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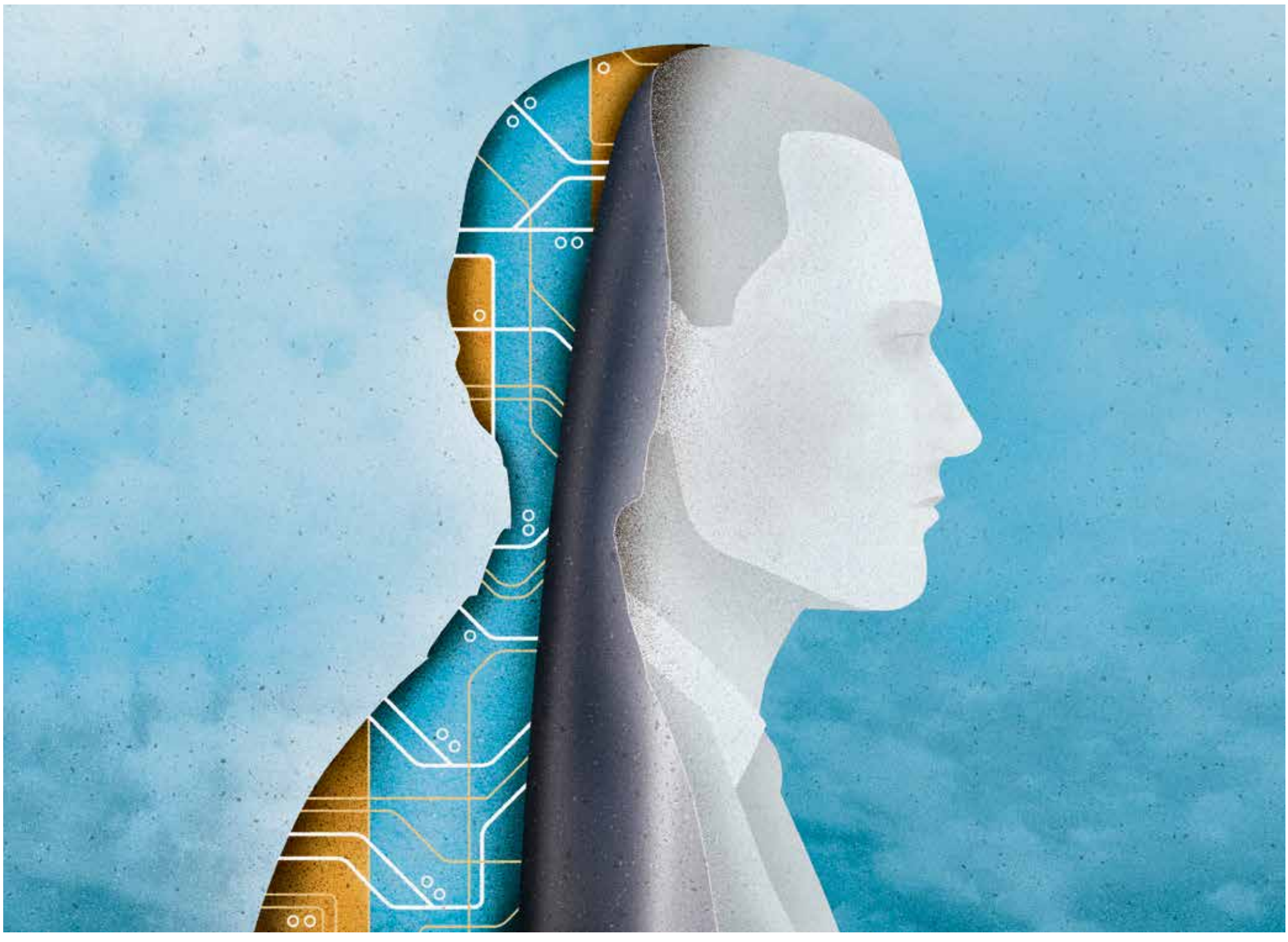
raconteur.net | #0390 | 26 / 07 / 2016

ARTIFICIAL INTELLIGENCE FOR BUSINESS



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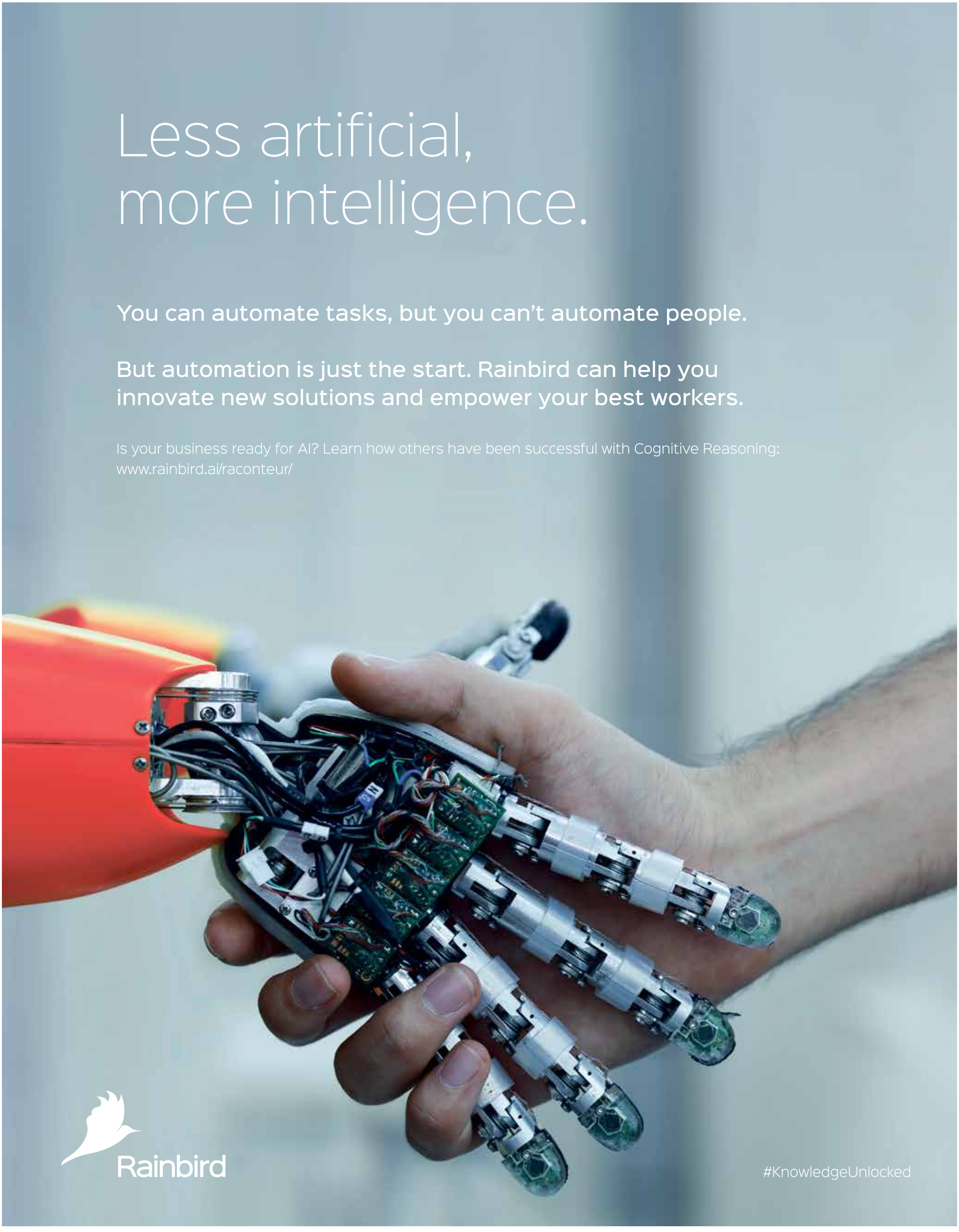

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#KnowledgeUnlocked

ARTIFICIAL INTELLIGENCE FOR BUSINESS

DISTRIBUTED IN
THE TIMES

PUBLISHED IN ASSOCIATION WITH
The AI Summit
www.theaisummit.com

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Alamy

Machines are learning business

Artificial intelligence is no longer a geeky research project – the technology is developing fast and is ready for adoption now

OVERVIEW

CHARLES ARTHUR

If you think it's not worth your business bothering with machine learning, consider what rivals might be doing. Google now uses it as the third most important weighting factor for producing search results. Amazon uses it for computer vision so teams of robots can pick from a million items in warehouses to make up goods parcels for delivery. Stratified Medical, a company in London, is using it to spot patterns in data that humans miss and so identify potential new drugs.

Increasingly, companies are using cognitive intelligence, also known as machine learning, artificial intelligence, or AI, and neural networks, to do work that people either don't want to, because it is tediously repetitive, or can't because it involves data on too large a scale for any person or group.

For example, Google's Photos app uploads photographs from your smartphone to your account on the search company's servers; there you can search for "dog" or "cat" or "mountains" and the system will find them in your photos without you or anyone else explicitly tagging them. Google's machine learning system analyses the pictures to figure out what is in them, and does that across 200 million users and billions of pictures. No person would want to do that; no group could.

But AI is not just a consumer-facing technology. The scale of use is potentially huge. Cumulative worldwide spending on AI systems in enterprise will total $40.6 billion from 2015 to 2024, according to a recent report by marketing intelligence firm Tractica.

An example is Rainbird Technologies, a Norwich company, which is providing an AI-based sales advice tool to the credit card company MasterCard.

"It's all about interaction with the consumer," says Ben Taylor, Rainbird's chief executive. "AI becomes a great way to deliver the best possible customer journey. We do a lot of work with the financial services industry where the question is how do you know you're providing the right product to the consumer?"

Rainbird's collaboration with MasterCard aims to capture the existing knowledge and experience of the salesforce, and put that into software which will "learn" over time how different teams optimise their work, and spread the best practice and techniques across the team. In time, it will be a virtual sales assistant.

Widespread concerns that AI systems will take away jobs are misplaced, says Laure Andrieux, an entrepreneur looking at opportunities being created by the rapid rise of easily deployable neural networks. "Nobody complains that washing machines or dishwashers are 'taking away jobs'," she notes. New forms of work are sure to be created, just as in every technological revolution before. We just don't know yet what they will be like, rather as the Wright Brothers' first flight didn't obviously imply a future need for cabin crew or carbon fibre turbine blades.

$40.6bn

will be spent on artificial intelligence systems for enterprises from 2015 to 2024

Source: Tractica 2015

However, machine learning is disrupting existing business models and will do so to businesses that fail to adapt. "The strongest argument for anyone wondering if they need to use it is that if you don't, change will be forced on you from outside by those who do," says Calum Chace, author of *Pandora's Brain*, who has studied the topic closely.

"Look at Uber; it's using AI to disrupt the taxi business. Look at call centres; in ten years that work will probably be done best and cheapest by AI. Banking is facing the threat. Vehicle makers have notably begun pouring billions into self-driving technology because they can see that could have a drastic effect on car use and ownership, and don't want to be left behind."

Often it is businesses with the biggest risk-reward ratio that are most tightly focused on the potential benefits of this technology and are embedding it into their workflows.

For example, according to John Overington, vice-president of Stratified Medical: "It's no longer economically viable to do drug discovery as it used to be done." At current costs, the $490-billion market value of Alphabet, Google's parent company, would pay for just 40 new drugs. But as more is understood about genetic sensitivity to drugs, the potential for reusing already discovered molecules for new treatments is growing.

"We now use the data that has been collected in the past and re-analyse it, and use it in inventive and creative ways, spanning all the phases from discovery to development," says Dr Overington.

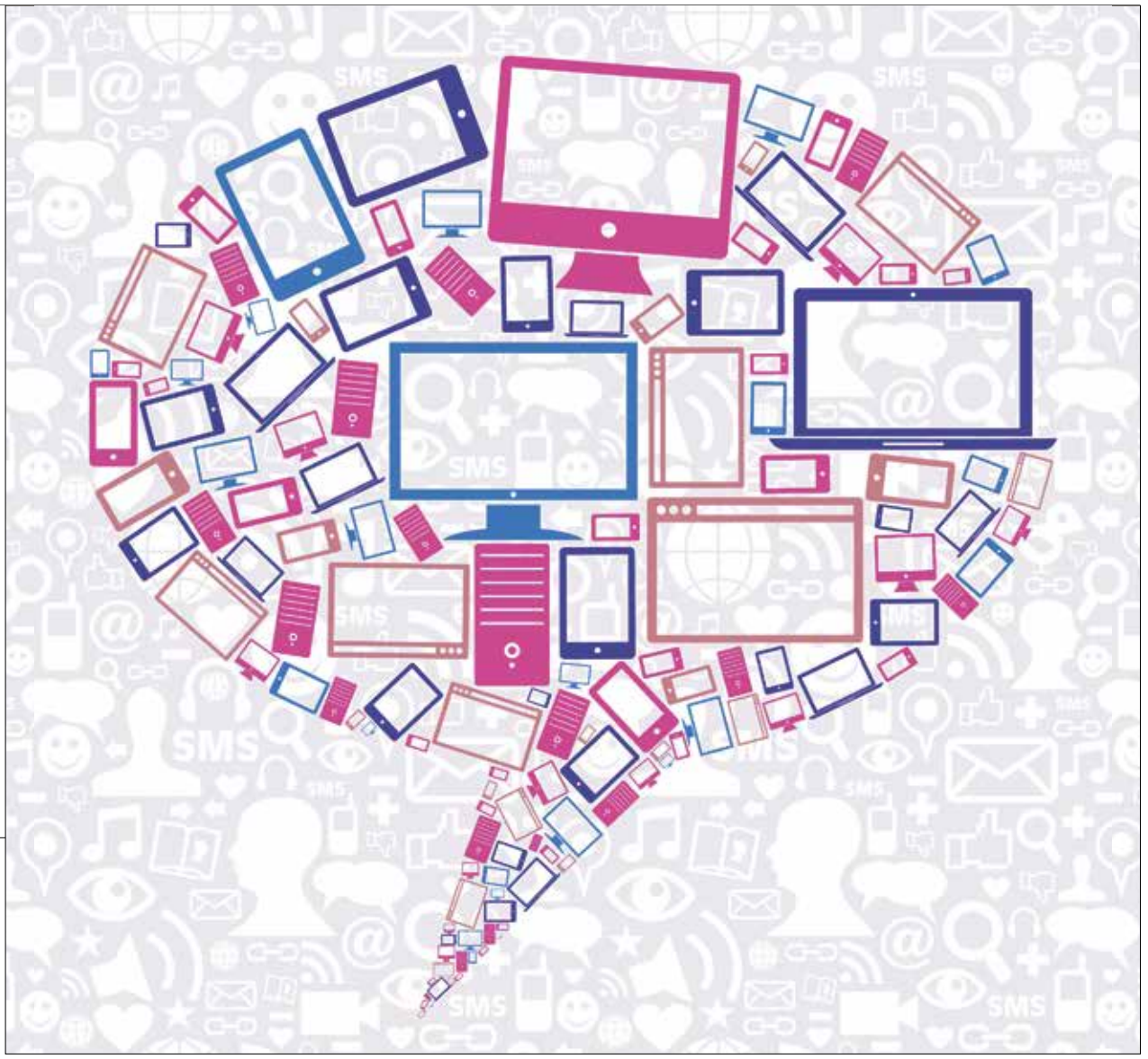
Transforming a business so that it is centred on AI requires identification of the elements that presently generate too much data for simple analysis. Rainbird's Mr Taylor says that after years when AI, neural networks and machine learning were all deeply geeky research topics in university laboratories, it's all now coming to fruition. "Now there's a will to use it, and we have access to large data sets and faster computers, which we never had before," he says.

Mr Taylor adds that it's also a time when early adopters can reap the benefits. "It's still quite early and there's space for first-mover advantage," he concludes. "If you can take a leap ahead of competitors, this technology is ready right now."

COMMERCIAL FEATURE

Q&A: MAKING AI WORK FOR YOUR BUSINESS

***Lawrence Flynn**, chief executive of Artificial Solutions, the software company behind Teneo, a natural language development and analytics platform, tells how it is transforming the way businesses use artificial intelligence*



ARTIFICIAL **SOLUTIONS**

Q Why do businesses need conversational, artificially intelligent technologies?

A Artificial intelligence, or AI, is fast becoming a business-critical factor for enterprises. It strengthens faltering customer relationships through closer engagement and realises revenue opportunities that might otherwise have been missed.

A key capability in any AI application is the ability to exhibit humanlike intelligence by holding a natural conversation, one in which the application can understand, predict and respond appropriately to the user.

The launch of Siri was the first step in this revolution and the near-constant stream of intelligent conversational devices launched since then has only heightened the consumer desire for more. Customers are already demanding an enhanced, more intelligent experience from their utility providers, telcos, banks and retailers.

This trend will become so compelling that by 2020 conversational applications will usurp even web technology's meteoric rise to business-critical status.

Q What is Teneo and why did you build it?

A Teneo is a platform that allows companies to create artificially intelligent applications that interact with users in a natural and realistic way.

Importantly for businesses, it delivers sophisticated capability without the need for extensive development effort and time because Teneo automates many of the processes that make developing these applications so resource intensive.

With Teneo, customers can talk to their technology just as if it was another human and receive an intelligent response. Teneo remembers past conversations and is able to veer off to discuss a different issue, then use its memory to return to the original topic. Unlike many humans, it also remembers a user's preferences from one interaction to the next.

Think of how many different ways there are to ask to book a train ticket to Edinburgh. Teneo's natural language interaction technology allows it to understand all possible phrasing of the same basic question and then act accordingly, even predicting the next move. Customer: "I fancy going to Scotland for Hogmanay." Teneo: "I'll check the train times to Edinburgh this New Year."

Q How is Teneo being used?

A Teneo is already used in millions of natural language conversations annually. It is deployed by our customers, partners and developer community across 26 countries and in 35 languages. Enterprises such as Vodafone, Shell, Telenor and DHL are using Teneo to enhance their customer experience.

Q Why build a platform rather than an off-the-shelf solution?

A We wanted to put the power of AI-based systems in the hands of businesses. There are thousands of use-cases for Teneo; by a bank to discuss account transactions, by a utility company to pay bills and change personal information, or by a manufacturer to interact with an internet of things device. Each company has a unique culture and a different way of doing things. Teneo makes it possible to build AI experiences tailored to each of them.

But this is only part of the story. Once companies start using Teneo, they see the difference it can make in other areas of the business. Teneo's flexibility means they can define their own use-cases and develop as many additional applications as they want to, reusing much of an original build and delivering an even greater return on investment.

> By 2020 conversational applications will usurp even web technology's meteoric rise to business-critical status

Historically, creating these sophisticated interfaces has required specialist skills, significant resources and a great deal of time. Teneo changes this by eliminating the need for specialist linguistic skill sets. For example, its advanced machine-learning capabilities automatically write the complex underlying language code and algorithms that simulate the way a human thinks.

Q How can companies use the data Teneo-based applications create?

A It is a virtuous circle. Every single conversation a customer has with a Teneo-based application is automatically logged. Teneo then uses other AI techniques to train itself automatically to improve its performance, use the information in real time to personalise the conversation and understand the mindset of the customer as never before.

Secondly, we offer a unique proposition to our clients. We don't try to compete with them for their conversational data. Many of the tech giants that offer alternatives harvest the data in order to use the information for their own benefit. But we believe it's vital companies own their data themselves.

To help maximise its hidden potential, we provide the tools to mine what is a huge treasure trove of unstructured, first-person, "voice of the customer" data. It's like being able to listen in to every sales assistant conversation and every customer support agent interaction with customers, understanding their intentions, actions and behaviours. Imagine knowing exactly what was the last thing your customer said before they purchased?

This information can then be used to optimise, not just the conversation, but business processes, product trends and hidden growth opportunities.

Q What is the future for AI?

A We predict that in the next 18 months, those customer-facing businesses that want to survive the digital transformation into AI will rush to have user-friendly, effective natural language interfaces.

In the longer term, this will develop into a more complex ecosystem where different interfaces are able to interact with each other to provide a seamless experience for the customer. To do that enterprises will need a technology that's fast and easy to use, and simultaneously works across devices and operating systems, in any language.

And this is exactly the vision that Teneo is delivering now.

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

CASE STUDY: SHELL

Shell created digital assistants Emma and Ethan to advise customers on the technical aspects of its lubricants business. The assistants know the details of tens of thousands of unique Shell products and specifications, and can answer a wide range of queries and technical information requests, from suitability for a particular vehicle, engine and use, to performance benefits.

Initially launched in the UK and US, the application is now available in several languages, including complex ones such as Russian and Chinese.

Shell say the technology has already reduced the activity to its call centre by 40 per cent. It also enables them to supply consistent and legally accurate answers across the many different markets and regulatory environments. The feedback to Shell's Teneo-based applications has been impressive, with 99 per cent of user expectations met.

VIRTUAL ASSISTANTS

JOANNA GOODMAN

Offices of x.ai, which has developed a virtual assistant compatible with major time-management apps to schedule meetings nearly autonomously

Get used to chatbots in your business life

They may still be a novelty, but virtual assistants look set to become labour-saving, revenue-generating additions to UK organisations

The digital virtual assistant or VA is shaping up to become a cornerstone of the post-app world. "In the not-too-distant future, users will no longer have to contend with multiple apps; instead they will literally talk to digital personal assistants such as Apple's Siri, Amazon's Alexa or Google Assistant," says Mark O'Neill, research director at Gartner.

Gartner predicts that by 2019 at least a quarter of households in developed countries will use VAs. And as they become more popular, they are evolving to reflect users' preferences and incorporate new technology.

VAs are personalised cross-platform devices that work with third-party services to respond instantly to a user's requests, which could include online searching, purchasing, monitoring and controlling connected devices, and facilitating professional tasks and interactions.

This type of artificial intelligence or AI-powered assistant provides genuine user-centricity as its natural language processing (NLP) and machine-learning capabilities mean its responses reflect user preferences in real time and evolve with each interaction.

While some businesses provide their own VAs, others make their services and data available on mainstream platforms. For example, you can use Siri or Alexa to call an Uber.

So-called conversational commerce offers instant consumer gratification and instant revenue for businesses. And there are parallel advantages within the enterprise as instant responses to queries improve productivity and job satisfaction.

A significant development in the VA market is the voice-only interface which started on smartphones – Siri, Cortana and Facebook Messenger's M.

Next-generation VAs are moving on from apps. At TechCrunch Disrupt, Siri's co-creator Dag Kittlaus gave the first public demo of Viv, which replaces apps by using NLP and dynamic program generation to write new software in real time in response to each natural language command.

Unlike Siri, Viv can deal with follow-up questions. This is an example of what Harrick Vin, vice president and chief scientist at Tata Consultancy Services, and inventor of ignio, an AI engine which converts IT operations into intelligent software, describes as "service-as-a-software".

The internet of things, ranging from connected appliances and smart environments to cars and smart cities, has accelerated use of the standalone intelligent speaker. Amazon's Echo has sold some three million units and there are plans to ship another ten million. Like Siri and Cortana, Echo's virtual assistant Alexa uses a voice-only interface.

In May, Google announced Google Home, an Alexa rival that will tie in with Google's services and platforms, including Google Assistant, which unlike Siri adds context to conversations.

The voice interface facilitates multi-tasking. "Voice enables unbelievably simple interactions with technology and customers love the convenience of being able to listen to music using only their voice, setting alarms and asking for information when their hands are busy, listening to the news in the morning as they get ready for work, and so much more," according to a spokesperson from Amazon Alexa.

Businesses recognise the potential of gateway VAs that interface with multiple services and standalone VAs that complete specific tasks. One example is x.ai's Amy Ingram, which works with Google Calendar, Office 365 and Outlook.com to schedule meetings "nearly autonomously", says founder and chief executive Dennis Mortensen. Users copy amy@x.ai into an e-mail and the VA liaises with the other party via natural language e-mails.

The VA is encroaching into mainstream enterprise technology. Microsoft added its voice-activated digital assistant Cortana to the Windows 10 operating system. Dave Coplin, chief envisioning officer at Microsoft UK, refers to "conversation-as-a-platform". He says: "VAs' interconnected capability focused on human outcomes will be massively powerful within organisations.

"Cortana works across all my devices. She knows my schedule, so she lets me know when I need to leave one meeting to get to my next appointment. Potentially, she could suggest flights and hotels as soon as I add a trip to my schedule, and connect me with colleagues working on relevant topics."

Apple announced at its Worldwide Developers Conference that Siri will be coming to desktop and laptop computers, enabling users to search for photos, documents and music via voice commands, and switch seamlessly between Apple devices. For example, Apple Watch users will be able to log in to their Macs without a password.

Google recently launched Springboard, its digital assistant for enterprise customers, which "helps you find the right information that you need at the moment that you need it", according to Prabhakar Raghavan, vice president of engineering for Google Apps. "It searches quickly and easily across all your information in Google Apps and... assists you throughout your workday by proactively providing useful and actionable information and recommendations," he says.

Although voice is not always the appropriate interface, Echo is proof that people engage with online services without a screen. Amazon Alexa is building prototypes with multiple verticals and industries.

> So-called conversational commerce offers instant consumer gratification and instant revenue for businesses

Kate Boeckman and Jennifer Singh, of Thomson Reuters' applied innovation group, are working on integrating billable hours tracking for lawyers, as an extension of their existing voice-activated app via the Eikon platform and access to publishing content, into the Alexa platform.

Dave Cox, head of innovation at M&C Saatchi, believes that VA take-up by business will be driven by added value. "A lot of our lives will be managed by VAs because businesses will realise infinite economies of scale. Gradually, bots will take over straightforward tasks and, when we look back in ten years' time, we will realise that half the stuff we've delegated to machines used to be done by people," he says.

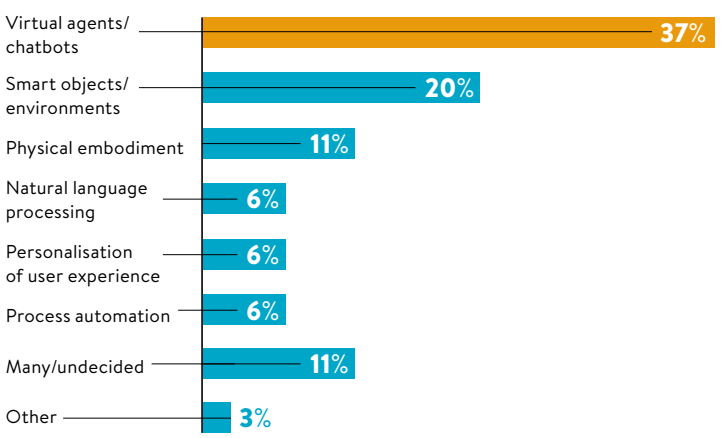
At Microsoft, Mr Coplin says the main challenges are around asking the right questions, as well as trust and control. This could include how far personalisation can go before the "uncanny valley" phenomenon – disengagement with things that appear nearly human – kicks in, particularly in relation to business applications.

x.ai's success suggests that automation is becoming more acceptable in a business context. But Ms Singh at Thomson Reuters believes VAs are limited because they are not yet able to engage in continuous dialogue. Microsoft's Tay incident earlier this year, when the AI chatbot released controversial tweets on Twitter and was taken offline, illustrates that VAs need to be positioned carefully so they learn from appropriate interactions.

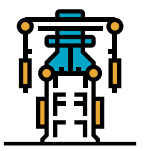
Mr Cox offers another, more philosophical, dilemma. He points out: "There is something satisfying about completing a technical task perfectly, but those logical tasks are exactly the ones that will be easy for businesses to hand over to VAs."

FUTURE CONSUMER APPLICATIONS OF AI

WHERE AI STARTUP FOUNDERS SEE APPLICATIONS IN FIVE YEARS



Source: TechEmergence 2016



25%+

of households in developed countries will use virtual assistants by 2019

Source: Gartner

‘Human’ bots are chatting up customers

Artificial intelligence, although embedded in a computer driven by clever software, can nevertheless connect with consumers on a personal level and, through management efficiencies, enhance customer service

CUSTOMER CENTRICITY

HAZEL DAVIS

KPMG and the Consumer Goods Forum have just released research revealing that retail and manufacturing executives are investing significantly in smarter analytics and technologies.

According to the research, usage of techniques such as predictive analytics, customer path to purchase analytics and artificial intelligence (AI) are expected to double over the next two years to 59 per cent, 54 per cent and 43 per cent respectively.

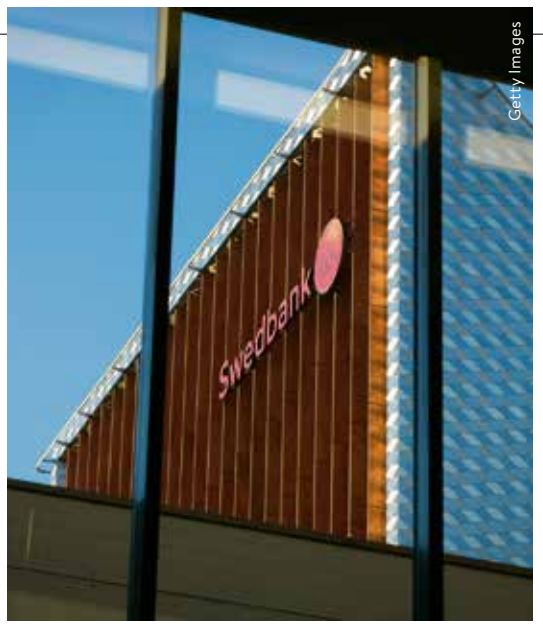
It’s no surprise why. We expect the human touch and if we haven’t got the human touch, we expect immediacy and accuracy.

According to the Institute of Customer Service *Customer of the Future* report, by 2025 customers will have a much lower tolerance threshold for mistakes, errors or technology problems and consumer power will play a more prominent role in influencing an organisation’s reputation and success. And AI plays a key role in this.

“AI may, on the surface, seem a daunting prospect, but in truth the technology presents a great deal of opportunity to help upskill workers and improve the worker experience,” says Justin Anderson, Europe, Middle East and Africa general manager at Appirio.

“For businesses, the implementation of AI should act as an extension to the current consumer-grade technology which is already finding its way into the business. The introduction of AI will allow workers to free up their time to take on more creative, strategic roles such as focusing on engagement and innovative leadership, things that will, at least in some sense, always require a human touch.

“AI systems aren’t here to create havoc in the way which horror-meets-science-fiction films would have us believe; they’re here to shepherd us into the next age of work for both human and machine.”



Getty Images

Swedbank’s Nuance Nina is an AI-driven virtual assistant delivering human-like conversational customer service

Some software works by using natural language processing to enable computers to understand words and meaning accurately in real time. Rant & Rave, for example, is a customer engagement technology currently powering the customer service of more than half of the FTSE. Rant & Rave’s technology involves fast feedback, analysing customer feedback in real time, through the use of a so-called sentiment engine, which accounts for things like sarcasm, idioms and emoticons, but flags ambiguities for human attention.

Banking group Swedbank has introduced its own Nuance Nina, an AI-driven virtual assistant, which delivers human-like conversational customer service. The bank says Nuance Nina has helped it improve the customer experience, including a 78 per cent first-contact resolution within the initial three months and a hit rate of eight out of ten questions answered.

Swedbank’s research found that 89 per cent of consumers want to engage in conversation with virtual assistants to find information quickly, instead of searching through web pages or a mobile app on their own.

“When we talk about AI, one of the biggest misconceptions is the idea that it involves a sentient and conversational machine or software,” says Stephen Parker, chief executive of digital engagement specialist Parker Software. AI can be anything from simple software analysing sentiment to artificially augmented intelligence.

“In customer service, there’s been a trend recently of using chatbots to deliver pre-determined messages to customer inquiries, removing humans from the equation,” says Mr Parker. “This seems like a simple solution and it is, though it isn’t the most effective one. In order for companies to make a connection with customers that truly matters, there needs to be a different use of artificial resources.

“For example, if a customer spends a lot of time on the customer service page of a website, it is highly likely they have a problem, query or complaint. Using reverse IP look-up, companies can identify these individuals and use automation software to notify the right member of the customer service team, while also using intelligent analysis to cross-reference with any inbound messages the customer may previously have sent.”

Use of intelligent software like this can enhance the customer service experience without being intrusive.

Software such as Trax is transforming in-store analytics by giving manufacturers visual access to stores. Trax offers AI to consumer goods manufacturers, such as Coca-Cola and Heineken, to understand better how products are performing on the supermarket shelf, and ultimately improve in-store execution and consumer engagement. Trax enables retailers to check that promotions are running correctly, items are not out of stock and are in the right position.

> Use of intelligent software can enhance the customer service experience without being intrusive

Retail management software company Retail Pro International is using AI to recommend relevant products to customers. Performing a kiosk function, the system draws upon three key data sets to provide relevant recommendations both at the time of purchase and when customers speak to a store associate.

Chief executive Kerry Lemos explains: “These recommendations can be made based on three key metrics – customer purchase behaviour, associated products and like purchases from other consumers. The system can begin recommending options to a consumer much in the way a store associate would be doing with direct interaction and engagement.

“We can begin to see a migration where an AI system in a kiosk environment serves as a store concierge to the consumer, giving them the freedom to explore and buy at their comfort of engagement. Doing otherwise would require a lot of time and research on the part of the store personnel and likely leave the consumer with a perception that the retailer doesn’t, or worse cannot, understand their needs and likes.”

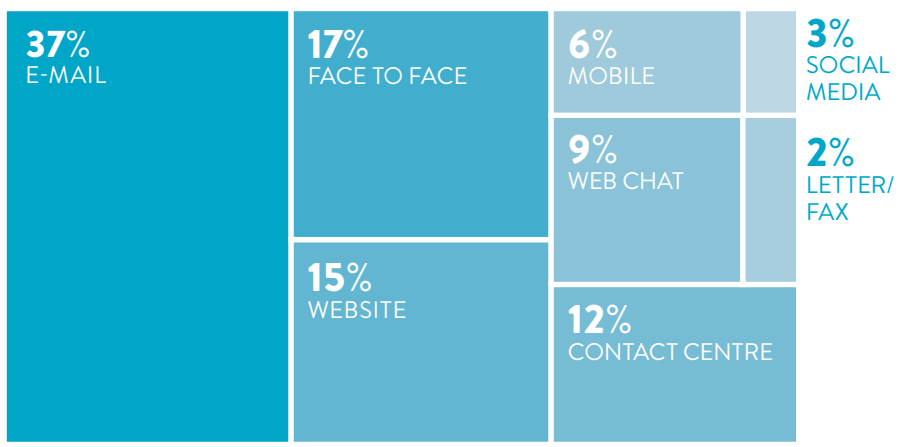
However, for any AI to automate accurate responses and serve customers most effectively, it must have access to the right pools of information and data.

Peter Wilson, strategic consultant at analytics company Verint Systems, says: “If a customer profile is incomplete, it limits the AI machine’s ability to manage customer interactions successfully. This can be challenging as many businesses struggle to aggregate and house their data effectively.”

Mr Wilson says transparency around the collection and use of data will be key for brands to capitalise on the power of AI. “Global research conducted by Verint found that UK consumers are more comfortable sharing data with their banks and financial service providers than other suppliers, so it’s not surprising banks are the front runners in implementing AI technologies,” he says.

Danny Bagge, IBM’s retail industry director, says machine learning is industry-changing. “A fashion retailer might have six or so high-level

CUSTOMERS’ PREFERRED METHOD OF COMMUNICATING WITH A BUSINESS



Source: myclever Agency 2016

IS THIS THE END OF THE CALL CENTRE?


Shutterstock

"By implementing a digital workforce of software robots, organisations can ensure that work is done around the clock, eliminate human error, reduce human dependency to drive revenue and ensure an 'always-on' service for customers," says Gajen Kandiah, executive vice president of business process services at technology consulting and services firm Cognizant.

Mr Kandiah doesn't believe it means the end of human interaction. "Businesses that are embracing these technologies are capturing more data, improving processes and generally empowering workers to be more effective at their jobs," he says.

"Having more customer data at employees' fingertips and being able to share it across the business can allow them to respond to customer queries directly and more quickly without having to ask colleagues across different departments."

Research into chatbots from social media experts at myclever has found that 68 per cent of consumers like the idea of the 24-hour service provided by bots. When told about the benefits, consumers in the research regarded chatbots as the key-holders to speed, unlocking immediacy and convenience in online services.

But Verint Systems' Peter Wilson says: "At this stage, a principal benefit of AI is to field many of the more one-dimensional inquires, such as balance checking and password changing, via virtual assistants, in-store virtual helpdesks and automated chat."

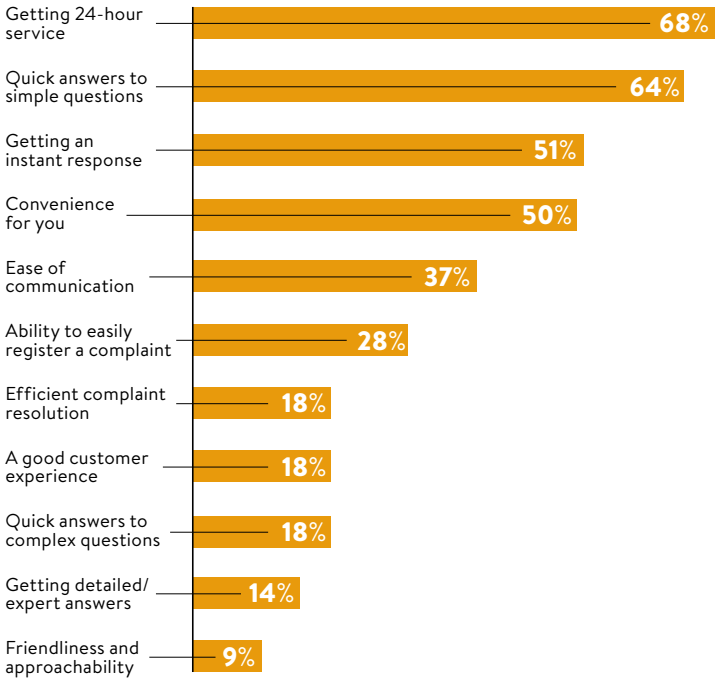
Mr Wilson believes that human customer service offering will remain integral as many customers will still value the personal touch for more complex or personal issues. "AI will allow businesses to prioritise these interactions and empower customer service agents to focus on responding in a timely and appropriate manner, helping to forge closer relationships and promoting loyalty," he says.

segments and a number of seasons. That's a low number of ranges, but they have armies of people doing detailed and complex work. Imagine if I could give you a personalised range," he says.

Machines can learn about styles, materials and cuts, related products and weather, resulting in an individually tailored offer.

Mr Bagge adds: "The bar on personalisation just gets higher, but where it really gets interesting is in the product area. Personalisation has been heralded as the thing that helps retailers get back to personal service. You have to be a big player with a lot of data to do this, but understanding your product in fantastic detail gives you an equal chance to offer great customer service."

CONSUMERS' EXPECTED BENEFITS FROM CHATBOTS



Source: myclever Agency 2016

COMMERCIAL FEATURE

SHINING A LIGHT ON CUSTOMER EXPERIENCE WITH AI

The key to business success is changing as consumers gain power and influence

LUMINOSO

In a world where customers can research products and compare prices online, buy from any company in the world and influence other shoppers via social media – which Forrester Research has termed the "age of the customer" – businesses must compete on the quality of the service they provide.

"Truly understanding what the consumer is saying and rapidly responding is becoming more and more critical to business survival – artificial intelligence (AI) is key to success in this," says Catherine Havasi, chief executive of Luminoso.

Not becoming customer-centric has real consequences. Research conducted this year by Accenture reveals that 52 per cent of consumers have switched to another company in the past year due to poor customer service. Once these customers have left, they're usually gone forever; 68 per cent of customers who have switched say they will not return.

The customer experience industry is changing to reflect this new reality. While companies could previously get away with sporadically collecting and analysing consumer data, real-time analysis is now a necessity. Companies are increasingly turning to artificial intelligence and natural language processing tools to track and address feedback, making it easier for instantaneous understanding and reaction.

Luminoso, a text analysis company, uses AI in conjunction with natural language processing and machine learning to help its clients understand not just the words customers are using, but also their underlying sentiment and intent. The software works, simply, by turning language into mathematical vectors using ConceptNet, an open-source semantic knowledge base created at MIT Media Labs. ConceptNet is part of the AI backbone that teaches computers to "think" like humans.

This semantic application of AI encases the words and phrases that people use, and the common-sense relationships between them. This enables computers to understand accurately and automatically human language and, critically, to learn new words like slang, acronyms and industry-specific terms from the context in which those words appear.

By incorporating AI, the time needed to analyse customer data with a high degree of accuracy has shortened considerably, especially compared with legacy systems that rely on keyword searches and Boolean queries.

In one instance, Luminoso worked with an industry-leading design software company to analyse its live chat data. Luminoso's software surfaced a small, but growing, subset of complaints. These complaints took many forms, including "empty cart", "can't check out" and "products disappear".

> Truly understanding what the consumer is saying and rapidly responding is becoming more and more critical to business survival – artificial intelligence is key to success in this

Due to the AI capabilities of its software, Luminoso identified these complaints as symptoms of the same root issue, namely a technical bug with the company's online payment system that was causing customers' online shopping carts to empty when they tried to pay.

Luminoso was able to drill down a step further and determine that this problem was isolated to European customers. While the company worked on a comprehensive solution, its customer success team acted quickly to notify European customers about how to navigate the issue. This swift action prevented $11.5 million (£8.7 million) in lost sales.

Another Luminoso client, a leading office supplies retailer, provided rewards in exchange for used supplies. Luminoso's software began picking up numerous complaints regarding this reward programme. Chat logs revealed many customers were confused about the details of the incentive and were frustrated after trying to exchange supplies that did not qualify for a reward. The retailer was able to take steps immediately to clarify directions on how the programme worked.

Quick responses like this matter. As these clients found, rapidly analysing and taking action on customer feedback can both improve customer satisfaction and prevent lost revenue. Gartner reports that while 95 per cent of companies surveyed collect customer feedback, only a tiny 10 per cent actually implement improvements based on insights from this data.

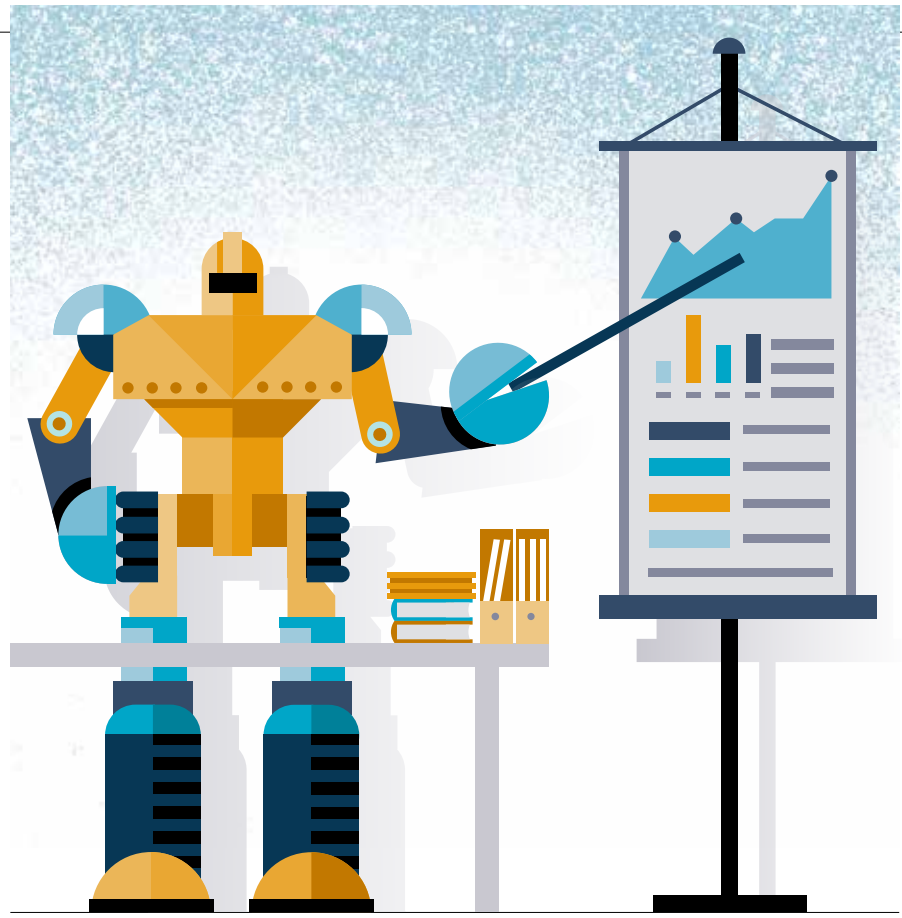
As Ms Havasi concludes: "If companies are to make the shift towards becoming truly customer centric, they need to work on not only capturing, but also understanding and responding to customer feedback."

For more information please visit www.luminoso.com

Top-down strategy to bring in AI tech

Introduction of artificial intelligence will transform business, but must be championed by the C-suite to reassure staff and customers alike that it is an opportunity, not a threat

BOARDROOM
DAVID BENADY



Business is on the brink of an automation revolution as artificial intelligence or AI transforms the way we work. AI powers virtual assistants from Apple's Siri to Amazon's Alexa and is the essential ingredient allowing Netflix to recommend films. AI systems such as IBM Watson are transforming the way banks and insurers assess risks, rewards and investments, and are helping doctors to analyse data about patients.

But the birth of AI is proving challenging for many organisations. It raises some complex questions about how the use of AI technology will change the way companies do business. Which areas will be affected? What are the first steps to take when integrating this technology and who should take them?

Some companies are starting to experiment with AI while others are unsure of the next steps to take. Josh Sutton, global head of the AI practice at consultancy Publicis.Sapient, gives the example of two global banks. At one, a senior executive told him the organisation is laying the foundations for deploying cognitive computing, an AI technology which uses machine learning to teach computers to mimic human ways of thinking and undertake human tasks. The bank is ready to start experimenting with this to find ways of driving down costs and serving clients.

But at a second global bank, the board of directors views AI with anxiety. They recognise the organisation is way behind in AI, but struggle to decide which executives in the business should lead the implementation of the technology.

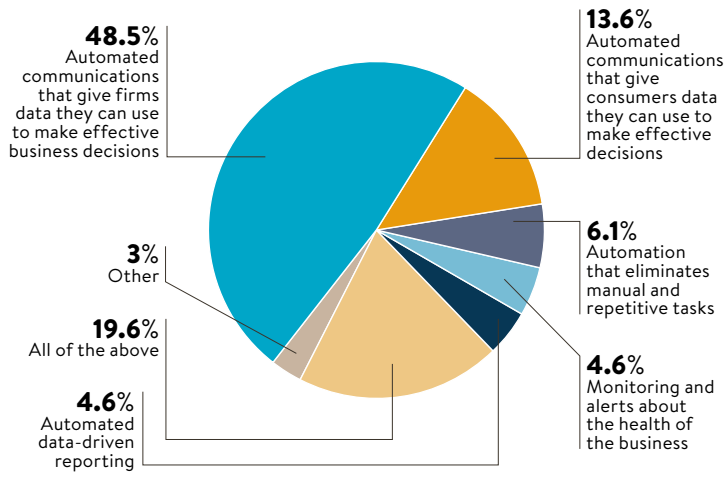
Mr Sutton says this paralysis occurs because AI does not fit neatly into any specific area of responsibility; it is not exclusively for the chief information officer, the chief marketing officer or even the chief operating officer. Rather, it needs to be part of an overall business transformation driven from the top down.

> AI needs to become something on the CEO's radar – it is not activity that lives within one of the traditional silos of an organisation

"AI needs to become something on the CEO's radar – it is not activity that lives within one of the traditional silos of an organisation, any more than being digital is something that lives with the chief information officer," says Mr Sutton. AI needs to be approached at a strategic level, he adds, as something that will transform the whole business.

Forward-thinking companies are handing responsibility for implementing AI to senior members of staff such as the chief innovation officer, who will evangelise for the technology across the business. More conservative businesses are bringing in management consultants to create a strategic plan and help implement it.

REASONS WHY COMPANIES CURRENTLY USE ARTIFICIAL INTELLIGENCE



Source: Narrative Science 2015

There is a sense of urgency to this. The lesson of recent years is that businesses need to disrupt themselves before a technology startup or innovation comes along and disrupts their industry from the outside, says Paul Chong, director of Watson Group for Europe, the Middle East and Africa at IBM.

Mr Chong says some companies are looking at implementing IBM Watson's AI capabilities through a "competency centre" approach, where they create a structure for working out how AI will affect different areas of the business.

IBM Watson is working with one global company which has put AI implementation under the remit of the chief technology officer, who is managing the competency centre. This starts by laying out a vision of how AI will broadly transform the organisation. Then a series of seminars and events run across the business to work with employees on how it will impact different departments. The idea is to create a hub of expertise in AI across many different areas of the business, though this knowledge doesn't need to be highly technical.

"You don't necessarily need machine-learning experts, but you need to know how these types of technologies can be applied. We've trained people to understand what makes a really good application of Watson or AI and what is not so good, what is applicable for today and for the future when the technology has advanced," says Mr Chong.

Meanwhile, Frank Palermo, executive vice president of global solutions at technology consultancy Virtusa, says executives need to know which jobs can be delegated to AI and which ones will always need the human touch. The technology is developing from "weak AI" focused on narrow, mundane tasks to "strong-AI" applications that use sentience and applied intelligence. This will transform the way enterprises manage their software. Strong AI will go beyond merely supporting employees working on customer relationship management and other software tasks; AI will start doing a part of those jobs.

Mr Palermo believes that every task now undertaken by humans will have the opportunity for AI input. "I'm a big fan of assistive technology, human plus machine is really where the benefits come from rather than machines replacing man or man fighting against machines. It is the combination of the two that will become really powerful," he says. The future for AI will lie in how the technology interacts and co-operates with humans, rather than replacing them, he adds.

Boards of directors will need to work hard to explain the benefits of AI to employees and customers. Otherwise they could face a backlash against the technology as the hysteria about AI's threat to jobs and customer service reaches fever pitch.

APPOINTING A ROBOT TO THE BOARD

DEEP KNOWLEDGE VENTURES

When Deep Knowledge Ventures (DKV), a venture capitalist firm based in Hong Kong, announced it was appointing a robot to its board of directors, it made headlines around the world.

This may have been little more than a public relations stunt, but it also raised some serious questions about the role of artificial intelligence (AI) in boardroom decision-making.

DKV, which invests in companies focused on age-related diseases and regenerative medicine, said the algorithm, called Vital, would make investment decisions by analysing large amounts of data. It would get to vote on whether to make an investment, just like other members of the board.

Observers quickly dismissed the move as a bid for publicity, claiming it would be incompatible with Hong Kong regulations as board members need to be accountable for their decisions and bear liability for any losses.

But the announcement played into the idea that computers could one day assume human responsibilities and take part in corporate decision-making.

The appointment of Vital raises the question of how much power should be delegated to AI. Algorithms are already tasked to make investment decisions on stock markets. However, while Vital and every other algorithm may make recommendations, ultimately the decision on whether to follow them is a question of human agency.

COMMERCIAL FEATURE

ARTIFICIAL INTELLIGENCE: A DIGITAL TRANSFORMATION ACCELERATOR

Nearly every industry in the world has been disrupted by digital technology, says ***Josh Sutton****, global head of data analytics and artificial intelligence at Publicis.Sapient*

PUBLICIS.SAPIENT

A recent survey by Russell Reynolds Associates of more than 2,000 C-level executives across 15 industries found that roughly 50 per cent expect their industry to be moderately or massively disrupted by digital in the next 12 months.

The question being asked by chief executives around the world is not if digital disruption will occur, but what it means for their business. Perhaps more importantly, organisations are considering how they can leverage digital transformation to advance their competitive position and improve performance. Increasingly, it has become apparent that artificial intelligence (AI) may very well hold part of the answer to those questions.

For the past 15 years, drivers of digital transformation have come in the form of information accessibility, initially by way of the internet and subsequently via mobile devices, principally smartphones.

The most recent wave of transformation is enabled by information insight, providing consumers with products and services that meet their needs when and where they need them. To provide such products and services requires the ability to collect and analyse vast amounts of structured and unstructured data, and to use those insights to inform business decisions and take action in real time.

Moreover, it requires the ability to fuse together multiple technologies and strategic solutions. The successful companies of tomorrow will be those that use this information insight to provide their customers with an experience which is personal to them and delivered on their terms. Furthermore, they will harness information insight from the outside in, from the perspective of their customers, as opposed to inside out, via traditional divisional and product silos.

There are three primary ways that AI is being used by market leaders to accelerate customer-centric experience design and achieve digital transformation – insight generation, customer engagement and business acceleration.

Insight generation involves extracting meaningful and actionable intelligence from ever-increasing quantities of available raw data. With the amount of information in the world nearly doubling each year, it is no surprise that data complexity is the top challenge standing in the way of digital transformation, according to preliminary results from a study by FORTUNE Knowledge Group and Publicis.Sapient.

One of the fastest growing uses of AI is to "listen" to all customer communications, both directly with a company and about that company in the market at large, ranging from call centre conversations to chat sessions and even social media activity.

AI tools are able to perform what no single human or even team of people could hope to do; they can read, review and analyse vast quantities of disparate data, providing insight into how customers feel about a company's products or services and why they feel the way they do. Luminoso, an AI company with its roots in MIT's Media Lab, has built a robust business performing precisely this task.

Customer engagement has long been the Holy Grail for marketing and customer relationship management programmes. Today, AI is radically enhancing the personalisation of information that fuels such engagement. Nowhere is this more evident than in AI's next big thing – chatbots and virtual assistants.

Chatbots are software programs that use messaging as an interface through which companies can help their customers answer questions, find information and offer personalised content. They are ideally suited to a mobile platform and have been made significantly more powerful by advances in machine learning and natural language processing.

Multiple companies, such as Viv, Facebook and Nuance, are providing frameworks and turn-key solutions in this space, allowing for services as diverse as media content distribution to customer service support and customised marketing campaigns. While the technology advances are exciting and bode well for business application, successful use cases will be grounded in a strong user-centred design process, leveraging the input of business and marketing experts as well as those of the IT division.

Business acceleration refers to how companies use AI to expedite knowledge-based activities to improve efficiency and performance. Examples range from hospitals finding potential patients for drug trials to financial institutions creating investment strategies for their investors.

While these types of activities are often viewed as opportunities to reduce costs through the automation of internal processes, they also should be considered in terms of their ability to transform the customer experience.

For example, if a bank can use AI to reduce the time it takes to approve a loan, it not only reduces its own costs, but also provides an improved customer experience. As a result, when AI tools such as Watson from IBM and Cyc from Cycorp are deployed, market leaders ensure they leverage the technologies with both cost-cutting and customer satisfaction in mind.

Market leaders are seeking practical applications to leverage AI in their pursuit of digital transformation. As a result, the AI industry is growing at a rate of 56 per cent annually, according to Tractica, and 25 per cent of jobs are expected to be impacted by AI technologies by as soon as 2019, according to Forrester.

> Market leaders are seeking practical applications to leverage artificial intelligence in their pursuit of digital transformation

This rate of change, particularly in consumer-centric industries, is unprecedented and requires a paradigm shift in how companies can reimagine their technological capabilities and organisational structure to engage better with their customers.

True digital transformation requires more than simply the application of the latest and greatest technology. It requires a customer-centric, outside-in perspective to enable the design of digital solutions that drive customer loyalty, engagement, consumption and satisfaction. Artificial intelligence will be the key to providing the tools, insight and acceleration that enable tomorrow's market leaders to thrive in this environment.

For more information please visit publicis.sapient.com

50%
of C-level executives expect their industry to be disrupted by digital in the next 12 months
Source: Russell Reynolds Associates

56%
annual growth of the AI industry
Source: Tractica

25%
of jobs are expected to be impacted by AI technologies as soon as 2019
Source: Forrester

A guide to AI market maturity

Robo-advisers can tell you which stocks to buy, but if you want to move into robot stocks you will need a cautious

INVESTMENT AND ADOPTION

DAN BARNES

This Christmas you could acquire a car laden with artificial intelligence (AI). It may only be a few inches long – AI startup Anki does not make them full size – but it's the direction of travel for the consumer market.

"We shouldn't underestimate how common AI systems already are in our lives," says Sarbjit Nahal, head of thematic investing at Bank of America Merrill Lynch Global Research.

Boris Sofman, one of the co-founders and chief executive of Anki, adds: "I believe we are now at the inflection point of realising AI's true potential, which will greatly impact many of the biggest and most entrenched industries, just as we're seeing with entertainment and transportation industries today."

As the use of this technology grows, so potentially does the commercial success of its developers. However, investors need to understand exactly what they are getting when they buy into stocks of firms that offer AI technology. The starting point is to understand what we mean by artificial intelligence.

> Firms are now able to put AI in a working environment with confidence so investors can get a clearer view of a business's offering and assess its potential

Back in 1980, John Searle, Slusser professor of philosophy at the University of California, Berkeley, split AI into two categories: strong AI, meaning a truly conscious mind; and weak AI, which replicates the action of the mind without understanding.

Professor Searle argued that digital technology could only develop weak AI. He said the former was impossible for digital computers to develop and that the commercial AI technology on offer today falls into the weak-AI category. Despite the moniker, this is powerful technology.

"The difference is akin to the way a child learns multiplication by rote, allowing them to give the right answer to a multiplication question without, at first, understanding why," says Professor Mark Bishop, director of the Tungsten Centre for Intelligent Data Analytics at Goldsmiths College, University of London. "Most people perceive that over time the majority of tasks humans do are vulnerable to being mechanised [using weak AI]."

Voice recognition, visual recognition and the reading of emotion all require weak AI to function. From a practical point of view these tools are specialist rather than being a general intelligence which can be adapted to different tasks. For the investor, this impacts where a firm has commercial opportunity. A self-driving car will not suddenly become sentient and begin to solve complex medical questions; the developers must have a particular market in which the technology can be applied.

The use cases of systems themselves fall into specific niches, which are incredibly varied. Hardware manufacturers that provide graphical processor units and other pieces that are necessary to deliver AI systems are one possible investment case.

A research report published by Bank of America Merrill Lynch Global Research last November noted eight key businesses that could serve as entry points for investors wanting exposure to AI stocks. These included the technology providers themselves, aerospace and defence, notably drones, automotive and transport stocks, financials, healthcare, industrials, domestic services, agriculture and mining.

The breadth of investment cases is, therefore, considerable. A dynamic that investors need to consider is the maturity of these systems. Firms are now able to put AI in a working environment with confidence so investors can get a clearer view of a business's offering and assess its potential as a stock to invest in.

A confluence of factors have led to a sudden rise in the growth of AI technologies, which allow for greater innovation and experimentation, says Professor Andrew Moore, dean of the School of Computer Science at Carnegie Mellon University in Pittsburgh, Pennsylvania.

"To help restaurants understand whether their customers are enjoying themselves, you can put in a system that measures smiles and face creases," he says. "Four years ago that was science fiction, now you can put that together pretty much using open source software."

ARTIFICIAL INTELLIGENCE STATISTICS, BY SECTOR

ARTIFICIAL INTELLIGENCE: Machine learning, deep learning, natural user interfaces

$70bn
estimated size of AI-based analytics market by 2020, up from $8.2 billion in 2013
Source: IDC

INDUSTRAL: Automation, industrial internet, robots

China
is the largest buyer of industrial robots and now makes up 25 per cent of the global market, forecast to rise to 38 per cent by 2018
Source: IFR

AUTOMOBILES/TRA…les

Up to $1.9trn
potential positive impact to the global economy from driverless cars by 2025
Source: McKinsey

AEROSPACE/DEFENCE: Unmanned systems, military and commercial drones, robots

10x
increase in US military spending on unmanned aerial vehicles between 2000 and 2016 to $2.9 billion,
Source: US Department of Defense

FINANCE: Robo-adv…

$2.2trn
of assets could be managed by robo-advisers by 2020, up from $255 billion in 2018
Source: AT Kearney/ MyPrivateBanking/KPMG/ McKinsey

…stems

90-115bn
hours spent performing household tasks could be saved a year in developing markets by 2025, equal to cost-savings of $200-500 billion
Source: McKinsey

570k
robo-surgery procedures were performed in 2014, compared with 1,000 in 2000
Source: Intuitive Surgical

HEALTHCARE: Medical robots and computer-assisted surgery, telehealth, carebots, bionics

SERVICE: Carebots, companions, domestic, education, entertainment, personal, transport, security

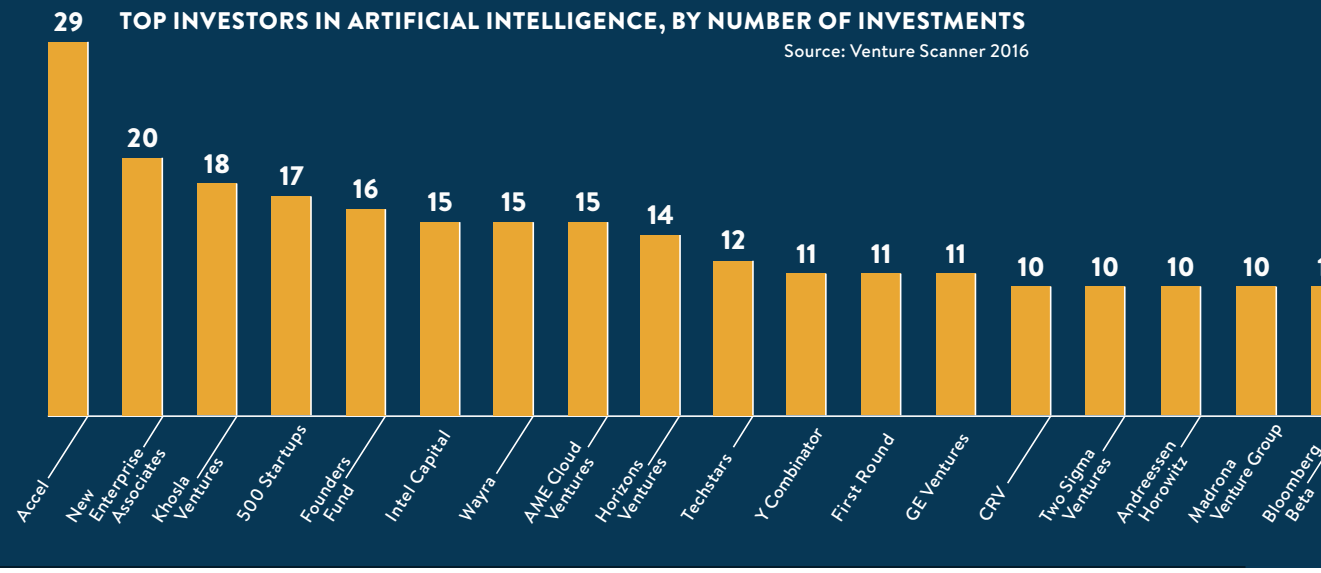
$16.3bn
estimated size of the global agribot market by 2020, up from $817 million in 2013
Source: WinterGreen

AGRICULTURE: Agr…

…s, precision agriculture

TOP INVESTORS IN ARTIFICIAL INTELLIGENCE, BY NUMBER OF INVESTMENTS

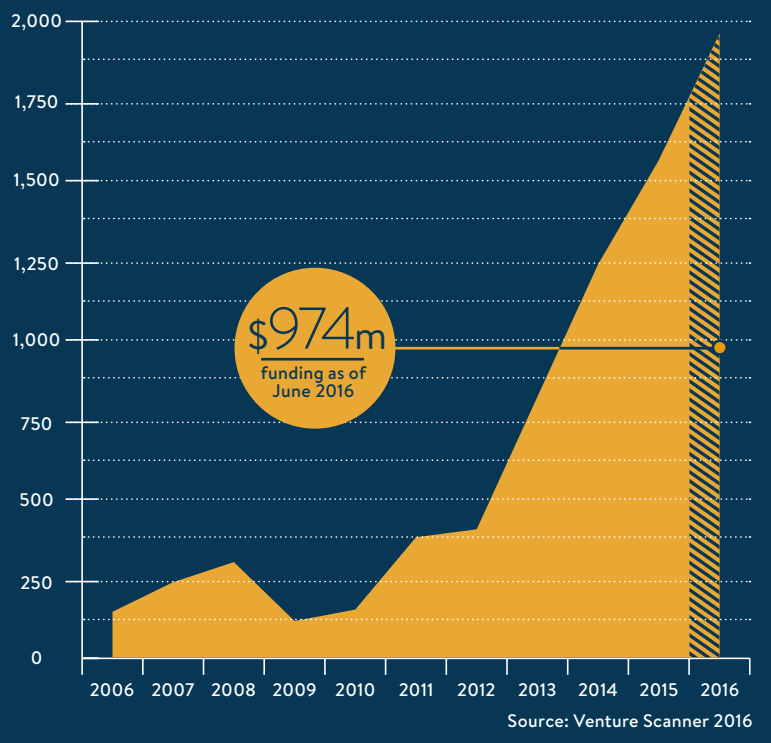
Source: Venture Scanner 2016



y and how to buy into stocks

s eye, although strong investment opportunities do arise in the global markets

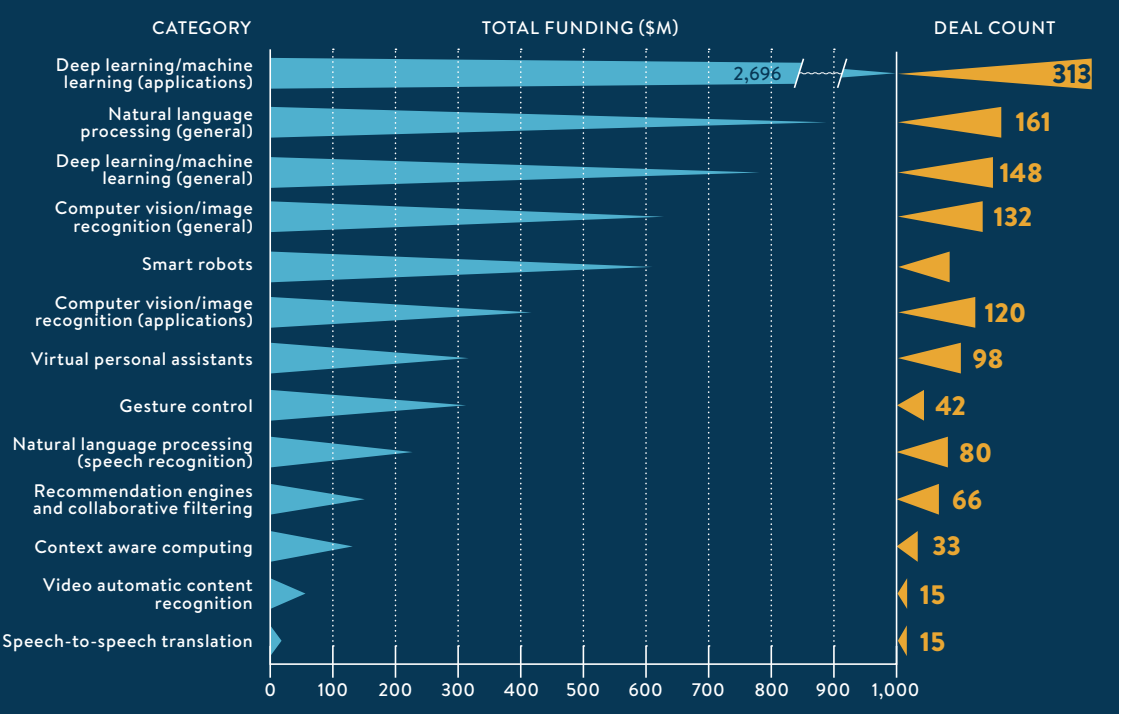
ARTIFICIAL INTELLIGENCE ANNUAL FUNDING ($M)



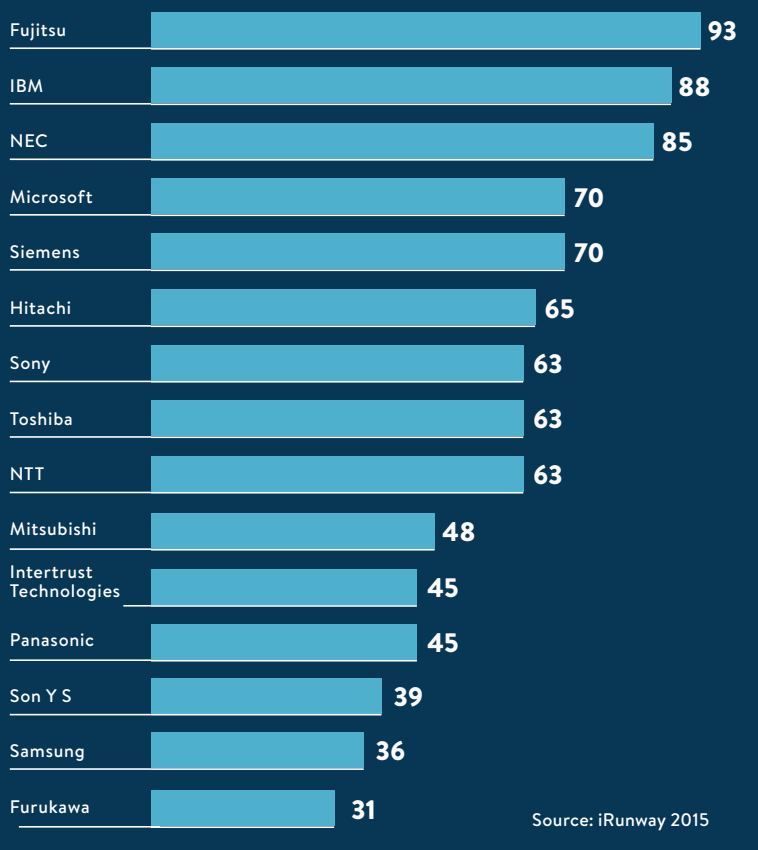
Source: Venture Scanner 2016

VENTURE FUNDING IN ARTIFICIAL INTELLIGENCE

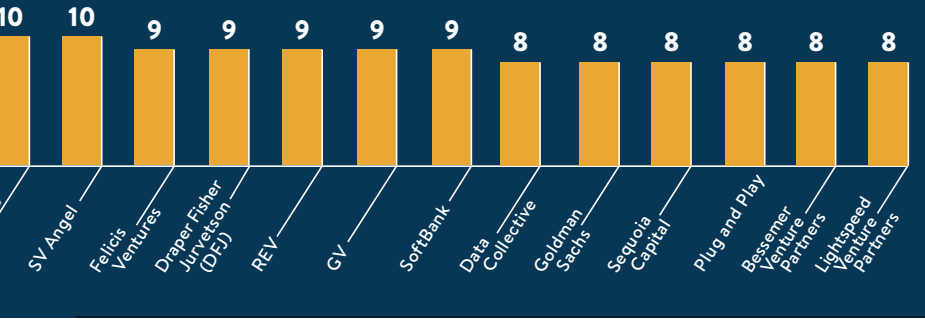
Source: Venture Scanner 2016



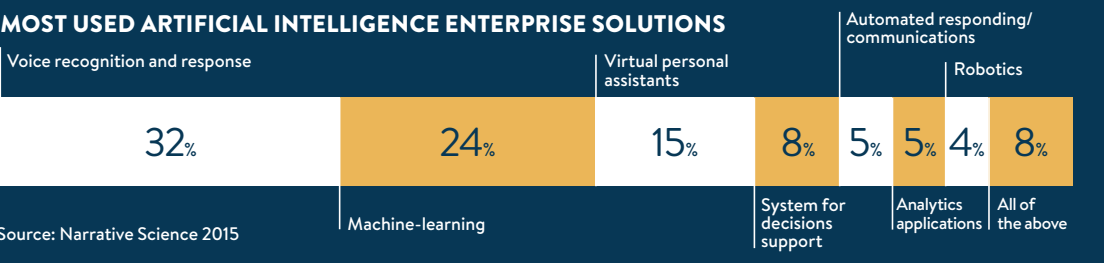
TOP HOLDERS OF ARTIFICIAL INTELLIGENCE PATENTS



Source: iRunway 2015



MOST USED ARTIFICIAL INTELLIGENCE ENTERPRISE SOLUTIONS



Source: Narrative Science 2015

An example visible to the public has been the rise of AI personal assistants. Apple's Siri, Amazon's Echo and Microsoft's Cortana are all downloadable or built in to devices and make smart interpretations of what the user is saying.

"We are entering a world where some companies have a pretty good road map for the next five to ten years so there is an investment opportunity, but there will also be a profound period of disruption; some companies are just waking up to the fact that customer interaction will be very different by 2019," says Professor Moore.

The large digital firms and established technology providers are leading the charge in developing technology. In a February 2015 report, entitled *The real consequences of artificial intelligence*, Goldman Sachs found that the greatest number of AI-related patents filed with the United States Patent and Trademark Office were by IBM, followed by Microsoft, then private individuals and Google.

"When you look at everything behind the investments made and the patents filed, those numbers have increased and there is a relatively small number of companies coming to dominate the space, including traditional American technology firms as well as several Japanese IT companies," says Mr Nahal.

Firms that operate in the online environment are able to expose their tools to a greater number of users and thereby help their systems to learn allowing some firms to extend their position as leaders.

"The more users that are involved, the smarter a machine can get," Mr Nahal says. "The smarter it gets the more users you will have. So there is a compounding or network effect which does very well for the tech companies that are involved in this space."

He gives the example of service robots where growth has been far quicker than the market had anticipated. "It has already gone beyond the levels expected of 2020," he says.

The issue of control over AI will mean device manufacturers that can aggregate control over multiple AIs with a single interface will get an advantage and potentially disintermediate other firms offering AI.

"The way that shakes out will determine who the winners and losers are during this period in the market," says Professor Moore.

There are also unusual dynamics in the technology business, such as open source technology, which can change the capacity of new firms to rise up and develop new systems, in some cases undermining existing value and in other cases creating it.

Anki's development of AI-enabled toy racing cars and robot companion Cozmo will not come purely from internal developments, says Mr Sofman, and will also contribute to wider sector growth.

"We certainly don't think this is something that we can or should do alone, which is one of the reasons we are planning to release the Cozmo [platform development information] in the near future, to empower academics, researchers, developers and aspiring roboticists to use this incredibly capable platform for both research and entertainment applications," he says.

The adoption of open source and information-sharing in the AI sphere may well mean the growth of the sector can be far greater than is predicted even now.

AI could rescue a failing

As cyber criminals wage a seemingly relentless and damaging learning and artificial intelligence could be the best defence

CYBER SECURITY

DAVEY WINDER

The EMC global *Data Protection Index* revealed 22 per cent of UK businesses have suffered data loss in the last year. This comes at an estimated average cost of £920,000 to breached organisations. Cyber crime will likely cost the global economy £335 billion this year alone, according to the World Economic Forum's *Global Risks Report 2016*.

Meanwhile, the Hamilton Place Strategies' report, *Cybercrime Costs More Than You Think*, estimates the median cost of cyber crime has increased by nearly 200 per cent in the last five years and is likely to continue growing, while Juniper Research predicts the overall cost of data breaches will rise by £1.58 trillion up to 2019.

It's obvious the bad guys are winning and something needs to change. That change could well come in the shape of solutions driven by artificial intelligence or AI.

What do security experts actually mean when they talk about AI? "In the context of cyber security solutions, artificial intelligence means the use of machine-learning techniques to enable computers to learn from the data in a similar way to humans," says Eldar Tuvey, co-founder and chief executive at mobile security vendor Wandera.

A formal branch of AI and computational learning theory, machine learning focuses on building systems that learn directly from the data they are fed, so they effectively program themselves in order to make predictions.

Industry verticals, such as healthcare, insurance, finance and high-frequency trading, have applied machine-learning principles to analyse large volumes of data and drive autonomous decision-making. Now cyber security is catching up.

"Machine learning as applied to computer security focuses on prediction based on thousands of properties learnt from earlier data, whereas current techniques, such as signatures, heuristics and behaviour-monitoring, rely on simplistic, easily evaded data points," says Lloyd Webb, director of sales engineering in Europe, the Middle East and Africa with AI security vendor Cylance.

The key differentiator of this technology is that both old, previously

HYBRID AI: UNLEASHING THE SECURITY CYBORG

How important is it for artificial intelligence (AI) and humans to work together to monitor cyber risk, and can such a hybrid approach provide better results than either humans or AI alone?

"In practical terms, AI eliminates human errors," says Cylance's Lloyd Webb. "Machines don't get tired, they don't need tea or smoke breaks, they tirelessly continue to operate at levels of scale and performance that will always outclass human beings."

As savage as that sounds, he has a point; humans have neither the brainpower nor the physical endurance to keep up with the overwhelming volume and sophistication of modern threats.

Yet, for now at least, most security industry experts agree that we cannot eliminate humans from the AI security spectrum. For a start, as Dr Kevin Curran, reader in computer science at Ulster University, points out: "Most practical AI-driven cyber security approaches are a hybrid approach. IT managers must prepare their IT ecosystems for machine learning by capturing, aggregating and normalising relevant data beforehand."

That's before the machines have even been allowed near the data, let alone produced their threat predictions. Once you reach that stage, there's the critical role of humans in determining how accurate the analysis has been.

As Chemring Technology's Daniel Driver concludes: "The AI component provides the support, analogous to the productivity of a team over an individual, offering indications and suggestions which can be accepted or rejected by the user."

It is likely, he adds, that a collaborative approach will be taken in the foreseeable future between artificial intelligence and humans with the AI component effectively becoming one of the team.

cyber security sector

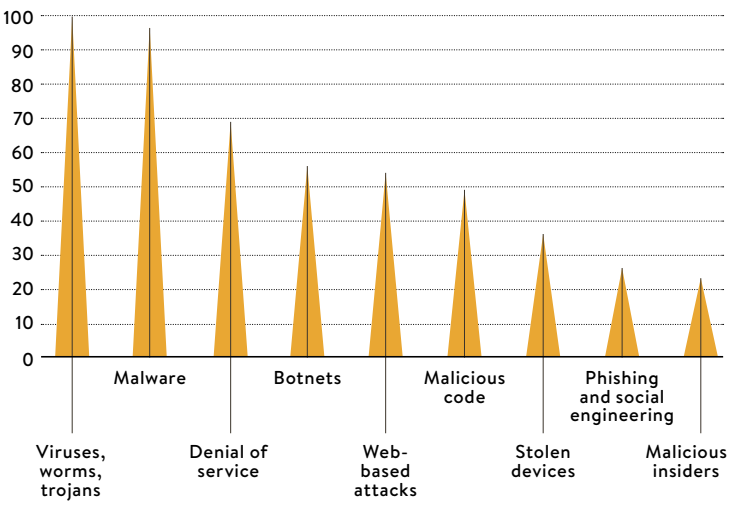
online war, which they appear to be winning, machine


Shutterstock

MIT's Computer Science and Artificial Intelligence Laboratory has developed an AI system that can detect 85 per cent of cyber attacks with high accuracy

SHARE OF COMPANIES THAT EXPERIENCED CYBER ATTACKS (%)

SURVEY OF SELECTED COMPANIES OVER A FOUR-WEEK PERIOD IN 2015



Source: Ponemon Institute/Hewlett-Packard 2015

known attacks, as well as new, previously unknown attacks, including those not yet written or conceived, are detectable. "This is the power of predictive machine-learning technologies to predict the future," says Mr Webb.

Neither he nor Cylance are alone in this belief. Guy Caspi, chief executive at DeepInstinct, is also a deep-learning evangelist. "Deep neural networks are the first family of algorithms within machine learning that do not require manual feature engineering," he explains. "Instead they learn on their own to identify the object on which they are trained by processing and learning the high-level features from raw data."

When applied to cyber security, the deep-learning core engine is trained to learn, without any human intervention, whether a file is malicious or legitimate. "The result of this independent learning is highly accurate detection – over 99.9 per cent of both substantial and slightly modified malicious code," says Mr Caspi.

Martin Borrett, an IBM distinguished engineer and chief technology officer of IBM Security Europe, thinks the IBM Watson system shows just what these AI-driven solutions are capable of. Watson is a cognitive computing system that learns at scale, reasons with purpose and interacts with humans naturally. It is taught, not programmed, and understands not only the language of security, but the context in which it sits.

"Watson will learn to understand the context and connection between things like a security campaign, threat actor, target and incident," Mr Borrett says. "This leads to cognitive systems not only understanding the language and connections, but learning from them and offering knowledge and suggested defence actions to security professionals."

It all sounds pretty straightforward, so why has it taken so long to come to the rescue of businesses under attack from the cyber-crime threat? The truth is that AI-driven solutions have had to wait for a perfect storm of four technological advances all blowing together.

"The most powerful results are likely to come where cheap high-speed processing capacity, data analytics that enables inferences to be drawn even from unstructured data, neural machine learning and the availability of large data sets of relevant digitised information to work on can be harnessed together," says Professor Sir David Omand, former director of GCHQ (Government Communications Headquarters) and now senior adviser to Paladin Capital.

> Machine learning as applied to computer security focuses on prediction based on thousands of properties learnt from earlier data

He thinks this puts GCHQ in a good position at the eye of the AI storm. "Ninety five per cent of the cyber attacks on the UK detected by the intelligence community in the last six months came from the collection and analysis of bulk data," he says.

"Right now GCHQ is monitoring cyber threats from high-end adversaries against 450 companies across the UK aerospace, defence, energy, water, finance, transport and telecoms sectors."

If malware, for example, can be detected with the assistance of AI at warp speed, then it may be possible to block the attack, including the deployment of active defences and the ability to reconfigure ICT systems in the light of an attack. "Just like the human immune system in the face of a hostile virus," says Sir David.

Martin Sweeney, chief executive at Ravelin, which is a UK specialist combining machine learning with graphing networks and behavioural analytics to help businesses with fraud detection security, sees AI-driven solutions as our immediate future.

"Current automated systems, in fraud at least, fall down because they try to mirror human decisioning – if X transaction originated in Y location with Z purchase price then decline," he explains. "These rules-based approaches require constant gardening and fail to allow the machines themselves to learn."

Mr Sweeney is sure that in the coming months the AI models will improve and the detection rates along with them. The main change, he insists, will be "the comfort that merchants feel in moving their fraud management from a largely human process to a largely automated one".

COMMERCIAL FEATURE

A MARKETER'S BEST BET: COGNITIVE CONTENT THAT INSPIRES ACTION

Emotion is the key to improving consumer engagement and inspiring action. Now, thanks to cognitive content, in other words "smart" or machine-intelligent content, scaling the production of the right words, phrases and images to elicit emotional connection is easier than ever

[PERSADO]

Caesars Entertainment, the owner of casinos, hotels and golf courses, was experiencing the challenge faced by many companies. Its marketing programme, albeit successful, needed a boost.

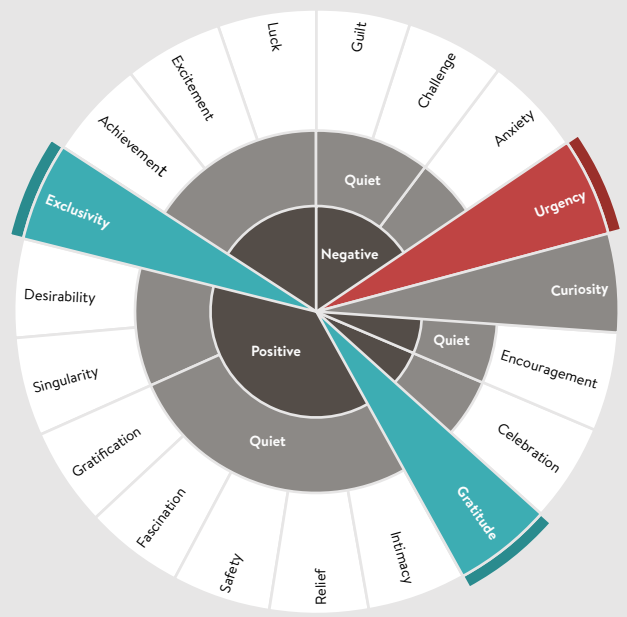
"We were achieving open rates on par with industry averages, but knew we could do even better. It was a matter of figuring out how," says Chris Jenner, vice president of e-mail marketing, in a recent webinar on customer experience. To get help, he approached Persado, a fast-growing, cutting-edge cognitive content platform for marketers.

"Marketers, especially ones like Chris, who are charged with addressing millions of consumers at a time, are all looking for ways to provide personally relevant content that drives engagement, at scale," says Lawrence Whittle, Persado's chief revenue officer.

Persado works on the basis that emotion is key to inspiring engagement in marketing. It has the world's largest database of more than one million tagged emotional and motivational words, phrases and images, collected over several years and scored against response data from over 40 billion impressions.

Its sophisticated software, what it calls "cognitive content generation", uses machine learning and natural language processing, along with a vast database of marketing performance metrics, to predict which message permutations will have the highest potential for success, unique to each touchpoint, including e-mails, landing pages, social media, mobile and display advertising.

PERSADO'S WHEEL OF EMOTIONS



Persado's database has a huge array of options in which to express emotions coupled with hundreds of thousands of offer and discount descriptions. The results are analysed and the system generates the best messages. It then creates a visual representation of the message performance and the most powerful content.

After working with Persado, Caesars Entertainment's Mr Jenner saw his e-mail open rate jump by 24 per cent and his click-through rate increase by a significant 46 per cent.

"We produced a 19 per cent open rate, but Persado came in with a 30 per cent open rate. I became a believer. Besides improved e-mail open rates, our click-through rate grew as well. That's because, as soon as we identified the right emotional language to use for each audience, recipients began to recognise our content as valuable," says Mr Jenner.

Powered by cognitive computing technologies, the platform eliminates the random processes behind traditional message creation, while also taking brand voice into account.

Persado, whose clients include more than 80 global brands, such as American Express, Citi, eBay and Microsoft, has earned its clients a combined $1 billion in incremental revenue in 2015. Its unique technology is helping more and more companies scale their ability to engage with their customers better with relevance and speed, expand this expertise across marketing teams and have an immediate impact on their top lines.

"There are an increasing number of solutions in the marketplace that claim some kind of smart or cognitive technology", says Mr Whittle. "When assessing the right partner, corporations should ask: how credible are these vendors in terms of proof points? How easy is the technology to implement? Are the results they deliver marginal or are uplifts significant and sustainable?

"Solutions that can help companies generate fast and substantial return on investment, but have minimal impact on resources or IT will advance the adoption of cognitive computing technology".

For Caesars Entertainment, Persado's cognitive content was a bet that has paid off handsomely.

For more information please visit persado.com

800%
difference between the best and worst-performing e-mail marketing messages

1m+
tagged words and phrases on the Persado database

68.4%
click uplift

Now it's all hail t

Artificial intelligence is impacting the fina trading, posing a serious challenge for tra

FINANCIAL SERVICES
JOE McGRATH

Demand for non-equity trading algorithms serving institutional asset managers and retail investors is expanding the prevalence of artificial intelligence in the world's financial markets.

A recent report by Thomson Reuters estimates that algorithmic trading systems now handle 75 per cent of the volume of global trades worldwide and this figure is predicted, by those in the industry, to grow steadily. The reasons are three-fold.

Firstly, while the institutional market has enjoyed a large variety of "algos" serving the equity markets to date, other areas such as futures are still witnessing huge product demand and innovation as a result.

Secondly, regulations affecting the institutional investment market, such as the European Union Markets in Financial Instruments Directive II or MiFID II, are pushing for greater automation of trades in some asset classes which traditionally were not executed electronically.

The fixed income market is a prime example and negotiations between industry groups are ongoing as to how practical a fully automated fixed income could really be, given the magnitude of the required shift from telephone to electronic trading.

Thirdly, the retail trading market continues to expand worldwide, which is opening up algorithmic trading to a whole new group and further increasing demand for the technological advancement.

Ralph Achkar, product director for capital markets at trading infrastructure group Colt, says algo-trading demand has shifted considerably over the past three decades from a focus on speed to a focus on an increased number of variables.

He explains: "We've seen a move away from pure access needs. Initially the move was towards a focus on low latency, but more recently [it has been] to a deterministic environment, and now participants are looking for the ability to chase short-lived opportunities across different venues, asset classes and geographies.

"This is directly correlated to the increasing sophistication of algorithmic trading. Initially people were looking for simply the fastest access to markets, then the ability to control their low-latency connections better, and into the future traders will need to look across asset classes and geographies as the world becomes smaller and events in one trading centre are rapidly felt in another."

A recent report from the US Commodity Futures Trading Commission found that algorithmic trading systems were responsible for nearly 80 per cent of foreign exchange futures trading volume, 67 per cent of interest rate futures volume, 62 per cent of equity futures volume, 47 per cent of metals and energy futures volume, and 38 per cent of agricultural product futures volume between October 2012 and October 2014.

And it's not just volumes that are being impacted by the development of new algorithms. Sell-side firms that take on counterparty risk are now using algos to ensure they set the right level of risk and fully understand their exposure.

Jilali Azzouz, a quantitative trader at Ayondo Markets, explains: "Our risk model is now using algorithms to provide momentum metrics on our exposure at every point in time and decisions that were human driven in the recent past are now taken by computers.

"Algorithms, especially those focusing on risk management, as opposed to discretionary trading, are able to simulate thousands of risk scenarios within a second. I believe every buy-side algorithm should have a strong risk management algorithm running in parallel with the trading algorithm. A more efficient risk management leads to less 'crazy' behaviours on the market and hence will bring more stability, although I'm not against volatility."

The development of the algorithms is only part of the story. Businesses such as Ayondo Markets have recognised the importance of machine learning, where the algos learn from their mistakes to ensure their statistics are likely to be more accurate. This is also an approach

he march of the algorithms

ncial services sector more than most, with sophisticated algorithmic ders and regulators alike


Getty Images

> As machine learning becomes more sophisticated and gives birth to the next generation of algos, market experts are warning regulators will need to keep pace to prevent major accidental market movements

being adopted by some investment management houses, employing risk premia or smart beta strategies.

According to Mr Azzouz, there have been improvements in back-testing, execution and liquidity. "With back-testing improvements, they now take into account slippage factors and margin requirements. The empirical issue with algorithmic trading, related to the way they run back-tests, is the fact they tend to ignore the liquidity available," he says.

"It's still difficult to assess what was the liquidity at a specific point in time in the past, but now trading algorithms are written to assess the best liquidity providers at the time of execution."

However, as machine learning becomes more sophisticated and gives birth to the next generation of algos, market experts are warning regulators will need to keep pace to prevent major accidental market movements.

Tony Virdi, head of banking and financial services in the UK and Ireland at fintech consultancy group Cognizant, says: "As machine learning improves, further growth of algorithmic trading is expected. The important factor, however, that regulators will watch is market integrity and equality to ensure non-algorithmic trading firms that compete against others employing automated solutions do not play in an uneven competitive market."

The difficulty for global regulators is the pace of change is so rapid and regulation should not stifle innovation. Adam Jones, senior consultant at financial software group Altus Consulting, believes that the regulation of AI engines operating within financial services more widely, and trading specifically, will require a sea change of regulatory thought.

He says: "If you thought it was a challenge trying to regulate bad behaviour out of a group of misguided bankers or financial advisers, try regulating something which is smarter than you and quicker than you.

"Day in day out, firms in the UK are grappling with the various rule books and guidelines published by the regulator. We might soon witness artificial intelligence engines devouring these rule books, and feeding back on the contradictions and inconsistencies within them.

"The regulator and the government need to be in a position to provide sensible and proportionate guidance to regulation for these firms, and to do so in a way which still manages to protect the UK retail investor and the UK economy."

Mr Jones' thoughts are shared by many. Cognizant's Mr Virdi cites the ongoing saga of MiFID II, which already addresses automated trading. "Among other things, this states that firms should have controls in place to make sure trading systems are resilient and have capacity, preventing them sending orders which are incorrect or inaccurate. Future regulation will need to define the set of controls appropriately," he says.

"In Germany, where high-frequency trading (HFT) is a licensed activity, fees are imposed on those who make 'excessive use' of HFT on exchanges, known as the excessive system usage fee.

"Overall, the biggest challenge comes when HFT presents new risks which wouldn't exist otherwise, such as flash crashes. It is therefore important that regulators are well versed in the operation of algorithms and have the flexibility to be able to engage new legislation where required."

So with technology advancement moving at such speed, should those working in banking, trading and financial services more broadly be concerned for their jobs?

Simon Smith, director of UK operations at trading group FXPro says this is a complex question that goes beyond the evolution of artificial intelligence. "The landscape is changing and not only because of algo trading. Banks used to employ technical analysts to spew out loads of charts and levels. I only know one remaining now of my contacts," he says.

Colt's Mr Achkar says the increasing focus on technology is nothing new and the evolution of markets has been happening for decades. "It's also in part due to the drive from regulators to increase transparency and there's clear pressure on participants who have been resistive to this technological change.

"Historically, it was the traders' relationships that stalled technological progress in these areas, but cost and regulatory pressures are making this position untenable. This does not mean that all roles in a trade life cycle will be automated or that there will be no role for human relationships. Rather the change will focus human intervention on some parts of a trade life cycle versus others.

"We expect some recycling of know-how to occur, as well as a change in the amount of human intervention in certain asset classes, which are being pushed to an electronic model over the next three to five years."

FUTURE OF THE STOCK MARKET


Richard Craib

Numerai, a hedge fund using crowdsourced artificial intelligence (AI) to make equity price predictions, is aiming to "solve the stock market", writes **Benjamin Chiou**.

Founded by South African mathematician Richard Craib, Numerai created the world's first encrypted data-science tournament for equity price predictions in December last year and has since received more than 2.7 billion estimates from data scientists all over the globe.

The concept, technology aside, is relatively simple: data scientists and computer programmers are able to download encrypted financial data, build their own algorithms through machine learning, and anonymously upload their price predictions. Numerai then uses the best models to trade on the stock market and the winning contributors are rewarded with a portion of the profits, paid in bitcoins.

While experts largely estimate AI will surpass human intelligence by 2040, Mr Craib believes this could happen in the stock market sooner. "I think it's really untenable to think that, long term, humans will be better than AIs at predicting the future of an equity in 100-dimensional feature space," he says.

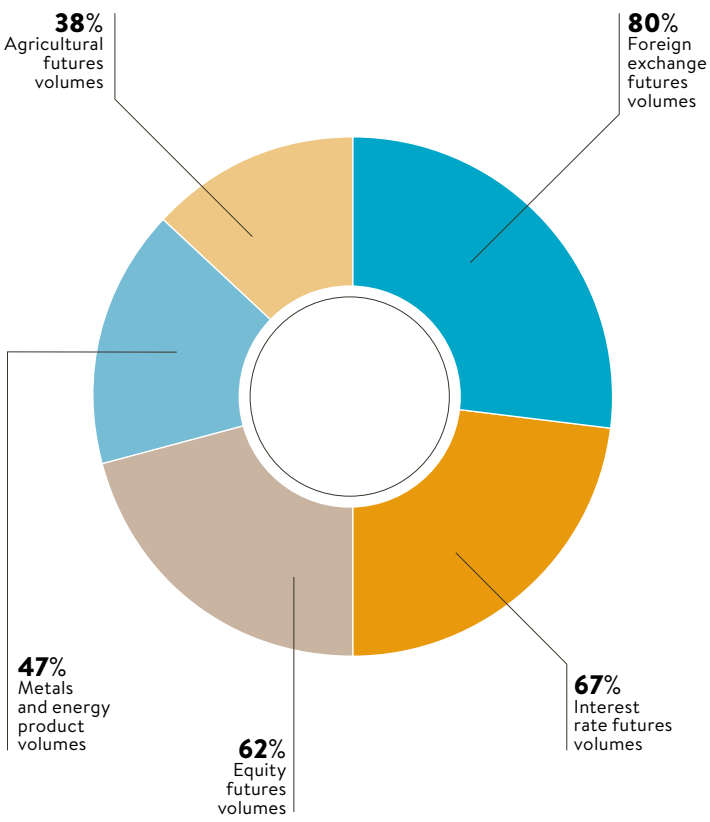
"I think we are already at the point where nearly every hedge fund in the world has a huge data-science component. Even value investors use sophisticated filters to screen investment ideas. But investors using rules of thumb learnt in finance textbooks rather than strategies learnt from data are going to lose badly."

Does this spell the end of the stock market analyst? Not just yet, according to Mr Craib. He says machine learning is only able to improve with large amounts of training data and human-generated earnings estimates provide them with just that. "I think it will take some time for human analysis to go away, but synthesising the collective human analysis is already the domain of machines," he adds.

The fundamental reason for using AI in the stock market is to improve efficiency. "However, the cost of efficient markets right now is that there is a lot of human capital locked up in hedge funds," he says. "The promise of artificial intelligence in finance is total efficiency and the freeing up of human capital to advance other fields or do whatever they want."

ALGORITHMIC TRADING SYSTEM (ATS) USAGE IN TRADING

IN THE TWO YEARS TO OCTOBER 2014, ATSs WERE PRESENT IN:



Source: Commodity Futures Trading Commission 2015

COMMERCIAL FEATURE

AT LAST AI FOR ENTERPRISE IT

Amid all the noise and excitement about artificial intelligence, the world's first cognitive computing system for enterprise IT is providing companies with practical benefits that can revolutionise their operations

ignio™

Artificial intelligence (AI) has grabbed the attention of science writers and commentators. "How brainy networks will remake our world," announced last month's issue of *Scientific American* magazine. Voice commands on smartphones, chess-playing computers and driverless cars have offered the public a fascinating early insight into AI.

Companies and their IT directors, though, are looking to AI to offer more important and tangible benefits. Currently most are simply employing static automation technology, usually as a way of reducing headcounts and costs, and without any cognitive capabilities.

At the same time, IT directors are finding themselves overwhelmed with the number of IT management tools available to them. Many can only handle their own particular technology silos, be they databases, storage, hypervisors or service management.

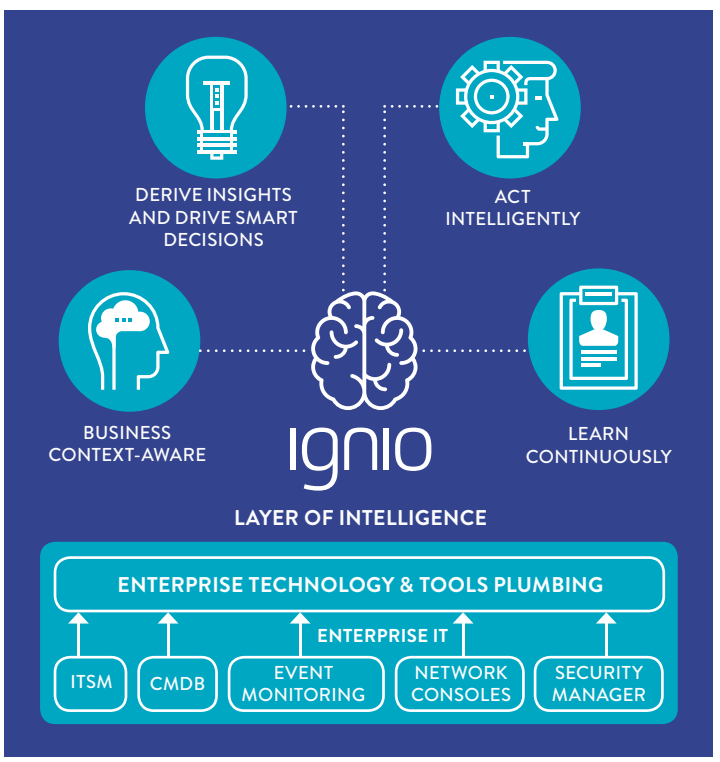
Even when these tools are provided by a single software vendor, very often they are not integrated and therefore offer very little contextual understanding of the infrastructure as a whole. IT infrastructure consists of interrelated systems.

Not only this, but IT administrators often receive too many alerts because of the sensitivity of the alert setting. Which they should address and which they can safely ignore is not obvious.

Now, however, a growing number of forward-thinking and open-minded IT executives are discovering a new enterprise AI solution that can address these problems and even revolutionise their operations. As a result they are enjoying greater benefits and seeing improved productivity.

Digitate, a Tata Consultancy Services venture, launched a product called ignio™ last year. As the world's first cognitive system for enterprise IT, ignio understands how applications are related to all underlying infrastructure components. This new solution automatically captures and creates a full blueprint of the entire infrastructure. It can then use this contextual information about the business to make decisions and perform tasks.

"What clients like is that ignio has a pre-built knowledge base," says Dr Harrick Vin, head of Digitate. "These are based on the IT applications and infrastructure expertise that Digitate has gained by studying thousands of customers of Tata Consultancy Services over many years. They're now made immediately available in ignio and this means that it can be effective in just six weeks, much faster than most cognitive systems. As a result customers can see a much faster return on investment."



> As the world's first cognitive system for enterprise IT, ignio understands how applications are related to all underlying infrastructure components

Importantly ignio can integrate and pull data from existing management tools to correlate all information into a single place. IT administrators can continue to leverage their existing tool sets as ignio is able to establish what is relevant using its cognitive engine.

"ignio can collate large quantities of data through various systems and provide IT administrators with easily actionable information. Then either our solution handles the problem or, having presented administrators with the data, it will allow them to take action themselves," says Dr Vin.

Another part of the appeal of ignio to companies is that it establishes a normal state of the entire environment after profiling and learning about the infrastructure over a period of time. This allows it to eliminate the false positives that are often associated with disparate management tools.

"For example, it might be normal for an organisation to see a spike for a variety of reasons in their infrastructure workload at the beginning of the week," says Dr Vin. "Most existing tools would see that as a problem and send out multiple alerts. Over time, IT administrators will simply learn to ignore them and this could be risky. But ignio establishes a normal state where it knows to expect this spike. If it detects an anomaly hidden within the weekly spikes, it will then trigger the necessary alerts."

Once it has done this, ignio can identify the cause of the anomaly within minutes and use its cognitive engine to identify the root cause of the problem. It already knows how each specific infrastructure component is interrelated to multiple applications that are relying on this component. Having identified the cause, ignio provides the IT administrator with a recommendation on how to resolve the issue.

Once they're confident about ignio's ability to identity errors and to provide the correct recommendation on error resolution, IT administrators usually allow ignio to take action autonomously. Even so, the solution always logs the relevant information in the IT department's records, ensuring that enterprises have all the tracking necessary for regulatory compliance. And, when ignio doesn't know how to fix a problem, it will learn the corrective actions from the IT person who resolves it.

RIGHT
Dr Harrick Vin
Head of Digitate

Agile, cost effective and, above all, easy to apply, ignio is set to change the way IT professionals view AI. Dr Vin concludes: "There's so much noise around AI at the moment, but ignio is focussed on practical solutions, and is about helping companies to streamline their systems and deliver for their customers now and in the future."

For more information please visit www.digitate.com

IMPROVING EFFICIENCY, REDUCING RISKS: NATIONWIDE BUILDING SOCIETY

With their digital portfolio expanding in recent years, the IT team at Nationwide Building Society last September chose ignio as a solution for delivering intelligent automation to reduce operational risks and simultaneously improve efficiency and responsiveness.

As the world's largest building society, Nationwide delivers a wide range of products to its customers, and recognises the importance of deploying new services rapidly and increasing the resilience of its digital solutions.

"In recent years, as our business has grown and new services have been introduced, our back-end systems have become evermore complex," says Mike Pighills, head of service integration and transition at Nationwide Building Society. "ignio will help us to simplify the management of these systems, giving us greater efficiency and control over critical aspects of our IT."


Getty Images

We're on the road to fully driverless cars

The self-driving car market is forecast to accelerate towards the end of the decade, but public confidence remains in the slow lane

SELF-DRIVING CARS
JOANNA GOODMAN

The first known fatal accident caused by a self-driving car occurred on May 7 when a Tesla Model S in Autopilot mode crashed into a tractor-trailer crossing a Florida highway. Investigations are under way into whether the Tesla Model S's semi-autonomous system was to blame.

Mobileye, the technology company behind Autopilot, offered some clarification. "This incident involved a laterally crossing vehicle, which current-generation AEB (autonomous emergency braking) systems are not designed to actuate upon," they said.

This was not the first reported accident caused by a self-driving car. On February 14, a Google autonomous vehicle collided with a bus while merging into traffic. Fortunately, this was a low-speed collision with no casualties.

As a result of the two incidents, Google has refined its software to recognise that buses are less likely to yield to traffic and from 2018 Mobileye systems will include lateral-turn-across-path (LTAP) detection capabilities.

This highlights one of the main advantages of autonomous cars – they collect and transmit data in real time, so the entire fleet can be improved as a result of the data related to any and every incident involving a driverless vehicle. And they can also react to weather and traffic conditions.

The latest BI Intelligence report anticipates that there will be ten million self-driving cars on the road by 2020. The market for driverless cars is expected to top £100 billion by 2021.

> "Volvo will start testing its driverless cars on public roads around London in 2017

Connected cars with internet access, links to other connected objects and assistive technologies include Tesla's semi-autonomous Model S. Chief executive Elon Musk anticipates producing a fully driverless car within two years. Google's cars cover more than 10,000 autonomous miles per week.

Mainstream car manufacturers are working on autonomous capability. In May, Fiat Chrysler confirmed a deal with Google to increase its fleet of self-driving cars. BMW recently teamed up with Intel and Mobileye, which also provides BMW's collision avoidance systems, to work on the BMW iNEXT, BMW's first fully autonomous car. And in 2017 Nissan's popular Qashqai will be equipped to drive autonomously on motorways and dual carriageways.

Last year, PSA Peugeot Citroën's prototype travelled 360 miles on a motorway from Paris to Bordeaux entirely in autonomous mode. Volvo will start testing its driverless cars on public roads around London in 2017.

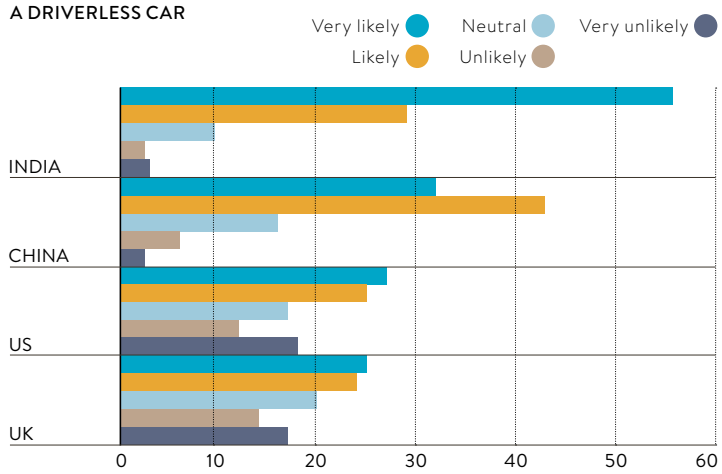
The fact that the UK did not ratify the European Union convention on road traffic that requires vehicles to have a driver has enabled the government to fund driverless car trials via its £100-million Intelligent Mobility Fund.

Professor Paul Newman, who leads Oxford University's Mobile Robotics Group, is co-founder of Oxbotica, which provides the autonomous control system for two of the UK's government-backed driverless car projects. Its Selenium autonomy system powers eight shuttle vehicles, which are being demonstrated in Greenwich as part of the GATEway project. It will also power 40 LUTZ Pathfinder pods carrying members of the public around urban and pedestrianised areas in Milton Keynes and Coventry.

Tesla's Model S vehicle, equipped with Autopilot technology, during a test drive on a highway in Amsterdam

GLOBAL CONSUMER VIEWS OF DRIVERLESS CARS

PERCENTAGE OF RESPONDENTS WHO ARE LIKELY/UNLIKELY TO TRY A DRIVERLESS CAR



Source: World Economic Forum 2015

Regulation needs to catch up with technology, particularly around accident liability. The Modern Transport Bill will include changes to domestic road traffic legislation and facilitate new types of motor insurance products.

Peter Allchorne, a partner in DAC Beachcroft's motor services division, explains that motor insurance will need to encompass traditional liability when the driver is in control and product liability when the vehicle is operating in autonomous mode.

Volvo has confirmed it will accept liability where it can be demonstrated that an accident occurred as a result of a defect in one of its vehicles while operating in driverless mode. "One can envisage evidential disputes as to whether a vehicle was defective and/or operating in autonomous mode at the point of collision," says Mr Allchorne.

Barriers to adoption include road infrastructure. Autonomous vehicles will need to interact with street furniture and respond to potential hazards. Oxbotica is working with insurer XL Catlin. "We expect there to be fewer accidents," says Professor Newman. "Autonomous and semi-autonomous vehicles share data. So the audit can be between the vehicle, the insurer and all the other vehicles the insurer covers. Insurers will be able to identify what causes accidents and manufacturers will be able to respond."

Although in theory fewer accidents would reduce claims and premiums, the saving could be offset by higher repair costs due to the complexity of driverless cars. Furthermore, the risk will shift from the driver to the manufacturer. Insurance brokers Adrian Flux recently launched the UK's first driverless car insurance policy and 13 motor insurers formed the Automated Driving Insurance Group.

Andrew Joint, a partner at Kemp Little, believes the law has to decide whether to give artificial intelligence a legal status because it is replacing the person driving the vehicle and how much responsibility to place on the manufacturer. "It's about reclassifying what we mean by driver," he says.

Perhaps reluctance to place their trust in an algorithm explains why people agree that driverless cars are safer, but don't feel safe in them. A KPMG report for the Society of Motor Manufactures and Traders claims that by 2030 autonomous cars will have saved 2,500 lives by preventing 25,000 serious accidents. However, more than half of 4,000 respondents to a *What Car?* survey felt unsafe or very unsafe travelling in a fully autonomous vehicle.

Kevin Chesters, chief strategy officer at advertising and marketing agency Ogilvy & Mather, observes that most people have no issues about being a passenger in autonomous transportation such as London's Docklands Light Railway, being driven by someone else, or relying on satnav or park assist. "The challenge is psychology rather than technology," he says.

Tom Roberts, managing director at Tribal Worldwide London, believes the confusion will be resolved during the transition to driverless cars. "Rather than building systems that are designed around how humans drive, we need to reimagine the driving experience. Driverless technology isn't there yet; for example, LIDAR machine vision does not work well in bad weather," he says.

We may buy into autonomous cars, but will we buy them? A long-term consideration is the potential disruption to automotive manufacturing of combining autonomous transportation with the sharing economy.

Dave Leggett, editor of *just-auto,* a website that analyses industry trends and emerging technologies, concludes: "Car manufacturers would like customers to carry on buying cars on three-year cycles and taking out finance. However, car sharing firms like Zipcar and ride-share operations like Uber are already disrupting the market."

Source: Opinion Matters/EPSRC UK-RAS Network 2016

UK CONSUMER ATTITUDES TO DRIVERLESS CARS

26.1% believe the biggest benefit will be a reduction in the number of accidents

20.7% believe their road rage will decrease

71.8% feel it would have a positive impact on everyday commuting

21.2% think the automotive sector would have the most to gain from robotics in the next ten years

56.4% believe robots will be driving cars in the next 25 years

Doctors and nurses will work with AI

Medical artificial intelligence could save the NHS from a looming shortfall of £20 billion and the demands of an ageing population, with 30 per cent over the age of 60 by 2039

HEALTHCARE

DANNY BUCKLAND

01
570,000 robo-surgery procedures were performed in 2014, up from 1,000 in 2000, according to Intuitive Surgical

02
Babylon is an AI-based app using speech recognition to check patients' symptoms and connect them with GPs

Healthcare is a numbers game and the figures are running wild. Every indicator shows the creaking NHS cannot cope with rising demand and dwindling resources.

But the relentless gloom over hospital waiting lists, budgetary shortfalls and demographic time bombs is being challenged by a fresh approach that could revolutionise personal and national health.

A wave of innovation driven by artificial intelligence (AI) is being hailed as both a saviour of traditional healthcare and the dawn of a new era in the public's engagement with their own health.

"Healthcare is one of the highest cost areas for all modern economies, which makes it ripe for AI as providers look for efficiency to care for patients," says Dan Housman, chief technology officer at ConvergeHEALTH by Deloitte. "Healthcare is complex as an industry and is generating vast volumes of data from imaging, genomics, sensors, daily care and scientific research.

"AI can generate insights from this data that people can't easily do, so again it makes healthcare a good fit for the technology."

We all worry about the overstretched NHS's ability to treat our ailments, but imagine if your body could be monitored like a Formula 1 car with every subtle change analysed for optimum performance. The dream is a reality.

McLaren, the FI team with Fernando Alonso and Jenson Button in the driving seats, has turned its formidable technical skills on healthcare to raise the prospect of future generations being able to respond swiftly to health fluctuations to minimise GP or hospital visits.

McLaren's race team deals with more than a billion pieces of data from more than 200 sensors on both its cars over a grand prix weekend. Tweaking performance is the difference between a podium or an also-ran finish, and now the same skills and techniques are being used by its Applied Technologies division to improve health outcomes.

It has joined forces with pharmaceutical giant GSK on clinical trials to monitor recovering stroke and motor neurone disease patients by using a discreet patch positioned on the neck to transmit activity readings.

Dr Ali Parsa, the pioneering health guru behind Babylon, the online service that fuses clinical expertise with the latest technology to provide symptom checks and increasingly diagnostics, says: "There is not an area in our lives where AI is not already doing a big job – it is all around us.

"Using AI will free up doctors and nurse time. There are so many combinations that no human brain can compute all of them and that is why one in eight of NHS diagnoses are wrong. It is not that the doctors are bad, it is just that it is mathematically impossible to configure all these in your head.

"Simple stuff will be done much better by machines, but then humans will be able to do the treatment – the surgery, the care – more effectively and with more time for empathy."

The statistics underscore his point: there are 10,000 known human diseases and the *British National Formulary,* the Royal Pharmaceutical Society's pharmacology reference book, runs to 1,349 pages of detailed information from asthma to zinc adhesive tape.

Dr Parsa champions AI for its potency to process a forest of data into clear medical guidance with man and machine working in harmony. The revolutionary gains will come by AI interrogating the deep wells of medical information to devise disease prevention protocols to reduce the burdens from crippling conditions such as obesity, which costs the UK around £10 billion a year.

Investment is pouring into healthcare AI with Babylon securing £17.3 million funding and the Network Locum startup, which matches doctors with temporary vacancies, just announcing it has won £5.3 million in backing from BGF Ventures.

The NHS is certainly keen to take advantage with its chief executive Simon Stevens proclaiming that smartphones are "one of the most powerful diagnostic tools available". NHS funding is being reformed to allow hospitals and GPs to apply for reimbursement for apps and devices on an approved list.

NHS England's Small Business Research Initiative awarded £42 million of funds for NHS innovations in 2015 which have the potential to save £1.5 billion.

The honeypot is also attracting the big players Google and IBM. Google's DeepMind project pledges to build technology tools that will support the NHS so it can continue to be free at the point of use. Its first visible effort is a collaboration with London's Royal Free Hospital to develop an app for speedier recognition of acute kidney injury, which causes 40,000 deaths a year.

DeepMind is also working with the smartphone app Hark, developed by surgeon and former health minister Lord Darzi, of Imperial College Healthcare NHS Trust, London, which smoothes out communications across busy hospital wards. A pilot at St Mary's Hospital, London, found that medical staff responded 37 per cent faster when alerted by the app than by pagers.

IBM is continuing to build the capabilities of its Watson system that aims to have the world's health knowledge at the mercy of its superfast processors. Barely a month goes by without Watson rolling out demonstrations of how its machines outperform humans at virtually anything from playing word games to diagnosing nuanced strains of cancer.

> Governments cannot afford to say we will do this in five or ten years' time – the problems are here today

The mechanics are in place, but the public still needs to learn to trust computers and have confidence their records will remain private.

Bleddyn Rees, digital health consultant at Osborne Clarke, also cautions that, although the NHS is data rich, a lot of work needs to be done to collate it into meaningful data sets.

"There is a wealth of clinical data stretching back 48 years, but the analysis of it and the conclusions that can be drawn from it are poor," he says. "We are making massively insufficient use of it compared to financial services. Where is the equivalent of a Bloomberg or Reuters in healthcare?"

Harnessing computing and analytic skills from other industries is a tantalising prospect for the NHS which can be slow to adopt change, Mr Rees adds.

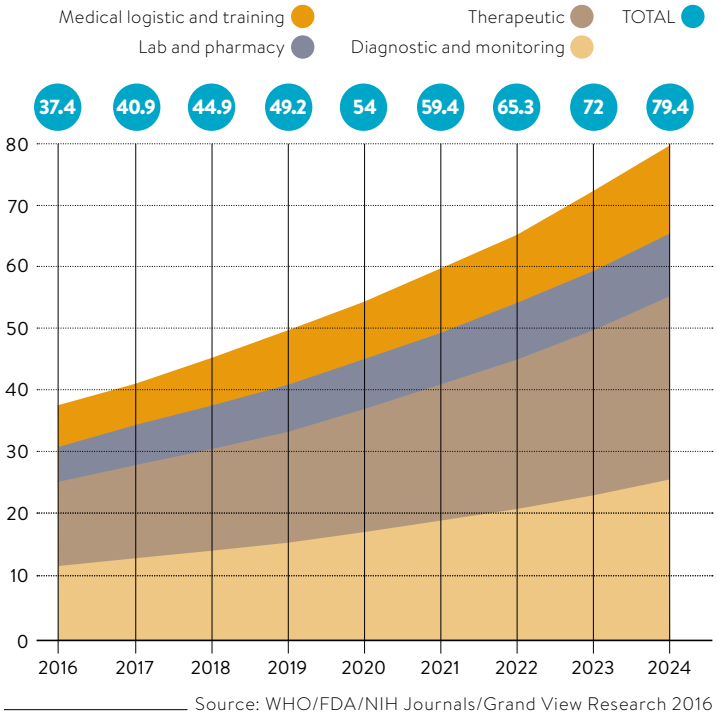
"The disruption will come from outside healthcare, and the exciting part is how the combination of wearables, data, modern systems and the predictive analytics will work," he says. "People are now getting used to their car telling them when it needs a service, and the same approach with people could have a huge impact on individuals and patient groups.

"Whatever can facilitate this needs to be adopted at pace. Governments cannot afford to say we will do this in five or ten years' time – the problems are here today."

Manish Tandon, Executive Vice President and Global Head of Life Sciences, Insurance, Healthcare and HiTech at Infosys Limited, says: "Big data on its own is not a solution; it requires AI and automation to make personalised healthcare more sustainable, scalable and cost effective.

"AI based on knowledge management and machine learning can be applied to curate information, automatically learn from it, and recommend outcomes

GLOBAL MEDICAL AUTOMATION MARKET FORECAST ($BN)



Source: WHO/FDA/NIH Journals/Grand View Research 2016

AI APPS SET TO CHANGE HEALTHCARE

01 BABYLON

£7.99 per month subscription service that has attracted 300,000 users checking symptoms with a bank of 100 GPs and is about to demonstrate its diagnostic capabilities. It reduced waiting times by a week and resolved 79 per cent of consultations in a pilot scheme with an Essex GP surgery. Its aim is to connect a person's health data – from genome imprint to daily steps – to create a matrix to provide early warnings and expert advice in real time.

streams by DeepMind Health

02 GOOGLE DEEPMIND

The internet giant promises much from its dedicated healthcare division and the first app, Streams, is supplying blood test results instantly to clinicians to help the treatment of kidney patients. A trial at the Royal Free Hospital, London, enabled doctors to intervene rapidly and improve the care of more than 50 per cent of patients at risk of kidney failure. It is also developing the Hark system that improves hospital medical efficiency.

03 ALIVECOR

A £65 smartphone heart monitor that can detect abnormal rhythms when a person places two fingers on an electrode for 30 seconds. The device, which works on the same principles as an electrocardiogram, provides results that can be transmitted direct to a doctor. It has been hailed as a game-changer in detecting atrial fibrillation, which affects 1.8 million people in the UK and is a major cause of stroke.

MedyMatch

04 MEDYMATCH

A decision-making tool used in hospital emergency departments that uses machine learning to interrogate a well of data, from patient information, disease records, diagnosis history and imaging results, to help physicians reach informed decisions under extreme pressure. It is being trialed in stroke departments where fast, on-the-spot diagnoses are critical to saving brain function. "With actionable insights, so they can perform the right treatment immediately, this effective acute treatment prevents years of chronic-condition care," the company says.

entire organisation. Automated processes reduce dependency on care-givers and can more quickly help introduce the model of personalised care that is the future of healthcare."

The landscape of health is being redrawn, but for many GPs there are major concerns about a computer's ability to see through the fog of symptoms and related personal information. Computers deal in empirical data; patients are driven by feelings, conceptions, personality – traits that are less readily factored into data-driven guidance.

Dr Sarah Jarvis, a practising GP, health educator and medical broadcaster, believes AI has a place in the future of healthcare, but not at the exclusion of the doctor-patient relationship.

"A machine cannot read subtle facial expressions and pick up on non-verbal cues, the sort of behaviour that gets doctors' radar on alert," she says. "One of my colleagues describes it as 'not smelling right' and AI cannot tell when something doesn't smell right."

The rise of AI devices could also put an added strain on services as they will be forced to insure their diagnoses by advising a check with a doctor, Dr Jarvis adds.

OPINION COLUMN

Get involved with AI - now

Ahead of the second AI Summit, which takes place in San Francisco on September 28 and 29, business leaders are urged to embrace artificial intelligence and transform productivity

GEORGIOS KIPOUROS
DANIEL PITCHFORD
ROBERT WOOLLIAMS

The AI Summit editorial team

66 AI is here and it's already transforming many industries, with business gearing up for the fourth industrial revolution. In the past 12 months we have seen demand for AI in the enterprise increase exponentially, with the world's largest companies investing well over half a billion dollars into AI-centric research.

Indeed, some of the biggest recent success stories in AI have been practical applications in specific industry sectors. AI Business researched FTSE 100 and Fortune 500 organisations in the first half of 2016 and found 32 per cent are already implementing some form of AI, with 75 per cent investing in machine and deep-learning applications, 45 per cent in natural language processing and 15 per cent in image recognition technologies.

With the increase in AI uptake across the enterprise landscape, there have been many new opportunities for technology providers from emerging startups through to long-standing giants such as Microsoft, Google, TCS and IBM.

According to Microsoft's chief envisioning officer Dave Coplin: "AI is at the heart of the company's vision," having recently announced Microsoft Cognitive Services, a new collection of intelligence and knowledge APIs (application programming interfaces).

IBM Watson, IBM's versatile and market-leading cognitive platform, has found wide application, particularly in healthcare diagnostics. IBM Watson's European director Paul Chong frequently underlines that in the next ten years our professional lives will be inexorably influenced by AI and cognitive systems.

All industries are set to be impacted by AI technologies in a variety of different ways, but some are already seeing strong results and promising return on investment with early adoption. Among FTSE 100 and Fortune 500 organisations, AI Business identified transport, financial services and retail as the sectors with the strongest uptake of AI at this stage, with 87 per cent, 68 per cent and 53 per cent respectively.

In addition, logistics, legal, healthcare and manufacturing are investing heavily in AI, many in joint projects that also make the most of advances in robotics and automation.

The progress of Google's self-driving car has been a mainstay of AI news in the transport and automotive

sector. But many other major manufacturers are now investing in this space – Toyota, Bosch, Ford, Mercedes and Audi to name but a few.

AI work in the sector is not restricted to the roads. Phillip Easter, director of mobile apps and wearables at American Airlines, hails AI as "the next golden age". British Airways' owner IAG is also investing heavily in the field, recently winning Best Innovation in AI at The AIconics Awards.

> "Business and technology leaders largely agree we are only at the beginning of what is expected to be a significant departure from business as usual

The financial services sector has seen some of the most significant developments; banking, insurance, professional services, private equity and asset management are gearing up to greater efficiency parameters, improved customer service platforms and enhanced risk management.

Nationwide Building Society have implemented Tata Consultancy Services' ignio platform to transform IT services for the company. RBS's intelligent assistant Luvo recently made headlines in digital customer support. KPMG have partnered with IBM Watson to assess masses of structured and unstructured audit data cognitively. Looking ahead, PwC's lead of transformation and innovation Michael Rendell says: "AI will become part of the firm's DNA."

In the retail sector, Amazon has been using machine-learning algorithms to recommend products for years, and US companies including Kohl's and Walmart are investing heavily in predicting what their shoppers want.

Tailoring advertising and marketing to each individual customer is also an area where AI offers a competitive advantage. David Harris, senior vice president of IT at Burberry, says the company is currently formulating their own AI strategy, with chatbots in service functions and insights from pattern recognition firmly on the agenda for the immediate future.

The legal sector is expecting a profound impact, with many law firms saying that within ten years new attorneys and paralegals could be replaced by AI technologies. Last September in the UK, Berwin Leighton Paisner implemented RAVN Systems' Applied Cognitive Engine. In the US in May, Baker-Hostetler announced they had employed their first robot lawyer, built by Silicon Valley startup ROSS Intelligence and powered by IBM Watson. America's largest law firm by revenue, Latham & Watkins, is test driving new IBM Watson-based applications, including cognitive and predictive coding technologies.

While a number of initiatives are already delivering results, business and technology leaders largely agree we are only at the beginning of what is expected to be a significant departure from business as usual. Indeed, Josh Sutton, head of AI for Publicis.Sapient, speaks of a paradigm shift, a systemic change based on AI helping to expand what's humanly possible.

AI Business found that FTSE100 and Fortune 500 organisations are planning to invest a combined $25 billion in developing and implementing AI technologies over the next three years alone. Not surprisingly, 82 per cent of our respondents told us they are looking to implement some form of AI in the next 12 to 18 months. The Bank of America projects a $95-billion growth for intelligent machines over the next five years and Forrester predicts that 25 per cent of jobs will be impacted by AI in some way by 2019.

But the statistics will not look after themselves – it's down to the business leaders, developers and consumers alike to bear them out. Now is the time to get involved with AI, secure a competitive edge and transform productivity throughout your organisation. 99

Amelia transforms customer experience

A cognitive agent is helping Londoners access public services in Enfield Council

Enfield Council in North London serves a population of over 300,000 residents who, per month, make 100,000 visits to its website and 55,000 telephone calls to the council. Demand for service is growing fast while UK local government funding has been slashed. Like many public sector bodies worldwide, Enfield's council quite literally has to do more with less.

The council's response has been to hire its first digital employee. Her name is Amelia. Amelia is a cognitive agent created by IPsoft. She communicates in multiple languages, can read and understand training materials designed for her human colleagues, learns by observing interaction between those colleagues and customers and even senses emotions. Enfield Council will be the first local government in Europe to use such a cognitive agent to provide services to its residents. It's unlikely to be the last.

> "Amelia will be integrated into council systems that will allow her to help residents actually apply for housing benefit or register their children for school"

Amelia is being deployed not just to stretch limited resources but to improve service. "Banks and businesses are now available 24/7 digitally," says James Rolfe, Director of Finance, Resources and Customer Services, Enfield Council. "Councils can't stick to a 9 to 5 schedule. The council will be looking at how Amelia can guide people swiftly to the information they need, 24 hours a day, 365 days a year."

Enfield Council provides a complex web of services to residents, all of which are documented on the council's website. But residents often abandon the site and revert to calling instead, which means it takes longer to help them. Initially, Amelia will provide links, forms and contacts in response to questions like "How do I find out whether I qualify for housing benefit?" or "How do I register my children for school?" In later iterations, Amelia will be integrated into council systems that will allow her to help residents actually apply for housing benefit or register their children for school. Amelia is also aware of her own limitations. If she cannot address an issue herself, she will escalate it to a human colleague, who can then dedicate time to answering more complex queries.

With the rise of powerful cognitive platforms such as Amelia, government organisations can completely reimagine how frontline public services are delivered. By automating high-volume operations, they can transform the customer experience and unlock the full creative potential of their people. Public sector employees will be shifted away from mundane tasks to tackle the more important and complex issues affecting citizens. The public sector exists to serve the people. Now its digital employees will too.