails, Mr Mortensen reiterates that it is important not to take anthropomorphisation too far. The fact that an AI agent is given a personality and a gender doesn't make it human, but helps it fulfil its primary purpose.

> Ideally, users should be free to choose the gender they feel most comfortable with

02

Because x.ai operates in a controlled environment, Amy and Andrew respond to specific input data – people, times, locations – and the output data is a date and time for a meeting. If you ask Amy or Andrew anything else – and they get some bizarre requests – they bring the conversation back to the task in hand.

According to mobile analyst Benedict Evans, partner and consultant at Andreessen Horowitz, giving assistants with a broader remit a "personality", which may include gender, can conceal limitations while maintaining engagement. For example, Siri may tell a joke instead of saying, "I do not understand the question".

Personality also establishes the agent as an independent application. "Google's voice product has no human name because it is positioned as a universal aspect of Google, not a separate siloed product," says Mr Evans. However, this raises the question how to address a voice-only interface. "You need a keyword to invoke it – so that it responds to the next thing you say," he says. It needs a name and this raises the gender issue again.

Hadrian / Shutterstock

01

01 The default voice of Apple's Siri virtual assistant is female, but users are able to change their settings to male

02 Dennis Mortensen, founder of x.ai whose users can choose either female or male AI assistants to organise meetings via e-mail

Aaron Miller, director of solutions engineering at Agent.ai, a startup focused on customer support chatbots, agrees with Mr Mortensen. "Ideally, users should be free to choose the gender they feel most comfortable with. But the message is more important than the medium. The words that Stephen Hawking expresses via his synthesised voice far outweigh their mode of delivery," he says. "As gender roles shift, our attitudes towards AI and one another will evolve because gender doesn't have a traditional role in this new world order."

Jason Alan Snyder, chief technology officer at Momentum Worldwide, says: "A brand is a metaphor for a story and the chatbot's personality, and potentially its gender, are part of its story and therefore its brand identity. But we don't need to make AI confirm to the gender binary of humanity in order to like it.

"It is human nature that we anthropomorphise AI. We've been talking to objects for years, and we give them names and genders, but now that they are talking back and taking decisions about us and on our behalf, we have a moral duty to take a humanistic and responsible approach to AI."

ARMS RACE

Global tech giants slug it out to be top gun

Hollywood films depict fictional conflicts between artificially intelligent robots and the humans who created them, but a real AI fight is breaking out among some of the world's largest companies

Michael Nagle / Bloomberg via Getty Images

01

BEN ROSSI

When most people think about artificial intelligence, their minds turn to glorified fights to save the human race from rogue robots, a familiar story played out on Hollywood screens in decades gone by.

While machine intelligence is still far from resembling human consciousness, an AI fight is playing out in real life, not between robots and humans, but rather among the businesses vying to lead an increasingly lucrative market.

The origins of AI stretch back to 1950, when computer science pioneer Alan Turing published a paper speculating that machines could one day think like humans. Last year, research firm IDC valued the market at $8 billion, forecasting a rise to $47 billion in 2020.

Between Turing's landmark paper 67 years ago and today's wild market valuations, most major AI developments have either fallen in the realms of research and academia or involved computers beating people at human games.

IBM won acclaim when its Deep Blue computer defeated chess grandmaster Garry Kasparov in 1996 and 15 years later its next AI iteration, Watson, dominated human opponents on TV game show *Jeopardy!* More recently, Google stole headlines with the 2015 victory of its AlphaGo program over Lee Sedol, an 18-times world champion of the ancient Chinese board game Go.

In the last few years, however, AI has moved beyond research and televised standoffs between man and machine to become a technology used by millions of people every day, thanks to a trio of critical developments.

Firstly, the ubiquitous use of online services, smart devices and social media has made data available on a mass scale. Data is the fuel for developing algorithms for deep-learning, a form of AI that allows machines to learn and write software. The more data is fed to the system, the better it gets at performing tasks.

Hosting huge quantities of data was previously an extremely expensive undertaking that would have continued to hamper AI development had it not been for the advent of affordable, on-demand cloud storage from Amazon, Microsoft and Google.

Completing the trio was the development of more powerful chipsets, accelerating that process for training computers to think like humans.

All this means the great promise of AI can finally be realised in industries ranging from healthcare and energy to self-driving cars and manufacturing. The result is a race among the world's largest technology companies to position themselves as a leader as AI applications become some of the most in-demand and lucrative products on the market.

The significance of the AI industry can now be seen not just in the scores of enterprises beginning to deploy this technology at scale, but in the market performance of companies that are already enjoying its demand.

American chip maker Nvidia, for example, has seen its stock price treble in the past year after its graphics processing units became the chip of choice for companies training AI systems. This urged rival Intel to spend $15.3 billion acquiring Mobileye, a chip maker for cars and trucks.

01
IBM has been an early-mover in the cognitive-computing market with Watson

02
Intel last month spent $15.3 billion acquiring Mobileye, an Israeli chip maker for driverless cars

MANJUNATH KIRAN/AFP via Getty Images

02

> The past five years have been defined by a flurry of acquisitions by large tech companies looking to expand their AI product portfolio and gain the expertise of niche startups

"Several years ago, Nvidia committed itself as a company to investing in deep-learning," says Jaap Zuiderveld, who leads Nvidia in Europe, the Middle East and Africa. "Now that commitment is bearing fruit and we find ourselves in a position of leadership as this new computing model takes the world by storm."

Intel isn't the only company that is targeting a piece of the AI gold through mergers and acquisitions. The past five years have been defined by a flurry of acquisitions by large tech companies looking to expand their AI product portfolio and gain the expertise of niche startups. Google's 2014 acquisition of London-based DeepMind was one of the largest at an estimated $500 million.

With the startups often snapped up before they can scale, these aggressive acquisition strategies have resulted in an industry divided between tech giants building AI services with the cloud infrastructure and vast data they own, and niche players applying AI to specific verticals or industry problems.

Ownership of data is critical because, try as they might, large tech firms can't acquire all of the world's AI talent, but they can own the data needed to train the AI with. This has resulted in a big six of tech firms primed to lead AI due to the data-intensive nature of their core businesses – Google, Amazon, Microsoft, Facebook, IBM and Apple.

Google, Amazon, Microsoft and Apple, for example, have been able to utilise the data they've gathered from their other businesses to take an early lead in the market for intelligent personal assistants. Facebook has used machine-learning to develop a messenger chatbot, while IBM has been an early-mover in the cognitive computing market with Watson. All six have willingly opened up their AI technology so any developer can build on their cloud infrastructure because they know data is the real differentiator.

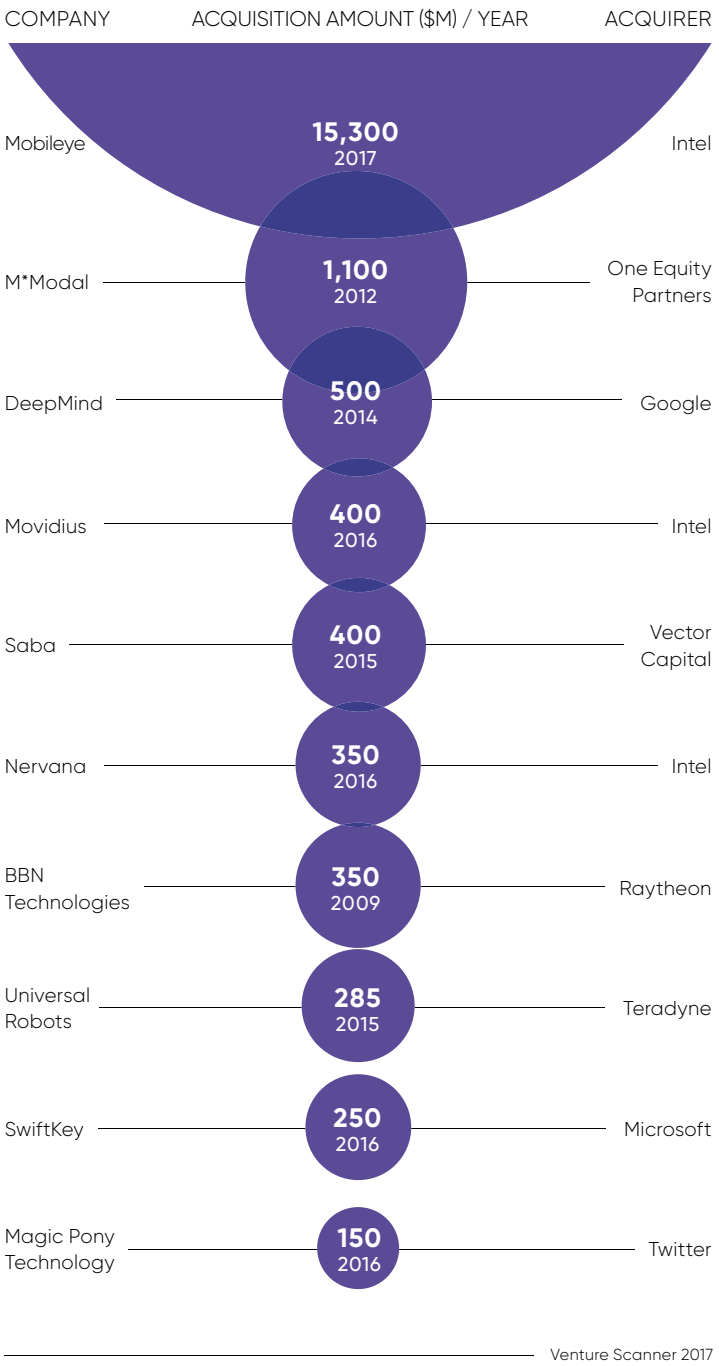
"If AI is to truly resemble human consciousness, the stuff of films, in our lifetime, it will probably come from one of those companies as they're the only ones with the data to train a model of that complexity," says Brandon Purcell, senior analyst at Forrester. "AI will precipitate a new data gold rush, marked by data-motivated acquisitions. Companies that acquire data assets around a specific use-case will win. The resulting barrier to entry will be insurmountable."

This ability to lead in certain use-cases means traditionally non-tech companies have the opportunity to grab a slice of their segment. Engineering giants GE, Siemens and Boeing are investing in factory automation while the likes of Ford, Toyota and BMW are battling with Google, Apple and Tesla in the car industry.

Meanwhile, there is a view that AI startups and companies in other industries can benefit from the democratisation of AI through the big six's open source tools, such as Google's TensorFlow and Microsoft's CNTL.

Many think this democratisation is vital to ensuring AI can address the widest reach of business and societal problems, and that confining

LARGEST AI ACQUISITIONS IN HISTORY



innovation to a small pool of companies will give them too much control and harm AI's potential.

"This is worrying because even Google's huge reservoir of data has blind spots," says Mr Purcell. "If the Googles and Amazons of the world control AI, the resulting systems will inherently be biased – even if they have the best intentions."

Stephan Gillich, Europe, Middle East and Africa director for high-performance computing and AI at Intel, adds: "The more people involved in the AI conversation, the more industries will be able to benefit, and the sooner we will see the impact across government, business and society."

However, others think the opportunity to democratise AI is already gone. Distributing innovation extensively beyond the big six is unrealistic due to a worldwide lack of programming talent and the hefty costs of acquiring it.

"Even with free platforms available, you still need highly trained, experienced and specialised data scientists to build good solutions that provide real value to end-users," says Michael Feindt, founder of AI startup Blue Yonder.

> The big six have laid the foundations to benefit most, but they still have each other to compete with

When more AI programming skills are eventually introduced to the market, the big six needn't worry. By open-sourcing their AI technology, they've already told the world that software isn't a source of advantage to them – data is.

Despite AI sitting in people's homes and driving big business investments today, the most powerful applications are yet to be seen. When they do emerge, the big six have laid the foundations to benefit most, but they still have each other to compete with. Meanwhile, the market will be more than large enough for enterprises and startups to carve out a lead in specific use-cases.

COMMERCIAL FEATURE

Building an enterprise AI strategy

Intelligent applications hold the key to evolving the enterprise

AYASDI

Buoyed by a decade-long run that has seen plummeting storage costs and massive gains in compute power, enterprises have the necessary ingredients to make intelligence a reality.

The question before enterprises today is not whether to become intelligent, it is a question of how and how fast. Every business will be an intelligent business in the same way every enterprise is a digital enterprise. If they don't become intelligent, they will simply cease to exist.

To achieve intelligence, enterprises need to adopt and deploy an intelligent application strategy while simultaneously preparing the organisation to scale that intelligence. A strategy built around intelligent applications allows enterprises to gain experience, show business value and build a framework for repeatability.

The key, however, is to build truly intelligent applications. To be truly intelligent requires each of the following five characteristics.

The ability to discover patterns in data without preconceived notions: this relies heavily on unsupervised machine-learning techniques. An unsupervised approach automatically selects algorithms and dramatically reduces risk by eliminating bias.

The ability to accurately predict depends on new data models trained on historical data. This is standard fare for many machine-learning algorithms, but is often mistaken for the entire field.

Intelligent applications must be able to justify their assertions. Black-box models cannot win mission-critical tasks if they cannot be explained to the business owner. Justification and transparency build trust.

Uncovered intelligence must also be accompanied by action. This means intelligence must feed other applications autonomously or end up in the subject matter experts' workflow.

Finally, intelligent applications are designed to detect and react as the data evolves. An intelligent system is one that is always learning.

By building intelligent applications that encompass all these characteristics, enterprises have a starting point. To scale that effort, however, requires additional considerations involving technology strategy and organisational transformation.

For example, organisations will often perform small-scale experiments with a subset of the components above. This creates a false sense of security for many enterprises. Wins executed against sterile data or in an operational vacuum are not likely to translate well when asked to scale to real-world scenarios like detecting cyber-criminals within billions of financial transactions, or tracking and mitigating global health epidemics. Building real-world applications will position an enterprise for longer-term success. This commitment to deployable intelligence shouldn't come at the cost of speed, however. Enterprises that commit to fast timelines learn faster.

Intelligent systems will change how you perform certain business processes. Recognising this fact ahead of time will enable the enterprise to capitalise on the knowledge and to consolidate the wins, thereby building momentum for the future applications of intelligence. At the heart of a successful transformation sits a centre of excellence. This is where best practices are developed, process change is accelerated and prioritisations are made based on operational readiness, business need and other considerations.

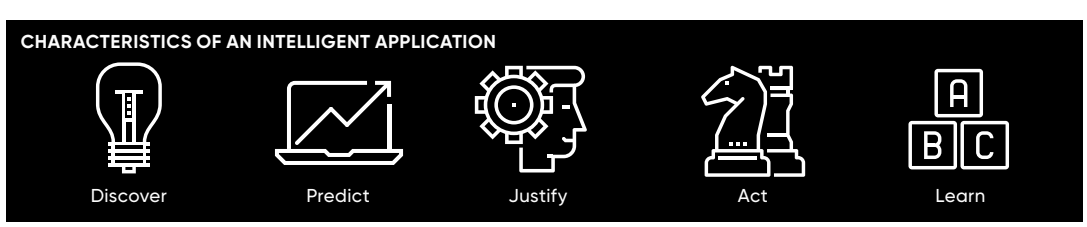
CASE STUDY

One of the world's largest banks turned to AI to transform their AML process. Using the framework outlined below they discovered new transaction segments that predicted fraud more effectively, were easily justified to the regulator, resulted in actionable lists and sit in the live workflow, adapting to new laundering examples. The results were exceptional, reducing false positives by more than two orders of magnitude over other approaches and saving the bank more than $50 million a year. The bank now operates an AI Centre of Excellence to find new application areas within the institution.

The next generation of leadership will come from this centre of excellence. Staff it accordingly.

Every organisation should tailor its intelligence strategy to distinct business needs. In the coming years, every analytics company will claim to be an AI company. Such claims will make it difficult to distinguish truth from fiction, but the characteristics outlined to discover, predict, justify, act and learn should present a framework to assess their validity. That framework, coupled with an application-first approach, should help organisations to navigate these transformational changes.

For more information please visit www.ayasdi.com



SECTOR SNAPSHOTS

Checkout-free shops and chatbot estate agents

Finance and law are often cited as the sectors leading adoption of artificial intelligence, but several others, notably retail, oil and gas, and real estate, are benefiting from the technology

LEO KING

RETAIL

Amazon has long employed machine-learning, a type of artificial intelligence that recognises patterns, to serve shoppers' preferences.

But other online retailers are now investing in this personalisation. Shop Direct, which operates the Very.co.uk and Littlewoods brands, says AI is its "big bet", enabling the personal relevance needed to capture flighty mobile shoppers.

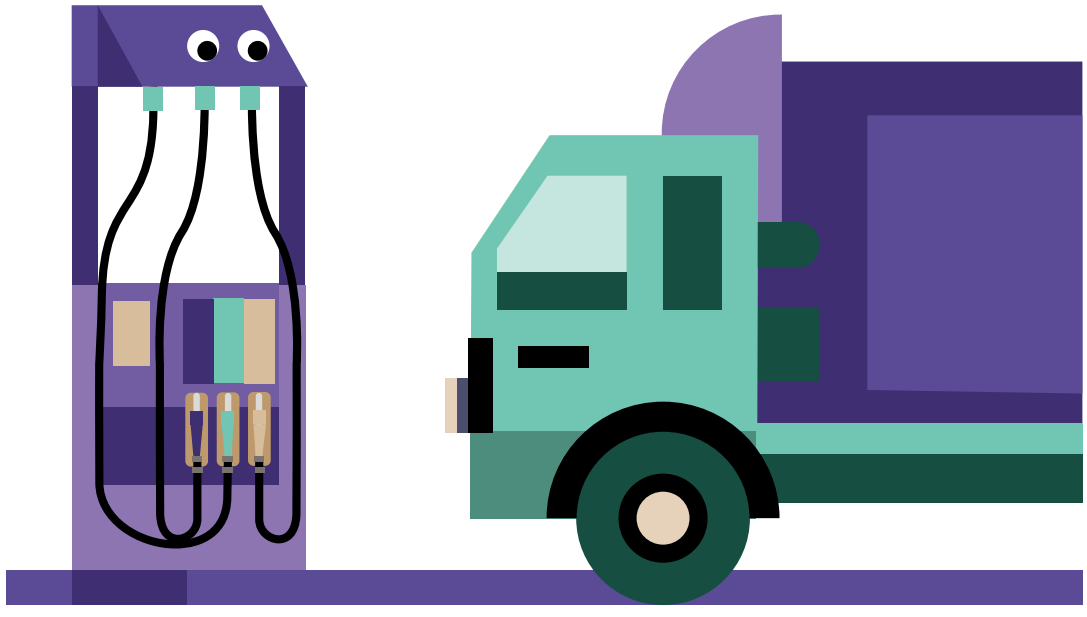
"We now have just three seconds to grab a customer's attention on a five-inch screen," says Sasha Berson, customer and strategy director, explaining that AI is essential to personal relevance. "If we don't serve up thumb-stopping content, they'll swipe on."

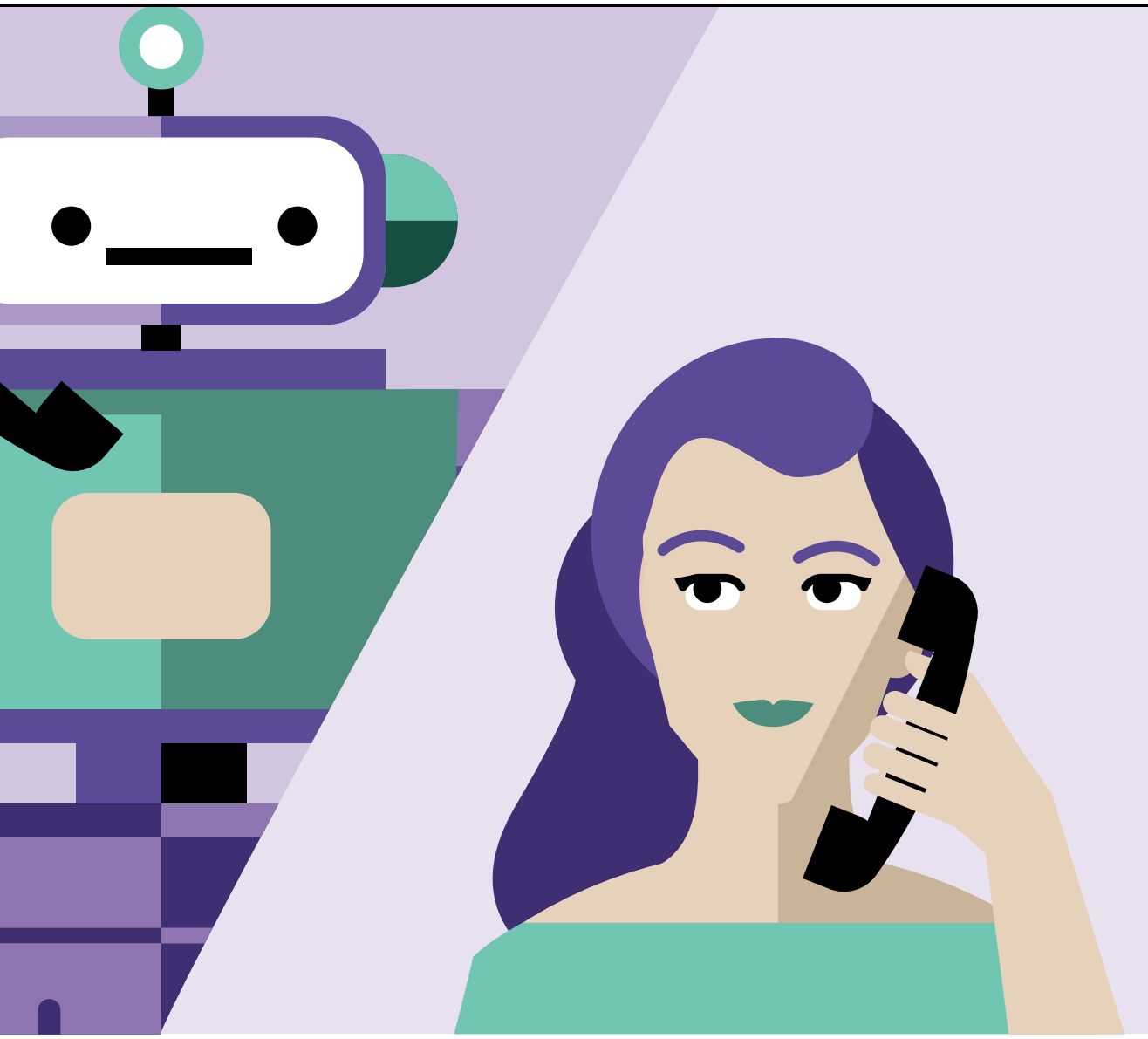
Evermore powerful processing also lets machine-learning decide timely e-mails for hundreds of thousands of individual customers. Mr Berson explains: "Our retention engine listens for the signs of 'lapsitis' – behavioural patterns that indicate falling customer engagement – and automatically contacts customers with a relevant incentive to shop again."

Last year, Shop Direct launched an in-app chatbot called the Very Assistant, in which users can talk to a virtual customer agent through their phone. It plans to turn this into a full personal shopping assistant that can learn each customer's needs and advise on purchases.

Meanwhile, online takeaway business Just Eat uses AI to personalise recommendations and to enable customers to make voice orders through the Amazon Echo home AI

> Checkout-free shopping is made possible by the same types of technologies used in self-driving cars





> Chatbots are increasingly important in eliminating lengthy processes

documents, agreements and leases," explains Nick West, chief strategy officer at the firm. "But ultimately the process is about data and we can automate a huge amount."

The technology enables customers to understand a deal quickly. A firm considering buying a property and being faced with huge documents can count on machine-learning to read and interpret contracts, and help determine the quality of investment. "It can also identify any problems in the lease, highlight rules around rents and find licences needed for alterations," Mr West adds.

The company is so keen to make the most of AI that its in-house technology incubator, created to identify startups, has shortlisted six machine-learning companies among twenty of interest.

Other firms are using AI to help find property. CityBldr, a startup, rapidly locates good under-used sites for developers. Its system scans properties and ranks them, an entire process that typically would have taken experts more than a month.

The system accesses 118 million data points for buyers, including other sales, permit applications, planning data, land size and topography, traffic and location. Equally, it helps sellers see whether commercial developers or house builders would pay more.

Bryan Copley, CityBldr chief executive, explains: "AI has allowed us to create a marketplace specifically for under-used real estate. Humans' insights are imperfect, but a machine can get better all the time. It draws in over 200,000 updates overnight." The system is currently available in Seattle but is expanding to Los Angeles and then to a raft of other American cities.

Chatbots are also increasingly important in eliminating lengthy processes. Startup Apartment Ocean has created bots that enable estate agents to answer inquiries and shape good leads. "Real estate firms use the system to secure up to five times as many leads, asking the questions they want," says president Nick Kljaic. "The system automatically captures the data, converting it into a lead even when the agent isn't there.

"People love to chat. Now they can have a personal conversation at any time."

device. Adrian Blair, Just Eat chief operating officer, is reported as saying AI shows "the way to the future, making things unbelievably easier for the customer and more efficient for the provider".

AI is far from exclusive to online businesses. Starbucks is testing a chatbot in its app that enables customers to place an order conversationally, then collect it at a café. Japanese fashion retailer Uniqlo and US department store chain Macy's are preparing in-app AI to advise customers browsing their shops on styles.

There is one bricks-and-mortar type of AI likely to dominate called pick up and walk out. Amazon's first food shop, in Seattle, uses sophisticated machine-learning to enable customers to walk in with their phone, then simply pick up items and be charged. The technology identifies what is taken and by whom.

The company says on its website: "Our checkout-free shopping experience is made possible by the same types of technologies used in self-driving cars: computer vision, sensor fusion and deep-learning."

OIL AND GAS

In recent years, the oil and gas industry has looked to AI to improve customer experience, with chatbots at petrol pumps and online.

But the big change will be behind the scenes, in exploration and drilling. Management firm McKinsey expects $50 billion of savings will be made across the industry by using AI to improve exploration, well development and other processes.

> Smart workflow automation has enabled operators to increase production

Shell has installed sensors in thousands of oil wells for better understanding of their status. This is then analysed by AI and presented in 4D maps to the crew. According to a spokesperson, the volume of data "is of course impossible to understand correctly if not properly visualised" in this way. The company is also sponsoring a $7-million prize for technologists creating devices that can search smartly for oil below 4,000 metres deep.

Elsewhere, oil field giant Halliburton says its smart workflow automation has let operators increase production by 7 per cent through learning what is working and informing human decision-making.

BP, which collects extensive information from rigs and other sites, expects AI to be crucial. "At one level, AI offers a significant opportunity to maximise the use of the vast amount of data we collect on our operations, to optimise the many physical and commercial processes that are critical," says Morag Watson, vice president for digital innovation.

AI can handle "complex situations such as computer automation of the analysis of pipeline video inspections", she says. Other applications include interpreting reports created by operators and engineers.

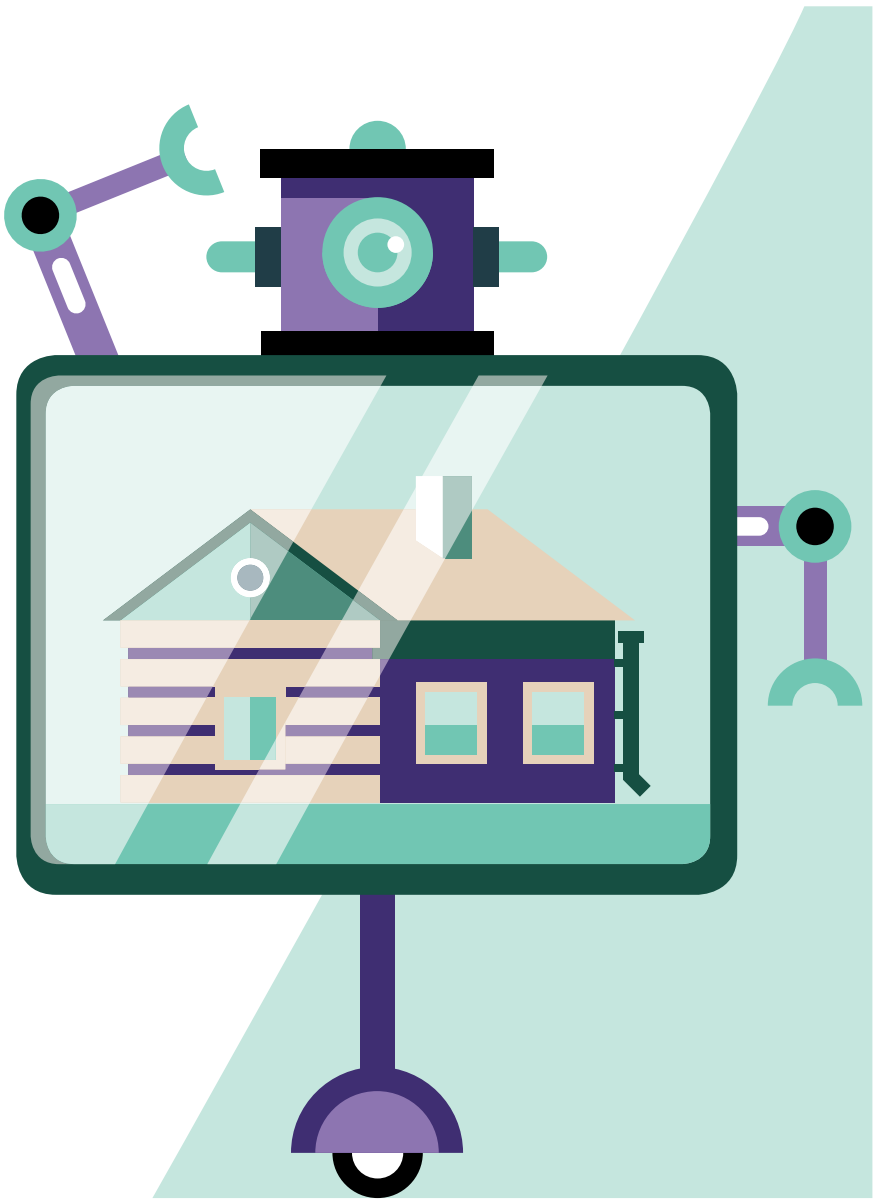
Ms Watson expects cognitive computing, an advanced form of AI, to augment employees' decision-making by absorbing their knowledge, "allowing computers to learn and behave with human-like reasoning in the many technical domains, while assimilating more data than a human can possibly hope to". Computers could become the constantly available technical experts "making exploration more successful, well designs more effective, and drilling faster and safer", she says.

The challenge is achieving cultural fit. "The advent of big data and analytics allowed us to take a different approach to interpreting our large volumes of data, and this takes time to permeate an engineering culture," says Paul Stone, senior technology principal at BP. "AI and cognitive computing are showing us we can, and need to, bring engineering and data science principles to work together."

REAL ESTATE

The property and land sector sees huge potential for AI in simplifying bureaucratic procedures. Buyers and their property managers are working with law firm Mishcon de Reya's machine-learning to improve transactions.

"Historically, people would think about sales as a flood of



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