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The Rise of the Machines Technology Enabled Investing

IS&P Liquid Alternatives

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Reports, conferences, and everyday conversations increasingly revolve around the topic of technological progress and in particular, the widening influence of Artificial Intelligence (AI). Investors looking to benefit from the opportunities face several trade-offs (including liquidity, access, and scalability). An interesting alternative to traditional investments is to allocate capital to strategies that utilise AI as a core part of their investment process. These approaches have the ability to generate new sources of returns and do not expose investors to significant market or liquidity risks. In order to better assess the risks and rewards of such investment options, in this paper, we provide an overview of some of the most fundamental technological shifts within the investment industry, and how to profit from them.

The Technological Tsunami

We are currently experiencing one of the most significant periods of technological advancement since the early 1800s industrial revolution. One key factor that sets this revolution apart from all others in history is the increasing speed of its advance and the resulting economic changes. In the space of just a few years Uber successfully turned the taxi industry on its head, and the likes of Netflix and Amazon are quickly making the TV networks of yesterday redundant.

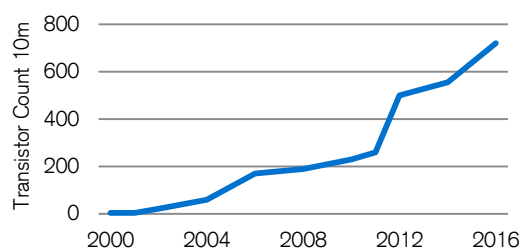
Technology has also revolutionised the way we deal with many day-to-day tasks and is increasingly proving itself to be superior to humans in a range of complex situations. Machines have the ability to analyse and interpret vast amounts of information faster and more accurately than any human ever could. Self-driving cars are already making their way to the streets and are set to be the safer choice by removing the sub-optimal human error component¹.

This technological tsunami is bringing waves of change across industries, and the world of finance is no exception. For many years now, investment firms have utilised ever more advanced computing techniques to their advantage in the analysis and interpretation of data. However, even the most advanced techniques were often constrained by processing power, utilised limited data-sets, and relied on inhibited human thinking to define an approach. Today, due to the technological advancements of recent years, the financial industry need no longer be held back by these constraints and is starting to use Artificial Intelligence in a more fundamental way.

Artificial Intelligence

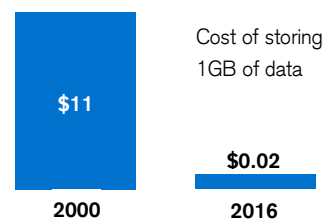
The simulation of human thought process by machines; these can include learning, reasoning, and self-correction.

Computer power has increased over 170x since 2000



Source: Intel²

Data availability rockets while storage costs plummet



Source: Statistic Brain³

Advancements in the analysis of complex data sets



An algorithm identifies which parts of an image will be most memorable to humans (red:high, blue:low, ranking from 0 to 1)

Source: MIT CSAIL / NVIDIA⁴

1 Imperfect Self-Driving Cars Are Safer Than Humans Are. *The Wall Street Journal*. [Online] <https://www.wsj.com/articles/imperfect-self-driving-cars-are-safer-than-humans-are-1471188659>.

2 50 Years of Moore's Law. Intel. [Online] <https://www.intel.com/content/www/us/en/silicon-innovations/moores-law-technology.html>.

3 Statistic Brain. *Average Cost of Hard Drive Storage*. [Online] <http://www.statisticbrain.com/average-cost-of-hard-drive-storage/>.

4 NVIDIA. Predicting Photos' Memorability at "Near-Human" Levels with Deep Learning. [Online] <https://news.developer.nvidia.com/predicting-photos-memorability-at-near-human-levels-with-deep-learning/>. Published with permission from MIT CSAIL.

Data, Data, Everywhere

Every day, we create 2.5 quintillion bytes of new data, and 90% of the data in the world today has been created in the last two years alone⁵. Investors are no longer limited to the confines of financial reports, sales estimates, and growth statistics as an indicator of likely future returns; it is now possible to utilise a vast range of data sources, and while many appear surprising at first, the logic behind the thinking is sound:

- **Social media flows** can be interpreted using a method known as Natural Language Processing that assesses if a remark made about a company is positive or negative, and the subsequent market impact.
- **Satellite imaging** provides managers with real time information on (for example) supermarket carpark usage, and the potential implications on sales and revenue growth.
- **Temperature analysis** of the ocean can be used to predict weather patterns, the effect on crop yields, and the corresponding price change.

In addition to the above, most of today's information is captured electronically in, or close to, real time. Large volumes of structured and unstructured data generated with increasing frequency are referred to as Big Data. The challenge in utilising this effectively is that as the data set grows, so does the level of complexity required to capture beneficial insights. This phenomenon is known in the technology industry as the 4 Vs:

- **Volume:** Growing in size from gigabytes to terabytes to petabytes and beyond.
- **Variety:** Moving from well-structured financial information to noisy sensor data, free text, and ultimately completely unstructured data such as video and voice.
- **Velocity:** Increasing speed of delivery from quarterly financial statements, monthly economic indicators, and daily intraday stock prices to almost fully real time for social media flows.
- **Veracity:** The increasing uncertainty of the accuracy of the data as it grows in size and comes from ever more diverse and unknown sources.

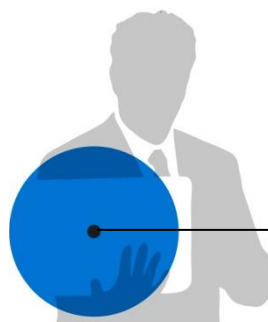
Big Data

Used to describe large and complex data sets that are often out of scope for traditional analysis techniques.



90%

of the data in the world was created in the last two years alone.⁵



2.5 quintillion bytes

of new data is created every day⁵

[Equivalent of 2.3 Trillion Gigabytes]

⁵ IBM. *What is big data?* [Online] <https://www-01.ibm.com/software/data/bigdata/what-is-big-data.html>.

Thinking for Yourself

In order to make use of the Big Data revolution, the industry is increasingly utilising a process known as Machine Learning. The technique systematically identifies patterns and relationships in data sets and uses that information to make predictions on new data (much in the same way a financial analyst would manually). Machine Learning has evolved substantially over the past two decades, but has recently exploded in use as participants from a variety of industries race to interpret the Big Data challenge. The technique can be divided into two categories: supervised and unsupervised.

Supervised Machine Learning involves training algorithms using labelled examples, where the desired output is known. This approach has been widely utilised in handwriting analysis and was successfully implemented by the US Postal Service in the 1980s⁶. In this instance, the algorithm is supplied with pictures of hand written letters which have already been matched to their actual characters. The machine therefore learns how to identify cursive characters through pattern recognition. Once fully trained, the algorithm is able to make predictions based on live data and automatically read the addresses on letters, in many cases better than a human could.

Input: Analysing data feeds concerning a stock (i.e. news releases from a variety of sources); analysis of data on a stock in relation to another entity

→ **Output:** Trading the stock from the long or short side (or not trading); trading vs another stock (positive or negative correlation)

Unsupervised Machine Learning utilises data sets that have not been labelled and the algorithm must decide what is being shown. The goal is for computers to identify repeatable patterns and relationships within the data without being told the types of patterns and relationships to look for. Overtime, the system learns from experience in certain tasks and uses that knowledge to improve future performance. The goal is for the machine to explore the data and find a structure within. Here, we increasingly move towards what could be considered as an artificially intelligent researcher and trader.

Input: In genomics, DNA genes

→ **Output:** Clustering of genes, i.e. finding some combination of genes whose expression levels can distinguish different groups of patients

Algorithm

A process or set of rules to be followed in calculations or other problem-solving operations, especially by a computer.

Machine Learning

The process by which a computer program is able to identify repeatable patterns in data without human involvement and adapt to changes in that data set overtime.

6 Postal Mechanization and Early Automation. *US Postal Service*. [Online] https://about.usps.com/publications/pub100/pub100_042.htm.

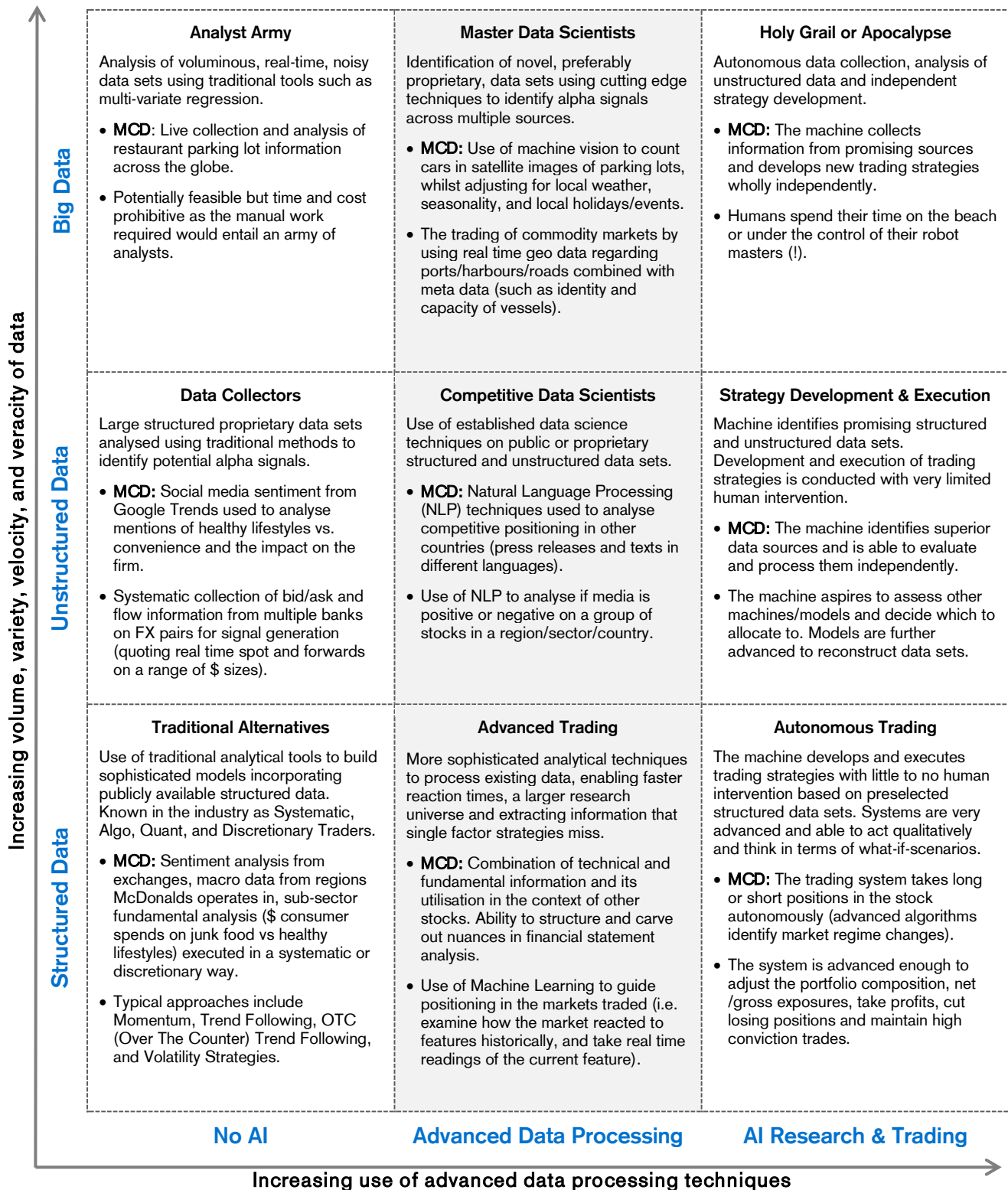
Navigating the Landscape

In an attempt to better understand the potential development of investing through Artificial intelligence and the utilisation of Big Data, we have classified the industry into the following chart. As we move up along the y axis, data complexity increases in-line with the 4 Vs of Big Data mentioned previously. On the x axis we gradually introduce more advanced data processing techniques that are better equipped to interpret these complex data sets: from traditional tools (like analytical statistics) to AI-based research systems (e.g. Natural Language Processing) to fully autonomous artificial intelligent trading systems.

In order to demonstrate how the techniques differ in practice, we have taken the case of trading McDonalds stock (NYSE: MCD) and subsequently provide wider examples from the investment management industry. Similar processes could be used for other companies and assets with more complexity.

The central column is where we currently spend much of our focus. These trading strategies utilise advanced processing techniques to analyse large data sets and tend to have proven performance track records.

Chart: Applications of Big Data and Artificial Intelligence in Alternative Investment Strategies



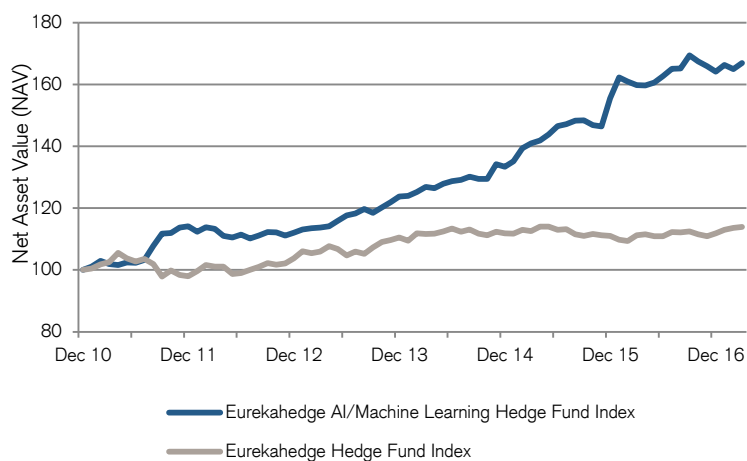
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First Mover Advantage

The concepts discussed previously are intriguing, but how do they perform in practice? The chart below compares the performance of these emerging strategies with more “traditional alternative techniques”.

The initial returns look attractive as managers have been successful in utilising new techniques and data sources to generate differentiated returns. However, as Machine Learning and Artificial Intelligence driven investing are relatively new approaches; the sample size is small and performance comparisons must be taken with a pinch of salt. Part of the outperformance can be explained by first mover advantage, which is an edge that will diminish as the industry grows. Nevertheless, as an increasing number of investors utilise alternative data sets, it is also likely that markets will begin to react in advance of the traditional sources, and at some point, Big Data and AI will become a core tool in the investment management industry.

Figure 1: Eureka hedge AI/Machine Learning vs. Traditional Alternatives



Source: Eureka hedge as of March 2017

Historical performance indications and financial market scenarios are no reliable indicators of future performance.

A World of Expertise

Whilst Big Data, Machine Learning, and Artificial Intelligence are reshaping the finance industry, one component remains unchanged: those who develop the systems in the first place. The investment landscape has traditionally been dominated by men of a similar age, who studied the same subject at similar universities, and now work together in the world's financial super cities; this concentration reduces the potential for new ideas. In reality, talent is distributed widely across the globe and for an industry that highlights diversification as a core driver of returns, the potentially limited diversity of ideas clearly raises some questions.

Here, we look towards a phenomenon known as the crowd sourcing of ideas and democratisation of finance, whereby anyone can be the next star trader. Thanks to the growing technological landscape, platforms are emerging online, where participants from any background are encouraged to develop their own trading strategies and can even use them to trade via their own personal accounts. Strategies are evaluated using a range of statistical techniques, and those that demonstrate the most attractive risk-reward characteristics are awarded an allocation by the firm and a share in any profits.

It seems natural to access a wider pool of talent that can provide new thinking and ideas regarding trading strategies. The concept is appealing as it removes much of the bias involved in the selection process of professionals and provides a framework for accessing a diverse pool of talent. This approach is relatively fresh to the investment landscape and is an area that is worth keeping a close eye on as it develops.

Crowd Sourcing

A specific sourcing model that obtains ideas, services, or content from a large group of online contributors rather than traditional employees or suppliers.



FOMO (Fear of Missing Out)

The advancement of technology and AI are clearly the hot investment topics of the moment and it can be all too easy to jump in head first for fear of missing out, but we believe the era of an AI only investment landscape remains some way off. Human guidance in the real world application of AI calls for drawing parallels to medicine. Tools available to surgeons have improved significantly over the last decade by providing greater precision, but still require professional guidance and judgement at various stages of the operation. As an example, the development of the micromanipulator in the late 2000s was viewed as a breakthrough in microsurgical fields within the application of eye surgery and the removal of scar tissue. The device uses optical tracking and filtering to adjust for unwanted movement of the hand, significantly improving results, but still requiring the input and guidance of a highly trained surgeon^{7,8}.

Similarly, in investment management, investors still need to define a tradable universe, risk guidelines, and data sets to be used. In addition, as AI has not (yet) the ability to understand the bigger picture, discretionary traders have an edge when it comes to interpreting more complex human involvement, such as political shifts and regime changes. Indeed, a number of premier partners we work with have incorporated some of the more intelligent processes discussed previously into their trading strategies, but maintain significant human oversight.

This shift in dynamics brings with it great opportunities, but also great challenges for investors. In the past, a money manager could be assessed in person and their skills, qualifications, and experience verified through simple checks. But how do you evaluate the completeness of a data-set, or the skill of an algorithm, or the experience of a person you may never know? As the investment landscape evolves, Credit Suisse Liquid Alternatives remains at the forefront and is ready to guide clients through this exciting new landscape of technology enabled investing.

Background on Liquid Alternatives

The Liquid Alternatives team oversee approximately USD 13bn across a range of alternative investments. The team has a track record dating back to 1998 and currently comprises over 60 professionals based around the globe. Typical solutions include UCITS and offshore funds, as well as customised and advisory solutions.

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⁷ Autonomous Robot Surgeon Bests Humans in World First. *IEEE Spectrum*. [Online] <http://spectrum.ieee.org/the-human-os/robotics/medical-robots/autonomous-robot-surgeon-bests-human-surgeons-in-world-first>.

⁸ *Microsurgery Device Reduces Surgeon Tremor*. s.l. : National Institute of Biomedical Imaging and Bioengineering, 2007.

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