MAKING AI REAL

A 2019 REPORT INTO AI & MACHINE LEARNING

WHY NOW?

In the [2019 WIPO Technology Trends report](#), The World Intellectual Property Organization revealed that we are in the middle of an AI patent boom, with more than half of all AI patents filed since 1960 coming in the last five years alone (180,200 in total).

And while technology companies such as Microsoft, IBM, Google, and Amazon have driven recent advances (and acquisitions) in AI, we may need to look beyond tech–to areas like agriculture, manufacturing, and healthcare–to see the true potential of what can be achieved with AI.

In this report we have surveyed more than 2,500 business decision makers (BDMs) around the world about how they are currently utilizing AI in the increasingly competitive global market. ●

JACK DAVIES
GLOBAL HEAD OF CONTENT, QUALTRICS

70%
SAID AI WOULD SAVE THEM MONEY

THE SURVEY

The 2019 **Making AI Real** report surveys global business about real world AI usage

This report reveals how technologies such as machine learning and AI are being used in 2019. To achieve this we surveyed a panel of 2,633 business decision makers (BDMs) in China, South Korea, Japan, the USA, Germany, and the UK, filtering out any respondents not currently running or developing an AI project. Qualtrics–in association with Dell EMC–then surveyed these BDMs with AI experience about the application of AI within their businesses and organisations, and about where they see the biggest benefits and challenges.

Respondents to the **Making AI Real** report have revealed the key benefits of using AI, showcasing the technology you need to consider, whilst shining light on the pitfalls.

And to accompany the survey findings, we have also conducted a series of in-depth interviews with a cross-section of AI experts, working within sectors such as healthcare, manufacturing, financial services, agriculture, and property. These interviews add vital context to our survey findings, and the additional input provides businesses looking to implement an AI project, not only with the necessary facts, but with additional insight from people with practical experience in implementing AI technologies today. ●

THE EXPERTS

Six experts – covering the corporate, agency, startup, and developer views of AI – share their insight and advice
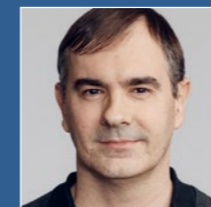
RODRIGO SENRA
TECHNOLOGY DIRECTOR
WORK & CO

Rodrigo Senra has a MSc and PhD in Computer Science, and over the last 20 years he has worked extensively in the software industry. Prior to joining product agency Work & Co, Senra was a Senior Principal Data Scientist at the EMC R&D Center in Rio de Janeiro.

SECTOR:
TECH & DESIGN

EMILY MACKAY
HEAD OF AI & DATA STRATEGY
CONGENICA

Emily Mackay is head of AI & Data strategy at Congenica. She crafts plans to use machine learning and data tech to achieve business goals, and then makes those projects happen. She was shortlisted as Data Leader of the Year in Information Age's 2017 Tech Leaders award.

SECTOR:
HEALTHCARE

KAI HENNIGES
CEO & CO-FOUNDER
VI

Having set up Viewster around a decade ago with co-founder Joerg Boksberger, Kai Henniges helped evolve the company into vi. Throughout this journey, optimizing processes has been key. And vi focuses on how problems can best be solved using tech.

SECTOR:
WEB PUBLISHING

KRIS CLARK
HEAD OF AI
LANDMARK

Kris Clark's background is in product strategy and transformation. Clark has worked with property data since 2003. As a keen technologist, whose career originally started in web development back in the 1990s, Clark's role pivoted in 2018 to oversee AI.

SECTOR:
PROPERTY

RICHARD TIFFIN
CHIEF SCIENTIFIC OFFICER
AGRIMETRICS

Richard Tiffin is Agrimetrics' chief scientific officer and Professor of Applied Economics at the University of Reading. He was a Director of the Centre for Food Security, leading strategic research in the area. His research has examines the impact of alternative food policies.

SECTOR:
AGRICULTURE

DOUG BROWN
CHIEF DATA SCIENTIST
CAPITA

Doug Brown has extensive practical experience of delivering award winning digital/Big Data transformation projects gained from working at big four advisory firms and start-ups both in Europe and the US. Prior to joining Capita Brown had a variety of management roles.

SECTOR:
HUMAN RESOURCES

qualtrics ●● EXPERIENCE MGMT

HOW AI IS BEING USED TODAY

Here we provide an introduction to how our experts are using AI, and reveal some of the key findings from our survey

To ensure a robust sample size, we initially surveyed 2,633 business decision makers (BDMs) for the **Making AI Real** survey. Of these, 43% had no interest in AI, and 32% were interested, but hadn't undertaken an AI project. Therefore, a key take away from the initial phase of our research is that in 2019 a quarter of businesses are developing, or have already developed an AI project. In the expert interviews that follow, we speak to this 25%, showcasing some of the ways AI technologies are adding value and insight across an array of different sectors.

RICHARD TIFFIN, CHIEF SCIENTIFIC OFFICER, AGRIMETRICS: At Agrimetrics we are building infrastructure to catalyse the use of data in the agrifood sector. This market will support new ways of innovating in the sector which will, for example, make it less dependent on agro-chemicals. Fundamentally, our business is about tackling the challenge of ensuring that we are able to meet the food needs of the global population in a sustainable and resilient manner, and AI is going to

be one of the best ways to achieve this. Data is a currency which can be used to better connect the food system, so that it can innovate more effectively and respond better to unforeseen shocks.

KRIS CLARK, HEAD OF AI, LANDMARK INFORMATION GROUP: The goal at Landmark is to streamline property buying and selling processes; cutting laborious administrative processes and delays by weeks, and enabling decisions to be qualified by authoritative data and insight at the earliest possible stages in a transaction. It's an industry that is ripe for automation, and I'm enjoying working with the team and with industry partners to identify where AI tech can be applied to improve transaction times and process.

EMILY MACKAY, HEAD OF AI & DATA STRATEGY, CONGENICA: We're using machine learning to automate genomic analysis. That means we're looking at a patient's sequenced DNA and trying to find where the DNA has varied in such a way it's

causing a serious illness. It's a massive challenge because of the complexity of genomic interpretation and the vastness of the human genome. New genetic abnormalities ('de novo' variants) occur all the time, so there's always that indefinable new possibility to consider.

ROD SENRA, TECHNOLOGY DIRECTOR, WORK & CO: There are two main goals at Work & Co. The first is to better understand customer behaviour, separating signal from noise. The second is to obtain a high level of process automation to enable seamless user experiences. We apply data science techniques to understand the business domain of our clients and their customers' behaviour. Some examples include establishing the criteria behind a vast taxonomy tree for IKEA and exploring time-series of customer preferences for the fast-growing coffee chain Philz.

KAI HENNIGES, CEO & CO-FOUNDER AT VI: We've employed AI to optimise the buying of advertising space. And our most popular technology delivers contextually relevant content and advertising to publishers. So you know your audience is going to be engaged with your advertising. Put simply, vi stories brings contextual video content and advertising opportunities to your site.
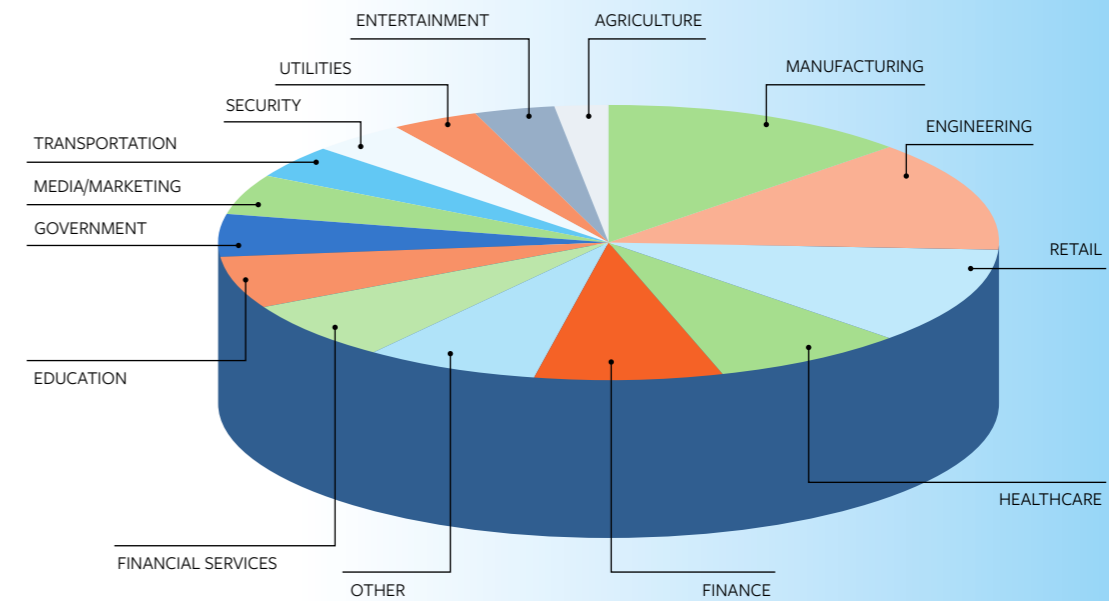
DOUG BROWN, CHIEF DATA, SCIENTIST, CAPITA: In terms of AI and HR, we cover the entire hire-to-retire spectrum, to support an employee and the employers across each phase of their employment experience. Most departments are benefiting from the use of advance analytics and data science, whether back, middle or front of house. ●

Clinical Scientists Use Sapientia, the clinical genomics platform created by Congenica

SECTOR BREAKDOWN: WHERE AI IS BEING USED IN 2019

ENTERTAINMENT · AGRICULTURE · UTILITIES · MANUFACTURING · SECURITY · ENGINEERING · TRANSPORTATION · MEDIA/MARKETING · GOVERNMENT · RETAIL · EDUCATION · HEALTHCARE · FINANCIAL SERVICES · OTHER · FINANCE

Source: Making AI Real, 2019

"THE TOP FIVE SECTORS ARE MANUFACTURING, ENGINEERING, RETAIL, HEALTH AND FINANCE."

DISCOVER THE REGION BREAKDOWN FOR AI USAGE BY SECTOR

These are the top five business sectors where AI is being used today. And our panel of 652 experts revealed that, within the 'Engineering' sector, East Asian companies are twice as likely to use AI than their counterparts in the UK, US, and Germany

1. MANUFACTURING
CHINA · USA · SOUTH KOREA · UK · GERMANY · JAPAN

2. ENGINEERING
CHINA · JAPAN · SOUTH KOREA · UK · GERMANY · USA

3. RETAIL
JAPAN · UK · CHINA · GERMANY · SOUTH KOREA · USA

4. HEALTHCARE
USA · UK · SOUTH KOREA · GERMANY · CHINA · JAPAN

5. FINANCE
GERMANY · UK · CHINA · SOUTH KOREA · JAPAN · USA

Source: Making AI Real, 2019

AI USE CASES

We know that 25% of businesses are now working with AI, but here we take a closer look at exactly how and where are they using it

As we highlighted in the previous section, a quarter of businesses are now working on AI projects. And of those businesses, we can see that the top five sectors–covering more than 50% of all AI usage–are manufacturing, engineering, retail, health, and finance.

In the following pages we dig deeper into how AI is being used within different business departments, and also reveal the top use cases.

KRIS CLARK, HEAD OF AI, LANDMARK INFORMATION GROUP: One example of how we've applied AI tech is around image and text recognition and interpretation. One of the organisations in our Group, which manages property searches for lawyers and conveyancers, is using text recognition, image prediction and hashing via Microsoft's Custom Vision API to create a more automated approach to identifying properties from location plans and title deeds.

In addition, it is helping to improve the way information on new build sites is captured and made available. By automating this process, it has removed manual work that previously required intervention by customer service representatives.

ROD SENRA, TECHNOLOGY DIRECTOR, WORK AND CO: The technologies that we use vary from project to project. There is no silver bullet. And the characteristics of the types of problems that require solving usually dictate the shape of the solution. Contextual and predicative digital product behaviours are really interesting to us, and they are coming up more and more across retail, especially within restaurants and hospitality. For our coffee client Philz we are trying to shorten the number of steps needed for a customer to get their favourite drink. The usage of association rules mining (frequent item sets) is simply not applicable in that domain, so we have created our own ranking algorithm to classify customers in a single monophagous-explorer scale, and used that ranking as a feature input to build supervise classifiers.

RICHARD TIFFIN, CHIEF SCIENTIFIC OFFICER, AGRIMETRICS: We are currently using AI as a means of interpreting imagery in agriculture, mainly from satellites. This has made it possible for us to create technologies capable of identifying land parcels which do not require vast amounts of ground-based observation. We are also creating a knowledge graph which facilitate powerful searches across multiple disparate data sets. Our infrastructure will support the creation of a market for data in which data will be shared in exchange for value. The infrastructure provides the means to permission data, to integrate data from different sources and to return value to data providers.

KAI HENNIGES, CEO & CO-FOUNDER AT VI: So we've used learning algorithms to identify where advertising placements can be purchased at the best value, and increase the volume of those purchases. Once these algorithms have been given the inputs (such as budgets, price, and target audience), they can run on their own, delivering advertising impressions to people around the world, in real-time.

EMILY MACKAY, HEAD OF AI & DATA STRATEGY, CONGENICA: We already have a range of algorithms at work that clinical scientists use in their search for pathogenic DNA variants. Each provides a bit more information on the variants. The genome is 3 billion base pairs long, and there are an infinite number of variations that can occur, only some of which are pathogenic, so our challenges are substantial! Now we're a bit further along as a company we've built a rich data set of our own interpretations. That gives us new opportunities to apply machine learning.

DOUG BROWN, CHIEF DATA, SCIENTIST, CAPITA: In HR, we start with the recruitment process, for example. Knowledge mining coupled with text analytics will enable us to automate the selection of CVs, sift through them and convolute them with legitimate content collected from social and professional media, apply psychometric profiles, rate candidates and match them to available positions, with the certainty of clearing all the hurdles to on-boarding. We hope de-prejudice many of the aspects related to face-to-face interviews by anonymising those aspects that would otherwise introduce a bias. The on-boarding process can be greatly enhanced by chatbots that evolve and learn from their interactions with recruits and employees. Chatbots will be able to answer almost all generic and mundane questions related to policies, benefits, pensions, insurance, healthcare, and everything else besides. This will leave HR free to do the human things: sorting out grievances, enhancing talent and nurturing people. ●

"WE ARE CURRENTLY USING AI AS A MEANS OF INTERPRETING IMAGERY IN AGRICULTURE."

TOP 15 USE CASES FOR AI IN 2019

We asked our panel of 652 BDMs to identify the areas and processes they were looking to improve using AI. 'Research', 'speech recognition', and 'virtual agent creation' took the top three positions

Source: Making AI Real, 2019

65%
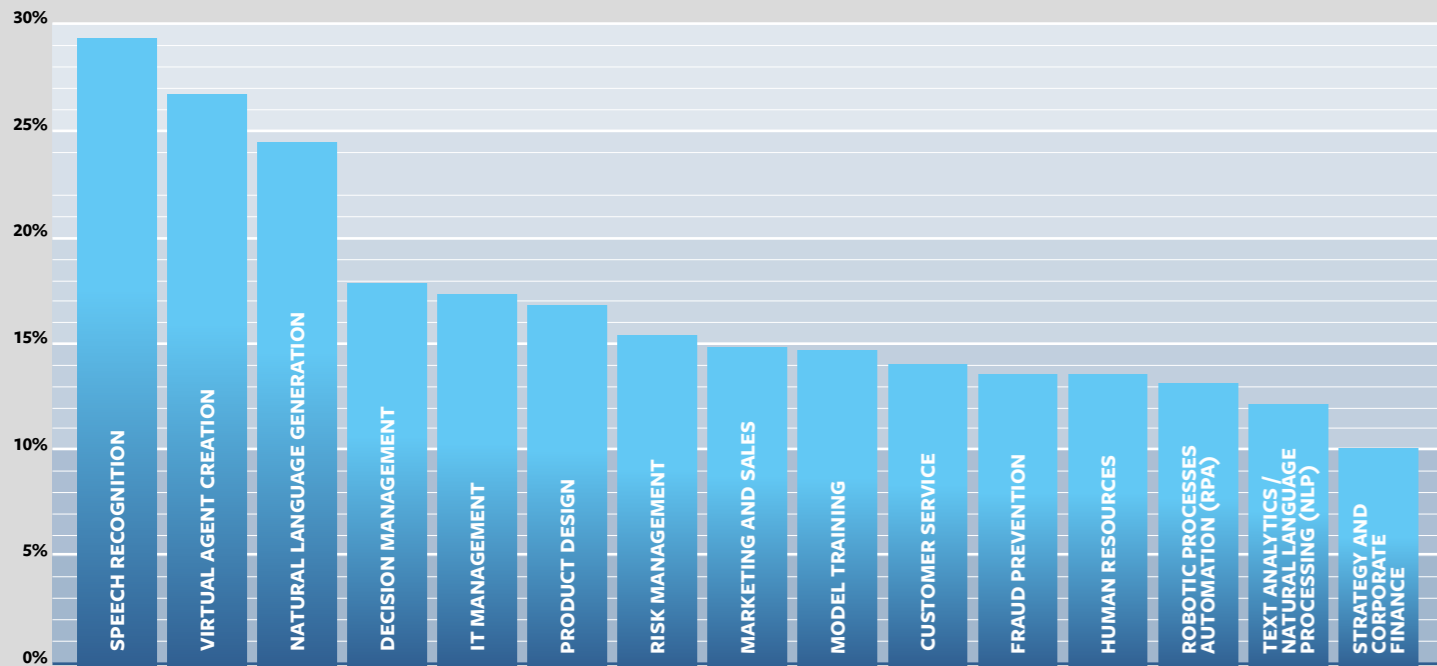### SAID AI WOULD HELP IMPROVE EFFICIENCY

HOW CAPITA HANDLES ITS DATA

Chief Data Scientist, **Doug Brown**, reveals 5 ways Capita deals with its data

ONE "FROM DISPARATE DATA SOURCES (STRUCTURED OR UNSTRUCTURED, BOUNDED OR UN-BOUNDED) WE BRING THE DATA INTO OUR IN-MEMORY DATA PIPELINE."

TWO "ALL THE DATA AT THIS STAGE GETS TAGGED FOR GDPR PURPOSES AND ALSO TO SHOW WHICH ATTRIBUTES ARE USED FOR WHAT ASPECTS OF MACHINE LEARNING."

THREE "THE LATEST RECORDS ARE ALWAYS IN MEMORY. THE HISTORICAL RECORDS ARE MATERIALISED INTO GRAPHS, DOCUMENTS, AND SEARCH INDEXES, WHICH ARE EXPOSED AS MICROSERVICES TO BE CONSUMED BY INTERNAL/EXTERNAL CLIENTS."

FOUR "THE USERS THEN USE THESE MICROSERVICES TO GAIN INSIGHTS TO THEIR DATA. WE USE THIS OPTION TO GET THE DATA INTO THE SYSTEM IN REAL-TIME, FROM MULTIPLE SOURCES, AND IT MUST BE SANITISED SO AS TO MAKE IF FIT FOR USE."

FIVE "IN ADDITION, WE USE THIS (DAG – DIRECTED A-CYCLICAL GRAPH) APPROACH WHERE THE OUTPUT OF ONE PROCESS IS USED AS AN INPUT OF ANOTHER AS NO DATA IS PERSISTED DURING THIS PROCESS."

Source: Interview response

qualtrics EXPERIENCE MGMT

DISCOVER WHERE AND WHY TO USE AI

If you think getting people excited about AI is a problem, think again. It's when you need to decide how to apply it that problems can begin

Despite being aware that AI can provide benefits within their business, many organisations are unable to take the next steps, and identify exactly where AI technologies can be applied (see boxout opposite). Of the six regions we canvassed in our survey, the UK had the biggest issue in identifying how AI could help businesses improve, with 60% agreeing that it was a problem.

Identifying how AI can be used may not be an easy undertaking, and you may fall into the 60% of those struggling to identify where it can help. Here our experts offer some inspiration, and reveal some of the ways they are doing more with data.

KAI HENNIGES, CEO & CO-FOUNDER, VI: Whenever we encounter a problem of scale, we turn to automation. So whether it's buying millions of advertising impressions, or analysing millions of webpages, you know there's a way to use a program to interpret and learn from it. In order to make sense of that data, you then need to train the algorithm, and ensure it understands the important data-points, and disregards the irrelevant. Ideally this training is an ongoing process, so the accuracy and quality of the understanding improves with time.

We've used machine learning (ML) trained technologies to understand the contents of a page. So natural language processing is used to find terminology on a page which is likely to be of interest to users. We then aggregate that data, and match it with our library of content. Natural language processing (NLP) allows us to separate out relevant text content, and assign value to it at a scale humans never could. We possess hundreds of thousands of videos, so we use NLP to build metadata on our content library. Video intelligence and image analysis can be used to identify people, items and brands that appear in these videos, and create a database. This can then be matched with the analysis we've done of pages, to create a contextual match. To then match that text with video requires speed, accuracy and processing power that can only be achieved with algorithms. And context is a key component of a successful online user experience; it's amazing to see machine learning actually making the web more usable.

KRIS CLARK, HEAD OF AI, LANDMARK INFORMATION GROUP: We use a range of algorithms across our portfolio depending on the best-fit for the product, service or dataset at hand. Our most recent research project deployed a supervised neural network to output parallel predictions from our flood modelling datasets.

Today, a percentage of our environmental risk reports are 'referred' for manual assessment by a consultant after production when additional factors outside the core data get flagged. While these investigations are typically completed the same day, AI presents an opportunity to deliver this type of insight and interpretation in real-time.

By using a network with a fairly standard 4-layer perceptron with rectified-linear units ('relu') in two hidden layers, the test model was able to accurately predict the outcomes of 74% of cases in-line with the qualified consultant's opinion. This demonstrates potential for us to extend the roles of environmental consultants in future from 'reactive' after-the-event analysts, to 'proactive' model designing technologists who enable further workflow automation. It also means that the ability to answer more complex flood risk questions in 'real time' is within reach; a small but vital step in proving another aspect of the
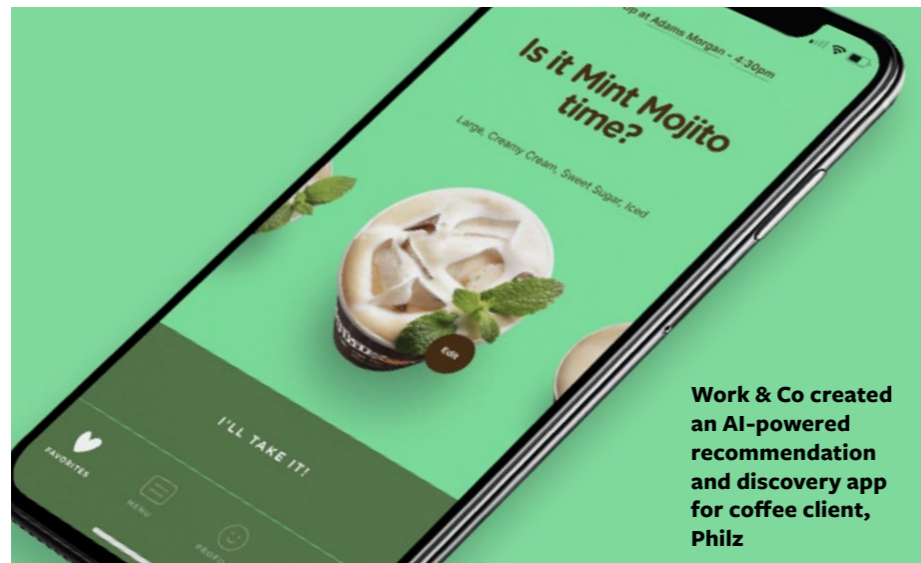
homebuying process has the potential to be automated. We're now looking to scale this approach up, one dataset at a time.

EMILY MACKAY, HEAD OF AI & DATA STRATEGY, CONGENICA: As a genomic diagnostic support company, our aim is actually very clear: we need to accurately identify pathogenic variants as quickly as possible. Patients can suffer considerably from life-changing diseases while awaiting a diagnosis, so it's very important we use all tools at our disposal to shorten that wait. Our expert clinical scientists show us very clearly where in the process machine learning can help, and we're now expanding our machine learning team to support this need.

ROD SENRA, TECHNOLOGY DIRECTOR, WORK AND CO: Within Work & Co we have a highly collaborative environment, so AI isn't something that's relegated to one discipline within the organization, or applicable to only one project. That's the benefit of having a team of experts in-house that can leverage AI technologies when appropriate that we know can align with our internal engineering approach as well as our clients' engineering teams within the realistic bounds of budget and schedule of projects. After understanding a business domain from real data, we can apply cutting-edge technology to achieve design goals. For example, with IKEA we looked at how to better distribute furniture physically in the retail stores in such a way that allows customers to explore the product taxonomy, both in depth as in breadth. With another client, Philz, we looked at how to create a single click coffee recommendation engine that pleases both explorers (customer that like to experiment with different products every time), from monophagous (customers that are faithful to a subset of products or sometimes a single product).

RICHARD TIFFIN, CHIEF SCIENTIFIC OFFICER, AGRIMETRICS: We consulted widely with the AgriTech industry and realised that the traditional model for providing data was not fit for purpose. Instead of providing data in a model driven by the way in which data is collected, we make it easy to access data in ways that are appropriate to a broad range of varying use cases.
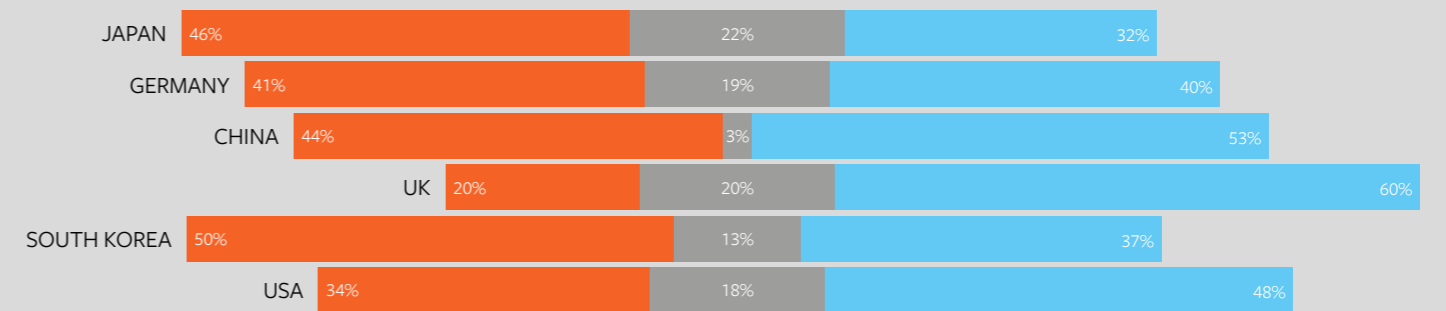
DOUG BROWN, CHIEF DATA, SCIENTIST, CAPITA: Identifying what we do with data is becoming easier as many of the cloud tools offer semi-automated processes for analytics to presentation. Value itself is measured using a range of both tangible and intangible measures including both the value of the data assets created and as example as the business value generated from the application and usage of the analytic models/proposition themselves. The growth in the popularity has largely been driven by the generation of large volumes of diverse data, and the developments in data analytics. AI enables us automate tasks that require traditionally relied solely on human cognition, such as anomaly detection. It is aiding human decisions on everything from recruitment to retention and assessments and retirement. It is the ability to develop insights into an executable business outcome coupled with a commercial structure to extend IP that will drive the increase adoption and usage of AI products and services.

57%
SAID IDENTIFYING AI USE CASES WAS DIFFICULT

Work & Co created an AI-powered recommendation and discovery app for coffee client, Philz

WE ASKED RESPONDENTS WHETHER THEY HAD A PROBLEM IDENTIFYING HOW AI COULD BE USED

The UK stood out as the country with the biggest issue identifying how AI could be used, with 60% of respondents agreeing that it was a problem

- DISAGREE
- NEITHER DISAGREE OR AGREE
- AGREE

Country	Disagree	Neither	Agree
JAPAN	46%	22%	32%
GERMANY	41%	19%	40%
CHINA	44%	3%	53%
UK	20%	20%	60%
SOUTH KOREA	50%	13%	37%
USA	34%	18%	48%

Source: Making AI Real, 2019

TOP 3 AI BENEFITS

In the **Making AI Real** survey we found that three reasons emerged as clear leaders when businesses were asked about AI benefits

Having surveyed our Qualtrics panel of AI users across China, South Korea, Japan, the UK, Germany, and the USA, we found that three key benefits began to emerge across all regions. And with almost identical results (36%, 35%, and 35%), 'competitiveness', 'efficiency', and 'cost' emerged as the three main AI benefits for business, each being cited by just over a third of respondents.
Here we take a deeper look at what's driving businesses toward AI technologies..

KRIS CLARK, HEAD OF AI, LANDMARK INFORMATION GROUP: One of our developers built a prototype email processing application using a combination of Microsoft LUIS (Language Understanding Intelligence Service) and some sentiment analysis, to actively screen inbound emails into one of our property services. These services traditionally have a four-four turnaround time in the Scottish market, and on very busy days emails had been left sitting in inboxes for an hour or more, severely eating into the processing SLA, and increasing pressure on the production team. But this new AI tool is capable of accurately identifying specific types of order that arrive by email from case

management vendors, extracting the relevant requisition details from the body of the messages, and creating a structured XML or JSON message than can be pushed through our Orders API. It's now a living, breathing adaptor between a manual and a digital process in our business, and is being scaled to a fully-productionised service. Longer term, our preference would be to achieve fuller API integration with our customers and suppliers, but we appreciate not everyone is at that stage in their technical journey, so this is a great example of how AI can help bridge the gap.
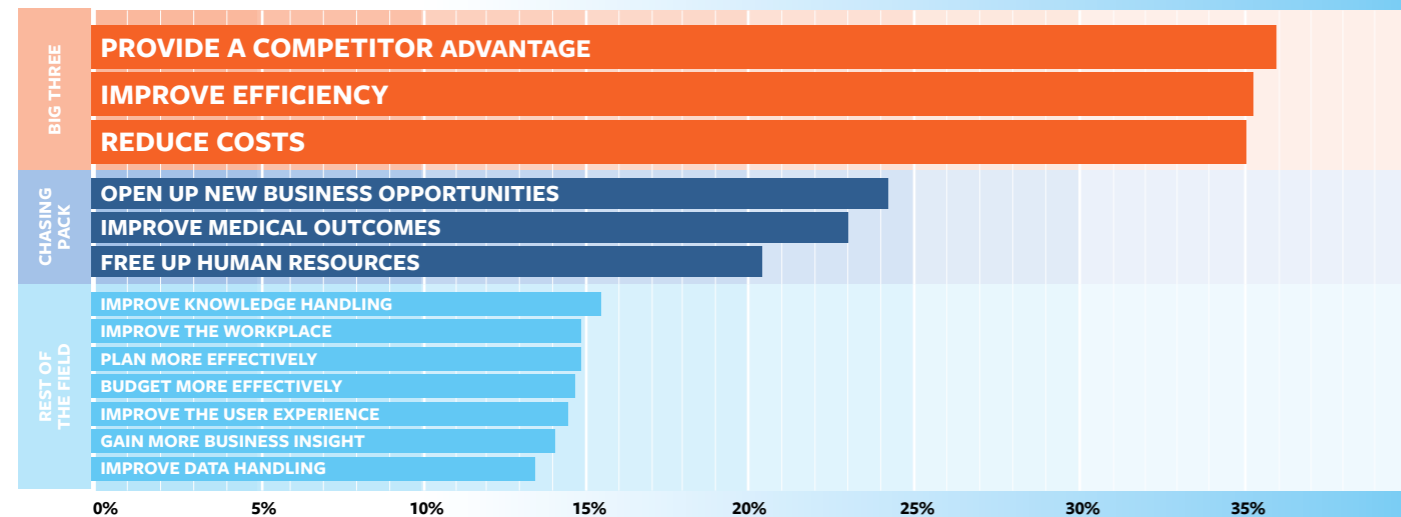
KAI HENNIGES, CEO & CO-FOUNDER, VI: One of our clients is Austrian news site, Die Presse. Like most news sites, they produce a huge volume of pages every day. And like most legacy print publications, they rely on advertising for their revenues. Video pays the best, so they need video on their pages, to be able to charge a premium for video advertising. So our ML-trained algorithm reads their content immediately, and matches it with relevant video content. So the speed and scale of a huge news site is met. In 2016 Die Presse were able to create enough video to sell 300,000 video ad impressions.

After implementing our solution, that increase in 2018 to 31m. This is the kind of automation that makes significant impact on a business, and that just wouldn't be possible without ML.

DOUG BROWN, CHIEF DATA SCIENTIST, CAPITA: Identifying the benefits of AI is easy enough as it is the natural solution to our processes as we begin to bring all our data into a common data lake and we start ingesting big data associated with personal and professional data from the web. We look at the areas where investment in AI can make a significant difference to the overall workload/efficiency. These usually are volume processes, where a small increase in efficiency can lead to significant performance gains. Good candidate areas are Chabot's for websites, speech recognition in a call centre, clustering and segmentation to develop next best actions appropriate for a wide range of use cases. AI has delivered meaningful benefits in the areas of advanced segmentation, leading to high engagement in employee benefit campaigns that we run on behalf of our customers. Higher take-up rate of employee benefits generally leads to employees feeling more valued by their employer. ●
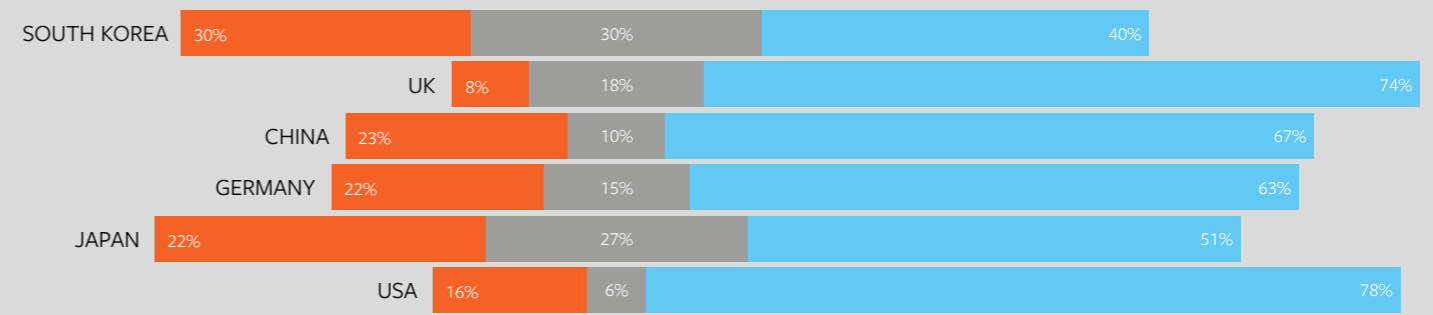
THE BIG 3 AI BENEFITS

We asked our survey panel what the main benefits of implementing artificial intelligence had been. And three clear benefits stood out

BIG THREE	
PROVIDE A COMPETITOR ADVANTAGE	
IMPROVE EFFICIENCY	
REDUCE COSTS	

CHASING PACK	
OPEN UP NEW BUSINESS OPPORTUNITIES	
IMPROVE MEDICAL OUTCOMES	
FREE UP HUMAN RESOURCES	

REST OF THE FIELD	
IMPROVE KNOWLEDGE HANDLING	
IMPROVE THE WORKPLACE	
PLAN MORE EFFECTIVELY	
BUDGET MORE EFFECTIVELY	
IMPROVE THE USER EXPERIENCE	
GAIN MORE BUSINESS INSIGHT	
IMPROVE DATA HANDLING	

0% 5% 10% 15% 20% 25% 30% 35%

Source: Making AI Real, 2019

Legend:
- DISAGREE (orange)
- NEITHER DISAGREE OR AGREE (grey)
- AGREE (blue)

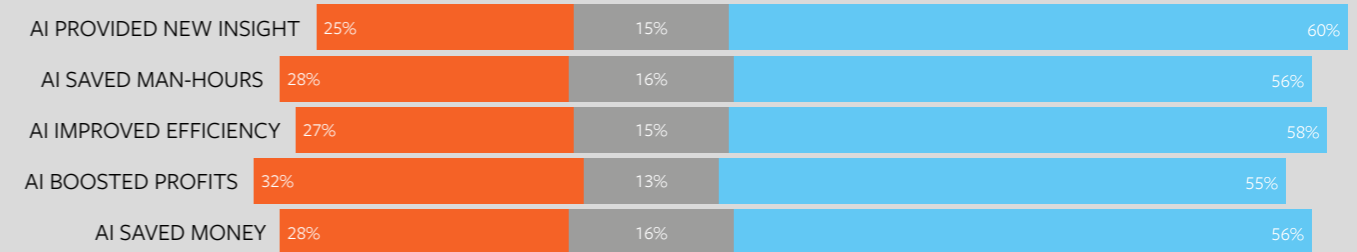## EFFICIENCY: AUTOMATING A MANUAL PROCESS

We asked people with current or past experience working on an AI project about whether their work was to replace a manual task. Here's what they said

	DISAGREE	NEITHER	AGREE
SOUTH KOREA	30%	30%	40%
UK	8%	18%	74%
CHINA	23%	10%	67%
GERMANY	22%	15%	63%
JAPAN	22%	27%	51%
USA	16%	6%	78%

Source: Making AI Real, 2019
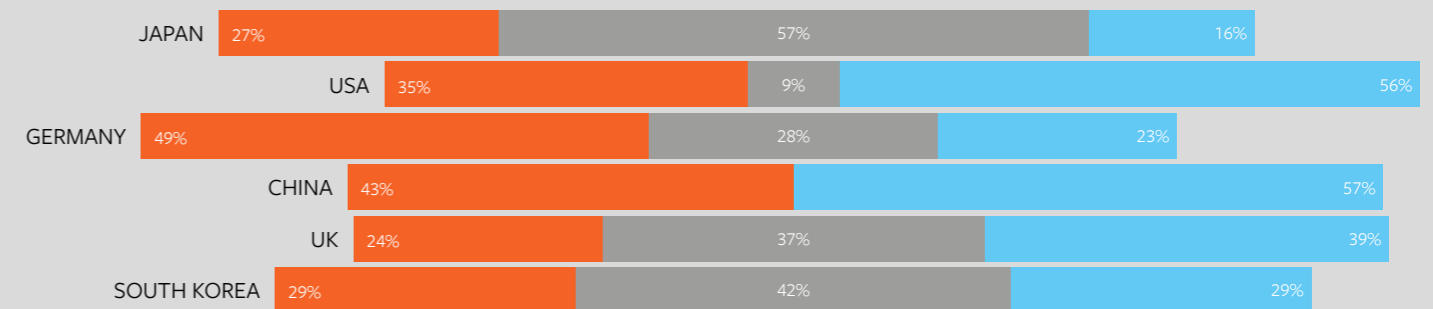
COMPETITIVENESS: FIVE AREAS OF IMPROVEMENT

We looked at a number of factors, and found a general consensus that artificial intelligence provided competitive benefits across five key areas

	DISAGREE	NEITHER	AGREE
AI PROVIDED NEW INSIGHT	25%	15%	60%
AI SAVED MAN-HOURS	28%	16%	56%
AI IMPROVED EFFICIENCY	27%	15%	58%
AI BOOSTED PROFITS	32%	13%	55%
AI SAVED MONEY	28%	16%	56%

Source: Making AI Real, 2019

COST: REDUCING OVERHEADS

Generally speaking, more people working on AI projects said that they had reduced costs as a result of implementing artificial intelligence

	DISAGREE	NEITHER	AGREE
JAPAN	27%	57%	16%
USA	35%	9%	56%
GERMANY	49%	28%	23%
CHINA	43%		57%
UK	24%	37%	39%
SOUTH KOREA	29%	42%	29%

Source: Making AI Real, 2019

qualtrics EXPERIENCE MGMT

5 WAYS AI CAN BOOST YOUR ROLE

Here our experts reveal a variety of ways that artificial intelligence can enhance employee roles across a number of different disciplines

1. FOR MARKETERS

KAI HENNIGES, CEO & CO-FOUNDER, VI: "Marketing is currently undergoing an automation revolution, with a number of benefits:

- The process of content creation can now be done, based on algorithmically suggested topics
- Distribution of social media messages benefits from AI, which learns the optimum time to send tweets and posts
- Email communications can be designed using programs that apply basic learning principles
- Email composers learn what words, phrases and sentiments elicit positive responses, and suggest alterations to messages based on feedback. And emails to customers can be triggered based on learned events

Every marketing function you can think of is able to benefit from artificial intelligence."

2. FOR EXPERTS

ROD SENRA, TECHNOLOGY DIRECTOR, WORK AND CO: "We recently created a recommendation engine to match charitable giving programs from non-profit organisations (around 100 at launch) to a wide-range of businesses (about 10,000). This recommendation engine augments the power of human experts, though. Instead of analysing all combinations manually, our product allows experts to create spreadsheets containing tagging rules that are automatically applied to companies, based on their public information, or from curated data sources (MCI, Dun & Bradstreet). Work that would take months is done in a fraction of a second for all registered programs."

A data specialist using Sapientia, Congenica's genomics analysis platform

3. FOR WEB PUBLISHERS

KAI HENNIGES, CEO & CO-FOUNDER, VI: "AI removes the need to find and place relevant video content. That's not a task anyone misses, and allows editorial staff to do their core role better. With regards to advertising placements, ML-trained algorithms have enabled scale that previously would have required hundreds of media buyers. Their jobs weren't replaced, it was a task that was uneconomical – impossible even – without AI."

4. FOR DATA SPECIALISTS

KRIS CLARK, HEAD OF AI, LANDMARK INFORMATION GROUP: "Our biggest AI success so far is actually in how we manage our own data. What could previously be a very manual and labour-intensive process to structure, prepare and on-board third-party datasets is now being increasingly automated using a combination of RPA and NLP. It has meant our data people can be refocussed on more valuable tasks and has freed-up members of the team to get more involved in L&D and hackathons."
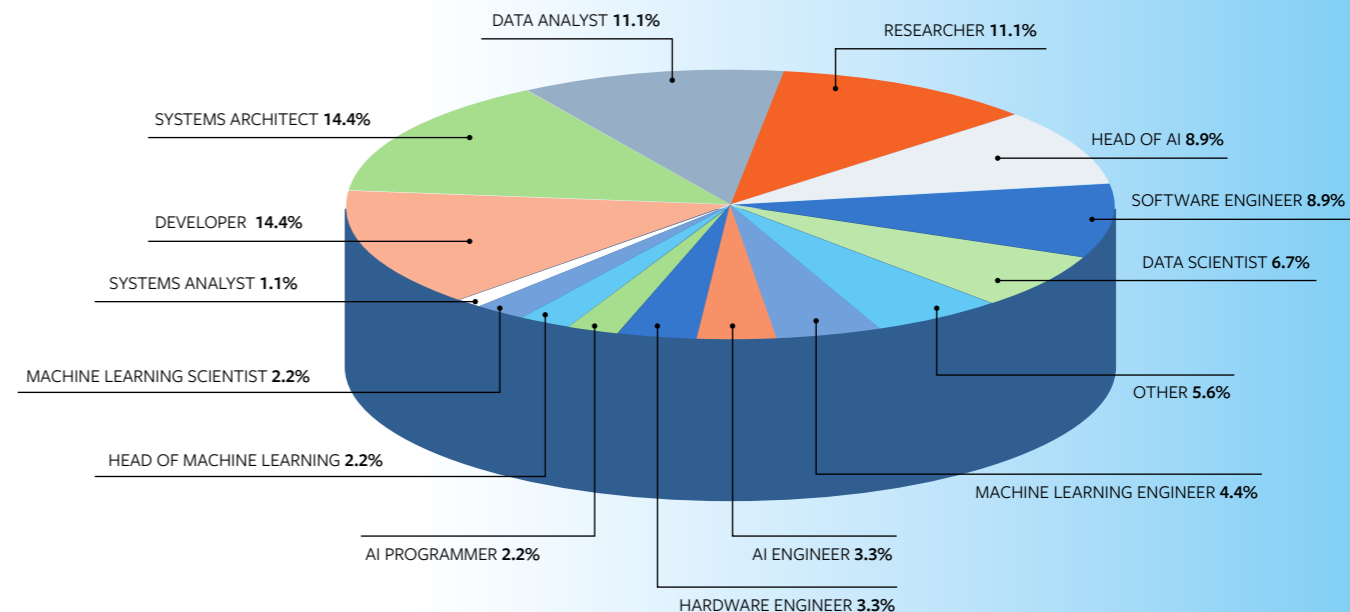
5. FOR RESEARCHERS

EMILY MACKAY, HEAD OF AI & DATA STRATEGY, CONGENICA: "It would be impossible for a human to review, annotate and recall every possible genomic variant, so models are a crucial part of genomic analysis. However, we're still a long way from the day when genomic conditions can be safely and accurately identified by AI alone. A human will remain in the loop with healthcare for the foreseeable."

ROLE BREAKDOWN: TOP AI ROLES

- DATA ANALYST **11.1%**
- RESEARCHER **11.1%**
- SYSTEMS ARCHITECT **14.4%**
- HEAD OF AI **8.9%**
- DEVELOPER **14.4%**
- SOFTWARE ENGINEER **8.9%**
- SYSTEMS ANALYST **1.1%**
- DATA SCIENTIST **6.7%**
- MACHINE LEARNING SCIENTIST **2.2%**
- OTHER **5.6%**
- HEAD OF MACHINE LEARNING **2.2%**
- MACHINE LEARNING ENGINEER **4.4%**
- AI PROGRAMMER **2.2%**
- AI ENGINEER **3.3%**
- HARDWARE ENGINEER **3.3%**

Source: Making AI Real, 2019

> ## "AI REMOVES THE NEED TO FIND AND PLACE RELEVANT VIDEO CONTENT. THAT'S NOT A TASK ANYONE MISSES."

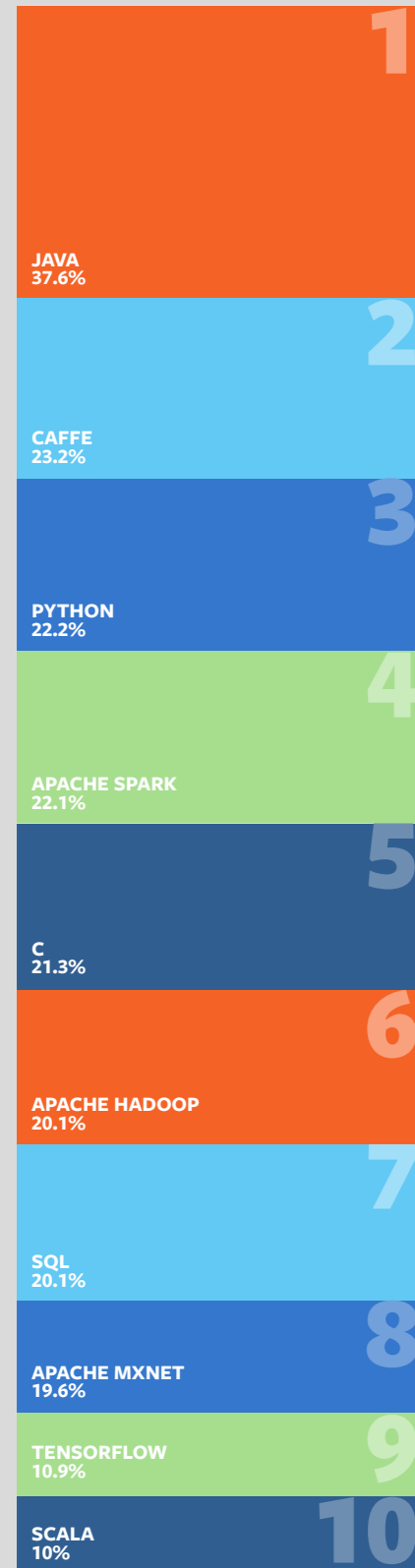**Work & Co created 'Roo', Planned Parenthood's first-ever AI chatbot**
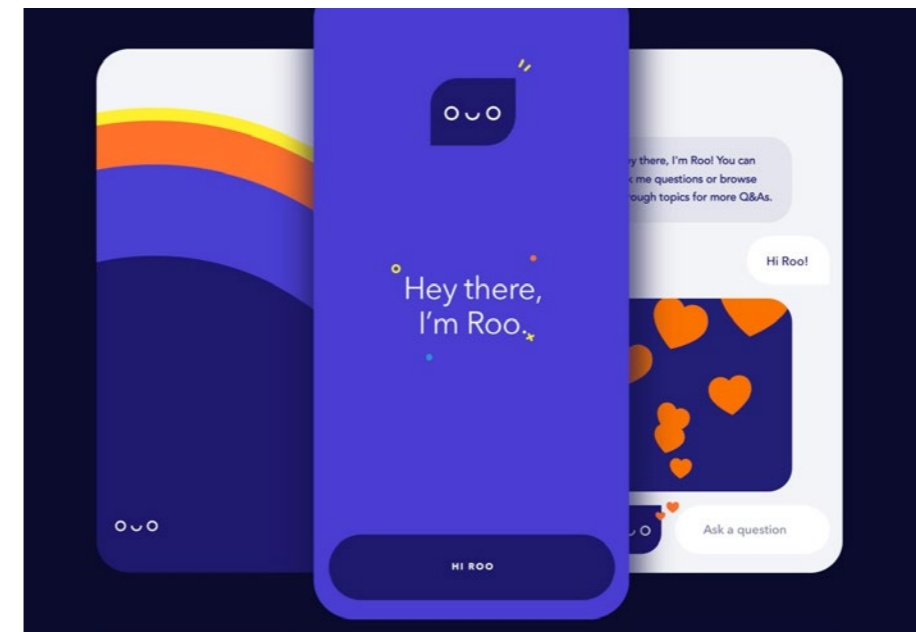
52% SAID SECURING AI FUNDING WAS DIFFICULT

We asked our panel of 652 people working with AI to tell us about their tech. Here's a rundown of the top tools that they use

1 JAVA
37.6%

2 CAFFE
23.2%

3 PYTHON
22.2%

4 APACHE SPARK
22.1%

5 C
21.3%

6 APACHE HADOOP
20.1%

7 SQL
20.1%

8 APACHE MXNET
19.6%

9 TENSORFLOW
10.9%

10 SCALA
10%

YOUR AI TOOLKIT

Discover the frameworks, libraries, apps, and platforms, used by pro AI devs. And see how they could be used within your own projects

Choosing the right tools and technology for any IT project can be a daunting proposition, and that's especially true when you are working with emerging technologies such as AI and machine learning.

In the Making AI Real Survey 2019 we asked our panel of 652 AI practitioners about the different products that they used within their projects. We asked them about the libraries they used. We quizzed them about their data handling. And tried to get a snapshot of the best tools, platforms and services that you can use as a starting point when you begin to work with artificial intelligence. There's no silver bullet. But these tools are tried and tested, and all deserve further consideration when you embark upon your next AI project.

KRIS CLARK, HEAD OF AI, LANDMARK INFORMATION GROUP: We work with a combination of on-prem, cloud and hybrid datasets, mostly due to the legacy way some of the businesses in our Group were acquired. We work with geospatial data, API integrations and self-hosted and governed databases, in addition to third party data acquired and normalised to our cloud data centre. We identified early in our AI journey that the disparate nature of these datasets may not serve us well in readiness for the next-gen services we are evolving,

so we're working on a number of data warehousing initiatives that will see more of our holdings centralised or virtualised to simplify discovery and production. As most of our product-stack is developed and deployed in Azure, we've tended to continue with a Microsoft-first mindset. This suits our software engineers and data scientists who are already familiar with the tech stack, enabling them to play in Azure Machine Learning Studio in a plug-and-play fashion without requiring significant upskilling. We do also give teams space to prototype and play off-piste, with concepts being proven at recent hackathons and in R&D projects in Python, Keras and TensorFlow. We are fortunate to have a dedicated Azure account management team as part of our Microsoft contract, which comes with ready access to both solutions architects and data scientists at Microsoft.

ROD SENRA, TECHNOLOGY DIRECTOR, WORK AND CO: We usually use an anonymised data sample from the client and process it locally, but the solution in production is usually engineered to be cloud based from the start.

In some rare cases, when the data is too sensitive or too voluminous, even the exploration phase is done in the cloud. In those cases where model building demands a lot of processing power, the GPU-based
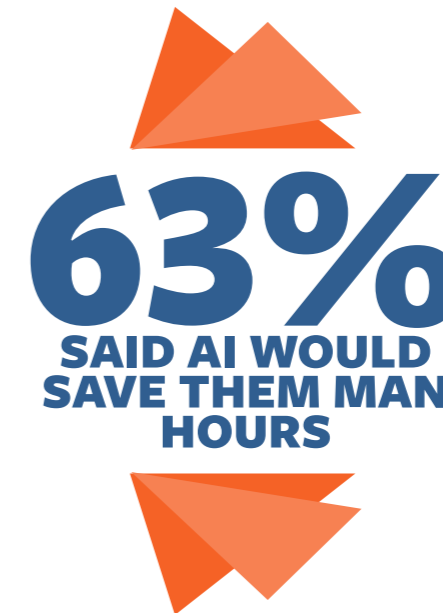
cloud resources are also more cost-effective for us. We have been using the Python stack for exploratory data analysis and model building (Pandas, NumPy, SciPy, Sci-Kit learn, Gensim, Jupyter Notebooks). In the case of voluminous data processing, we include Spark clusters. It's always a matter of two critical factors coming together. The first is what is realistic and extensible. We only want to build things that last. The second is what's our engineering team comfortable working with? In general, our teams are flexible and eager to learn about new tools that could bring benefits such as speed to market or things that can enhance the quality of our final products.

We're also big on peer-to-peer learning and knowledge sharing to expand on what we currently know. No, we have never used specialised hardware, other than occasional GPU mapping to speed up number-crunching.
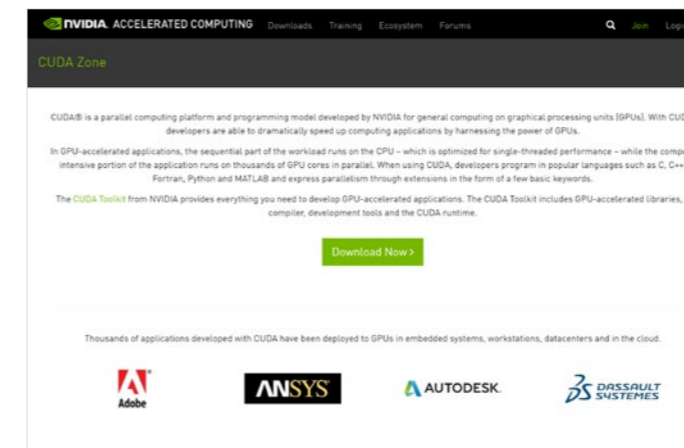
EMILY MACKAY, HEAD OF AI & DATA STRATEGY, CONGENICA: At the moment we're focusing mostly on supervised learning techniques. We have a rich data set of our own, so there's plenty of opportunity to delve deep to find new patterns.
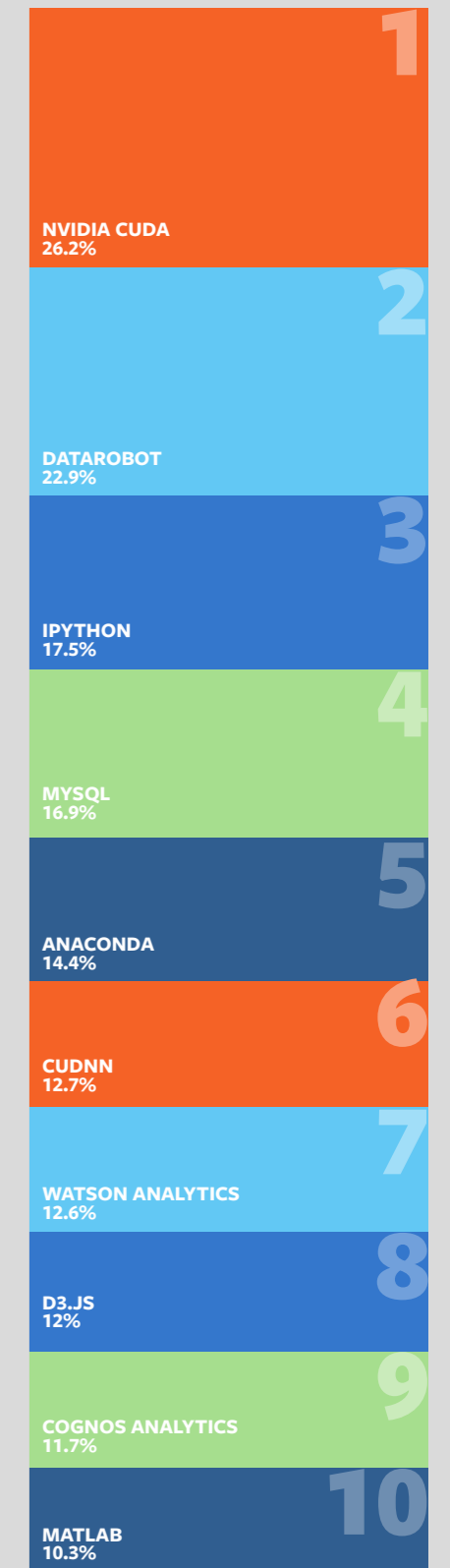
63%
SAID AI WOULD SAVE THEM MAN HOURS

"WE HAVE BEEN USING THE PYTHON STACK FOR EXPLORATORY DATA."

Above: Java is the top choice for frameworks and languages

Left: NVidia CUDA is the number one of the apps and libraries used

Our panel of AI experts reveals which apps and libraries they are using to deliver real-world artificial intelligence projects

1 NVIDIA CUDA
26.2%

2 DATAROBOT
22.9%

3 IPYTHON
17.5%

4 MYSQL
16.9%

5 ANACONDA
14.4%

6 CUDNN
12.7%

7 WATSON ANALYTICS
12.6%

8 D3.JS
12%

9 COGNOS ANALYTICS
11.7%

10 MATLAB
10.3%

Congenica offers both on-site and cloud services depending on the client need, so we handle a range of data systems. As a high regulated business, any experimental development work has to be separated from live services to ensure the integrity of the diagnostic support platform, so AI experiments are run separately.

As our experiments get more substantial there's a tipping point at which it may make economic sense to buy hardware. Although the cloud services are highly flexible, for extremely large data sets it can also be expensive, even when using in bursts.

DOUG BROWN, CHIEF DATA SCIENTIST, CAPITA: Our biggest opportunities are around the automation of most of our processes and the availability of both the data and insights that could be utilised by the client themselves either via a self-service or indeed an insight as a service. Opportunities could range from data ingestion to using the data taxonomy to automate making sense of the nature of the data we have; from a mega-bandwidth data pipeline to wrangled data that can be fed into appropriate cognitive engines; from cognitive engines making sense of which algorithms to apply to presentation of reports with meaningful narratives and visualisations. All these can be coupled with the transition to production ready apps that our

customers can interact with and gain deep and connectedness sense of their business models, processes, and methods.

RICHARD TIFFIN, CHIEF SCIENTIFIC OFFICER, AGRIMETRICS: We have used both supervised and unsupervised algorithms to identify land parcels. The attraction of this mixed approach is that it significantly reduces the need for ground based observation. This means that the product is rapidly scalable. We use cloud based technology because it means we can rapidly scale our infrastructure and that we have access to state of the art data science technologies. We operate in a multi-cloud environment. We make use of GCP, AWS and Azure. And we also use the following tools:

- SPARK for real-time in-memory processing;
- Tensorflow, pytorch, CTNK machine learning libraries to train our models;
- And we use SaaS and server-less computing pattern as a way to abstract the underlying hardware. In some special case, where there are specialist hardware dependencies, we may resort to CUDA or TPUs.

In some cases, where there are specialist hardware dependencies, we can utilise to GPUs or TPUs. ●

66%
CHOSE AI TO TRANSFORM THEIR BUSINESS MODEL

DISCOVER THE KIT THAT'S POWERING AI TODAY
The platform you use can have a bearing on the success of your AI project, and here we present a rundown of the tech being used by our survey respondents
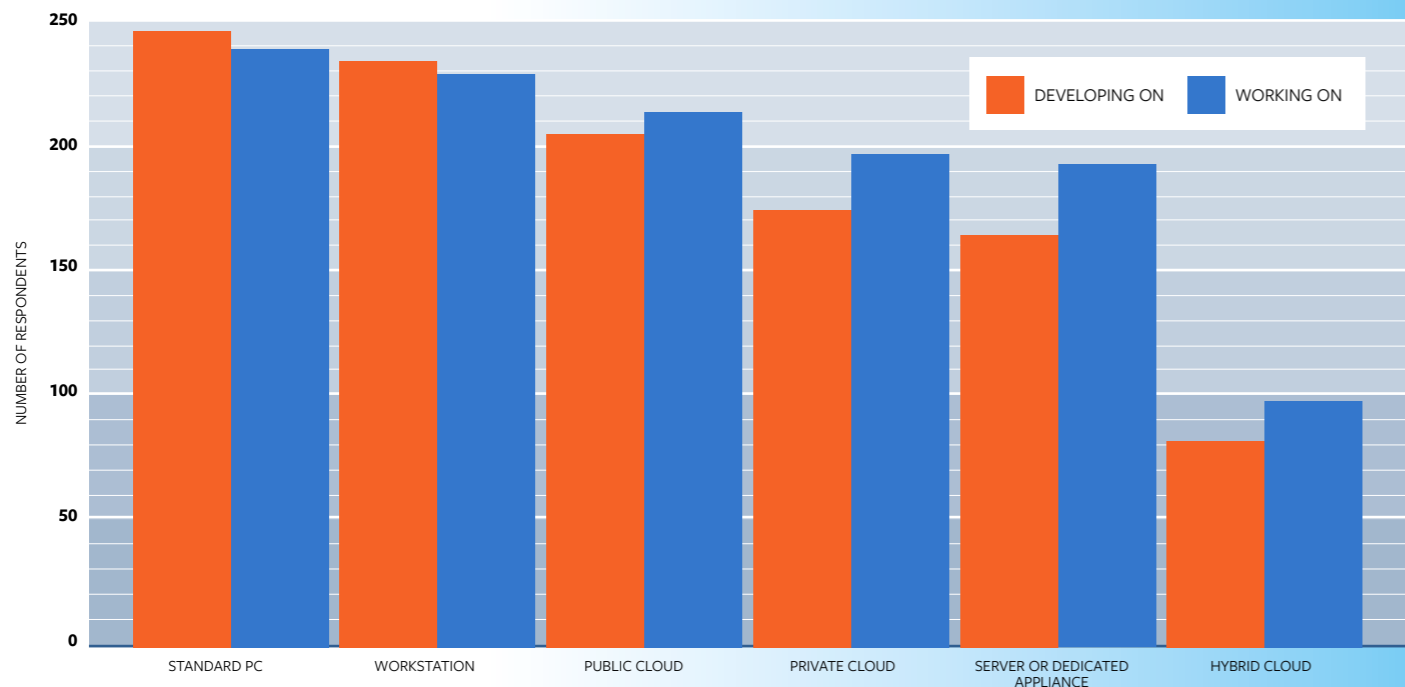
Source: Making AI Real, 2019

DELL READY SOLUTIONS FOR AI
HARNESS THE POWER OF AI

Dell Technologies provides an extensive portfolio of technologies, spanning workstations, servers, networking, storage, and services

Dell EMC provides a portfolio of Ready Solutions for AI, simplifying your IT infrastructure to provide faster, deeper insights.
And you can rely on the Dell EMC team of experts to help you adapt as AI, machine and deep learning evolve over time.

Dell EMC Ready Solutions for AI are validated, hardware and software stacks, optimised to accelerate your AI initiatives (and they can shorten the time to architect a new solution by 6-12 months).

They increase data scientists' productivity by offering self-service workspaces, allowing each data scientist to configure their environment from a library of AI models and frameworks.

And all in just a few clicks.
Dell EMC Ready Solutions for AI customers are able to do more with machine learning and Hadoop, with some saying it boosted data scientist productivity by as much as 30%.

Dell EMC Ready Solutions for AI provide for deep learning at scale, via leading Dell PowerEdge servers (with NVIDIA® GPUs), high-speed networking, and Dell Isilon all-flash scale-out NAS storage.

Designed for accelerated performance while eliminating I/O bottlenecks, Dell EMC Ready Solutions for AI deliver fast access to larger data sets to help improve model accuracy, while inferencing at scale can drive actionable responses in real-time.

And if you're looking for AI-ready workstations, there's the Dell Precision 5820 Tower, ideal for cognitive solution development and inference applications; the Dell Precision 7920 Tower, which handles learning model training and larger solution frameworks with ease; and the Dell Precision 7730, a mobile AI solution, and one of the world's most powerful 17" mobile workstations.

Whatever your industry, the evolving space of artificial intelligence will impact everything. And whether you're just getting started in AI, or are a seasoned Data Scientist, Dell Technologies can help you capitalise on the latest advances, saving you time and money, while reducing risk.

"DELL EMC PROVIDES A PORTFOLIO OF READY SOLUTIONS FOR AI."

qualtrics EXPERIENCE MGMT

AI IN THE FUTURE

Here we look at what the future might hold for AI use in business. And although concerns remain, they are dwarfed by AI's potential

Our survey has outlined many benefits of using AI, but it also captures a number of concerns that are shared across the business world. And despite being used for decades, AI still suffers from an 'emerging technology' label that can put more traditional organisations off. And as we've seen from our expert panel, it's often more traditional sectors that can reap the most rewards from AI. Here we look provide an overview of what the future holds for AI.

KRIS CLARK, HEAD OF AI, LANDMARK INFORMATION GROUP: Service industries that rely on disseminating complex information to customers are most likely to succeed by deploying AI. Taking my technology cap off and placing my business transformation cap on, I can replay the success we had with our SearchFlow property

THE TOP 5 AI USE CASES IN THE NEXT 24 MONTHS

We asked our panel of 652 BDMs to identify the AI they expect to be using within the next two years

SPEECH RECOGNITION

VIRTUAL AGENT CREATION

DECISION MANAGEMENT

NATURAL LANGUAGE GENERATION

IT MANAGEMENT

business at the UK Customer Experience Awards in 2018. Consumers are increasingly demanding instant digital access to information and services, and this demand continues to ramp up as new features land on the ever-smarter smartphones in their pockets. Continuing to adopt an old-school, 9-5 office-hours, premium-number access-only mindset in this day and age to talk to someone is something I believe we will see less and less of, in an era of voice activation and digital assistants.

Making core data accessible and interpretable, and continuing to keep it private and secure must be a key priority for service operators in all industries in the coming years. Beyond this, I see new opportunities in areas such as consumer protection, especially in a world where personal data is all too easily extracted from social media, and where our children or vulnerable members of society could find themselves at risk. Whereas today social networks manually respond to malicious content reports – placing employees in compromised positions where they must view content that could be obscene or disturbing – AI could soon take away this burden. If properly executed, ethically deployed and well supervised, it is a great example of the type of job no human would be battling to retain..

ROD SENRA, TECHNOLOGY DIRECTOR, WORK AND CO: We see two main goals that AI will help us to achieve. The first is to better understand customer behaviour, separating signal from noise. The second is to obtain a high level of process automation to enable seamless user experiences. We apply data science techniques to understand the business domain of our clients and their customers' behaviour. Some examples from our

recent projects include establishing the criteria behind a vast taxonomy tree for IKEA, and exploring the time-series of customer preferences for the fast-growing coffee chain Philz. After understanding a business domain from real data, we can apply cutting-edge technology to achieve design goals. Continuing with the aforementioned examples: how to better distribute furniture physically in the retail stores in such a way that allows customers to explore the product taxonomy both in depth as in breadth, or how to create a single click coffee recommendation engine that pleases both explorers (customer that like to experiment with different products every time) from monophagous (customers that are faithful to a subset of products or sometimes a single product).

KAI HENNIGES, CEO & CO-FOUNDER, VI: Any task that involves a modicum of predictability has potential for automation, and that's happening before our eyes. But tasks that involve analysis and response have huge potential to grow by combining automation with AI. That's going to happen in every sector imaginable.

DOUG BROWN, CHIEF DATA SCIENTIST, CAPITA: Working in the background, AI will monitor data in a company's ether, checking signs (through workplace analytics and all the data exchanging between the various digital task assistants) for heartbeat flutters and perturbations, by complementing it with big data. It will be possible to predict when an employee is about to start looking for another job, perhaps, or whether an employee is in the outliers of performance and productivity norms. It is entirely possible that the HR systems will
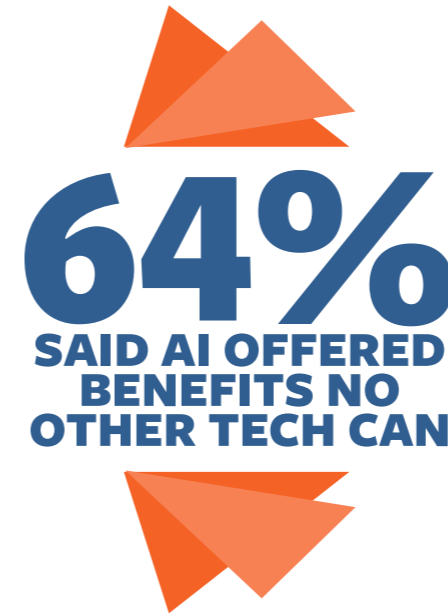
be able to tell when someone's health has deteriorated, perhaps even before they realise it themselves. We recently launched our thought leadership campaign "Human to Hybrid: The next workforce frontier" with the thesis that there is a new dynamic where humans will work in a fully digitised and technologically optimised environment, and increasingly work alongside robots and AI, over the next ten years. The research can be found at https://content.capitapeoplesolutions.co.uk/insights/wp-human-to-hybrid. The conclusion is that we are getting more connected and that we will make more use of technologies around data to make better, smarter decisions. In our case, we recognise that whole employee life-cycle will be disrupted by the implementation of digital identity in the form that can be realised using blockchain technology - be it private, federated or public. The current procedure to hire and on-board a recruit is lengthy. From conducting the interviews and checking qualifications to validating work backgrounds and gathering references– it all takes time.

The possible uses of blockchain include: verifying and validating the skills and education of recruits; enabling a trusted record of upskilling and workplace performance, enhancing cybersecurity and fraud prevention; and managing secure and instant payments to employees. Many companies will use the blockchain as the fabric of their processes. Establishing a digital identity will have an impact on the entire hire-to-retire lifecycle. The push for hyper- and super-convergence of many processes and services in the cloud will require that AI and blockchain be intertwined inextricably. IoT will fundamentally impact mush of what we do in the field of HR. It will provide us with generation and analysis of data that were not available earlier and open a new spectrum of possibilities for an AI. Work-place analytics will become much more current and insightful.

"IT'S OFTEN MORE TRADITIONAL SECTORS THAT CAN REAP THE MOST REWARDS FROM AI."

64%
SAID AI OFFERED BENEFITS NO OTHER TECH CAN

AI HELPDESK

Data expert **Emily Mackay** addresses the top five concerns that businesses have around AI adoption

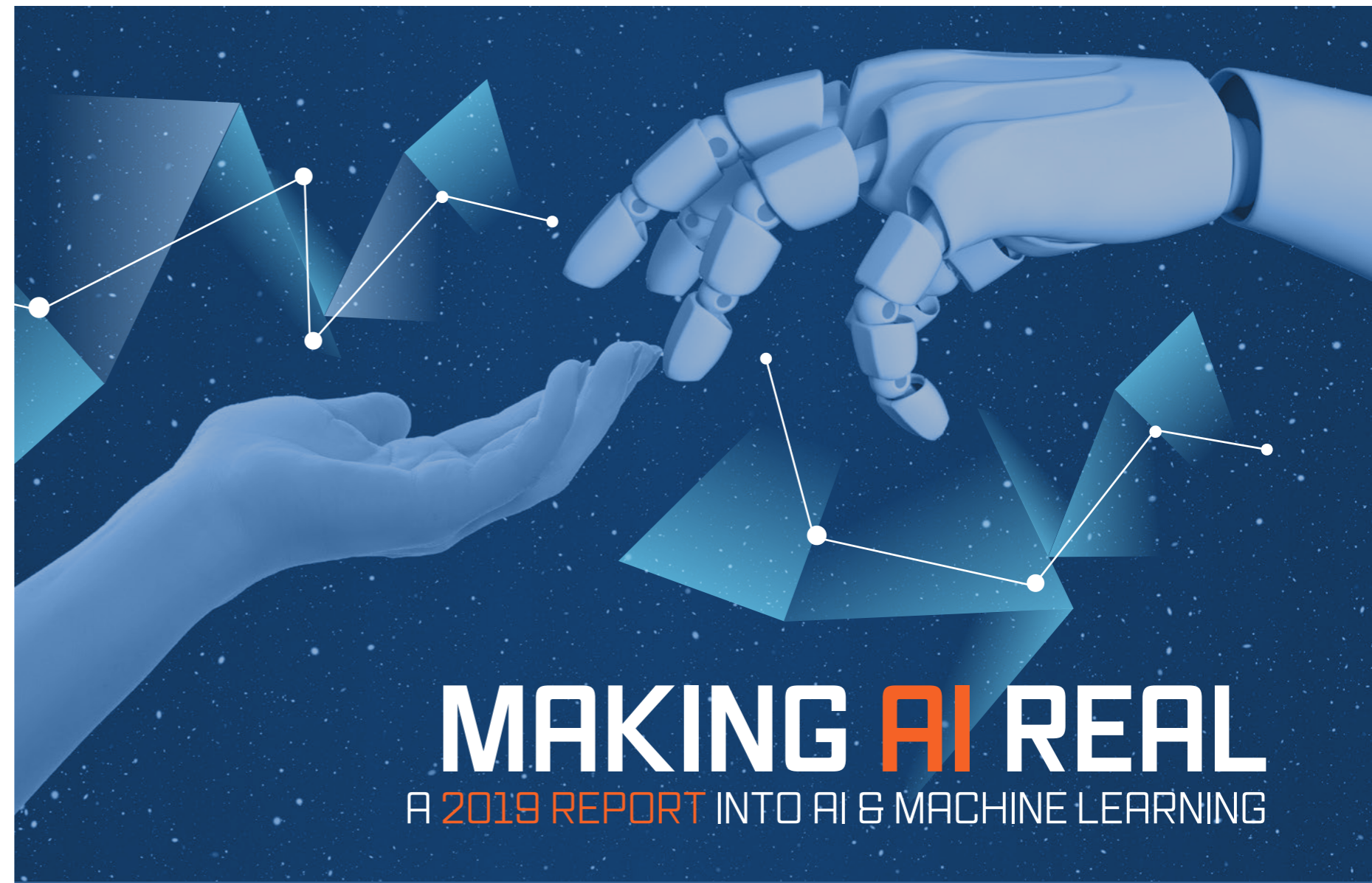| AI CONCERN	REAL-WORLD RESPONSE
AI IS STILL AN EMERGING TECHNOLOGY 29.8%	AI is not one technology, but a group of diverse technologies, including machine learning, robotics, sound recognition and much more. Actually, the foundation of machine learning (a major branch of AI) is statistics. The evolution we're experiencing is we now have scalable cloud computing, vast quantities of digital data, and desire to automate tasks done manually, which is why it's exciting. This is a time for exploring potential applications rather than waiting until it's mainstream then playing catch-up.
DATA LABELLING IS DIFFICULT 28.7%	Data wrangling is often an important part of AI, but there are options to consider before committing to lots of data clean up. More data does not always equal better models. So do ask how much data do you really need to label? Can you use unsupervised learning techniques instead, and would this reduce your effort? Perhaps manual data labelling can be outsourced, to a service such as Amazon Mechanical Turk.
TOO FEW PEOPLE HAVE AI DEVELOPMENT/ DATA SKILLS 24.5%	Access to talent is a challenge but there are excellent academic teams looking for applications for their skills and research. In the UK we have the Alan Turing Institute precisely to connect skills in academic teams to real world challenges.
THERE IS TOO MUCH HYPE AROUND AI 19%	I believe there's a need for robust education over sensationalist headlines. There is undoubtedly substantial benefits to be had from AI technologies. To build and gain market adoption and trust, clear explanations of how it works will be essential.
EMPLOYEES ARE WORRIED ABOUT THE USE OF AI 18.7%	Don't be. Also, it's important here to distinguish between general AI and narrow AI. The former is the vision of an artificial entity that can match or exceed the general capabilities of a human. This is understandably a contentious concept. However, the vast majority of AI is a very narrow application, such as predicting the weather, or understanding the flow of people to optimise energy consumption. In the case of Congenica, it's predicting where in a person's genome a change may have or could happen that will make them ill.

FINAL WORD

The **Making AI Real** 2019 report highlights the growing use of data science within almost every area of business and research. And our survey data reveals that AI's primary uses are in improving efficiency, reducing costs, and gaining a competitive advantage.

In our survey, 70% of those that had undertaken an AI project said it had saved them money, 68% said AI provided new business insight, and 65% said that AI helped improve efficiency.

The benefits are clear. But what's also clear is that AI is no longer an emerging technology – it's already arrived. And of the 2,633 business decision makers (BDMs) that we surveyed, 25% had already undertaken an AI project.

For businesses and organisations looking to introduce AI, we hope that this report gives you an inclusive overview of the primary considerations and benefits of artificial intelligence, and that it inspires you to go on and do more with your data.

62%
CHOSE AI TO REPLACE TASKS CARRIED OUT BY HUMANS

MAKING AI REAL
A 2019 REPORT INTO AI & MACHINE LEARNING