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Old MacDonald Had a Bot, A-I-A-I-O

If you've asked Amazon's Alexa what the weather was, have ridden in a self-driving car or noticed how Netflix suggests new content for you to watch, then you have come in contact with some form of artificial intelligence (AI). In this edition of Trends & Ideas (T&I), we look into how AI, a technology that is evolving every day, is set to shape the future of our world and the ways to invest in such a transformative technology.

What is AI?

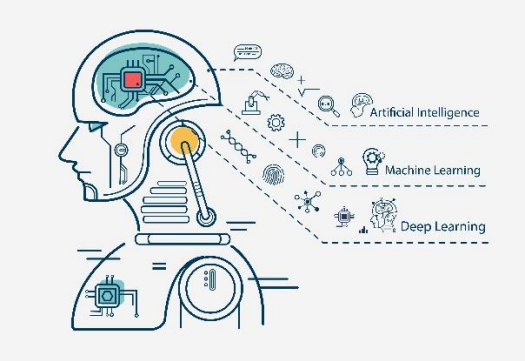
While AI may seem like a new form of technology, research in this field has actually been around for over 60 years; and the term "artificial intelligence" was first coined by John McCarthy at Dartmouth College in 1956. The field of study remained mainly in classrooms and top secret labs in its early years, but has become a lot more mainstream in the last decade. AI systems allow computers and machines to perform tasks that would normally require human intelligence such as recognizing speech and images, planning, learning, and solving problems. However, as opposed to humans, AI is not prone to things like short term memory loss, sleep deprivation or information overload. Today, terms such as machine learning (ML) and deep learning (DL) are used interchangeably with AI, but while AI is the field of study in computer science, it encompasses both ML and DL. Companies at the forefront of AI are focusing on ML, a process whereby machines can access data, apply algorithms and learn to create useful insights. ML has been used for voice, facial and object recognition, which have been implemented in personal assistants such as Apple's Siri. As for DL, this subset takes AI a step further by trying to mimic how the human brain works using artificial neural networks. In addition to voice and image recognition, DL is being implemented to recognize handwriting, detect fraud, conduct health diagnoses, and predict consumer preferences among other applications.

As a whole, AI is expected to lift global GDP through both increased consumption and labour productivity. In 2017, some had estimated that AI would lift global GDP by over $15 tln by the year 2030, or the equivalent of China's and the UK's GDP combined. While some may associate labour productivity with lost jobs, during the industrial revolution, machines helped humans solve complex problems, increased efficiency in repetitive tasks and allowed for scalability. In a similar fashion, AI-powered machines should allow today's worker to focus on bigger and more complex tasks while leaving the smaller/simpler tasks to robots and machines. As such, humans could accomplish more in less time, and focus on mastering strategies and building relationships - what humans do best.

Data – Fuel for AI

For AI to function properly, it needs data. For instance, facial recognition technology requires around 15 mln images while speech recognition needs 150k hours of audio data (or around 17 years' worth). Even though the concept of AI

AI, ML and DL



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AI to Lift People and Businesses

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AI Needs Data

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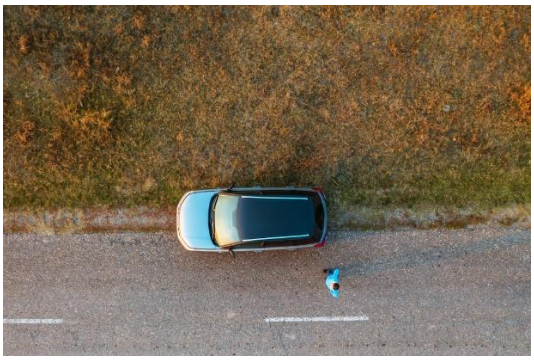
has been around for over half a century, the lack of data and the inability to process large sums of data limited its potential. However, that is no longer a problem. There are ~4.6 bln people connected and feeding the internet with data via search, content preferences, location data and much more (as scary as that seems). As at 2017, 90% of the world's data had been collected in the two preceding years; and this is expected to grow exponentially over time thanks to advancements in areas like the Internet of Things (IoT).

Perfect Storm – IoT, 5G, Cybersecurity and AI

IoT is the idea of fitting any "thing" or machine you can think of with a sensor that can provide users with information. This could be the machine's temperature, acceleration, position or anything of scale that the user may be interested in. Devices connected to the internet and equipped with sensors can collect vast amounts of data, which can in turn be fed into an AI system to analyze in order to provide insights and help users make decisions in their environment. Think of your smart watch reminding you to get a doctor's checkup, your fridge helping you complete your grocery list, or your driverless car picking you up after a romantic dinner with your significant other. In order for such connectivity to exist seamlessly, there is need for an ultra-fast and low latency network infrastructure, also known as 5G. The next generation of network connectivity is essential to allow a smooth connection for IoT devices. Without 5G your self-driving car may stop during the middle of a trip because the vehicle lost the network signal. If this future becomes a reality and almost everything around us is linked to the internet, one can't help but imagine the great need for securing those connections and devices from malicious cyber-attacks. The combination of 5G, IoT, cybersecurity and AI systems go hand-in-hand and it is expected to lead to a future of intelligent connectivity, allowing companies to securely collect data and analyze it, producing accurate insights securely. For those interested in reading more about 5G, please see our T&I titled *The Fifth Generation* published on June 7, 2019; the Internet of Things in *A Connected World* on February 2, 2018; and cyber security in the edition titled *Cyber Security* from May 1, 2015.

No 5G Connection?



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Beneficiaries of AI

- **Data owners.** Large tech companies that own vast amounts of data can leverage this information to fuel their AI systems to perform more analytics, giving these tech giants a deep moat that allows them to fight off new entrants. These companies monetize their AI by powering their digital advertising, using it as part of their voice-activated personal assistants or as a way to recommend products/content to website visitors among other applications. Think of companies like **Amazon.com (AMZN-US), Facebook (FB-US), Microsoft (MSFT-US), Netflix (NFLX-US),** or **Alphabet (GOOGL-US)** as being on the forefront of such advancements.
- **AI programmers.** While companies that create AI systems to enhance their own products and services are set to benefit, those that offer AI cloud-based products to customers through an AI-as-a-Service (AIaaS) subscription model are also beneficiaries in this area. Companies that offer pay-as-you-go services allow customers to leverage their own data in order to improve their product and service offerings. Companies here include **salesforce.com (CRM-US), Alteryx (AYX-US), Amazon.com (AMZN), International Business Machines (IBM-US), Microsoft (MSFT-US), Alphabet (GOOGL-US), Dynatrace (DT-US)** and **SAP (SAP-US).**
- **Hardware producers.** The software on which AI runs needs ample computing power in order to derive insights. As such, the companies that create semiconductors, memory storage or other hardware required to apply AI technology are just as important. Such companies are necessary to meet computing demands to power drones, data centers or robotics that employ AI software. Companies involved here include **NVIDIA (NVDA-US), Intel (INTC-US), Micron Technology (MU-US), Advanced Micro Devices (AMD-US)** and **QUALCOMM (QCOM-US).**

Applications of AI

- **Robotics and industrial automation.** Advancements in robotics and AI are expected to automate many industrial processes from assembling large aircraft engines to small microchips. Around a tenth of manufacturing functions were automated in 2015 and some estimate this to increase to 25% by 2025. Robots are now more empowered by being equipped with cameras and voice recognition software. Sensors and camera data analyzed by AI systems can alert assembly line operators of any

errors in production; or the system could rectify those errors themselves. Additionally, the advancement of virtual or augmented reality headsets may also allow future workers to remotely monitor and adjust industrial machines as well as make inspections and repairs – think of such applications within mining sites, nuclear plants or oil rigs. Companies in this space: **Brooks Automation (BRKS-US), ABB (ABB-US), Cognex (CGNX-US), iRobot (IRBT-US), Rockwell Automation (ROK-US)** and **Teradyne (TER-US).**

AI & Robotics

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- **Transportation**. AI systems take data points from radars, GPS and camera sensors and analyze them to allow cars to effectively navigate themselves, suggest assistance to drivers in order to avoid collisions or plan the best itinerary. 5G infrastructure's low latency networks are expected to power self-driving cars by allowing vehicles to communicate with their surroundings and collect an abundance of data from vehicle location, speed to weather and road conditions. Some estimate that by 2023, 15% of passenger vehicles could be autonomous cars. In addition to self-driving cars, such infrastructure may also enable the development of unmanned aerial vehicles such as drones to deliver goods to areas characterized by challenging terrain or that are inaccessible by land. Companies in this space: **NVIDIA (NVDA-US), AeroVironment (AVAV-US), Tesla (TSLA-US)** and **Cerence (CRNC-US).**

AI Powering Self-driving Cars

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- **Health care**. AI is expected to advance many areas of the health care sector from virtual nursing assistants to surgeries by robots. For instance, data from Smart wearable devices may be analyzed by AI-powered health care providers and monitor the wearer's current health status as well as predict possible issues in real-time. Some medical procedures such as neurosurgery and cardiac valve repair employ AI and robotics in their medical procedures today. In combination with 5G and IoT, future care may allow for remote diagnosis, in addition to providing access to medical care for those geographically far from medical experts. Such developments are expected to make health care services more efficient and accurate. In fact, IBM's Watson supercomputer is able to diagnose lung cancer in patients with 90% accuracy versus 50% for human physicians. Companies in this space: **International Business Machines (IBM-US), Alphabet (GOOGL-US), Health Catalyst (HCAT-US)** and **Intuitive Surgical (ISRG-US).**
- **Retail**. AI is at play anytime you get an ad for a product that you searched for only once in your life. Generating recommendations for customers allows retailers to grow their top lines. AI systems can also help retailers reduce costs by planning better supply chain solutions and reducing inventory by being better able to predict customer orders. Companies in the space: **Shopify (SHOP-T), Amazon.com (AMZN-US), Adobe (ADBE-US)** and **Trade Desk (TTD-US).**
- **Personal assistants**. Voice and speech recognition technology have made digital assistants more useful from asking them to play our favourite song, today's news, weather, make reservations or buy goods. Companies in the space: **Apple (AAPL-US), Alphabet (GOOGL-US)** and **Amazon.com (AMZN-US)**.

Conclusion

We've only scratched the surface of AI in this piece, but it's safe to say that AI is a fascinating tool for companies that know how to leverage it in today's fast-moving world. With the buildout of 5G, advancement in IoT and cybersecurity, AI will be apt to provide solutions to both consumers and businesses. And it's not all business – AI is also being utilized for creative endeavours, including paintings, poems, and even scripts for films. Clients interested in individual company or fund solutions to invest in this space can reach out to their financial advisor for more information.

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