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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON BUSINESS

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About this briefing

We live in what is possibly the most exciting period in human history. Artificial intelligence (AI) – defined as the ability of computer systems to exhibit intelligence – is being used to improve the quality and efficiency of systems and operations in sectors ranging from health and education to transport and energy. AI is the key driver of what is known as the fourth industrial revolution – the development of new technologies that bridge the physical, digital and biological worlds. It has made huge strides in recent decades and will have an increasing impact on business, the economy and society in coming years.

This briefing provides an overview of key challenges for the development and implementation of AI technologies, including consequences for business and society and questions that will need addressing. It outlines some of the leading thinking in the field and defines key concepts.

Machine learning

Current models of AI stem from cognitive and neural science, with the idea that we should not programme machines by telling them what to do each step of the way, but that we should teach them to learn to solve problems themselves. This approach is made possible by the convergence of increasing computer power, big data and machine learning. We must therefore think more in terms of cognition and neuroscience, rather than algorithms.

One of the main hardware architectures used in AI technology is Neuromorphic Computing, a model for computation that is closely aligned with the natural structure of a neural network. Neuromorphic hardware has a very low power consumption and can scale easily to perform under expanding workloads – it is anticipated to gain momentum with the increasing demand for AI.

Cognitive Horizon

The concept of cognitive horizon, a phrase coined by Dr Felix Hovsepian, can be used to describe the cognitive

Implications for business and policy

- AI technologies are likely to provide new market opportunities and competitive advantage. Perceptive organisations are already investing in proof of concept studies to determine whether there are opportunities to benefit from AI.
- AI technologies will require a different set of skills and a new mind-set to develop solutions for problems we can't solve with today's technology. Organisations – even those in the technology sector – should not underestimate the challenge.
- Rather than individual technologies, it is the fusion of a number of advanced technologies together with novel problem-solving approaches that is likely to have a significant impact on business and society. For example, intelligent machines are too complex to produce using conventional methods so will require new manufacturing techniques like 3D printing.

limitations of a system. It is the sum total of all knowledge that a system can potentially possess at any instant in time – that is, a set of given 'facts', or information, that it holds together with the result of all reasoning performed on this information to produce new deductions. For example, a smart watch worn to monitor by a patient's health might possess the information to recognise when factors such as their heart rate or blood sugar are higher or lower than their normal baseline. Using this information, the system would have the ability to then deduce when the patient is getting sick, and formulate a relevant treatment. Adding a new set of facts to the system (e.g. baseline readings for other health measures) will significantly expand its cognitive horizon as it will be able to make more deductions, based on a greater number of combinations of different facts. In other words, the whole is greater than the sum of its parts. Ultimately, an AI system has the capability to expand its knowledge and insights – its cognitive horizon - far beyond what a human can do themselves, reaching new levels of understanding.

Defining innovation

The effort, funding and time that can be consumed by AI development should not be underestimated. For example, neural networks were a concept that began in the 1940s but are only just beginning to bear fruit. In order to determine the resources and time needed for a successful AI project, it is useful to have a framework for defining the nature of the problem being addressed, and the type of innovation needed to approach it. In a 2012 article, Greg Sattell outlined 4 categories of innovation:

- Basic research: The type of work done at universities to discover how things work, with no clearly defined problem or outcome.
- Sustaining innovation: Work commonly done by corporate organisations such as Apple to address clearly defined problems, e.g. developing pocket-sized iPods with a large amount of memory.
- Disruptive innovation: New approaches to old products and services – often you won't know what you are looking for until you see it.
- Breakthrough Innovation: A field may have trouble moving forward and breakthroughs often come from newcomers with a fresh approach.

A 'Breakthrough Innovation' can be described as an 'Invention' because it involves a paradigm shift in order to create something entirely new. In contrast, an innovation can be defined as a shift in context which takes an existing concept and makes it better.

Ethics and jobs

Most leaders within the AI community have predicted that a significant proportion of jobs will be automated, in as little as 20 years - from factory workers and farmers to doctors and lawyers. McKinsey & Company suggests the figure could be as high as 45%. As the leading AI scientist and director of research at Google recently warned in an interview, "the real worry is how to prepare for the mass elimination of jobs that is surely coming."

In a recent article, Klaus Schwab highlights the widening gap between progress and society's ability to cope with its consequences. He emphasises the need for all stakeholders to collaborate to deliver our future by design rather than default, and to ensure new technologies are used to create a better world rather than one of increased disparity and insecurity. Much debate is needed before we decide on the form our future society should take.

Conclusion

AI is still evolving but it is important that we pursue meaningful and useful machine intelligence and consider the impact new technologies have when used together rather than individually. Whether AI is used for the imitation of human tasks or for more complex human and non-human work will be driven by the quality of models of computation. For example, whether self-driving cars will be completely automated or need human assistance is open to debate. However, businesses looking at AI should not be asking 'how can we do what we do but better, cheaper and faster?' The question is 'what can we do today that is fundamentally different to what we have done up to now?'

Further information

This briefing is based on:
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The views contained in this briefing do not necessarily reflect the views of the University of Warwick.

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