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Machine Learning and its application in Financial Industry

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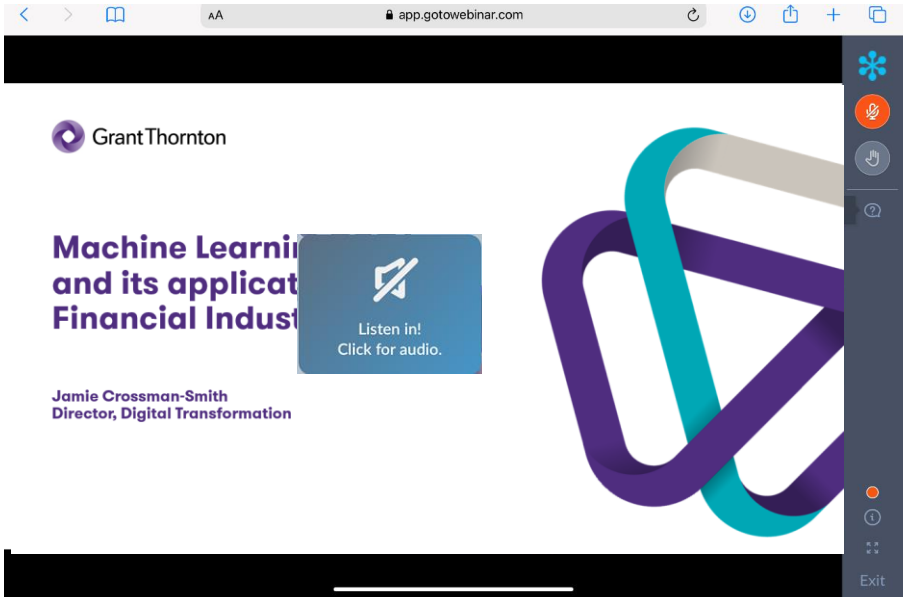

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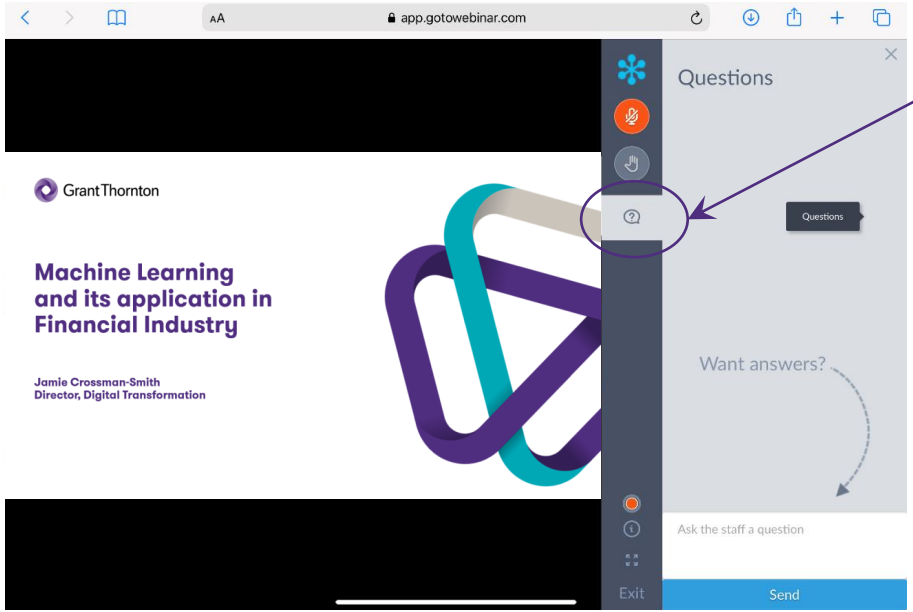

Your Participation

- Please continue to submit your text questions and comments using the controls panel.

For more information, please contact FSGEvents@uk.gt.com.

Your presenter today

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Expert Systems to ML

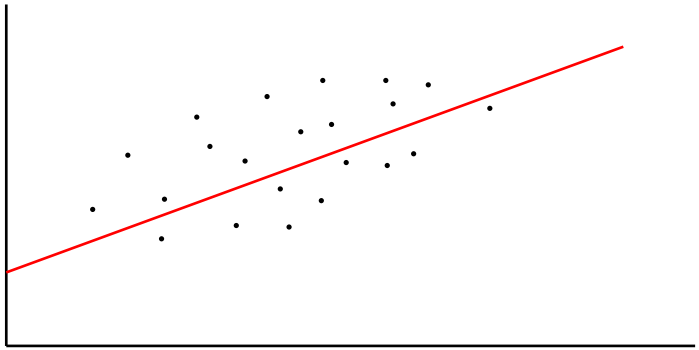
- Machine learning is the basis of many recent advances and commercial applications of AI.
- Modern machine learning is a statistical process that starts with a body of data and tries to derive a rule or procedure that explains the data or can predict future data.
- This approach—learning from data—contrasts with the older “expert system” approach, in which programmers sit down with human domain experts to learn the rules and criteria used to make decisions, and translate those rules into software code.
- An expert system aims to emulate the principles used by human experts, whereas machine learning relies on statistical methods to find a decision procedure that works well in practice.
- An advantage of machine learning is that it can be used even in cases where it is infeasible or difficult to write down explicit rules to solve a problem.
- For example, a company that runs an online service might use machine learning to detect user log-in attempts that are fraudulent. The company might start with a large data set of past login attempts, with each attempt labelled as fraudulent or not.

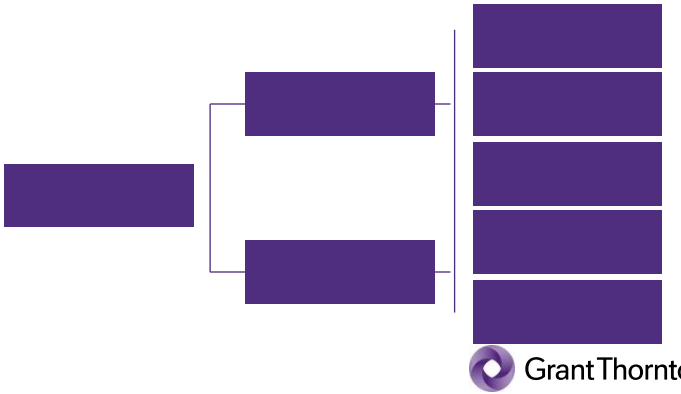
What is AI & Machine Learning

- Exactly what it says – where the machine learns from data. Also known as Narrow AI.
- However it only learns from data you give it. 'Black Swan' events will catch ML algorithms out.
- General AI is doesn't really exist in any (known) application, although 'integrated narrow AI' does appear to mimic elements of General AI to the user (e.g. Alexa or Siri)
- Machine Learning is not a new concept and has been around decades. Indeed the first 'self-driving' car was created in the 1980s.

Supervised Learning – Regression & Classification

- Supervised learning algorithms are called ‘supervised’ because they rely on training data to ‘train the model’ before it is used.
- Linear Regression Algorithms are simply ‘lines of best fit’ analysis. We can predict future values by ‘fitting a line’ between historic data points and extend that line to predict new values. For example, what will the price of X be in Y years?
- Classification algorithms are used when we want to give a label, or class to the output. For example, is it a ***good*** or ***bad*** film? They generally work by assessing the probability of any data point, and/or any combination of data points being associated with a particular label, or class.





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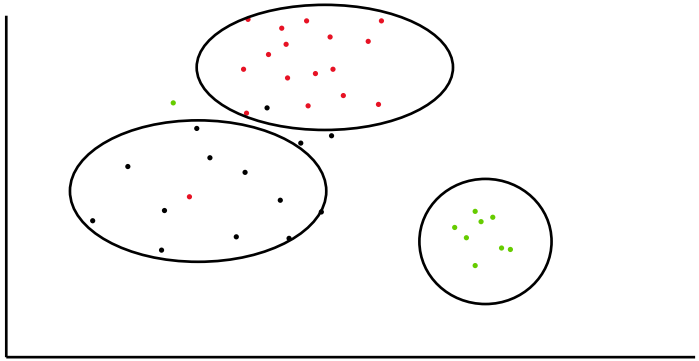
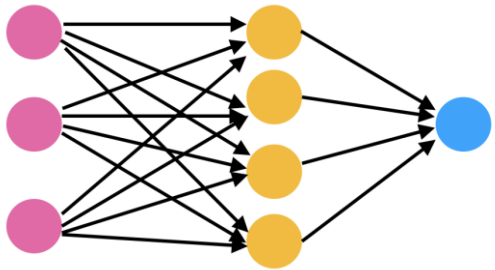
Unsupervised Learning – Clustering

- Unsupervised learning algorithms are called ‘unsupervised’ because they don’t rely on training data, these are static analysis.
- Clustering Analysis simply works out the groups that are clustered together on a chart by grouping together the points that are closest together from a mid-point. The tough bit for the computer is working out what that mid-point is!
- Clustering analysis can be used to identify classes as previous, but is very valuable in identifying outliers. Outliers are data points that don’t fit into any cluster.



Deep Learning

- Deep learning uses structures loosely inspired by the human brain, consisting of a set of units (or “neurons”).
- Each unit combines a set of input values to produce an output value, which in turn is passed on to other neurons downstream.
- For example, in an image recognition application, a first layer of units might combine the raw data of the image to recognize simple patterns in the image; a second layer of units might combine the results of the first layer to recognize patterns-of-patterns; a third layer might combine the results of the second layer; and so on.
- Deep learning networks typically use many layers—sometimes more than 100—and often use a large number of units at each layer, to enable the recognition of extremely complex, precise patterns in data.
- In recent years, new theories of how to construct and train deep networks have emerged, as have larger, faster computer systems, enabling the use of much larger deep learning networks.
- The dramatic success of these very large networks at many machine learning tasks has come as a surprise to some experts, and is the main cause of the current wave of enthusiasm for machine learning among AI researchers and practitioners.



Predicting wine Colour using KNIME.

How many ‘risks’ can you see?

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ML Strengths

- In financial trading when factors such as speed, and consistency of outcome are preferential.
- Where it has the potential to perform better than humans, as ML can overcome human emotions and biases.
- Where the 'ask' is clear, and future events are likely to mirror the past,
- There is sufficient data to train algorithms correctly.
- Where ML provides the opportunity to augment or challenge human decision making.

In one recent study, given images of lymph node cells, and asked to determine whether or not the cells contained cancer, an AI-based approach had a 7.5 percent error rate, where a human pathologist had a 3.5 percent error rate.

A combined approach, using both AI and human input, lowered the error rate to 0.5 percent, representing an 85 percent reduction in error.

Dayong Wang, Aditya Khosla, Rishab Gargeya, Humayun Irshad, Andrew H. Beck, "Deep Learning for Identifying Metastatic Breast Cancer," June 18, 2016, https://arxiv.org/pdf/1606.05718v1.pdf.

[BoE] AI could potentially:
- Improve customer choice, services and pricing
- Increase access to credit for households and SMEs
- Substantially lower cross border transaction costs
- Improve diversity and resilience of the system

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BoE/FCA 2019 Survey on ML use

The key findings of the BoE/FCA survey were:

•Deployment is most advanced in the banking and insurance sectors.

•From front-office to back-office, ML is now used across a range of business areas. ML is most commonly used in anti-money laundering (AML) and fraud detection as well as in customer-facing applications. Some firms also use ML in areas such as credit risk management, trade pricing and execution, as well as general insurance pricing and underwriting.

•Regulation is not seen as a barrier but some firms stress the need for additional guidance on how to interpret current regulation.

•The biggest reported constraints are internal to firms, such as legacy IT systems and data limitations.

•Firms thought that ML does not necessarily create new risks, but could be an amplifier of existing ones. Such risks, for instance ML applications not working as intended, may occur if model validation and governance frameworks do not keep pace with technological developments.

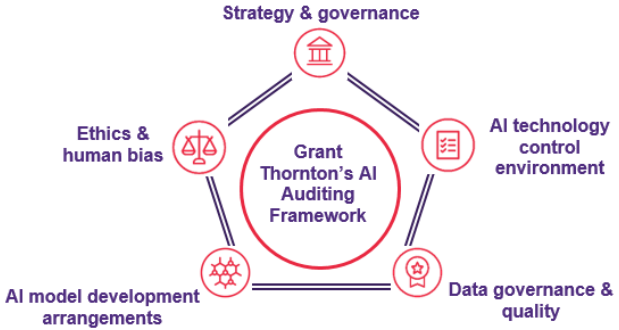
•Firms validate ML applications before and after deployment. The most common validation methods are outcome-focused monitoring and testing against benchmarks.

•Firms mostly design and develop ML applications in-house. However, they sometimes rely on third-party providers for the underlying platforms and infrastructure, such as cloud computing.

•The majority of users apply their existing model risk management framework to ML applications. But many highlight that these frameworks might have to evolve in line with increasing maturity and sophistication of ML techniques.

ML Weaknesses

- Too little data means algorithms may not be suitably trained.
- The auditability and interpretability of black box algorithms.
- Increased dependency on third parties, single points of failure
- Bias in data and increased interconnections in data can lead to incorrect conclusions
- Fundamental trade-offs between innovation, performance, and privacy



GT AI Auditing Framework

Strategy and governance

It is key that a firm's use of AI supports the wider business strategy and corporate objectives. It is equally important that firms' boards and/or senior management teams implement appropriate structures, processes and procedures to direct, manage and monitor the use of AI across the firm.

AI technology control environment

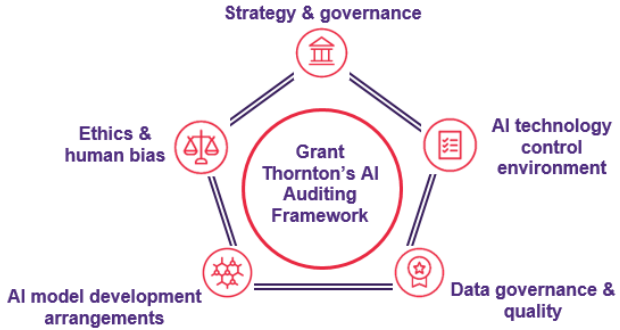
All AI solutions and the data they rely upon reside in infrastructure – whether that is hosted internally or externally in the cloud. Both the AI & the infrastructure needs to be properly managed, maintained and secured.

Data Governance & Quality

All AI is underpinned by data. If the quality of these data is poor, the data are not sufficiently maintained, or disparate systems holding data are not well integrated, this could lead to difficulties in implementing an AI solution or invalid decisions being made based on the AI output.

AI model development arrangements

The development of AI solutions must be formally managed and controlled, even in Agile environments, to ensure they deliver the intended results and meet the required quality levels.



Ethics and human bias

AI developers should pay careful attention to this when developing and testing solutions (including the data and models underpinning them) to ensure they have a complete understanding of the biases, including those of the team, the data, and the implementation. The ethics and trustworthiness of using AI to help make decisions should be considered before adopting a solution, and decisions should be transparent, explicable, and auditable when possible. It should also be robust, with reliable, repeatable outputs. Furthermore, all those who are subject to AI processes should be made aware of this in accordance with the GDPR, and their data should not be processed, by AI or otherwise, for any other reasons than for the purpose it was originally obtained for.

Questions

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Grant Thornton's upcoming events

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Event	Date/Time	Description	Registration link
Event: The financial services NED network: Leadership	Tuesday 13 September 12:00 pm–14:00 pm	The value of NEDs' leadership and independent insight is rising. Join our financial services NED network forum for an insightful lunch and get guidance on understanding and leveraging your leadership style.	https://bit.ly/3PAyCGY
Webinar: Consumer Duty CPD Technical Update Programme	Wednesday 23 September 10:00–11:15am	Join our technical update for insights on the FCA's new Consumer Duty, due to come into force in 2023. You'll get a preview of how this will impact your firm and practical guidance on meeting the FCA's expectations.	https://bit.ly/3Ni2YM8

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