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How data will transform our lives

Quantum computing is poised to provide the processing power to analyse a growing avalanche of information

The real world around us is rapidly being digitalised. Consider for a minute the notion that our environment is a living system with infinite characteristics from which we can measure and capture data. This data can then be processed into information to help us have a greater understanding of our environment so we can better manage our lives – for example, predict adverse weather, the impacts of climate change, pollution etc.

Similarly, industry and commerce are also dynamic and living systems in which people trade and machines produce, with systems and processes forever being developed and improved to transform raw inputs into finished goods and services.

The characteristics of these systems are also infinite and the more characteristics we measure through data capture, the more we can understand, predict, control and optimise industry and commerce to better serve us.

The scope of data-gathering is growing in all walks of life. Consumer sectors including games, finance, health and consumer goods and services are identifying new ways to acquire user data.

The emergent bioeconomy promises to shape the future of sectors such as medicine and healthcare delivery. It relies on massive harvesting of biodata – DNA, health statistics, disease symptoms and additional insights generated by our bodies. Analysts estimate the market for the health data collected through connected wearable fitness and medical devices, namely the internet of things (IoT) will be worth at least $US300 billion ($450 billion) by 2025.

These practices gather the building blocks of life and develop massive and ever-growing health data sets, which present an opportunity for doctors to gather reliable, long-term patient insights to develop more targeted treatment plans.

These large volumes of data sets will unlock immense and, at present, unimaginable possibilities for improving our health and quality of life, and extending average age. Imagine doctors being able to receive real-time reporting of the effects of different drugs on a patient and using this information to modify and optimise a treatment plan rather than waiting on imprecise verbal feedback from patients and time-consuming and costly follow-up diagnostics and blood tests.

The amount of data we are creating is rising exponentially. The world created two zettabytes of data (a big number – it has 21 zeros) in 2010 and by 2025 we will create 181 zettabytes. That is an unimaginable volume of data, which would have been okay if it just posed a storage challenge, but the emerging issue for companies like Google and Amazon, and countries like the US and China, is the immense amount of computing power required

to retrieve and allow consumers, companies and governments to convert this data into increasingly innovative and wide-ranging information for making decisions.

Improve information

Data itself is meaningless, but once you start mapping it using algorithms, you convert data into meaningful information, which is powerful for improving the accuracy of predictions and decision making. Algorithms are sets of computer-coded rules applied on stored data with an objective of solving real-world problems.

For example, my doctor can use my health data measured by my wearable fitness device to identify correlations between my physical activity levels and heart health or weight management. Based on the analysis, the doctor can generate personalised recommendations for improving my health. This may include exercise plans, nutrition recommendations or medication changes.

Computer algorithms to date have been generated by humans to analyse data. However, with the advent of AI, computers can generate their own algorithms, analyse the data and make recommendations to humans for actioning. If we allow it, the algorithms will act themselves. It is powerful and transformative technology so, yes, there is a lot of paranoia around how AI could potentially be destructive for humans.

I will leave that debate for another time, however, and focus on the positives. The fact is AI technology is going to become mainstream in all facets of our lives and we need to understand what that means and where we can participate in this trend as investors.

Computers hit a wall

With a huge volume of data and algorithms to process, the focus is shifting to whether or not computing power can keep up with the demand for processing all this information.

Current supercomputers that run our internet are built on the fundamentals of classic computing, which involves storing data in binary bits (1s and 0s) and then running sequential processing (one after the other) to generate information from the stored data. In the coming years, classical computers are going to hit a wall in how much they can handle the relentless avalanche of data.

3 FUNDS TO WATCH

Defiance Quantum ETF (NYSE: QTUM)

The investment seeks to track the total return performance, before fees and expenses, of the BlueStar Quantum Computing and Machine Learning Index. The index consists of a modified equal-weighted portfolio of the companies that derive at least 50% of their annual revenue or operating activity from the development of quantum computing and machine learning technology.

VanEck Semiconductor ETF (NASDAQ: SMH)

The fund tracks the overall performance of the 25 largest US-listed companies that produce semiconductors, which act as the brains in numerous devices that we rely on today, including smartphones, calculators and computers. As technology improves and expands, these chips will invariably be in demand to help power new devices.

Semiconductor ETF (ASX: SEMI)

The Global X Semiconductor ETF seeks to invest in companies that stand to benefit from the broader adoption of devices that require semiconductors. This includes the development and manufacturing of semiconductors.

Classical computers are made of microchips that use transistors to store and process information. (I wrote about microchips in February.) The size of transistors has been shrinking over the past decades, which has allowed for an exponential increase in computing power.

However, there is a physical limit to how small transistors can become before they are no longer functional due to quantum mechanical effects, which basically means transistors become so small (smaller than atoms) that they start to lose their physical nature and start to be defined in terms of wave(energy)-particle duality.

So, what will be the solution for continuing the expansion of computing power in line with demand for data and information processing?

How to solve the problem

There is growing interest in an alternative computing processing power that can provide a solution to the limitations of classical computing. Quantum computers use quantum bits (qubits) instead of classical bits and are not limited by the same physical constraints as classical computers.

In a quantum computer, a qubit can exist in multiple states simultaneously, which is called a superposition. This is like having a switch that can be in two different positions at once. This fundamentally changes the way computers process information, allowing them to perform calculations much faster.

Imagine a world where a computer can perform, in mere seconds, calculations that would take current systems millions of years to complete.

With this incredible processing power, quantum computing will enable breakthroughs in many fields and handle the gargantuan increases of data that will need to be processed. It is poised to revolutionise the world of computing as we know it.

There are a number of companies, including IBM, Google, Microsoft, Intel and Honeywell, racing to develop quantum computers. They will offer quantum computing to power cloud systems like Amazon Web Services and Google's platform, where myriad applications will flourish to extract information from large and disparate data sets.

ChatGPT is the latest example. It is still being powered by classical computing, but at some stage it will move to quantum computing processors and will become unimaginably predictable, wise and – dare I say – beneficial to us humans.

The investment returns for semiconductor stocks (as measured by the VanEck Semiconductor ETF) over the past one and five years have been streets ahead of the Nasdaq composite index, the S&P 500 index and the S&P/ASX 200 index. My sense is we will see similar returns for a quantum computing ETF in the next five years and beyond.

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