ARTIFICIAL INTELLIGENCE

A more intelligent future

Artificial intelligence (AI) is expected to be one of the most pervasive disruptive technologies, touching every part of our lives and fundamentally changing the way we use and interact with technology. AI's ability to transform vast amounts of complex, ambiguous information into real insights has the potential to help solve some of the world's most enduring problems and to undertake tasks with greater efficiency and scale than a human could.

The technology

AI is the construction of computers, algorithms and robots that mimic the intelligence observed in humans, such as learning, problem solving and rationalising. Unlike traditional computing, AI can make decisions in a range of situations that have not been pre-programmed into it by a human.

Much of AI is about systems that can learn and evolve through experience, often to carry our specialised tasks such as driving, playing a strategy based game, or making investment decisions. This subset, also referred to as cognitive computing, needs to be trained by learning from experts.

Looking to the future, the focus is on creating an Artificial General Intelligence (AGI) that can apply itself to a broad range of tasks in a much less structured way.

The potential

As part of a wave of automation, we are seeing widespread and rapid adoption of early AI technologies that are transforming industries across every sector. This will have wide ranging implications for the global economy, countries and organisations, and will only accelerate as parallel technologies, such as the Internet of Things, unlock more opportunities.

The barriers

Although AI would be very different from human intelligence, high profile commentators such as Stephen Hawking and Elon Musk have pointed to the potential risks should its performance and capabilities dramatically exceed that of humans. AI also raises questions about how its decisions should reflect a moral/ethical code.

There is currently a significant debate and little consensus about when (and indeed whether) true AGI can be achieved, but many industry observers believe it is unlikely before 2030. However, given the current rapid evolution of such technologies, we may be at the early part of a dramatic increase in AI development.

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Some Example Applications…
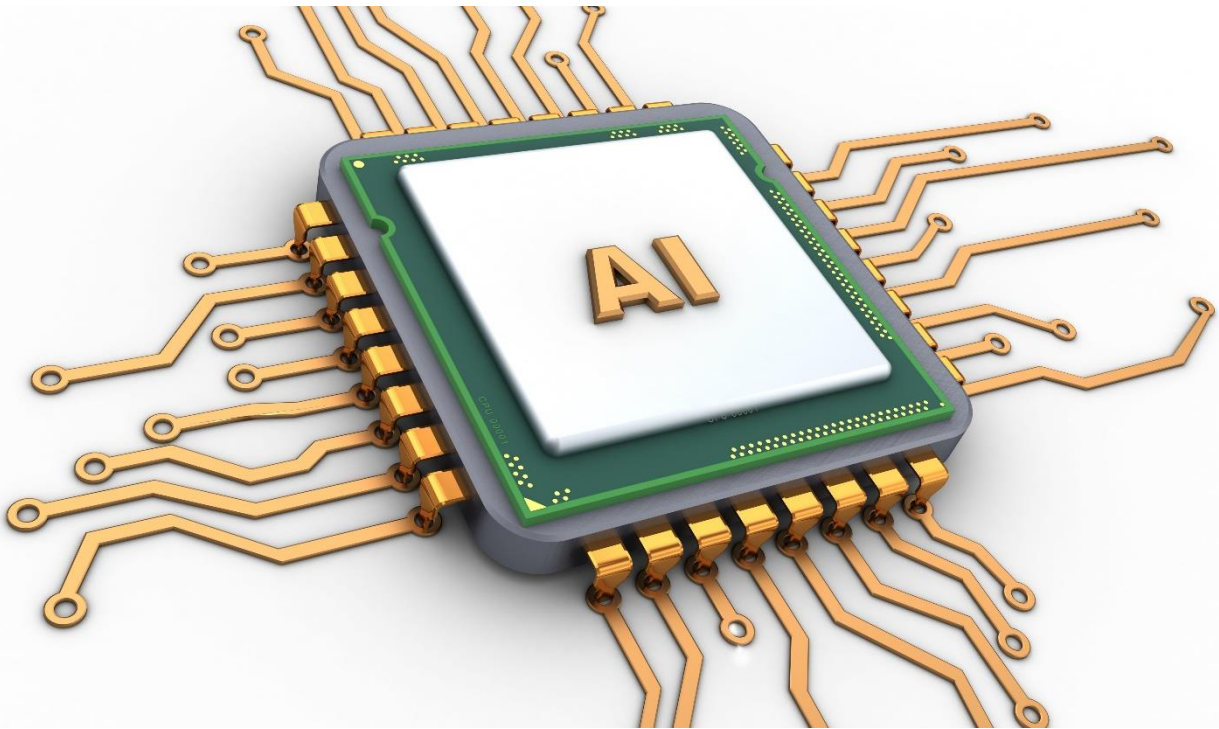
Identifying poverty hotspots from satellite images

A team of computer scientists and satellite experts at Stanford University have created a self-updating world map to locate poverty. Analysing household survey data, and day and night time satellite images, the system looks for signs of poverty, such as intensity of nightlight, and finds correlations with roads, urban areas, farmlands and waterways. Initially focused on five African nations, the team plan to create a worldwide poverty map that will be publicly available online to support governments target their policies and programs more effectively .

Just-in-time water management

JEA (a Florida water company) is using artificial intelligence to reduce withdrawal of water from the area aquifer in Jacksonville, USA. Their system forecasts consumption, then monitors, regulates and adjusts supply in real-time, providing a just-in-time water supply. This minimises well production during peak hours, optimises reservoir storage, and reduces the number of pump starts required, lowering energy consumption and maintenance costs. It means JEA can meet the growing demands of its customer base, reduce the need to dig new wells and preserve Florida's aquifer for the future.

Cognitive revolution for healthcare

STFC Hartree® Centre at Alder Hey Children's Hospital is harnessing the power and potential of IBM Watson's cognitive computing technology to personalise healthcare and enhance the patient experience. It has an enormous range of potential applications including quicker identification of clinical trends and monitoring admission patterns.

This project is creating a path to more personalised treatment, better health outcomes, increased patient satisfaction and significant cost savings.

Key Numbers

$6.1 bn
Estimated AI market size in 2020

Source: Statista

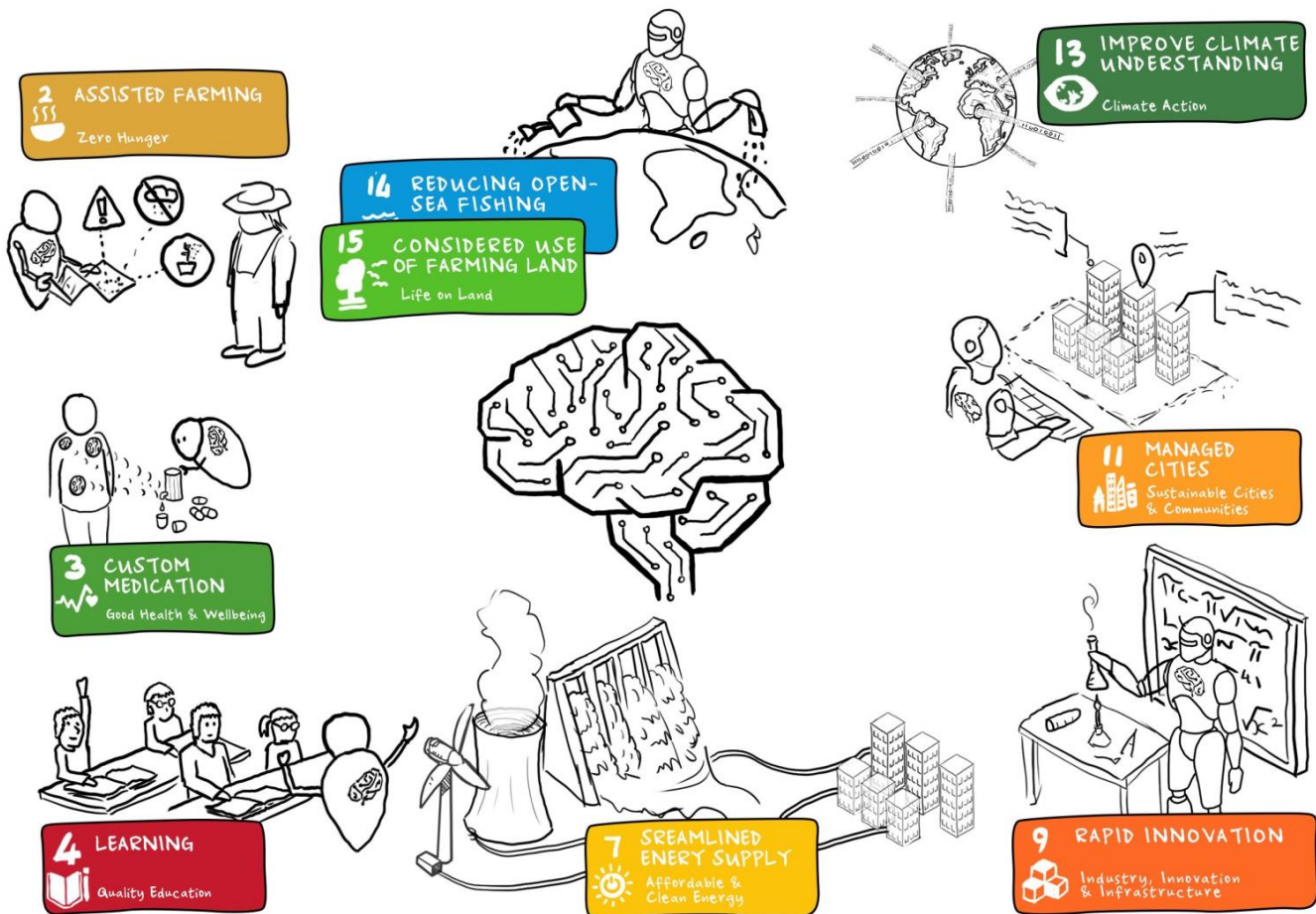## $47 bn
Estimated spending on AI technologies 2020

Source: IDC

283%
Increase in published patent applications involving AI 2010-2016

Source: Hoffman Warnick

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Advancing the Sustainable Development Goals (SDGs)

2 ASSISTED FARMING — Zero Hunger

14 REDUCING OPEN-SEA FISHING

15 CONSIDERED USE OF FARMING LAND — Life on Land

13 IMPROVE CLIMATE UNDERSTANDING — Climate Action

3 CUSTOM MEDICATION — Good Health & Wellbeing

11 MANAGED CITIES — Sustainable Cities & Communities

4 LEARNING — Quality Education

7 SREAMLINED ENERY SUPPLY — Affordable & Clean Energy

9 RAPID INNOVATION — Industry, Innovation & Infrastructure

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Artificial Intelligence has the potential to advance many of the SDGs. Below are some examples of areas of application across a wide variety of sectors.

π SDG 2 Zero hunger
- Analyse seed genetic data to create crops that can thrive and adapt in changing conditions.
- Increase effectiveness of food supply chains through the use of AI technologies to drive insights that improve efficiency and reduce wastage.
- Support for farmers' decision making and increases in productivity.

π SDG 3 Good health and wellbeing
- Mine healthcare records to improve quality of treatments and provide better and faster health services.
- Analysis of large-scale genetic data sets to help create new types of treatment and precision medicines customised for individuals.
- Provide expert assistance in diagnosis especially in repetitive tasks such as analysis of images and large bodies of research information.
- Provide immediate first line consultation to improve waiting times to see a doctor.
- Reduce pressure on frontline staff by using robots in healthcare.
- Speed up the development of new drugs allowing treatments to reach those who need them more quickly.

π SDG 4 Quality education
- Improve learning outcomes through the analysis of data about individual learning, social and learning contexts, and personal interests.
- Provide virtual mentors for learners by integrating modelling, social simulation and knowledge representation.
- Provide lifelong learning companions that help the learner to adapt and build new skills throughout their lifetime.

π SDG 7 Affordable and clean energy

- Optimise energy generation and reduce environmental impact through analysis of operational and environmental data.
- Help consumers to find the most affordable and clean energy deals by using AI agents.

π SDG 9 Industry, innovation and infrastructure

- Help employees to make better decisions by providing insights based upon the analysis of complex data sets.
- Accelerate innovation cycles and improve time to market through the use of machine learning and predictive analytics.

π SDG 11 Sustainable cities and communities

- Enable smarter and more efficient design of cities and communities, for example by discovering the correlations between design decisions and their impacts on peoples' daily lives.
- Empower citizens to make wiser choices for themselves and their collective communities.
- Orchestrate and optimise traffic flows and energy allocation within cities, as well as the use of wider physical and human resources to maximise benefits.

π SDG 13 Climate action

- Improve actions to mitigate climate change through better modelling and analysis of large, complex data sets.

π π SDG 14/15 Life on land/below water

- Generate insight to help to improve the sustainable management of land resources – soil, forests, biodiversity and allow greater understanding of the impact of land use choices through predictive analytics and machine learning.

Potential Negative Impacts and Barriers

As a less mature technology, the potential negative impacts of Artificial Intelligence are still being explored. However, science fiction and human imagination provide an insight into what we can expect.

Do as we say, not as we do

Organisations will need to put in place strong governance for AI activities to ensure that systems perform ethically and do not embed harmful assumptions that have unanticipated consequences, or discriminatory behaviours in their algorithms. Furthermore, AI will inevitably be deployed for criminal purposes, and in warfare, with implications for current legal and ethical frameworks.

Workforce considerations

The adoption of AI and the technologies of automation may lead to unemployment in many industries and professions. Society and organisations will need to respond to this. Concepts such as Universal Basic Income are being discussed by some as potential policy responses. Other options could be to make the technologies of automation a common good to ensure that benefits are felt fairly across society and not just by those at the top, and the creation of insurance schemes to protect against technological redundancy.

Organisations will need to plan how to integrate AI into their workforces and understand where it will be of greatest benefit and how it complements the human workforce. There is great potential for humans and AI to work together, for example the way that IBM's Watson enhances the diagnostic capabilities of medical professionals rather than just replacing them.

AI can also improve the effectiveness of individual workers by acting as a personal assistant e.g. a conversational robot advising a shop worker to help answer a customer's questions. It also has a role to play in innovation, enhancing the generation of ideas and creativity of humans across all sectors.

There will, however, be new demands on education systems to equip children with the right skills and qualities for a future in which many of today's jobs will not exist.

Equality of access

At present it is not entirely clear whether AI technologies will be fully democratised and accessible to anyone who wishes to use them, or whether there will be significant barriers to entry for those outside mainstream business. The business landscape could be dominated by a few small players who capture most of the value, or could open up platforms to enable innovation and value creation by start-ups and experimenters. As with many emerging technologies, the military are one of the early adopters, meaning those countries with larger defence budgets may benefit from early applications.

Technical Considerations

Whilst AI is now a commercial technology, there are still significant technical challenges to overcome in order to fulfil its potential.

Learning to learn

The use of the term intelligence often leads to misconceptions about the capabilities of AI and risk of anthropomorphism (assigning human-like traits and behaviours to non-human things). Much of the AI technology available today learns or optimises its activity to specific goals, and so is only capable of doing what it is told. Its capabilities reflect the training data and its quality, and the design of the AI processes. Typically there is still a need for human involvement to handle exceptions.

That means AI in its current form is narrow and specialised to work specific applications and the processes and programs it follows are non-transferable. The Google Deepmind applications that triumphed against the best human players of the board game Go! could not beat even an average human player at chess.

The major change will come when AI starts to become truly intelligent and able to learn actions that it has not been taught. However, there is no agreement whether this technical milestone is achievable.

Unknown unknowns

Another technical challenge that will have to be overcome is the comprehension gap with what humans can themselves understand. The internal workings of AI systems are often not transparent and it can be difficult for humans to understand how AI learning systems have arrived at their conclusions. To combat this, designers and observers have discussed requiring a certain level of explanatory logic in AI systems, to allow for the checking of errors and for humans to learn and understand in parallel.

Enabling New Business Models

AI has the potential to solve problems that humans and current systems cannot

AI's capability to create new insight, to learn, and to automate tasks on a large scale has huge potential to transform industries and how businesses work, improving efficiency, effectiveness and speed.

AI can make business models more efficient by taking on responsibility for more routine work, which has well-defined goals, at lower cost. It can also augment human capabilities with expertise such as the way IBM's Watson's supports oncologists by providing analysis of a breadth of research that no human doctor could ever hope to read.

Specific applications could include:

- Advances and breakthroughs in medical research, material sciences and energy technologies
- Automated monitoring and analysis of the environment, satellite imagery
- Automation of vehicles reducing pollution and traffic deaths
- Intelligent automated supply chains - reducing waste and driving efficiency.

AI technologies are closely associated with data science and analytics and much of the impact on business models will come from new approaches to securing insight from large and often unstructured data. Increasingly sophisticated AI algorithms will often be able to function without human intervention allowing existing business models to be fine tuned and streamlined.

Many of these algorithms can already be found in investment banking and high frequency trading. Future examples where they could be applied include the optimisation and balancing of energy usage, both in consumer and industrial settings, and the potential for reduced waste and fuel usage.

Artificial intelligence will enable a number of the disruptive business model levers identified on the Project Breakthrough website, specifically:

A more personalised product or service

AI will allow the creation of highly personalised products and services, based on deep customer insight from multiple datasets, and learning of preferences over time.

A closed-loop process

AI will allow more effective and efficient production and consumption to be designed and managed, at a scale and complexity that is beyond existing approaches.

An agile and adaptive organisation

AI will allow organisations to make more sense of the data they have about their customers, markets and operations, and to anticipate how best to adapt and respond to changing needs.

More Examples...

Helping game keepers identify where poachers could strike

https://news.nationalgeographic.com/2016/06/paws-artificial-intelligence-fights-poaching-ranger-patrols-wildlife-conservation/

Helping refugees find trusted information using a smart phone

https://www.theguardian.com/public-leaders-network/2016/oct/17/refugee-information-facebook-social-media-tech-help

Building an AI Doctor to diagnose illnesses

https://www.babylonhealth.com/

United Nations Global Compact

The United Nations Global Compact is a call to companies everywhere to align their operations and strategies with ten universally accepted principles in the areas of human rights, labour, environment and anti-corruption, and to take action in support of UN goals and issues embodied in the Sustainable Development Goals. The UN Global Compact is a leadership platform for the development, implementation and disclosure of responsible corporate practices. It is the largest corporate sustainability initiative in the world, with more than 9,000 companies and 3,000 non-business signatories globally.

Project Breakthrough

Project Breakthrough – a collaboration between UN Global Compact, Volans and partners – spotlights the best thinking in sustainable innovation. It showcases innovators across mainstream companies and next generation entrepreneurs who are developing solutions with the potential to achieve exponential impact. It features analysis and resources designed to help leaders understand the new business models and technologies that will be crucial in achieving the SDGs, catalysing action amongst today's businesses to meet the needs of tomorrow's world.

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The Disruptive Technology Executive Briefs are produced in collaboration with PA Consulting Group, combining cross sector technology, innovation and business design expertise. The briefs are intended as an easy to digest introduction to disruptive technologies, to help organisations understand how they could advance the Sustainable Development Goals and business performance. These overviews explore key features, examples of applications, potential positive and negative impacts, and how they may enable the new business models.

Visit www.projectbreakthrough.io for more information, or contact projectbreakthrough@unglobalcompact.org