raconteur.net / # 0354 / 15 / 12 / 2015 RACONTEUR -**ARTIFICIAL INTELLIGENCE FOR BUSINESS**



Artificial intelligence is opening up a new era when robots will help humans at work and in the home





Systems based on artificial intelligence are proving their worth in several sectors

Putting 1() AI power to work

Powerful artificial intelligence is now

cheap, simple and a natural fit for business

15

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ARTIFICIAL INTELLIGENCE FOR BUSINESS | 03





Learning to live with robots

Artificial intelligence is opening up a new era in which robots will help humans at work and in the home – the challenge is to co-exist without major impact on jobs

Pepper, created by Aldebaran for SoftBank Mobile, s a humanoid robot designed to talk to you, recognise and react to emotions, move and live autonomously

♦ OVERVIEW ● NIC FILDES

t is hard to think of the words "artificial intelligence" without conjuring up Doomsday images of *The Matrix* and *The Terminator* where man and highly intelligent machine are pitched into battle. Even a step further back from that science-fiction precipice conflates the term with massive job losses and the eventual irrelevance – or liberation – of humankind from labour as we know it.

Artificial intelligence or AI is, of course, all around us already in obvious ways – Apple's voice recognition service Siri or Google's increasingly reliable search results – or in more obscure ones such as better weather forecasting and lower levels of spam e-mail in your inbox.

There is nothing new about the concept of AI which started to gain traction in the 1950s when Alan Turing explored the notion of machines that could think. J.C.R. Licklider's paper *Man-Computer Symbiosis* from 1960 may have sounded like something penned by sci-fi writer Philip K. Dick, but was instead a formative paper on how the world would move beyond programmable computers to one where computers "facilitate formative thinking". This second age of machine-learning is what IBM now calls the "cognitive era" which began when Watson, IBM's Big Blue cognitive computing system, won the US game show *Jeopardy*! Yet even then, companies like the UK's Autonomy had been applying specialist algorithms to vast swathes of unstructured data for a plethora of purposes.

The world has been moving in the direction of cognitive computing for years – think autonomous cars, fraud detection systems in banks and complex trading systems that can act faster than human traders – so it is no surprise some companies have started to appoint chief AI officers with one eye clearly on the future.

Dr John Kelly III, senior vice president IBM Research and Solutions, says: "The success of cognitive computing will not be measured by Turing tests or a computer's ability to mimic humans. It will be measured in more practical ways, like return on investment, new market opportunities, diseases cured and lives saved."

The reason that AI has become a mainstream issue is partly the result of investment in so-called big data technologies. Gartner, the research company,

has calculated that the world's information is set to grow by a

colossal 800 per cent over the next five years. That will have the statisticians salivating until you factor in the point that 80 per cent of that morass of data will be in an unstructured form – e-mails, images, sounds – all of which can be analysed, but not by programming a computer.

> Success will be measured in return on investment, new market opportunities, diseases cured and lives saved

"This data represents the most abundant, valuable and complex raw material in the world. And until now, we have not had the means to mine it," says Mr Kelly. And he believes it will be genomic companies looking for better ways to tackle cancer or oil and gas companies looking to improve the accuracy of exploratory drilling or billion-dollar businesses looking to speed up relations with their thousands of suppliers that

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will drive this revolution. "In the end, all technology revolutions are propelled not just by discovery, but also by business and societal need. We pursue these new possibilities not because we can, but because we must," he says.

It has not gone unnoticed that all stripes of business are investing in AI and London appears to be thriving. Google may have paid £400 million for the UK's DeepMind – a company so complicated that it struggled to elucidate what Google wanted it for – but smaller investments are working their way down the chain.

Imperial Innovations, the university fund, has pumped £1.5 million into a robotic startup called Telectic, while MasterCard has thrown its weight behind Rainbird, a startup that believes it can deepen a relationship with the customers of banks, insurers, retailers and music producers by better understanding human behaviour. Meanwhile Stratified Medical, a startup using AI to improve insight into the development of new pharmaceuticals, has just appointed Professor Jackie Hunter, previously head of the Biotechnology and Biological Sciences Research Council,

as its new chief executive.

One of the biggest issues in any

debate about AI is, of course, jobs. If cognitive computing takes off, then many of us may find a robot sitting in our desk. Consultants McKinsey forecast that just as word processors reduced the need for typists, many knowledge-based jobs could soon become obsolete. This creates challenges for employers looking to invest in transformative AI and will require "careful communication and change management", says the consultancy.

Yet the power of human workers could be augmented by the rise of the robots. According to McKinsey, who calculate the economic impact of AI could be as much as \$6.7 trillion by 2025: "Knowledge-work jobs generally consist of a range of tasks, so automating one activity may not make an entire position unnecessary."

It could also perversely prove to be a boom to sectors such as manufacturing as it would reduce the need for low-cost labour and outsourcing, and result in more advanced work returning to countries like the UK.

As with any technological revolution, there will be risk and reward. Ray Kurzweil, director of engineering at Google AI and a leading thinker on the subject, concludes: "Fire kept us warm and cooked our food, but also burnt down our houses. Every technology has had its promise and peril."

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COMMERCIAL FEATURE

HOW ARTIFICIAL **INTELLIGENCE GIVES YOUR BUSINESS**A **CRITICAL EDGE**

Everyone's talking about artificial intelligence, but what's the next step? How do you build AI capabilities into your business model that engage your customers and, more importantly, ensure it's the solution they demand? Lawrence Flynn, chief executive of Artificial Solutions, considers the issues

Technology that understands you, not the other way round



The rise of the digital assistant Major players are already investing in intelligent, speech-enabled digital assistants to achieve strategic differentiation



A platform that covers every angle Delivering artificially intelligent applications requires a platform that is scalable, multilingual, device-independent and offers seamless integration



One that's easy to use To avoid lengthy development timescales, escalating costs and highly complex computational linguistics, it must also be intelligent and automated



Why it's only the first step Tomorrow's digital assistants will no longer be confined to single devices. They will be deployed on multiple platforms and devices



Questions are never asked in isolation Al-based apps need to address many factors including context, memory, intelligent understanding and the ability to react appropriately



Hear every conversation Capture, interpret and use the conversational data of every interaction of every customer across every channel to deliver the ultimate customer experience

handle, or not, cross-platform requirements, and even how they treat your organisation as a customer.

Further, your customers don't restrict themselves to one platform or technology so you also need a solution that works across multiple platforms, devices and channels. All this aside, the biggest question remains over who would have access to, or even own, the goldmine of "voice of your customer" data that is generated. The real risk may be that despite all your investment, your business has no more information than it did when you had nothing but a point-and-click website.

Artificial intelligence is here. As a key component, natural language interaction will be critical as humans increasingly use natural, everyday language, gestures and more to control apps, online services, devices, cars, mobiles, wearables and the internet of things. They now expect technology to understand them and simplify their lives

The critical point then is how enterprises respond to the AI imperative facing them and use it to gain a competitive edge.

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ARTIFICIAL SOLUTIONS

Artificial intelligence or AI has moved from the realms of fantasy to reality and is rapidly becoming a critical success factor for the customer experience. Businesses that address this demand not only strengthen faltering customer relationships, but also realise unexpected revenue opportunities.

But most organisations aren't geared up to take on the complexities of delivering a Siri-like AI application, even though they can clearly see the advantages.

Key to the success of artificially intelligent applications is a seamless interface between the user and the application. Fundamental to delivering this flawless experience is ensuring the application understands the user's natural language input, whenever or wherever it's given. But understanding is

only half the story as

consumers expect technology to do more, to meet their needs and get things done. It's so much more than just providing a smart answer.

Unibet, one of Europe's largest and fastest growing online gambling operators, has developed an artificially intelligent natural language interaction (NLI) capability that it believes will transform the betting experience for its customers. The app makes it simpler and more intuitive, while eliminating some of the current barriers.

such as finding the particular wager they want among the many thousands on offer. Customers can simply use everyday language to place a bet - "I want to place a tenner on Hobson's Choice at Newmarket tomorrow" or "a fiver on Liverpool to win" - and the app intelligently analyses the request and responds appropriately. If there is any ambiguity, the app will either make some safe assumptions or ask the customer to clarify. By using natural language, the app

traditional frictions and .66 complexities in what Artificial Solutions' can be a complicated patented natural and even intimidating environment language interaction technology platform Teneo is designed

expressly to develop

and deploy advanced

AI solutions

"Using natural language removes the rigid and impersonal barrier between us and our customers," says Will Mace, head of strategic development at Unibet. "The simple. intuitive manner of the

removes some of the

interaction makes for a really positive and easy experience. Customers are making increasing demands on their service providers. They expect a seamless experience, and quite rightly they are less and less tolerant of clunky or complex interactions.

"Early forms of digital interface are being replaced with more sophisticated AI technologies such as NLI. This is driven by technological development certainly, but primarily by customer demand. Customers like easy and intelligent experiences."

application is no mean feat. Developing just the simplest of NLI applications inhouse can take an army of highly skilled computational linguists, engineers and developers. Choose the wrong technology and the end-result may well be nothing more than a long, tortuous and costly white elephant project.

Building this level of applied AI into an

In contrast, Unibet built its app using Artificial Solutions' patented NLI technology platform Teneo, which is designed expressly to develop and deploy advanced Al solutions. It applies the principles of artificial intelligence in the development of applications, shortening design time, and eliminating the need for extensive and expensive technical resources.

Teneo is a single integrated platform that covers every aspect required to create applications for business, it takes the human-machine interaction far beyond responding to simple speech commands and can even act as an interface to the deep-thinking of cognitive computing, all on a cross-platform, cross-device and multilingual basis

But these natural language-based applications aren't just about delivering a vague future customer engagement strateav or business process management improvements. As Unibet know, they fulfil a very real need today and will future-proof their business as they steal a march on their competition.

However, this is only one of the considerations. As consumers increasingly move their lives online, the once direct relationship businesses had with them has floundered. Businesses are now struggling to connect with their customers, leaving both sides with nothing more than a series of disparate transactions

Introducing an intelligent conversational element to customer interactions brings back that connection in several ways. People reveal a huge amount of information in conversation - why they are searching for something, particular features of interest, the reason they are hesitant to purchase. All this information can be analysed in real time, enabling the organisation not just to study trends, but to react immediately and personalise the interaction, ultimately securing the sale.

But relying on the technology goliaths like Apple, Google and Amazon to solve this is a risky strategy. Even if they were to open up their application programming interfaces or APIs. they'd undoubtedly still be hugely restrictive and prescriptive in terms of user experience, in how they

♦ MAN AND MACHINE • CATH EVERETT

hen boffins at Oxford University and management consultants Deloitte published a joint study, which forecast that over the next ten to twenty years 35 per cent of UK jobs are at high risk of automation by machines with artificial intelligence, it sent frissons of fear down many people's spines.

The shock was particularly great because, for the first time, it appeared that white rather than blue-collar workers would be hit, leading to labour-intensive. administrative roles in areas ranging from law to finance being eliminated.

But a year on and the situation appears less fraught following the publication of a second Deloitte study entitled From brawn to brains: The impact of technology on jobs in the UK that builds on the original 2014 research.

This report portrays a rather more positive picture. It claims that while technology may have contributed to the loss of more than 800,000 low-skilled, routine jobs over the last 15 years, it has also helped create four times as many higher-skilled posts - about 3.5 million each paying just under £10,000 more per annum than the one lost. This scenario has, in turn, added a net £140 billion in new wages to the economy.

As for those jobs that have been and will continue to be lost, they are found mainly in areas which are repetitive and mechanistic, and therefore easy to automate such as clerical, administrative and manual work.

But thousands of new positions have been and will continue to be created elsewhere in the technological and creative spheres, professional and management areas and caring professions. They are at low risk of automation as they require high levels of manual dexterity and/or social or cognitive skills such as problem-solving and decision-making.

As Robert Brown, global head of business and IT consultancy Cognizant's Center for the Future of Work, points out: "Computation, which involves huge amounts of pattern recognition or data analysis, is easy for artificial intelligence or AI systems, but hard for humans. However, if that information is fed to



Workers and robots assembling cars at a Fiat factory in Serbia

Man and machine are a winning team

Far from a dystopian future, when the human race is struggling against domination by robots, smart machines could free workers from mundane tasks and improve job opportunities

job categories will be disrupted by AI,

humans to help them decide on the right thing to do, the symbiosis is a winning combination and frees people from doing rote tasks." Mr Brown agrees that while certain

new ones will emerge. He cites the role of "Twitter data-wrangler" as a prime example. Although it would have been inconceivable just a few years ago to employ experts practised in gaining maximum social media exposure, it is now one of the most in-demand skills

in marketing. But even as the impact of AI in the workplace starts to grow over the next few years accelerating these trends already in progress, things are unlikely to come down to a "binary choice" of employment between either humans or robots, says Angus Knowles-Cutler, Deloitte's vice chairman and London senior partner.

This view would also seem to be backed up by a survey of 100 business leaders last year, in which three-quarters expected to see their workforces grow over the next four years

"While technology can indeed wholly automate certain routine manual tasks, other occupations benefit most from the partial integration of technology," Mr Knowles-Cutler says. "The resulting human-machine combination augments total intelligence, and can significantly raise both productivity and quality."

His colleague Costi Perricos, Deloitte UK's lead partner for analytics and information management, agrees. "When man and machine interact, you always get the best results," he says.

To illustrate the point, he quotes the example of Russian chess grandmaster Gary Kasparov. He created a new version of the game called "freestyle chess" after IBM's Big Blue supercomputer beat him in 1996 due to a bug in its code, which led it to make such a bold move that

The human-machine

combination augments

total intelligence,

and can significantly

raise both productivity

and quality

With the freestyle variant, two humans either plav each other or a computer, but are also allowed to employ their own technology too.

"It's consistently been shown that a human playing with computer will

human or machine," says Mr Perricos. "It's a simple case of how; when you combine the two, they're more powerful than either is on their own - and it's the same with AI."

But beyond a few pockets, adoption of the software is still only very much in its infancy. This means that most organisations are still trying to understand what they can do with it and what it can do for them, not least because the term AI covers numerous different forms of the technology.



have been lost to technology over the last 15 years



higher-skilled posts have been created Source: Deloitte 2015



of business leaders believe Al improves worker performance and creates jobs Source: Narrative Science 2015

According to Lee Beardmore, chief technology officer of global business process outsourcing at management consultancy Capgemini, the most established of these is machine-learning.

Software's predictive algorithms and pattern recognition capabilities are used by search vendors such as Google to build up pictures of their users in order to provide them with the most relevant search results. Retailers such as Amazon also use it to make purchase recommendations to consumers based on their previous buying behaviour.

Similar in nature is cognitive computing, but rather than specialising in numbers and structured data, it focuses on unstructured data such as text. This means it can locate relevant clauses in legal documents based on given parameters, for example.

The next most common form of AI is natural language processing. This software acts as a translation layer between machines and humans as is the case with the speech recognition capabilities provided by Apple's Siri or Microsoft's Cortana.

At the enterprise level, such technology is also employed in the form of

virtual assistants. They handle basic customer service queries such as bank balance inquiries either on the phone or via webchat before handing over to humans when problem-solving abilities are required.

As Mr Beardmore concludes: "The

business case and the objective are to have fewer humans working on mundane tasks so they can focus on value-add and exception management. So in future one of the biggest areas of advancement will be in freeing people up to achieve things that are now impossible."

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PERCENTAGE OF BUSINESSES WHICH EXPECT AUTOMATION TO REPLACE **AT LEAST 5% OF THEIR WORKFORCE**



Kasparov gave up.

always beat another

Time to buy robot and sell human?

Investing in artificial intelligence as it takes off over the next few years could bring good returns, but investors must look for the winning technologies

♦ INVESTMENT DAN BARNES

f robots are taking our jobs, they may also support our retirement. Bank of America Merrill Lynch estimates that 47 per cent of US jobs and 33 per cent of UK jobs have the potential to be automated. But the technology that could fill those jobs - robotics and artificial intelligence - is both a threat to some workers and a potential area of growth for investors, notably pension funds, seeking to capitalise on the new wave of industrialisation.

"It's the next generation," says Phillipe Cerf. Europe. Middle East and Africa cohead of the technology, media and telecommunications group at investment bank Credit Suisse. "Machine-learning is applied to some extent across all tech these days."

Taking an investment position on the technology associated with a specific

\$67bn

2005

80 -

70

60

50

40

30

20

10

⁰2000

GLOBAL ROBOTICS MARKET, 2000-2025 (\$BN)

trend such as this, called thematic investment, first requires the theme to be well defined. As artificial intelligence (AI) is an umbrella term, covering a range of specific technologies, understanding what qualifies is the starting point for any investor.

Duncan Anderson, chief technology officer for Watson Europe at IBM, says there are three aspects of technology that can fall into the category of cognitive computing, which IBM uses to avoid the science-fiction connotations of AI. "The first aspect is understanding that typically includes natural language recognition, but equally it could be image recognition," he says. "Trying to make sense of data coming into a system that a traditional computer system could not understand."

The second element is reasoning, for example working out the meaning of a question then forming a field of hypothe-

2020

Source: Boston Consulting Group 2015

2025

Professional investors are taking a growing interest in firms that are either exposed to or are based upon AI technology, although most analysts have different but overlapping universes of

companies that are put in the AI bucket. Bank of America Merrill Lvnch research indicates some \$2 billion was invested in 322 publicly listed companies exposed to AI-based technologies in 2014.

just by being programmed."

Analyst firm Venture Scanner, which itself uses proprietary machine-learning algorithms to index,

search and cluster similar companies, tracks a smaller universe of 910 specifically AI-focused firms across 63 countries which have raised a total of \$3.68 billion in funding from a range of sources.

Sarbjit Nahal, equity strategist at Bank of America Merrill Lynch, says: "This market is going to take off over the next five years. To date we have seen a basic level, but I think that we are really going to see an uptake of machine-learning, natural language usage and image

stretch from direct investment in firms that are wholly or partially exposed to AI, buying into investment vehicles which are targeting investments, to crowdfunding startups. In many cases venture capital (VC) firms are funding these businesses from their early stages of development

> to the point of going public or being acquired by larger firms. Investors should be cautious, warns Mike Lynch, founder of Invoke Capital Partners, a VC fund with £1 billion in assets, which has invested in several firms that use advanced pattern-matching algo-

based on probability analytics, notes that publicly listed companies will typically have customers using systems. This provides investors with the opportunity to measure success. For startups testing their systems at demonstrations is crucial.

"A lot of people are going to lose a lot of money on things that look great, but don't work in the real world," he says.

Mr Nahal also cautions investors to examine the market carefully. "When we talk about the risks. I think there can be a tendency to overestimate the impact of technology in the short term and underestimate on a long-term basis," he says. "Shorter term, it's going to be more opportunity than risk, allowing multiple sectors to deal with issues like wage inflation, productivity, and quality of products and services.'

GLOBAL INVESTMENT IN AI (\$BN)

🔵 Private investment 🛛 🥚 M&A



BUY INTELLIGENTLY

When machine-learning companies are successful, they tend to gain an early lead over others as the data they accumulate allows them to then leap ahead, just as big players like Google and Facebook have done previously. "The technology learns from experience this is the revolution," says Dr Mike Lynch, founder of Invoke Capital Partners. 'Whoever gets the data, their algorithms learn more and they get better. You get a very powerful feedback loop."

2010

2015

But beyond the larger firms that are researching and investing in artificial intelligence or AI, other opportunities

might present themselves to investors. McKinsey Global Institute analysis has found that certain sectors are likely to be affected as AI automates knowledge work. These are

FINANCE

Automating routine tasks, such as answering customer calls or dispatching assistance

HEALTHCARE

Expanding access to advanced IT tools and other information systems through natural language interfaces

EDUCATION

Extending capabilities of professionals, for example doctors and lawyers, with machine-learning systems that can spot connections humans would miss

rithms and machine-learning.

really is machine intelligence involved,"

Dr Lynch, who was co-founder and

former chief executive of Autonomy.

which provides intelligent search tools

intelligence are done with humans."

MEDIA AND COMMUNICATIONS Providing automatic content creation and synthesis

GOVERNMENT AND SOCIAL SECTORS

Raising productivity and efficiency by increasing consistency of tasks, such as searching and analysing information.

The researchers at McKinsey also highlight infrastructure and utilities, transportation and retail as sectors that may be impacted.

For investors looking for professional investment support in identifying opportunities, there are several options. "There are a number of funds that have either integrated this as part of a larger focus on automation, disruptive technology or innovative technologies," says Sarbjit Nahal, equity strategist at Bank of America Merrill Lynch. "Or there are a couple of dedicated funds that have been set up in this space, as well as an exchange-traded fund in the United States.



Professional investors

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technology



THE KEY TO UNLOCK PROFITS

Artificial intelligence, long the topic of science fiction, is rapidly becoming one of the most powerful tools available to the business world



Industry analysts forecast that the market for business applications and services employing artificial intelligence or AI could exceed £150 billion by 2018. Despite this avalanche of spending, many business leaders have yet to discover the full extent to which AI tools can impact their businesses or how to best leverage them.

Al and cognitive computing are broad terms that encompass a wide range of technologies. Generally, these technologies are associated with rapidly scaled "data crunching" or analytics.

"Al for improved data analytics is just the tip of the iceberg," says Josh Sutton, global head of the Al practice at Publicis. Sapient, the business and marketing transformation platform created by the acquisition of Sapient by Publicis in early-2015. "I think about AI in terms of three categories: first, big data tools to capture ever-expanding sets of available information; second, machine-learning, deep-learning and correlation-based platforms that are used to identify what is happening; and third, causal AI, otherwise known as 'common-sense AI', platforms which can determine why things are happening."

Many companies have embraced big data tools during the past five years. More recently, several technology providers have rolled out correlation-based AI tools designed to improve business decision-making by providing clients with better insight into their data. While these tools are an important component of any company's AI arsenal, their value is limited, first by the data to which they have access, and second to the user-defined rules and constraints under which they operate. Causal AI solves problems in the same way people do by analysing information

way people do by analysing information while applying an understanding of how the world works, testing multiple hypotheses and drawing conclusions. Catherine Havasi, founder and chief ex-

ecutive of causal AI firm Luminoso, explains: "When people communicate, they rely on a huge body of unspoken assumptions about the world. This set of assumptions allows people to communicate quickly and effectively with one another, but is very confounding to rules-based and algorithm-driven systems." Luminoso applies common-sense AI to help firms understand the meaning behind what people are saying across various social media and digital platforms. Publicis.Sapient's Mr Sutton adds that while he believes all three types of AI categories create business value, causal AI displays the greatest potential to change the way industries operate and businesses compete. This led Publicis.Sapient in 2015 to make an investment in Lucid, one of the leading causal AI companies. Lucid was created to commercialise one of the world's leading common-sense AI platforms known as Cyc.

Michael Stewart, chief executive of Lucid, notes that more than one million PhD hours and hundreds of millions of dollars have been invested in "teaching" Cyc how to solve problems the same way a human would. Through its work with the United States

government and commercial customers, the technology has built the world's largest and most complete knowledge base of everyday practical concepts about how the world works. "Enabling a machine to apply common sense reasoning to problems is actually a very difficult task," Mr Stewart says.

Although many companies are now using elements of Al, most chief executives remain unsure of the technology's ultimate impact. Publicis.Sapient established its Al practice to help senior executives better understand how their businesses can benefit from the application of artificial intelligence and identify opportunities to leverage all categories of the technology for transformational impact.

Publicis.Sapient consultants draw upon lessons leant from existing programmes, such as the work undertaken by the National Institute of Health (NIH) in the US to map the human genome, by the US defence body DARPA – Defense Advanced Research Projects Agency – around oncology research, and by a leading global bank to ensure their traders are adhering to legal and regulatory compliance.

For example, the NIH has leveraged big data tools to capture and analyse data, correlation-based AI tools to determine which genetic sequences are associated with various health issues, such as osteoporosis, and causal-based AI tools includ-

Causal AI displays the greatest potential to change the way industries operate and businesses compete ing Cyc to determine which resulting research areas are most promising. Similarly, DARPA, which oversaw the creation of the internet, is using the Cyc platform as part of a programme to read and understand all the oncology research

performed around the globe in order to identify the most promising focus areas for future cancer research.

Mr Sutton explains that Publicis.Sapient has developed a proprietary approach for helping companies leverage AI to identify opportunities for increased revenue generation, cost reduction and risk mitigation.

He concludes: "In conjunction with big data and correlation-based Al tools, common-sense Al firms, such as Lucid and Luminoso, will have a transformative impact on the business world in fields including finance, healthcare, energy and retail. The business applications for the tools that are available today far exceed what most people realise."

There is nothing artificial about the profits AI will unlock for forward-thinking businesses.

www.sapient.com

Building a solid business cas

After decades of false starts, systems based on artificial intelligence, defined as software capable of pattern recognition, fuzzy la

♦ AI SECTORS

MICHAEL CROSS





LAW

A major chore of obtaining planning permission for a new development is dealing with neighbouring properties' "right to light". This involves obtaining and examining the title deeds of all properties likely to be affected and drafting standard nodevelopment might require the examination of hundreds of title deeds. Traditional law firms give this routine and repetitive work to trainees or paralegals. However, it is exactly the sort of work that lends itself to artificial intelligence or AI-based automation.

One law firm to have taken this step is international city lawyers BLP. Its business case for AI was based on the fact that capturing relevant details of a property from a Land Registry title deed and entering them into a system takes an average of 15 minutes to do by hand. Processing automatically takes seconds. Equally important it produces consistent results.

Such automation of the traditional grunt work of lawyering is going on throughout the legal sector. Several major firms already employ e-discovery systems to sift through documents, e-mails and other records to identify material that might be relevant to a piece of litigation. Simon Price, managing director of specialist IT supplier Recommind, says e-discovery can save 95 per cent of "lawyer time" in preparing for a case and generate consistency.

Another proven application for AI in law is to screen claims for personal injury damages for signs of fraudulent behaviour. Leading insurance firm DWF already does this with big data analytics. The system maps connections between different factors in claims and gives each one a score between one and ten to indicate how much or little input from a human lawyer the case is likely to need. AI is not only changing practice within law firms, it is opening access to the law as systems become available that can reliably draft documents, such as tenancy and employment contracts, to suit individual circumstances. In their new book The Future of the Professions, legal futurologists Richard and Daniel Susskind predict that document assembly systems originally developed for lawyers will increasingly become accessible to lay users who need to draw up legal contracts on hand-held computers.



MARKETING AND ADVERTISING

Imagine an advertising hoarding capable of sensing the presence of passers-by before displaying an advertisement and learning from their individual reactions how relevant it is. This was the aim of the artificially intelligent poster campaign demonstrated earlier this year by a partnership of advertising giant M&C Saatchi and media firms Clear Channel and Posterscope.

The poster uses a body-tracking technology originally developed for the Microsoft Kinect system to work out who is standing in its vicinity, assessing up to 12 people at a time. It displays a combination of pictures and advertising copy from a "gene pool" and learns from the audience's reactions which are the most attractive. These are then picked by a Darwinian algorithm which eliminates the less successful combinations.

David Cox, chief innovation officer of M&C Saatchi, claims: "It's the first time a poster has been let loose to entirely write itself, based on what works, rather than just what a person thinks may work."

Artificially intelligent posters are still experimental, but AI is being deployed in earnest behind the scenes in advertising and marketing. One promising development is the application of pattern recognition and cognitive learning systems to help process sales leads. "Rachel" a virtual persona equipped with such technology from supplier Conversica, is being used in vertical markets, including technology, automotive, education and financial services.

This year saw a significant tie-up between 6sense, a supplier of predictive intelligence engines for marketing and sales, and Bombora, a specialist in demographic and intent data. According to the companies, the integrated system automates the process of sorting predictively scored companies and contact profiles into campaigns by buying stage. The custom segment is automatically deployed for programmatic ad targeting.

Meanwhile, UK-networked consultancy firm B2E claims that an AI-based system called Role Exchange became a key differentiator for its business. The system scrapes the web daily for vacancies in interim consulting roles and sorts the results into useful categories. "It's looking at 60,000 potential jobs and categorising them down to about 200 every night," says Hugh Abbott, co-founder of B2E. The system was built on what Mr Abbott calls "tin cans and bits of string" off-the-shelf technology for around £10.000.



FINANCE

The financial services industry was one of the first commercial sectors to deploy AI in mainstream business decision-making. Citibank, for example, was working on first generation expert systems as far back as the 1980s. Such interest is not surprising given the sector's reliance on massive amounts of data. On top of structured data about millions of transactions held by every financial services business, Reuters publishes 9,000 pages of financial news every day and Wall Street analysts produce five research documents everv minute.

George Roth, chief executive of Recognos Financial, says some 80 per cent of the underlying data being processed in the financial services sector remains either semi-structured or not structured and has to be processed manually. With AI, firms can analyse and contextualise such data almost instantly. AI technologies being applied in financial services include natural language processing, data mining and text analytics, semantic technologies, and machine-learning.

IBM has identified the sector as a customer for its Watson AI system,

e for artificial intelligence

ogic and cognitive learning, are proving their worth in several sectors...



which uses natural language processing and machine-learning to glean insights from large amounts of unstructured data.

IBM says the "ultimate financial services assistant" is capable of performing deep-content analysis and evidence-based reasoning to accelerate and improve decisions. For example, a bank could use the system to make better recommendations of financial products based on comprehensive analysis of market conditions, the client's past decisions, recent life events and available offerings.

Another application is in compliance, fraud detection and security. Integrating structured and unstructured data ensures compliance rules are being applied and can help to detect offences, such as money laundering and insider trading. Natural language processing systems can uncover subtle cues in transactions that might indicate behaviour that does not show up in the numbers. So-called "know your customer" systems are another widespread use of AI to manage unstructured and constantly changing data in order to assess risk.



RETAIL AND CUSTOMER SERVICE

However good, or otherwise, their punctuality record, train operators have to deal with large volumes of customer complaints. The Department for Transport requires these to be classified into 470 categories. This was one of the challenges facing Virgin Trains when it set out to upgrade its customer service operations to meet expectations.

Thanks to the near-ubiquity of smartphones, a high proportion of customer communications now come in by e-mail. To improve the processing of these, Virgin deployed an AI platform called in-STREAM from Celaton, which is capable of categorising unstructured content and learning new patterns of unstructured data through the natural consequence of processing it. The system reads e-mails as they come in, understanding meaning and sentiment, and capturing key data for the customer relationship management system.

"A process that took 35 manhours has been reduced to four man-hours a day and increased the speed of answering," says Hugh Abbott of consultancy B2E, which worked on the project. "It has been a complete success." The next step in applying AI to retail service is to automate the conversation with the customer. A tool called DigitalGenius is already being used in the motor industry to conduct human-like text conversations with customers. The neural network system is based on what the supplier calls deep-learning technology. Deployed in a contact centre, the system provides a level of automation and intelligence to enable interactions that feel like actual conversations.

Automating customer services is also a target market for IBM's Watson technology. The company has announced it is developing systems with insurer Swiss Re to harness cognitive computing technologies to identify and act on emerging trends in customer communications.

"Insurers need the ability to spot operational issues or opportunities in real time and respond proactively," IBM says. "Cognitive technologies, coupled with human experience and insights, can enhance and help inform timely decision-making. By applying Watson's capabilities, the new platform could allow Swiss Re professionals to make better-informed decisions and more accurately price risk."



HEALTHCARE

Medical decision-making was one of the first applications envisaged for first-generation AI, so-called expert systems. The vision is now becoming reality.

Among the applications for IBM's Watson natural language processing and machine-learning system is a collaboration with Boston Children's Hospital to help clinicians identify possible options for the diagnosis and treatment of rare diseases.

Watson will be trained in nephrology by reading related medical literature and aggregating information on causative mutations for steroid-resistant nephrotic syndrome (SRNS), a rare genetic form of kidney disease. Then, experts at Boston Children's Hospital intend to feed genomic sequencing data from retrospective patients into Watson to further train the system.

The goal is to create a cognitive system that can help clinicians interpret a child's genome sequencing data, compare this with medical literature and quickly identify anomalies that may be responsible for the unexplained symptoms. At the other end of the healthcare environment is the apparently simple matter of ensuring that patients take the pills they are prescribed. An alarming percentage of patients do not complete courses of medication, creating dangers ranging from antibiotic resistance to underestimating the side effects of drugs.

This is particularly crucial in clinical trials, which often rely essentially on patients' say-so. Yet where tests are carried out, they find that fewer than 30 per cent of participants in clinical trials may be completing their course of medication. A mobile phone app called AiCure may provide an answer. The app records people taking their medication, identifying the patient and drug, with sophisticated features such as facial recognition to ensure it is not being tricked. The adherence data is available in real time to organisations conducting clinical trials, for the first time ensuring they are based on hard data

Putting AI power to work

Powerful artificial intelligence is now cheap, simple and a natural fit for business

♦ BUSINESS APPLICATIONS CHARLES ORTON-JONES

usinesses are embracing artificial intelligence. Even relatively low-tech sectors, such as toymakers, are adopting it. The new Hello Barbie doll, topping Christmas wish-lists, is wi-fi enabled so it can hold conversations with children in any language.

Marketers are getting into artificial intelligence or AI in a big way. They use data analytics to crunch the value of each new customer, factoring in hundreds of variables. It's the sort of maths Nasa was struggling with a decade ago. Even farmers use AI. Combine harvesters are pilotless, driven by robots. Data is gathered on crop yield, so fertiliser can be varied to boost production.

So what's happening? Why is AI now being harnessed by businesses?

The obvious answer is that computing power is so cheap. Moore's Law predicted computing power would double for the same cost every two years. Today, a Raspberry Pi computer costing \$5 packs data storage or RAM that retailed for \$681,472 in 1984. Storage costs are falling exponentially. A gigabyte of storage has fallen from \$690 in 1995 to \$0.03 today. Businesses can use AI knowing the cost of computing is affordable on any budget.

The collapse in the cost of computing has coincided with the rise of a number of other trends, all of which are feeding into each other. The emergence of the cloud is a major factor. Before the cloud

companies needed to host data and power computing on-premises. This is expensive in terms of capital expenditure, licences, and maintenance costs. It requires a lot of technical expertise. By contrast, the cloud means business-

es can access storage and computing the ToyTalk servers, which process the power on demand, with a pay-as-you-go cost model.

Data analytics provider Blue Yonder employs the algorithms written for the Large Hadron Collider at CERN to pro-



Facial recognition system at Heathrow Airport, which is upgraded without human intervention

MOST WIDELY USED ARTIFICIAL INTELLIGENCE SOLUTIONS BY ENTERPRISES



of things is the name for the trend to connect objects to the web so they can communicate with servers. Indian consultancy Tech Mahindra is pioneering smart cities, where sensors are ubiquitous. Dustbins report when they are full. Traffic lights can be rephased automatically throughout the day to optimise vehicle flow. Car parking spaces report when they are occupied to re-route cars to other locations. Milton Keynes is currently working with Tech Mahindra to install these sensors in order to manage the city with AI.

A key ingredient in adoption of AI by businesses is that it is increasingly simple to use. Some of the most sophisticated AI platforms are designed to be used with no tuition.

Amazon's machine-learning engine illustrates this perfectly. Ralf Herbrich, director of machine-learning at Amazon, explains how easy the service is to use. "We wanted to make AWS [Amazon Web Services] machine-learning something any developer could use. We are aware that what might be easy for me and my colleagues to use isn't necessarily easy for some developers to learn. Our feedback at first was that we made it too complex. Developers didn't want all the fine tuning knobs. They didn't want to understand the maths. So we removed them," he says.

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|--|
| MAIN REASON WHY ENTERPRISES CURRENTLY USE AI |

| Access to data businesses can use to make effective decisions | | 48.5% | , |
|---|---------|------------------------|---|
| Access to data conusmers can use to —— make effective decisions | | 13.6% | , |
| Automation that eliminates manual ——— and repetitive tasks | | 6.1% | , |
| Monitoring and alerts about the health —— of the business | | | , |
| Automated data-driven _ reporting | | 4.6% | ł |
| All of the above | | 19.6% | , |
| Other | | 3% | , |
| | Source: | Narrative Science 2015 | 5 |
| | | | |

Cut hours, days and weeks of report writing, to seconds.

Automated written reports from your data, in real time.

vide businesses with accurate forecast-

ing. It's a cloud AI solution. Companies

to speak all within a second.

der's service.

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An infinite iteration

of improvement is

possible leading to what

some claim will be a

god-like intelligence



First-party data assets

CRM/loyalty data
Product data and value

Website interactions

Examples of predictions

Likelihood to purchase

Similarly behaving users

Potential customer value

Ad selection/valuation

Alternate products

Machine-learning

user prediction

Example data points: Customer purchase history
Socio-demographic profiles

Programmatic feedback loop

COMMERCIAL FEATURE

'Holistic' data and

machine-learning driven real-time

marketing solution

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A BRIEF HISTORY OF AI



rld chess champion Garry Kasparov a match against the IBM Deep Blue computer in 1997

One of the features of artificial intelligence (AI) is that no one can agree on a definition. John McCarthy coined the term in 1955. He admitted the word "intelligence" was problematic. All definitions relied on comparisons with human intelligence with implications of creativity and consciousness. Though he stressed that machines would work very differently, this conflict has never gone away.

In the late-1980s, the futurist Ray Kurzweil predicted chess computers would able to beat the best players by 2000. This was an exciting concept. Chess is a near-infinitely complex game. An AI grandmaster would surely need to "think" like a human. Yet when IBM's Deep Blue beat world champion Gary Kasparov in 1997, there was little applause The brute-force algorithms of Deep Blue weren't evidence of real intelligence, critics countered, merely blind maths.

Now using AWS is spookily simple. A

click-through wizard guides developers.

Click on the data you want to crunch.

Specify what you want. And a couple of

minutes later the predictions return, to-

gether with an indicator of the reliabili-

ty. "For developers who want the knobs,

they can have them," says Mr Herbrich.

But he is proud of the fact that the most

cutting-edge AI money can buy is availa-

As AI develops, one of the biggest trends

won't involve any humans at all. AI is de-

ble to any company.

veloping itself. The

ultimate goal is to

produce a machine

so clever it can up-

grade autonomously.

At that point, an in-

finite iteration of im-

provement is possible

leading to what some

claim will be a god-

like intelligence. The

Each leap forward is met with the same lament that it isn't "true" Al. Robot pioneer Rodney Brooks created the Roomba autonomous vacuum cleaner in 2002, which used sensors to navigate a room. It ushered in a new era of autonomous robots. But was the Roomba AI? It's so crude, said critics. It could do one job and not too well.

As AI has improved, with land-marks such as IBM Watson winning the Jeopardy! quiz show and Google Translate instantly converting Estonian into Japanese, this debate has flared up. Are these engines really intelligent or merely advanced calculators, blindly throwing up answers?

In the coming decades AI is going to improve exponentially. Mr Kurzweil forecasts by 2029 machines will chat so well they will pass the Turing test. In the 2040s machine intelligence will be a billion times more powerful than human intelligence.

At what moment will true AI emerge? The philosopher Daniel Dennett says no machine can think like a human without being human. Consciousness is a requirement. Everything else is imitation.

Does it matter? Probably not, for two reasons. First, in the coming decades AI software will acquire faculties so profound they will resemble human intelligence for intuition and versatility. And second, we'll merge with these machines. Mr Kurzweil predicts by 2045 humans and AI will integrate, multiplying our intelligence by unimaginable orders of magnitude At that point, the debate will be moot.

THE MACHINE-**LEARNING REVOLUTION** *The next stage in the data revolution has arrived. A branch of computer* science called machine learning is about to become the next big

IPONWEB

development powering the business world

Businesses have spent tens of millions of dollars collecting data about the activities of their customers, but have struggled to put this data to good use. Machine learning systems are used to help computers identify patterns from big data sets and enable them to perform tasks such as predicting consumer behaviour and forecasting how people will react to different marketing strategies. This technology holds the key to unlocking the value from big data. It will help companies sharpen up their marketing and boost the effectiveness of their advertising.

US tech and internet giants, such as Google, Facebook and Amazon, have built their businesses by gaining access to huge amounts of data about customers and their online behaviour. They have deployed machine learning to analyse this data to generate new sales, make their advertising more effective and to make themselves more relevant to users. The more data they gain access to, the better their machine learning performs.

Other companies need to find different methods of accessing machine learning capabilities so they can put their own unique and valuable customer data assets to work. Importantly, they also need to be able to harness their own advertising footprint to access online behavioural information and other data to generate more effective insights on new and potential customers.

Banks, telecoms companies, retailers, insurers and travel businesses are just some of the companies that are all looking to apply their own in-house machine learning systems in pursuit of competitive advantage.

IPONWEB, a technology infrastructure business founded by theoretical physicist and entrepreneur Dr Boris Mouzykantskii is offering companies bespoke machine learning applications to help them make the most of this opportunity.

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IPONWEB can help businesses stride ahead of their competitors by applying machine learning to their unique data assets and digital footprint

A decade ago, IPONWEB first started using machine learning to automate digital advertising and helped pioneer a new field known as programmatic advertising. The company has already custom-developed programmatic systems for more than 100 companies in the advertising technology sector. Now it is applying this expertise to help large corporations to leverage and activate their data digitally They offer highly customised, data-driven platforms built around a company's unique data to harness the ability of machine learning to identify and predict user behaviour in their advertising.

Machine learning performs best when applied to massive data sets, so it is ideal for very large businesses with huge ad budgets. A really cool application is analysing buying patterns and online behaviour to predict the likely purchase Machine-learning customer modeling

- Examples of data points: Purchase path behaviour
- Seasonality trends
 Product user associations
- Customer acquisition and
- lifetime value

Digital advertising data

- Examples of anonymous user data:
- Browsing history Location and device
- Search terms Third-party intent data Context data signals
- (page content, weather and so on)

behaviour for millions of individuals simultaneously. This is on a scale far beyond the very best planning and consideration by human minds. Machine learning is also useful for informing brands how they should then price (and make a decision) for each user on a digital advertising slot, whether on a website, mobile or video. make huge performance gains by tight-

Predictions such as these can help brands ening up their targeting and cutting out advertising inefficiencies This technology has wide uses. For instance, an airline may have extensive data assets about previous customer purchases, website data, loyalty programmes and reservations. It could incorporate ma-

chine learning to identify numerous patterns of customer behaviour that lead to a purchase. By marrying this with digital advertising data, an airline can incorporate anonymous users' browsing history, locations, devices, searches, weather and other such information. It would then be able to identify more accurately and predict each and every user's unique potential travel needs at that exact point in time. context and location.

Over the next five to ten years, major competitive advantage will be created by those companies that use data the most effectively. IPONWEB can help businesses stride ahead of their competitors by applying machine learning to their unique data assets and digital footprint. They will then take their place at the forefront of the data revolution.

www.iponweb.com

2016 is the year machine-learning will make the leap from the workplace to the consumer

process is underway. Facial recognition is being transformed by machine-learning. Engineering company Atkins designed the facial recognition system used at Heathrow Airport. The UK Border Force uses Atkins' technology to process millions of passengers a year and to weed out suspects. Atkins works with partner Aurora to refine the process with machine-learning.

The software notices what works and what doesn't, and the code is upgraded without human intervention. In August, Aurora announced it had reduced errors by 65 per cent when recognising faces through the application of machine-learning. This methodology will accelerate AI development, making it evermore powerful for commercial applications

simply, powerful AI is now cheap and simple for businesses to deploy. The Slack messenger platform, used by thousands of companies, has the Slackbot virtual assistant. It can answer questions. The goal is to have a truly conversational Slackbot which can perform sophisticated tasks. Financial reports are written by jour-

So where does this leave us? Ouite

nalism-bots. Associated Press uses AI bots to turn quarterly earnings statements into articles. It's cheaper, quicker and more accurate than employing

> We have phones that converse with us and cars that correct lanedrift automatically. The tech industry is aware of how far we've come. Abdul Razack head of big data and analytics at Infosys, the \$9-billion sales IT consultancy, ob-

serves: "2016 is the year machine-learning will make the leap from the workplace to the consumer. We're already seeing it happen with self-driving cars from Tesla and Amazon Echo's [cloud-connected smart speaker that responds to] voice commands. Next year, machine-learning will quietly find its way into the household, making the objects around us not just connected, but smarter every day."

The challenge for businesses is to become part of this explosion in AI. When even farmers are running algorithms, it's time to get stuck in.



human hacks



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Smart machines are a ne

Robotic automation of manufacturing and even some white-collar jobs is noth

♦ ROBOTICS DAN MATTHEWS

utomation is the past, current and next big thing. For a long time, getting robots and software to work for us has been the Holy Grail of business. In theory it makes everything cheaper, more reliable, more powerful and it frees humans up to work on creative projects.

It's not new. Ever since the first industrial revolution, capitalists have looked for ways to extract human labour from the means of production and replace it with smart systems.

This, of course, was initially driven by greed. Factory owners wanted to put a jack under their profit margins. Removing wages, the biggest cost in almost all businesses, was the best way to do it.

More recently new incentives have driven progress – reducing human error, improving health and safety standards, and by no means least importantly, saving the sanity of the poor beggars who stand day in day out on production lines attaching one bit of kit to another.

The 20th century saw the rise of the machines, typified at first by heavy milling equipment and pumping pistons, then by large mechanical arms in manufacturing capable of lifting cumbersome parts and screwing them into position with mundane, efficient regularity.

In the 21st century machine CVs have lengthened, their skillsets broadening into new areas. What they can do now is a quantum leap from what they could before the digital age -

and the pace of change is accelerating.

Today machines don't just replace humans and speed up output, but are capable of working far beyond the human spectrum of ability. This is thanks in a large part to the nascent internet of things and big data.

speed up output, but

are capable of working far beyond the human spectrum of ability

which is producing machines capable of them with the intelligence to know "learning" if not "thinking". when to change what they are doing

It's what is being called the fourth industrial revolution or Industry 4.0 to its friends. If you're interested, the second revolution was in electricity and mass production. while the third was essentially the first part of the current digital great leap forward.

"The combination of data, analytics and robotics will yield smarter, self-learning tools that perform judgment. Think claims handling, fraud detection, better buying decisions, improved complaints handling - the list is long," says James Hall, chief executive of process automation business Genfour.

Technology will be able to deal with menial process-driven tasks initially, but is steadily gaining the capacity to take on more sophisticated projects.

"With speed to implement and low cost to run, we can start to tackle millions of roles that just perform rules-based processing," says Mr Hall. "As we move up the intelligence scale, we could consider



legal discovery work, mail room sorting, underwriting, medical diagnosis, financial and human resources advice.

66

Today machines don't just replace humans and tive thought."

has huge implications for the global

labour market.

"The list is extensive, with decisions based on data analysis and interpretation. Once technology can make a determination from assembled data, it becomes tantamount to cogni-Asking machines to perform even simple tasks and equipping



GLOBAL SPENDING ON INDUSTRIAL ROBOTS, 2010 - 2025 (\$BN)



w industrial revolution

ing short of an industrial revolution



In the last 30 years, great chunks of the British manufacturing industry have been spun out to China, India and Eastern Europe. With automation, it will become materially viable to bring it all back again. Robots don't want money, they don't sleep and they can work in the dark.

Japanese technology company Seiko Epson has created a prototype that is an example of how manufacturing will evolve. "This autonomous dual-arm robot is 150 kilograms, with a tiltable head, two arms that can grasp objects and cameras for 'eyes' in its hands and head; this robot has the ability to recognise 3D objects and make visual inspections," says Minoru Usui, Seiko Epson's president.

"But most exciting of all, he can learn. In my view, a robot like this could help enhance the productivity of reshoring manufacturing firms, while also giving them a new flexible option for high-mix, low-volume production runs in a world where product life spans are becoming shorter and shorter."

The company is also investing heavily in 3D printing and is reported to be planning the launch within the next five years of a machine capable of mass-manufacture.

"3D printers have the potential to revolutionise the manufacturing process and, coupled with autonomous robotics, the possibilities are endless," says Mr Usui.

"They range from revised development and production lead-times, reduced supply chains and just-in-time solutions, to enabling solutions for immediate, one-off part production at remote engineering sites anywhere in the world."



1. Welding robots in a car factory 2. KUKA Robotics Corp's Roboter industrial robot on show at Tokyo's International Robot Exhibition 3. Seiko Epson's autonomous dual-arm robot

All this is making the robotics industry as a whole rather valuable. Bank of America Merrill Lynch calculates it will be worth almost \$153 billion (just over £100 billion) by 2020, with robots performing 45 per cent of manufacturing tasks within ten years. That's up from about 10 per cent today.

Research firm Gartner expects three million workers to be answering to a robot manager – or robo boss – by the year 2018. Meanwhile, Barclays says automation will "safeguard up to 73,500 manufacturing jobs in the next ten years and help address the skills gap in the sector".

It adds up to a bright future for the production industries, says Antony Bourne, manufacturing global industry sales director at enterprise software business IFS.

> Once technology can make a determination from assembled data, it becomes tantamount to cognitive thought

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"Many factory processes are becoming automated, which allows companies to analyse their factors of production quickly, and communicate more effectively with customers and business partners," he says. "These processes span monitoring, co-ordination among different business units and management of product life cycles. Left to spreadsheets and manual legwork, these would be very slow and inefficient."

Mr Bourne points to other sectors getting in on the act. One is professional services, in which robots could do a job performing searches, finding precedents, and discovering the best offers automatically from a broad range of historical and current sources. That could make life a lot easier for accountants, auditors and lawyers, although it could also force them to create new points of differentiation to justify the lovalty of their customers.

Robots even have a place in the leisure sector, he says, as is the case with Japan's Henn-na Hotel. Here a humanoid robot will help you check-in, a robotic arm will take your coat and an automated car transports you luggage to your room.

Access is gained through facial recognition, and rooms have smart lighting and air-conditioning systems that switch off automatically when you are not there. For some people it's a vision of hell, but for many others it's a sign of things to come. The UK sits in the automation pack, while countries like Japan and Germany are out in front. According to PwC, German companies are investing 3.3 per cent of turnover on Industry 4.0 and expect a yield of 12.5 per cent in return.

Tony Hague, managing director of PP Electrical Systems, says by adopting the same approach UK industry could be £20 billion better off. There are nevertheless good examples of businesses doing great things in the UK, he says, including Nissan's plant in Sunderland and Jaguar Land Rover's new engine facility in the West Midlands, both examples of "automated workplaces delivering world-class products".

With quick advances in artificial intelligence, automation, robotics and the internet of things, it's obvious the world has entered a new industrial era. It's not science fiction or a prediction for the next century, it is here and now.

But so quick are modern cycles of innovation that naming each new stage will become pointless. Industry 5.0, 6.0 and 7.0, each a distinct and significant technological upgrade from the last, will not be 100 years in the making, but a decade or less apart.



blueprism.com

Software Robots -The Virtual Workforce

Blue Prism coined the term Robotic Automation in 2012 to describe how our business and operations configured software robot platform enables enterprises and service providers to build their own Virtual Workforce of multi-skilled "white collar" digital workers to execute administrative tasks and processes. Our goal is to take the robotic work out of people's jobs to free time for them to use their human skills. It's the Virtual Workforce of Software Robots.

Since then the term Robotic Process Automation has become an industry standard and numerous desktop scripting and automation tool kit vendors have begun to use the RPA term to describe what their products do, but if you look closely you can see that these technologies are not enterprise software robots - the are locally recorded scripts.

Our concept of a Virtual Workforce powered by intelligent software robots is an enterprise automation capability - configured and owned by business operations and supported within an IT governed and managed operational framework. Only this balance of business agility with operational risk management and enterprise security can work at scale and minimize operational risk.

With over 100 customers and with numerous clients running large multi-hundred robot deployments over a number of years we are the only RPA vendor to have deployed in the transactional data centers in demanding regulated industries including the worlds of banking, Insurance, utilities and Healthcare. Our robots transact autonomously, intelligent scheduled and centrally managed as a multi-skilled digital workforce.

Giving an agent a desktop scripting tool with a record button is certainly one way of increasing that agents productivity, but this is just yet another form of "grey IT"- It is next to impossible to build an Enterprise Virtual Workforce with such technology. You can't execute banking transactions in a lights out data center with a recorded script.

The London School of Economics recently interviewed 10 Blue Prism customers for their new research project on RPA. Their findings are startling and enlightening.

To find out more about how you can build your Virtual Workforce with Enterprise RPA and read the LSE research then please visit Blue Prism at www.blueprism.com



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What every CEO should be asking

The current sharp focus on the development and potential applications of artificial intelligence suggests it's time for chief executives to pay attention. Here are ten key questions they should be asking to invest in AI's transformative potential

U | WHAT'S THE FUSS ABOUT?

From security to blockchain technology and 3D printing, every new technology development comes with exhortations for chief executives to place it top of their agenda. However, in the case of AI, it may well be the most important change we'll see in the philosophy, practice and management of business. AI draws on and is combining with exponential performance developments in technologies such as computer hardware, big data management, the internet of things and the fields of machine-learning, neural networks, and robotics. As a result, AI is beginning to fulfill its potential of transforming businesses. Chief executives have to ensure they are investing the time and attention to understand what AI is, why so much is being invested and where the opportunities are.

02 what's its potential?

The place to start is to educate management about its potential, and undertake internal analysis of where it could be deployed and what competitors are doing. Medium to large enterprises in particular are bringing in AI experts to take a broader perspective of the potential roles it could play from smarter production management to customer targeting and broad-based decision-making.

O3 HOW FAST IS IT MOVING?

The pace of AI development has caught most unaware. We are beginning to understand the scale of the investment being made by companies such as Google, IBM, Microsoft, Uber and Baidu. Many of the biggest developments and research projects are kept under the radar until launch, and we can only speculate on what we might see next, from robot lawyers to ultra-intelligent personal assistants.

How DEEP SHOULD WE TAKE IT? Many firms are looking at relatively narrow deployments to automate



Global futurist

rule-based decision-making, and predict future demand and customer behaviour from accumulated data. Others are looking at much broader deployments such as intelligent human resources, finance and legal advisers, and real-time data analytics of live transactions. Deployment of AI could lead to deep insights into the potential behaviour of employees, customers and partners.

() 5 COULD IT TAKE THE CHIEF EXECUTIVE'S JOB?

Some of the most extreme applications of AI include the creation of "human-free" automated businesses where everything from strategy to operational processes are embedded in the system. But we are not there yet.

06

WHO SHOULD LEAD?

Some companies are making it the responsibility of the chief executive, chief operating officer or business transformation head to drive the identification, piloting and application of AI solutions across all aspects of the business.

WHAT WOULD SUCCESS

"Fail fast and cheap" – bringing in suppliers, customers and other value-chain partners early on to see if there is commercial merit in an idea. There can be as much learning from a failed project as a successful one.

() 8 HOW DO WE PRESERVE THE FEMININE?

Organisations display a mix of socalled feminine and masculine characteristics that manifest in organisational culture, service philosophy, and the assumptions and beliefs which underpin decision-making. The challenge is to maintain the feminine in the organization, avoiding the tendency for AI systems to display a more masculine and robotic persona.

HOW WILL STAFF RESPOND?

Focus needs to shift to how AI is supporting professionals within a business, saving time, driving efficiency and increasing the value of work done.

I U HOW DO WE ADDRESS SOCIAL IMPACT?

While no future predictions are certain, we all need to know as much as possible about the potential effects for good or ill of AI.

The pace and potential of AI mean it is not something we can afford to ignore. It is perhaps the single most important area of decision-making business leaders will face over the next few years. The depth of a chief executive's understanding could be the crucial differentiator between success and failure of firms in a fast-changing world.



ARTIFICIAL INTELLIGENCE FOR BUSINESS | 15

Virtual helpers will organise our lives...

Virtual personal assistants, powered by increasingly sophisticated artificial intelligence, have become an essential feature for many businesses and consumers

"

Virtual personal

assistants are set to

express them

Joaquin Phoenix in Spike Jonze's Oscar-nominated futuristic drama Her in 2013, about a man who falls in love with a Siri-like virtual personal assistant

t now seems a long time ago when businesspeople talked about checking the calendar on their PDA or personal digital assistant. The rather antiquated technology is now viewed at best as cute, on 1990s TV programmes, and at worst a source of great amusement.

VIRTUAL PERSONAL ASSISTANTS

LEO KING

Yet PDAs were the perfect predecessors for the virtual organisers of today because they helped set the foundation for a dependence on digital schedul-

ing. Today, virtual personal assistants. which can essentially organise large parts of our lives, are a standard feature on smartphones, owned by nearly seven in ten of the UK population.

These "assistants". including Google Now and Apple Siri, can practically organise our day, suggest-

ing routes for travel, advising whether to take an umbrella, finding restaurants, answering web searches and setting up meetings. They can choose presents online, based on the information on friends' social media profiles, and with the newest technology, they can even answer e-mails.

Research firm Gartner predicts the era of smart machines will be the "most disruptive in the history of IT" and it expects virtual personal assistants to play a crucial role.

cal growth, it has taken some time to get to today's relatively helpful technology. The spread of smartphones over the last decade, combined with the increased sophistication of artificial intelligence (AI) algorithms, have been essential in the improvements made. The key breakthrough for consumers

In spite of the phenomenal technologi-

came in 2011, when Apple added Siri, the speech interpretation and recognition interface, to its phones. Suddenly, anyone could dictate internet search terms and find a result. It was followed in 2012 by Google Now and in 2014 by Mi-

crosoft Cortana. Each has its own strengths, including Apple's established voice recognition and recognisable interbecome central in our face, and Cortana's lives, predicting and ability to search conacting on many of our tacts and predict travel needs. Google needs well before we Now, meanwhile, benefits from the company's advanced search

understanding and is likely to incorporate its new auto-reply system for e-mails, Smart Reply.

A plethora of other options exist on the market, such as Amazon with its Alexa system for search and music, and Baidu with Duer for arranging dining and movies, and there are companies linking voice control to connected home devices from heating and lighting to TVs.

Perhaps the most surprising approach comes from a social media giant. The new Facebook M system, which since August has been available to a test group of users, uses AI to help plan holidays, find local restaurants and make online purchases, but depends on humans to check the result and improve it if needed. Much has been made of the potential

usefulness of the different options. When Siri came out, consumers worldwide derived amusement inputting ridiculous requests, but like businesspeople, they had become frustrated that the answers they received to more straightforward questions were of very mixed quality. Now, however, Siri and its counterparts have moved on and are mainstays for many.

With advances in AI, these systems are capable of answering relatively complex questions about subjects of interest almost instantly, attempting to understand what the user needs based on their history of demands and preferences, and the requirements of others.

A Siri or Google Now user might use it to derive answers to dictated business or leisure web queries, while Cortana is attempting to differentiate itself with machine-learning algorithms that take note of the places a person travels and when, advising them of traffic and weather, or offering train and bus times to the next appointment in their calendar.

The usefulness and accuracy of all these systems is ever improved and Google claims its own technology gets less than 8 per cent of voice queries wrong.

For businesses, not only can the technology be used to schedule meetings, advise colleagues of late arrival or dictate e-mails, it can also completely redefine how they interact with customers, automatically answering written and voice queries.

Services such as Teneo from Artificial Solutions and the tools from Api.AI enable companies to create platforms based on AI and voice-recognition



software, designed on a bespoke basis with the needs of their specific customer-base in mind.

IBM is among the larger vendors well placed to grow in the market, given the prevalence of its Watson AI technology, with pattern-matching and predictive skills that are increasingly being deployed in professional settings from tax offices to cancer research. In 2014, IBM bought Cognea, a virtual assistant platform, to integrate into Watson.

Among the many non-technology companies seeking to work with AI firms, to offer their own systems, is Domino's Pizza, which has an AI-based app, called Dom, developed with speech recognition firm Nuance, to guide users through the ordering process and suggest additional options. Meanwhile, HSBC, Asda and other large companies are using technology from Creative Virtual to answer queries from web customers automatically.

For most of the world's enterprises, the crucial issue will be whether consumers rely solely on the virtual assistants already on their smartphones or whether these pave the way for a wider acceptance of different firms' offerings.

Whichever turns out to be the case, virtual personal assistants are set to become central in our lives, predicting and acting on many of our needs well before we express them.

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VIRTUALLY AT YOUR SERVICE



SIR Apple's intelligent personal assistant and knowledge navigator allows users of its devices to send messages schedule meetings and make phone calls. The voice-activated, interactive system has been incorporated into Apple's mobile operating systems since 2011 with iOS 5.

CORTANA

Microsoft's primary intelligent personal assistant, which was developed in time for the launch of the Windows Phone 8.1 operating system in 2014, is now integrated into Windows 10. The system can be used to track package deliveries, find files on a PC and set reminders. It even tells jokes.



GOOGLE NOW

Google's intelligent personal assistant is available for use on its own Android-operated mobile devices and via Google Search apps downloadable on Apple devices. First launched in 2012, it can answer queries, warr users of bad traffic, and provide reminders of dinner dates and flight times.



FACEBOOK M

This digital assistant service is being integrated into Facebook's Messenger platform. Its availability is currently limited, but it is designed to help users plan holidays, find local restaurants, and make online purchases through AI software that is trained and supervised by humans.

Teneo

TENEO

A development and analytics platform from Artificial Solutions, Teneo enables businesses to create their own natural language applications they can then deploy as a means of personalising and enhancing the automated services they offer their customers.



🕿 api.ai



NIKI

A smart-purchasing

assistant driven by AI

technology, Niki from

Niki.ai integrates natural

language and machine-

learning processes. It

is designed to simplify

everyday tasks, such

booking a taxi or paving

as online shopping,

utility bills

API.AI A platform designed to enable software developers and companies to collaborate in making voice-activated interfaces, Api.Al integrates Al technology to deliver services in the context of consumer-facing tools.



BRAINA

A virtual assistant for the Windows PC operating system, Braina from Brainasoft is focused on speech recognition for automating and executing specific requests. It uses a natural language interface so users can speak to perform various tasks on their computer.



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