

## The Challenges of Artificial Intelligence

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Technology is advancing at incredible rates. Whether it's in the field of transport, communication, health or the public sector, technology is becoming ubiquitous. Big data, machine learning and artificial intelligence are no longer in the realms of science fiction; They have become the day-to-day reality that shapes lives, businesses, industries, societies and politics at national, regional and local levels. Technology is the medium through which people perceive and don't perceive events and things.

It would be useful to have single definitions on terms such as big data, machine learning and artificial intelligence. Yet, a brief review of the academic literature suggests that these terms are used interchangeably, with an underpinning assumption that researchers and practitioners know the meanings of these terms. For the purposes of this article, the terms big data, machine learning and artificial intelligence have the following interpretations.

Big Data refers to data sets that have certain characteristics, typically referred to in terms of Volume, Variety, Validity, Velocity, Veracity, Value and Visibility. Briefly, volume is the amount of data that is being generated, stored and processed. The volume of data being generated continues to grow exponentially due to devices (cars, toys, phones etc.) being connected to the internet and peoples' social activities (sharing photos, videos, etc.). Variety has to do with the availability of structured data (from sensors, databases, forms etc.) and unstructured data (blogs, videos, text messages, image recognition etc.). Velocity is the speed at which data is created, communicated and analysed. Validity refers to the underlying quality of the data as well as data governance policies and procedures for ensuring

data, metadata, standards, definitions and structures are consistent and maintained. Whereas Validity is at the level of the data, Veracity focuses upon the provenance of data sources: is the data from a trusted source? Could the data have been corrupted in any way? Visibility is the use of techniques to infer meanings and interpret data for effective decisions. Value is about ensuring relevant data is retained and used to provide insights and the 'nuggets of gold' that can be used to predict events and peoples' behaviours.<sup>1</sup>

Machine Learning, draws from the field of computer science<sup>2</sup> and, although not new, is a re-emergent phenomenon due to the availability of big data. Machine learning refers to algorithms that are 'designed to tackle computationally intensive pattern-recognition problems in extremely large datasets'.<sup>3</sup> Whereas in the past computers had to be programmed by humans, algorithms iterate such that as new data is processed the computations change and adapt independently due to in-built feedback loops that enable machines to learn from new data.<sup>4</sup>

Artificial intelligence is the broadest of the three concepts. Artificial intelligence covers a wide range of computing capabilities that enable machines to infer solutions, suggest or take actions and create outputs based on rules and outcomes rather than pre-specified commands and lines of computer code that established the actions to be taken at every step to resolve a problem.<sup>5</sup> Machine learning and big data practices are two vital building blocks of artificial intelligence.

The wave of artificial intelligence is expected to transform jobs, processes, supply chains, business models and social structures.<sup>6</sup> Current examples of AI include smartphone devices that combine voice,

### Notes

- 1 G. George, M.R. Haas and A. Pentland, 'Big Data and Management', *Academy of Management Journal* (April 2014), 321-326. DOI:10.5465/amj.2014.4002.
- 2 R. Kohavi and F. Provost, 'Glossary of terms', *Machine Learning* 30 (1998), 271-274.
- 3 Amir E. Khandani, Adlar J. Kim, Andrew W. Lo, 'Consumer credit-risk models via machine-learning algorithms', *Journal of Banking & Finance*, 34:11 (2010), 2767-2787 <https://doi.org/10.1016/j.jbankfin.2010.06.001>.
- 4 L.A. Migliore and R. Chinta, 'Demystifying the Big Data Phenomenon for Strategic Leadership', *SAM Advanced Management Journal* (07497075) 82:1 (2017), 48-58.
- 5 C. Roberts, M. Lawrence and L. King, 'Managing automation: Employment, inequality and ethics in the digital age', IPPR (2017). <http://www.ippr.org/publications/managing-automation>.
- 6 Erik Brynjolfsson and Andrew McAfee, The Business of Artificial Intelligence: What it can – and cannot – do for your organization, *Harvard Business Review* (2017). <https://hbr.org/cover-story/2017/07/the-business-of-artificial-intelligence>.

image and text recognition, and anticipated applications include driverless cars and trucks, cybersecurity and fraud detection. Artificial intelligence is expected to have first, second and third order effects on jobs. Recent studies show that the effects of AI on low skilled jobs will create even greater inequalities in society [Ibid IPPR]. Moreover, AI combines technologies to create entirely new business models. Consider for example the introduction of driverless cars<sup>7</sup> and the business model where car ownership is replaced by pay-for-use cars. First order effects of driverless cars, include the need for fewer driving instructors and test facilities. The greater the number of driverless cars leads to lower numbers of accidents thereby having second order effects on repair shops and claims assessors as fewer may be needed. When driverless cars are combined with a pay-per-use model, third order effects could result in not as many dealerships, warranty repairs and professional roles (accountants, HR, lawyers) which currently support the car ownership business model.

## Data and algorithms

The common threads that run through big data, machine learning and artificial intelligence are data and algorithms. Arguably data is one of the most valuable and least well managed assets of most organisations. There are regular reports of organisations losing data as a consequence of cyber-attacks, human frailties or insiders walking away with vast quantities of data.<sup>8</sup>

EU regulators have stepped in to raise the level of governance and care companies have to give to data under their control. The EU's General Data Protection Regulation<sup>9</sup> (GDPR) was approved in May 2016 and is due to come into effect in May 2018. GDPR is expected to become binding upon UK organisations post-Brexit especially where goods and services are sold or supplied to EU citizens or companies, particularly where the provision is digitally-based. GDPR applies to all businesses that process the personal data of EU subjects, irrespective of the company's location or whether or not data processing takes place EU. The penalties for breaches of the Regulations are 4% of the global annual turnover or Euros 20 million (whichever is greater)<sup>10</sup> According to the EU website, 'The aim of the GDPR is to protect all EU citizens from privacy and data breaches in an

increasingly data-driven world that is vastly different from the time in which the 1995 directive was established.'<sup>11</sup>

Although significant attention is being given to data, the development and use of algorithms has received little or no attention, governance, control or oversight. This is not only at national and international levels but also within organisations. Most board members barely understand the mathematical and computational aspects of algorithms let alone discuss them at board meetings. Yet it is algorithms that run large parts of many businesses today. Some examples include allocating the fastest workers at peak times and automatically removing drivers and delivery people in the gig economy, based on poor customer feedback and performance metrics. Some companies use algorithms to sift employee selections based on characteristics that are deemed to fit or not fit with the organisations culture.<sup>12</sup> Bots, a type of algorithm, are already having widespread effects. These are usually single purpose algorithms that are used to automate actions based upon rules. Bots can be used, for example, to amplify specific issues, which in the recent past, has led to fake news stories being created or specific messages being relayed to people to influence their perceptions of situations. Increasingly, decisions are taken without any human intervention based upon sets of rules that, at first, are created by human beings, with subsequent iterations of rules developed by machines based upon their intelligence and ability to learn. Professor Stephen Hawking warns about the unbridled and extensive diffusion of artificial intelligence into every aspect of human interaction, be they social, business and political.

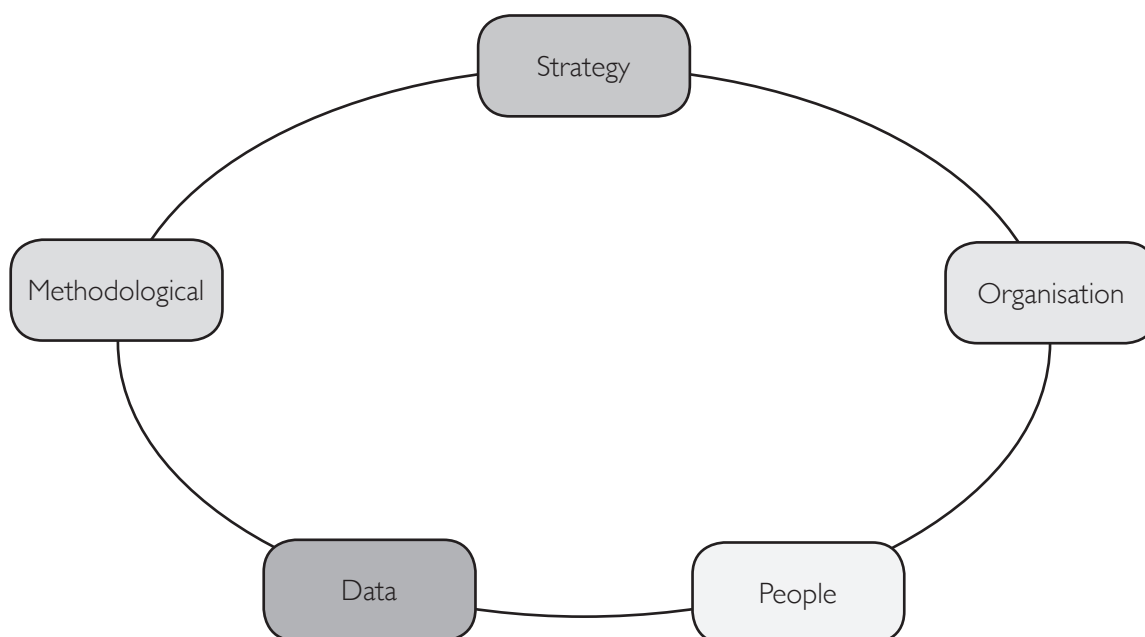
## Challenges AI poses

AI, machine learning and big data are shaping and influencing organisations and peoples' perceptions. There are many instances of big data and machine learning successes with few examples of organisations achieving repeated benefits. This suggests that there are no established processes for generating on-going, sustainable competitive advantage from these technologies. Moreover, these technologies are deemed to produce objective, scientifically-based outcomes. Big data's defining attributes are meant to remove bias and subjectivity. Yet, boards can get answers they want by

### Notes

- 7 D. Brougham, and J. Haar, 'Smart Technology, Artificial Intelligence, Robotics, and Algorithms (STARA): Employees' perceptions of our future workplace', *Journal of Management & Organization* (2017), 1-19. DOI:10.1017/jmo.2016.55.
- 8 Leaks such as the Panama Papers, documents released by Edward Snowden, and various corporate data losses including but not limited to Uber, Yahoo and Equifax to name a few. See <https://www.techworld.com/security/uks-most-infamous-data-breaches-3604586/>.
- 9 <https://www.eugdpr.org/> accessed 31 December 2017.
- 10 Ibid.
- 11 Ibid.
- 12 Henri Schildt, 'Big data and organizational design – the brave new world of algorithmic management and computer augmented transparency', *Innovation* 19:1 (2017), 23-30, DOI: 10.1080/14479338.2016.1252043.

Figure 1: Artificial intelligence, machine learning and big data challenges



configuring their choice of data sets, ways in which rules are conceived and embedded in algorithms and the statistical methods used. Big data provides the veneer of evidence based decision making that is predicated on skewed choices. The challenges are considered under five headings depicted in Figure 1.


### Strategic Challenge

Technology is changing well established and understood business models. Conventional logic and theories for developing strategies are found wanting and unable to fully explain how AI will impact upon longer term strategies. Internally, one of the biggest barriers organisations face when adopting AI, machine learning or big data is the prevailing culture. As with previous technological developments, peoples' mindsets and behaviours need to change to absorb the use of new technologies. People need to share data across internal and organisational boundaries, comply with regulations and collaborate with data providers they can trust. With the significant increase of cybercrime, organisations are becoming increasingly risk averse and yet, in the face of companies being formed based on business models that are almost completely driven by algorithms, there may be little choice other than to take on greater levels of risk.

### Organisational challenges

Technology requires organisations to work in more co-ordinated ways. Departmental silos have hindered the implementation of technologies due to lack of support and buy-in. Organisations may be driven to restructure and downsize their workforce. Whereas people in positions in formal authority take more significant decisions, the use of artificial intelligence suggests that decision making can be diffused to more decentralised positions if not incorporated completely in clever algorithms. This may lead to resistance from senior and middle managers in organisations.


### People challenges

Technologies in the past have affected manual jobs. Artificial intelligence has the capacity to question the very existence of knowledge based jobs. Experts such as accountants, customer services and administrators could be replaced by systems that are able to hold and process data in far greater quantities in shorter timescales than human beings. CEOs and board members often perceive AI as a 'techy' issue rather than recognising the strategic impact the emergent technologies can have. There is  widespread recognition that there is a shortage of skills required to support artificial intelligence such as data scientists and people with appropriate maths and statistical abilities. An underlying issue with the technologies is that people use data and methods that fit with their biases to reinforce their perspective.

### *Data challenges*

Managing data across their lifecycle continues to be poorly handled in many organisations. Data governance, where it exists, tends to be left to technologists rather than being seen to be a core part of everyone's job. The management of data – from its creation to its removal – is rarely seen as something that senior decision makers involve themselves with. Where external data is purchased or where real time unstructured data is used for big data or machine learning, there is always an element of leakage: data that is lost or corrupted during its stages of extraction, processing or analysis, which could reduce its veracity. Accessing data that is of high quality, the correct granularity and of sound provenance remain key obstacles.

### *Methodological challenges*

There are methodological wars going in the literature. Academics and practitioners are continually developing and publishing methods they claim are better at predicting the future than those that have gone before them. Arguably, many econometric and forecasting models have been shown to be lacking following the 2008 economic crash and polls being shown  to be wrong in a number of recent political elections. Selection of the range and number of input variables is open to the abuse of power, influence and idiosyncratic choices.

Artificial intelligence is the next wave of technology to cause seismic shifts in the ways in which organisations operate at all levels: strategic, operational and tactical. Organisations need to consider the ways in which they will overcome the challenges that AI, machine learning and big data poses to achieve sustainable competitive advantage.