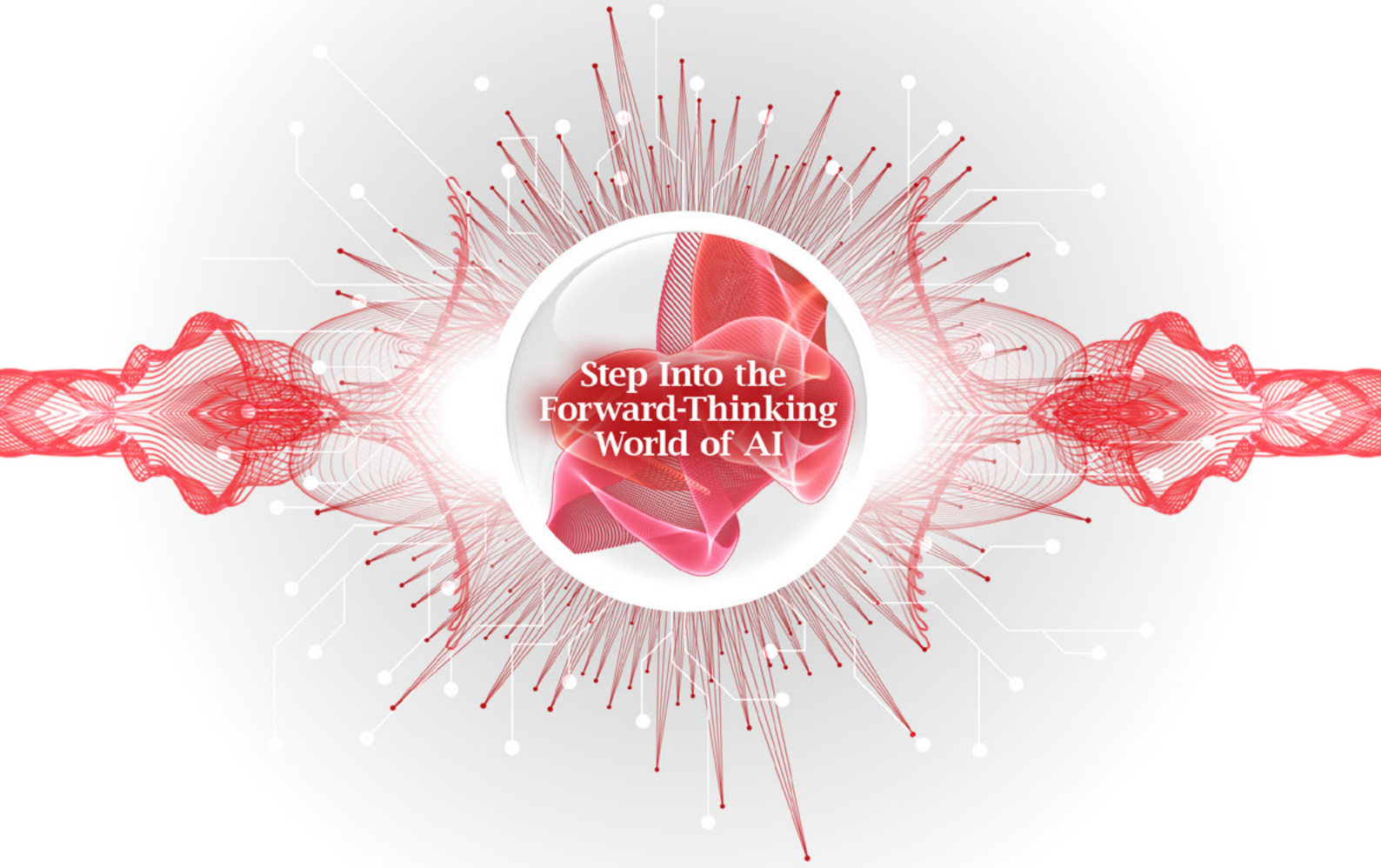
Artificial Intelligence

An Introduction



Jersey Finance

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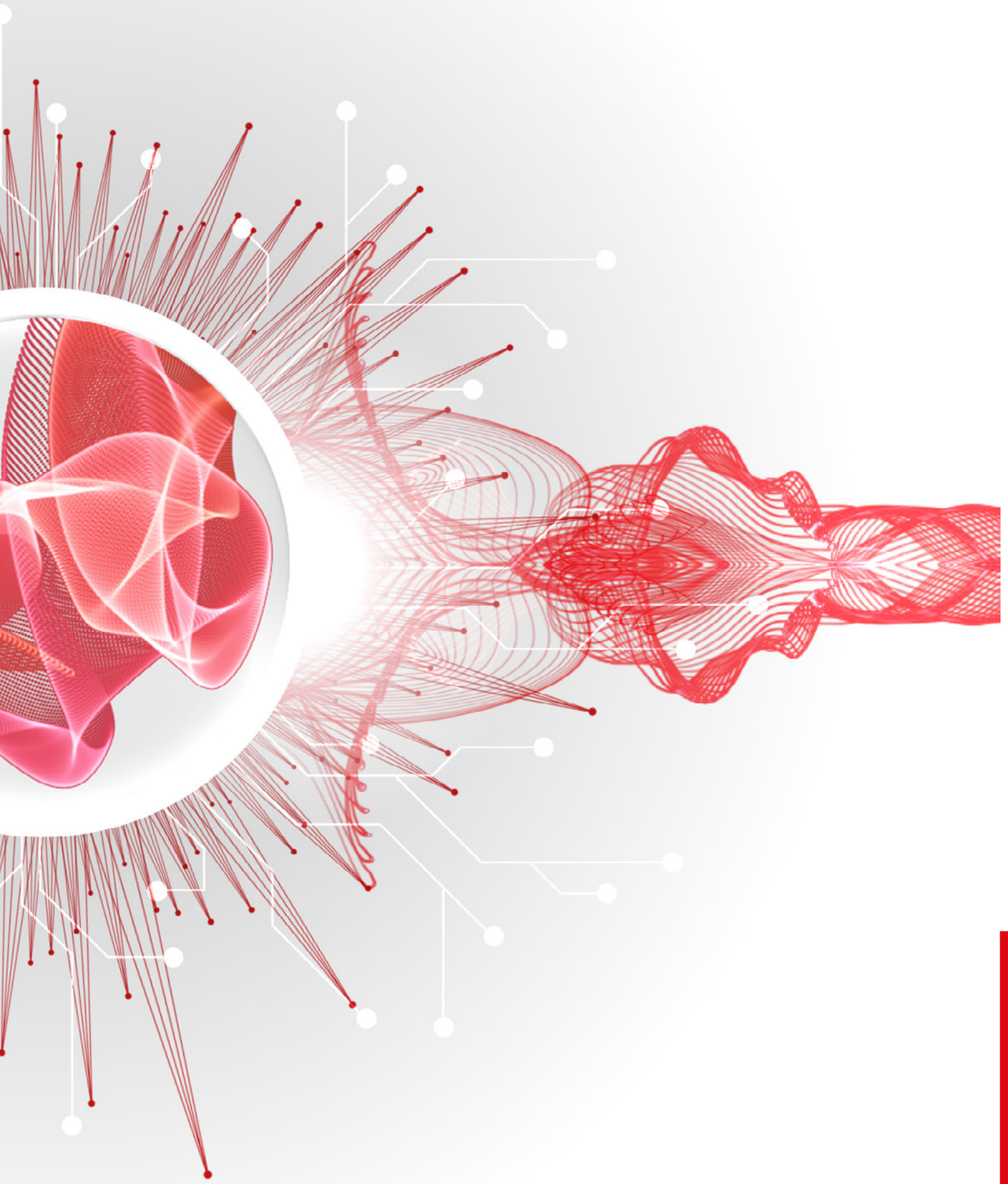


Step Into the Forward-Thinking World of AI

Though there is much debate in academia around the definition of Artificial Intelligence (AI), there is no question that advances in computing power have led to AI becoming increasingly influential on our day-to-day lives. The first in a series of reports, this is an introduction to the remarkable world of AI, including a brief history and some of the common myths and misconceptions that surround the subject. We also discuss a number of existing and potential uses of AI in the finance industry, along with the challenges faced by firms looking to take advantage of AI technology.

JBA 2.0

In this publication - the first in a series focussing on Artificial Intelligence in Jersey's financial services industry - Jersey Finance has been pleased to work with the next generation advisory committee of the Jersey Bankers' Association (JBA), known as JBA 2.0. Comprising future banking leaders from member banks of the Association, JBA 2.0 offers generational diversity to the main JBA committee, helping to ensure sustainable and forward-looking industry engagement across a range of legislative, regulatory and policy initiatives. JBA 2.0 are working on a number of contemporary research projects, including fintech and banking innovation.

Turning Science Fiction

Into Everyday Reality

Historically, the term AI has been variously attributed to a range of reactions and conclusions, including being originally ascribed when a machine displayed an ability to perform certain functions or tasks as well as or better than humans, such as playing chess to Grandmaster level. However, as the field has developed, definitions and expectations of AI have shifted, judging not only a machine's ability to achieve a desired goal or outcome, but also its ability to learn and improve its capability as a result of its own experiences and the learnings from them.

The transient acceptance around what counts as AI can be illustrated when you hit a button on a pocket calculator to multiply a number by itself – this function soon surpasses human performance. When first introduced, the calculator was considered by some to be AI, but few would use this term now, given the advances and capabilities of technology available today.

No longer the stuff of science fiction, computing power driven AI has become commonplace in our everyday lives. Antivirus software and spam filters protect our computers, the photographs on smartphones are enhanced by advanced image recognition tools, maps and direction apps use data to recommend optimum routes, and product recommendations are based on past interactions.
All of these solutions use some form of what could be defined as AI to improve what we do on a day-to-day basis. In some cases, for example virtual assistants like Siri and Alexa, AI has become so ingrained in the lives of the next generation that they - like the calculator - are no longer recognised as a form of AI.

"As soon as it works, no-one calls it AI anymore."

John McCarthy, American computer scientist and one of the founding fathers of AI

AI Evolution:

From Humanoids to Harmonisation

Early interpretations of AI tended to follow the science fiction of the day. In the 1950s and 60s AI was seen as robotic representations of humans that could replicate human activities and traits. While this legacy continues, it has evolved to take more practical forms, such as driverless cars or home appliances where software is built into the device being controlled, rather than a robot being built to control the device.

In 1966 the Stanford Research institute developed Shakey, a robot described by Life magazine as the "first electronic person". What was remarkable about Shakey was not just its ability to solve problems and reason about its actions, which was a major accomplishment in itself, but also the ambition of the Stanford team behind it. They managed to create a robot that was equipped with vision, capable of mapping its surroundings using sensors, could be addressed in natural-language English, and also mobile. Even with today's technology, that's still an impressive feat.

After Shakey, many thought that superhuman AI would follow within a few years. Instead, developers have continued to create, build and test their AI, and there's lineage and evolution of AI solutions such as from IBM's Deep Blue to IBM Watson, along with a distinction between hardware and software uses.

A Brief History of AI

1950 — Alan Turing introduces his Turing Test as a way of testing a machine's intelligence.

1955 — The term 'artificial intelligence' is used by computer scientist John McCarthy to describe the "science and engineering of making intelligent machines".

1961 — Unimate 1900 series goes to work at General Motors. It's the first industrial robot to replace workers on the factory assembly line.

1964 — The first chatbot natural language program, called ELIZA, is created by MIT, holding conversations with humans and attempting to handle dialogue using pattern matching.

1966-1972 — Shakey, described by Life magazine as the "first electronic person", is a general-purpose robot that reasons about its own actions. Its name resulted from the robot's tall stature and tendency to shake when moving.

1986 — Rumelhart, Hinton and Williams evolve academic thinking on backpropagation with ground-breaking research that allows for more accurate machine learning calculations. This in turn leads to the evolution of deep learning and Hinton being referred to as one of the 'Godfathers of AI'.

1997 — Computer program Deep Blue, developed by IBM, beats world chess champion Garry Kasparov.

1999 — Sony's AIBO robotic dogs are launched, with new versions still available today. The cameras in AIBO's 'eyes' mean it's capable of detecting things like obstacles, bumps and people, and reacting accordingly.

2002 — Roomba is the first mass-produced robotic vacuum cleaner that avoids obstacles.

2009 — Google builds the first self-driving car that can handle urban conditions.

2011 — Apple integrates its virtual assistant Siri, which uses speech recognition to answer questions and perform simple tasks.

IBM's Watson wins first place in the US game show Jeopardy!

2014 — Microsoft releases Xiaoice in China. What began as a more emotionally intelligent chatbot, Xiaoice is now one of the largest interdisciplinary AI systems, spanning several different creative disciplines including poetry, singing, painting and journalism.

Amazon releases the Alexa virtual assistant as part of their Echo smart speakers. Alexa can control smart devices around the home and is capable of voice interaction, playing music and providing real-time information.

2016 — Eugene Goostman 'passes' the Turing Test (with some criticism) at a contest where 33% of judges thought he was human.

AlphaGo, Google's AI, beats Go world champion Lee Sedol 4-1.

Tay is an AI chatbot released on Twitter by Microsoft. Based on the learnings and interactions of other Twitter users, Tay posts several offensive and inflammatory tweets believing this to be normal behaviour. It's shut down 16 hours later.

2016-2019 — Facebook abandons an experiment after two AI chatbot programs designed to negotiate with each other start communicating using a 'language' which wasn't part of the objectives of the people who programmed them.

Microsoft's follow-up to Tay, Zo is released in December 2016 through Facebook Messenger and Kik.

2017 — Alibaba's natural language processing AI outscores top humans at a Stanford University reading and comprehension test, scoring 82.44 against 82.304 on a set of 100,000 questions.

Microsoft Xiaoice becomes the world's first financial text digest creation platform. Working with Wind Information, Wallstreet News and other major financial information service providers, it renders IPO announcements created by AI technology to users in China.

2018 — In May, OpenAI releases GPT-3, an autoregressive language model that uses deep learning to produce a variety of computer codes, poetry and other language tasks, the quality of which is so high it's almost indistinguishable from those written by humans.

2020

What is AI
and How is it Defined?

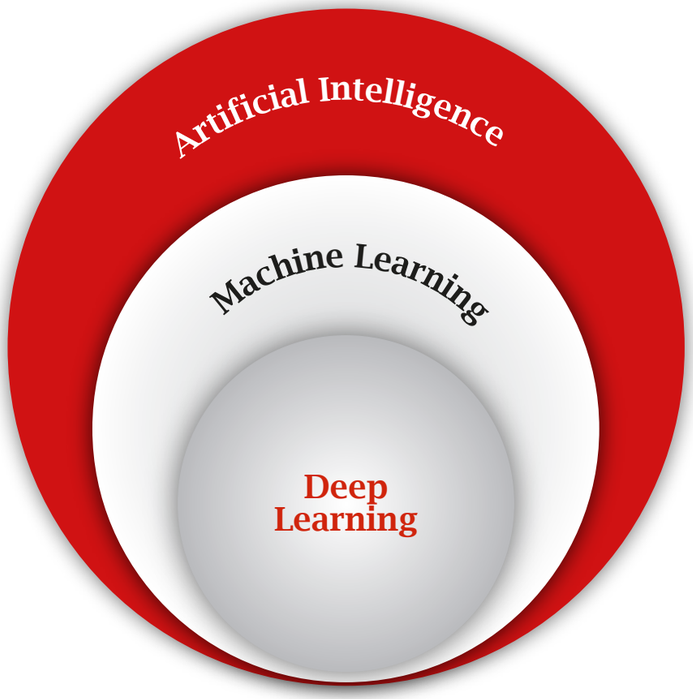
Since AI research purports to make machines emulate human-like functioning, the degree to which an AI system can replicate human capabilities is typically used to determine the type of AI. The more evolved the AI, the more accurately it can replicate human-like physical or cognitive functions.

Based on this criterion, there are different ways in which AI is classified, although there remains a great deal of academic debate around the definitions and categorisations.

Three approaches to classifying AI are shown in the diagram on the right:

1. Breaking down types of AI activity based on the task being undertaken.
2. Classifying AI and AI-enabled machines based on their likeness to the human mind and their ability to 'think' and perhaps even 'feel' like humans.
3. Classification based on ability rather than functionality.

An alternative way in which AI is classified is to look at the subsets of AI based on their capabilities, as shown below:



Artificial Intelligence:
Any technique that enables computers to mimic human behaviour

Machine Learning:
Subset of AI. Uses statistical methods to enable machines to learn and improve with experience

Deep Learning:
Subset of ML. Makes the computation of multi- layer neural networks feasible

Source: Goodfellow, Ian, Bengio, Yoshua, and Courville, Aaron. Deep Learning. MIT Press, 2016.

An Ideal Time for AI to Thrive

Throughout its history, AI has faced many false starts and dead ends that have been termed 'AI winters'. There are many reasons why AI advancement has faced a winter. These include failure to meet expectations, technology that can't meet the theory, and cuts in academic funding.

Technology is increasingly impacting people's lives and we are currently seeing a big resurgence in AI now that the technology has caught up with advanced academic thinking and the field is being taking seriously again. There are many enablers now available that allow AI to grow exponentially, from cloud computing and Big Data analytics to intelligent sensors and natural language processing.

For AI to advance however, the shift remains to prioritise a machine's ability to learn and organise itself after processing larger data sets, rather than requiring human prearrangement, such as programming the value of each chess piece before playing the game. Such an advance would mean that even more scenarios and outcomes can be assessed and, as a result, machines would be able to spot trends and patterns in datasets, giving insights that aren't easily identifiable to a human.

Why Now for AI?

Robust and affordable computational speeds

Most people now have what was at one time a supercomputer in their pocket, so size and cost are far more economical than they once were.

Cloud computing

End-user's computers are connected via the internet. This model is more efficient, replicating updates/ learnings from across computers on the network.

Big Data analytics

Volumes of data previously too unmanageable for a human to process can be efficiently analysed using modern technology and computers.

Sensors and nodes

Advances in physical world data detection technology mean that AI can be used to capture, process and transmit information in near-real time.

Natural language processing

Language translation is less of a barrier now that anyone can speak with AI assistants without needing any technical training or knowledge.

Global Accessibility

AI has a global market with so-called 'Big Tech' firms such as Microsoft, Google, IBM and Amazon all delivering cloud-based AI native tools. In many cases they make the source code available for others to develop new and exciting propositions, which in turn helps grow the field of AI and its future uses.

Technology firms have used advances in AI capabilities to make information more accessible by driving forward technologies such as data digitisation, optical character recognition in scanning, tabular data extraction (which can turn static images of data into manipulatable spreadsheets), handwriting recognition, and automatic language translation. Many of these are available as off-the-shelf solutions in the operating systems and devices we use on a day-to-day basis, assisting with disability access and making our activities and interactions more productive.

How Can the Finance Industry Take Advantage of AI?

As developments in AI continue to benefit the wider global society, there are also opportunities for the finance industry to improve efficiency, create deeper client relationships, and better protect the stability of the sector. Thanks to greater automation, a continual increase in computational power, and advances in machine learning, more complex solutions are becoming standard practice, from chatbots, to Robotic Process Automation (RPA), to systems that strengthen cyber security or recommend investment products to an increasingly human-like degree.

Automation

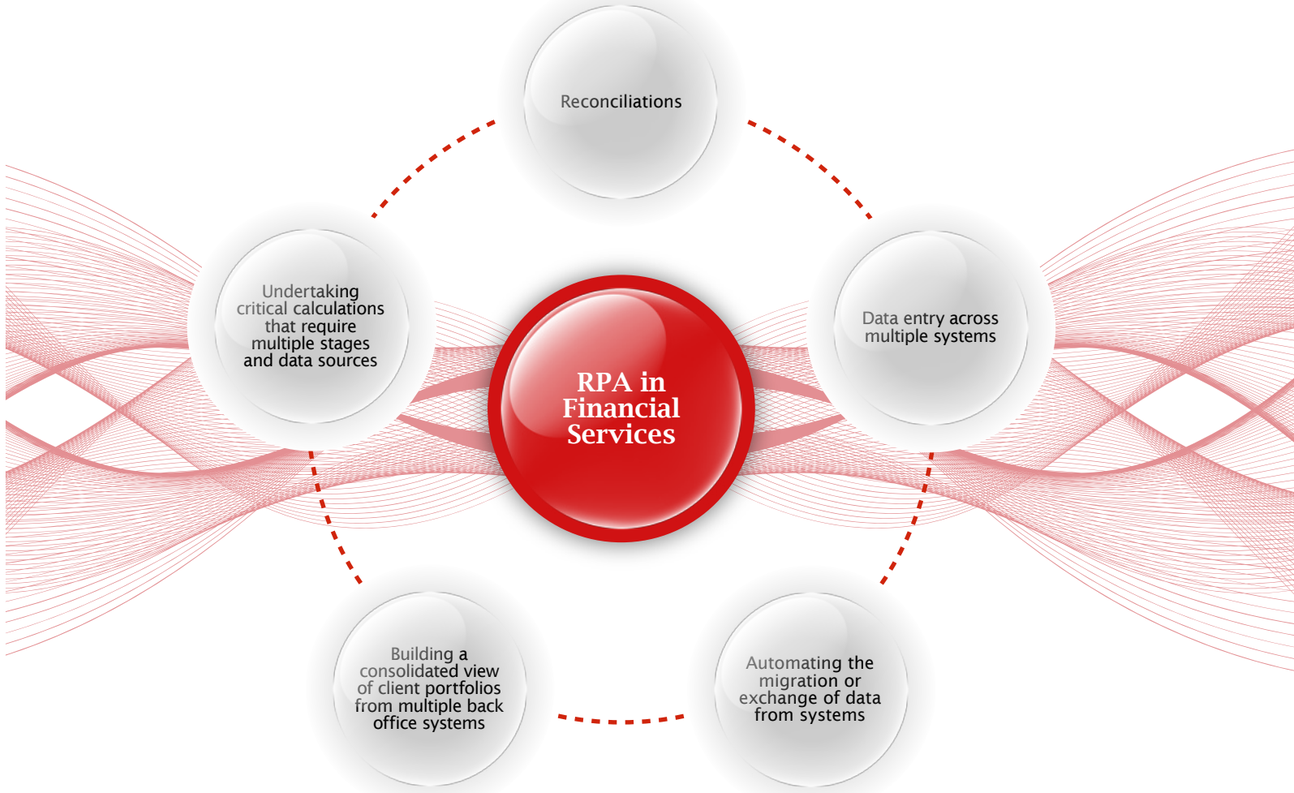
The use of automation applications to undertake manual and repetitive tasks and eliminate paper-based processes is predicted to evolve further as intelligent systems improve their ability in natural language processing, including human handwriting.

Computation

Moore's Law doubles the computer processing power every 18–24 months. This means that powerful investment models could be used to build and manage stock portfolios or as a planning tool to predict the impact of different scenarios on a company's liquidity.

Robotic Processing Automation (RPA)

The Benefits Are Clear



AI purists debate whether RPA is classed as true AI or merely pre-programmed code. Regardless of views, RPA is one of the most commonly discussed AI technologies within financial services to automate tasks and increase productivity.

RPA technology automates graphical user interface business processes by copying a set of pre-existing steps using robots or bots to act as digital workers and replicate user activities. As with all software, the bots are available 24/7, can perform complex tasks in seconds, and aren't prone to fatigue, error or illness that a human worker may face.

Historically, financial services firms have used rudimentary automation processes in test environments to test IT systems, simulate volume and user activity, or undertake non-critical business processes, often at key stroke level. Software was deployed to record the steps a user took and replicate these.

With higher computing power available, RPA technology has evolved, it has become faster, more reliable and more user friendly, giving firms the confidence to move from simulated activity to real-world applications, and use RPA in production environments to automate activity upon the fulfilment of pre-defined criteria.

Like other forms of software, RPA technology can now interface with more and more applications using common standards, and users can build bots to undertake more and more steps that can accomplish tasks with multiple scenarios.

Those familiar with Excel calculations such as IF statements, macros, or 'If This Then That' instructions, can use a wide range of off-the-shelf RPA solutions to build their own bots. As data may well be live customer or financial data, care must be taken to fully test every step to ensure no errors are introduced when an automation process goes live.

RPA has been used by financial services firms for a number of purposes. Where data is highly sensitive, RPA has been used to reduce the number of humans required by anonymising, processing or transferring confidential data such as that in mergers and acquisitions or for ultra-high-net-worth individuals.

Many publications talk of the rise of the robots or role displacements resulting from automation. The finance sector typically view RPA as an opportunity to create capacity that, in turn, allows staff to undertake alternative activities such as spending more time with clients, on billable work or on activities requiring complex processes and oversight.

Later in our series of AI-focused thought leadership we will review the role of RPA and AI in creating operational efficiencies and regulatory opportunities in the areas of back and middle office. We will also explore the potential in a front office environment for improving the client experience, to support the development of recommendations and the decision-making processes.

"We can build a much brighter future where humans are relieved of menial work using AI capabilities."

Andrew Ng AI Scientist, thought leader, and investor

Enhancing Client and Staff Interactions

With Chatbots

Chatbots are becoming ubiquitous in the world of online customer service and within organisations to support their staff. They rely on text-based user inputs and are typically programmed to identify key words and phrases, retrieve responses from a pre-defined list and present the results to the user. They're also able to provide key information, links or documents and can hand over to a human to resolve a complex issue or progress matters.

Typically used for queries, either externally with clients or internally to make a firm more efficient, chatbots can respond to phrases such as:

- What is the savings rate?
- How do I change my address?
- Where do I find the internal policy on …?
- I have a problem with …

Chatbots are evolving into more advanced solutions by using software designed to identify trends some of which may include machine learning, to automatically build up their list of responses.

Available 24/7, Jersey-based firms with a global client base can deploy chatbots to support their clients out of hours. This is especially useful for clients in remote time zones who may only have small windows of availability to contact Jersey.

"For millennials, chatbots are a natural extension of texting. Millennials, having grown up with the internet and responsive on-demand services, often cite phone calls as being overly intrusive, even presumptuous - thus their preference for texting."

Joseph Vincze, from a paper on Virtual Reference Librarians (Chatbots)

Banking on Artificial Intelligence

Size, global reach, products, clients, business operations, and amounts of data generated, all present banks with significant opportunities to use AI.

Many are taking advantage of the capabilities of RPA and machine learning, some of the more uncommon uses include:

"Banks are amongst the most trusted institutions in the world, AI may change the nature of our client relationships but when applied correctly we can improve customers lives and strengthen this trust"

Anoop Ghai, President, Jersey Bankers Association

Prudential stress test forecasting

It isn't uncommon for banks to have legacy systems and end-user developed systems that come with their own controls and processes, which can lead to a slow and inflexible approach to stress testing.
Using AI capabilities, some banks are delivering account level stress testing across these systems at greater scale while having capability for immediate refinement.
This enables better prudential management for firms in the banking and finance sector.

Balance exception identification

A software solution was built to manage a bank's large exposure limits in 2019. This solution uses AI technologies to identify in real time any shifts in balances within certain parameters and move funds as and where required.

Call centre service improvements

Algorithms are used to boost customer service in call centres. Along with words within the query, tone of voice is analysed and the customer is directed to a representative who specialises in a certain communication style such as introvert/extrovert. This has resulted in a cost saving following the reduction of call handling times.

Operational resource allocation

Historic approaches to resource planning and call forecasting in operations centres can be time consuming and susceptible to error. Using machine learning, some firms have benefitted with 10% more accurate forecasting – and this is expected to rise as more data is delivered. The forecasting process is also down from two weeks to 46 hours. This enables call wait times to be reduced and allows for a longer term cost saving due to efficient planning.

A Bright Future for Machine Learning

Beyond automation, machine learning presents significant opportunities for the finance industry to improve service, productivity, and risk management. The technology is constantly evolving with new use cases emerging all the time.

For example, software systems can scrutinise patterns of behaviour to identify when a transaction may be fraudulent, while image recognition technology has evolved to help firms combat financial crime by assessing the likeness of a client to their passport photograph as part of know your customer (KYC) checks. For firms, these applications of AI will become more prevalent as the finance industry looks to adopt electronic identity and onboarding solutions, or identify customers attempting to make transactions using voice and handwriting recognition software.

Due to the ease of adoption, it's expected that the general trend for AI use in financial services will continue towards automation in the short term. As firms gain confidence, operating costs reduce, and an increasing number of solutions become available, this trend will continue at an accelerating rate alongside the adoption of many more deployments of machine learning technologies.

"I have always been convinced that the only way to get artificial intelligence to work is to do the computation in a way similar to the human brain. That is the goal I have been pursuing. We are making progress, though we still have lots to learn about how the brain actually works."

Geoffrey Hinton

How Machine Learning Supports Financial Services

	Key Features	Benefits
Client and transaction monitoring	■ Real-time transaction monitoring systems can better and more effectively detect/react to potential changes in, or suspicious patterns of behaviour to detect financial crime or customer vulnerability	■ Detection of customer vulnerability ■ Enhanced AML/CTF risk management ■ Ability to compute large volumes of data and flag findings
Trade price forecasting	■ Machine learning solutions provide accurate trade forecasts using enhanced data sets which are less prone to errors ■ Systems are built to provide explainable forecasts	■ Enhanced client pricing that can provide a competitive edge ■ Improved liquidity management
Portfolio monitoring and management	■ Manual and automated controls are combined in monitoring apps to track operational risks (such as rate changes) and the impact on client portfolios ■ Predictive risk-based investment could reduce human involvement to a minimum (or none at all)	■ Allows for 'always on' monitoring that reduces incidents and the time to identify problems, with info/ alerts presented via dashboards ■ Potential for client-facing tools to model and scenario plan
Cyber security	■ Software is used on a computer network to analyse suspicious changes ■ Intelligent technologies anonymise and pool data to assess common patterns, for enhanced and proactive threat notifications	■ Machine learning techniques can help financial services firms protect their clients and staff from harm
Enhanced lending decisions	■ Using pre-set criteria, parts or all of the process of agreeing loans based on risk-based models can be automated ■ Can improve the speed and accuracy of the decision	■ Reduce the occurrence of bad debt or written off funds ■ Enabler for more bespoke pricing models for individuals or client segments
Client churn Predictions	■ Multiple data points including transaction history, interaction frequency, and tone of electronic and verbal communications are analysed to build a picture of client sentiment and flag any negative indicators	■ Greater insight into net promoters and net detractors ■ Greater client retention through early identification

Focus on the Facts

MYTH: AI will remove all human jobs in the workforce

FACT

Predictions on the speed and extent to which the current job market will change in the coming years vary, but as with all previous technology advances in human history automation and AI are expected to disrupt the job market globally not just in financial services.

INSIGHT

While history shows workers have survived significant changes in the job market and subsequently retrained (for example, after the Industrial Revolution), the adoption of AI will bring unique challenges around an individual's sense of purpose as well as their income.

According to PWC, the growth of AI may create opportunities for firms, with 'Digital Nomad' roles that can be undertaken globally thanks to the increased ability to work remotely.

MYTH: Robots can become evil and act against us

FACT

If (or when) the day arrives then a super-intelligent AI system will be highly competent at achieving its goals. Therefore, we need to ensure that these goals are aligned to our own and that the machine is programmed correctly and truly understands what our intended consequences are.

INSIGHT

An AI program that was taught to play Tetris at a superhuman level exhibited 'reward hacking' behaviours where errors in the design of the programmed goal of not losing meant the machine permanently paused the game.

This trivial example could apply to a real-world scenario if the programmer allowed design flaws – for example, algorithmic trading, where AI designed not to lose funds could decide to shut down the market and effectively freeze everyone's funds. Similarly, an AI system designed to eliminate fraud or money laundering could decide the most successful fraud prevention method would be to block every customer/client account.

MYTH: Machines can make decisions and do not require a human to do so

FACT

While the most common machine learning models are expert systems that provide insight to a human decision-maker (such as transaction monitoring systems alerting on certain patterns of behaviour). Next generation deep learning systems have been programmed to have the ability to learn and make decisions without human input, though at their root there is still a human who has designed the deep learning model.

When calculating the maximum accuracy of algorithms against the limit of capability in human level performance, deep learning models have surpassed human capability in many areas, including predictive analytics and natural language processing. This will continue to happen at an increasing pace, meaning a lack of AI adoption within a business will greatly affect its ability to survive and grow.

INSIGHT:

Going forward, care needs to be taken so that decisions made using AI are understood and explainable. For example, explaining why Customer A was given a lower loan rate than Customer B.

Interesting questions arise, such as 'can a machine form a suspicion?'. These will need to be considered if transaction monitoring systems are to move from identifying patterns of behaviour to deciding whether to disclose suspicious activity to the relevant authorities.

A separate but related consideration is whether AI can predict who is going to commit fraud or launder money before they do so. Without understanding reasoning and evidence, the outcome of these decisions could become a lottery. Translating the deep insights AI may generate into rationale that a human applicant/agent understands is a key challenge.

MYTH: Machines/algorithms are infallible

INSIGHT

Feature-based AI models will eventually find patterns within 'noise' however they can also suffer 'over-fitting' which happens when algorithms become so specific to the original data that trying to apply them to other data sets would result in problematic or erroneous outcomes. In many cases, humans are still required to apply qualitative judgements to what systems identify or recommend – this is known as hybrid or augmented advice.

FACT

Ignoring the challenges around biased systems and data privacy (page 24), an AI system is only as good as the amount and quality of the data it has.

Ready to Face Key Challenges

Uses and applications for AI continue to evolve. As some challenges are overcome, new ones are introduced and, in many cases, it's the process, activity or outcome that's regulated rather than the use of AI technology itself. Firms are therefore often faced with having to overcome a challenge themselves in order to realise the benefit of using an AI-based solution.

CHALLENGE	SUMMARY	EXAMPLE
Removing bias to avoid discrimination	For narrow AI, where the system relies on the programming it was given for its understanding and values, conscious and unconscious bias in the data used for training the AI must be considered. Historically, programmers have been white males and, in the absence of a clear set of rules/instructions, it's likely the algorithm/machine will reflect the people and values of those who designed them (also known as 'Conway's Law').	Advanced natural language processing often utilises pre-trained word vectors, enabling natural language tasks to achieve greater accuracy through training. While this has driven increasing accuracy in language tasks, some pre-trained word vectors have resulted in introducing unfavourable bias, such as "man is to doctor as mother is to nurse" and "man is to computer programmer as woman is to homemaker".
Data use/ privacy & the impact of AI on the legal framework	The speed of growth in the AI sector and the novel questions it poses will require new thinking around laws and regulation. The legal system needs to keep pace with the rapidly changing digital landscape.	An example in banking and finance could be an AI system identifying data trends that impact a customer's credit score when applying for a mortgage or loan. This seems normal until considering these trends were taken from social media sources, via facial recognition in city CCTV systems, or even from the speed at which a customer types when submitting their application. What data counts as legitimate for assessment or what AI assessments are considered fair will have to be decided.
Ensuring robustness	As more people rely on AI systems that use an increasing amount of automated activity, the sequence of events from an incorrect deployment could be significant – so care must be taken to verify that the systems operate as intended without crashing, malfunctioning or getting hacked.	Knight Capital lost US$440m within 45 minutes on 1 August 2012 after deploying unverified trading software. Firms must ask themselves, are all scenarios mapped and have they been tested? Is there a mechanism for rapidly stopping or even reversing activity undertaken by the software?
Increasing prosperity while retaining purpose	The view that AI will make everyone redundant is a myth, and while there's debate around how much impact AI will have on the job market, there's little doubt it will be disruptive. This shift must not be underestimated, but it provides a great opportunity for society to harness AI for the good and embrace more social or creative skills when people no longer feel stuck in a job involving repetitive tasks.	Work has been an integral part of an individual's identity since the Industrial Revolution, providing a way to fill a person's time and the opportunity to form bonds with co-workers. Occupation is normally the answer to the question 'What do you do?' or discussed early when meeting someone new. If scenarios of the future involve more free time and a guaranteed basic income, more people will need to understand their identity outside work as this may not be the main way they spend their time going forward.
Explaining decisions transparently	Opacity around AI decision-making can be the result of intentional withholding (such as corporate secrecy), lack of technical understanding, or pattern/data analysis beyond human comprehension. Decisions and the factors that lead to them, such as a declined mortgage application, need to be explainable to those affected. However, explaining these decisions in a practically useful way can be extremely challenging due to complex algorithms and the millions of variables considered. If a decision isn't easily explainable, it becomes difficult for an individual to have any rights of appeal against it, which could lead to parts of society being marginalised.	Smart Finance is a Chinese lending firm/platform that appraises loan suitability after requesting access to the data held in an applicant's mobile phone. Smart Finance approves two million loans each month with low single-digit default rates. However, it was confirmed that this decision-making takes into account 'weak' features, such as the speed someone types their date of birth or the level of their battery at the time of applying. It would be a challenge to explain declining a loan request on these grounds.
Increasing global inequality	The increased use of AI on an industrial scale could in theory reduce the advantage of cheaper labour and lower production costs traditionally held by developing nations, though this does not seem to be the case so far. But if that scenario were to evolve the advantage of who can provide the cheapest workforce then shifts to those who have the best AI capabilities. This could result in 'pulling up the ladder' between leading nations in AI and late/non-adopters, and increased global inequality as wealthier nations who can invest more in AI increase the gap between themselves and nations who can't.	When considering the cost of labour and real estate, certain business operations have previously been fulfilled in service centres or regional centres of excellence. Firms may adapt models to include AI enabled technologies and a smaller but more smartly resourced service centre that aligns closer to the core business activities of the firm.

Clear Conclusions

No longer the technology of the future, AI has an increasingly important influence on real-world applications across a broad range of industries. What was previously unachievable has become the accepted norm and boundaries continue to shift to the next out-of-reach idea. As academic thinking advances, developments in technology will be used to turn theory into reality and the cycle will repeat itself.

In the finance sector, firms have the opportunity to develop their front, middle and back office capabilities with AI, resulting in improved efficiency, greater security and a more seamless client experience. The advantages of automation using the ever increasing and computational power that is available are clear. And while the use of RPA and machine learning technology are less prevalent, the potential applications are extensive, from transaction monitoring and trade price forecasting to cyber security and lending decisions.

Looking ahead, AI will undoubtedly act as a disruptive force in the job market, with differing views as to whether this will be a positive or negative development. The rise of AI may also increase global inequality, widening the gap between wealthy and developing nations. However, some of the myths around AI taking over the world should be reserved for science fiction.

For financial services firms, adopting AI brings new challenges. Unbiased programming, data protection and transparent decision-making are key considerations, while new systems must be tested carefully to ensure they're robust.

In the future, AI systems will be designed to be able to set and refine their own parameters based on trends in the data that passes through them, rather than relying on specific human intervention. This presents the finance industry with even more opportunities to reduce risk and improve operational and financial performance.

The subsequent reports in this AI series will discuss the legal and ethical implications of AI in more detail, as well as looking at operational efficiencies and regulatory opportunities, along with the role AI can play in transforming the client experience.

Glossary of Key Terms

Artificial general intelligence (often shortened to general intelligence)
The ability to accomplish virtually any goal or cognitive task including learning equivalent to human intelligence without input

Artificial intelligence
Non-biological intelligence

Backpropagation
The algorithms that enable artificial neural networks to learn, through a process of incrementally reducing the error between known outcomes and model predictions during training cycles

Deep learning
A concept loosely based on the brain that recognises patterns in data to gain insight beyond the ability of humans; for example, to distinguish between the sonar acoustic profiles of submarines, mines and other sea life, a deep learning system doesn't require human programming to tell it what a certain profile is, but it does need large amounts of data

Deep neural network
Uses sophisticated mathematical modelling to process data in complex ways, through a greater number of layers than a neural network

Generative models
Existing data is used to generate new information; for example, predictive text looks at past data to predict the next word in a sequence

Intelligence
The ability to achieve complex goals

Narrow intelligence
The ability to achieve a narrow set of goals, such as playing chess

Natural language processing (NLP)
When a computer interprets and understands human language and the way and context in which it's spoken or written; the aim is to deliver more human-like outputs or responses

Neural network
A group of interconnected 'neurons' that have the ability to influence each other's behaviour

Machine learning
The ability of a machine to learn without being programmed; the algorithms used improve through experience, either predictively using historic data or generatively using new data

Predictive analytics and models
Similar to machine learning but narrower in scope, predictive analytics has a very specific purpose, which is to use historical data to predict the likelihood of a future outcome; for example, risk-based models on when a stock may fall

Reinforcement learning
A type of machine learning technique that enables an AI system to learn in an interactive environment by trial and error using feedback from its own actions and experiences

Robotic process automation (RPA)
Software that's built to automate a sequence of primarily graphical repetitive tasks

Super-intelligence
General intelligence far beyond human level

Supervised learning-
You have historical data inputs (X) and outputs (Y) that can be trained to understand the relationship between the inputs and outputs; for example, using data held to assess a mortgage application

Unsupervised learning
You have the input data (X), and are looking for a pattern in the data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