



ROTHKO

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How to use Machine Learning in Financial Markets?

Panel Members:

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Moderated by:

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Key Takeaways

- ◆ **Growing role: Artificial Intelligence ('AI')** and **Machine Learning ('ML')** will play a significant role in the future of financial markets.
- ◆ **Data is key:** Key challenges are gathering and pre-processing of data, selecting the most appropriate ML method to use, and ensuring that complexity is minimised.
- ◆ **Different tools, different research questions:** Asking the right research questions will be even more important as new resources that make it practical to test multiple model behaviours in a fraction of the time open up many new opportunities.
- ◆ **Disruption is certain:** ML and AI techniques have significant advantages over those used by traditional investment managers, both quantitative and fundamental. There is no doubt that AI and ML will disrupt the status quo.



Panel Discussion

1. How do you define machine learning?

- *The panellists described Machine Learning ('ML') as a subset of Artificial Intelligence ('AI') and quite distinct from it. ML is the process of getting computers to program themselves.*

Rothko: *Philps added that AI had a more ambitious objective than ML, seeking to emulate expert human decision makers. Rothko is focused on AI rather than ML.*

2. How do you use machine learning to drive alpha in your process?

- *The panel divided into two schools of thought, firstly answering this question from the perspective of practical application and secondly, from a theoretical perspective.*
- *The non-linearity of ML was discussed, as well as the benefits of ML approaches in handling large amounts of data. The weaknesses of ML were also discussed. The panellists described ML as Toolkit that could be used in quantitative finance.*

Rothko: *Philps agreed with the advantages of ML and enumerated 3 more key advantages that AI can deliver:*

- 1) pattern recognition, in that AI can identify repeating events or situations at the stock level to drive investment decisions;*
- 2) learning and evolution, in that while traditional quants are fairly static over time, an AI system can evolve and learn;*
- 3) memory augmentation, where an AI process can be enhanced by incorporating memories of past events into modelling outcomes.*

Philps added that given the potential advantages of AI, it made less sense trying to tinker around the edges of a traditional approach and much more objective sense to reengineer a quantitative approach from the ground up, as Rothko had been. Additionally, AI was described as being inherently 'bottom up', best used to drive security selection, which contrasts with traditional factor approaches which are inherently 'top down'.

3. What trading signals has machine learning given you?

- *The panel explained that ML techniques could identify signals that are too complex for human analysts to identify – subtle signals hidden in vast amounts of data. The panel also discussed whether AI or ML should be used to emulate human decision makers or rather to adopt a purely data-driven approach to investing.*
- *The panel commented that non-linear models could be advantageous but disagreed at the assertion of one panelist that transaction costs may make most ML approaches unprofitable. An overview of the various machine learning based signals was provided. It was also commented by some that ML approaches may be less stable, resulting in greater levels of turnover, though not all agreed.*
- *The group then spoke more theoretically about ML and AI alpha potential with some critiquing, critiquing the complexity of ML trading signals and implicitly questioning whether out of sample performance of AI or ML was stable.*

Rothko: *Philps stated that it is possible to identify company specific situations to generate alpha. One example was Rothko identifying and selling down stocks exhibiting signs of stress, by monitoring the changing financial state of a company, with respect to many different observations including debt position, earnings generation, margin changes, deteriorations in cash-conversion cycle and more. The pattern of change could be used to identify value traps, where a company appears undervalued but turns out to be overvalued as fundamentals deteriorate further.*

Philps also commented that AI had a significant advantage over traditional quantitative analysis in investment management. AI can use larger amounts of stock specific data that traditional quantitative factor-based approaches simply do not see. It can also result in lower levels of turnover, where Philps cited Rothko's relatively low turnover when compared to traditional quants.



4. How do you access machine learning? Proprietary libraries and systems? Or open source code?

- *The panel discussed their different preferences for the use of open source code versus developing their own algorithms in house. They also provided an overview of programming languages used. Some commented that open source repositories such as GitHub can be a good source of code.*
- *Additionally, the group indicated the process involved in selecting one ML method over another. Chaudhry specifically asked panellists to comment on Auto-Machine Learning (AML).*
- *It was noted that much depends on the data you have, as well as the number of observations. The panellists seemed to form a consensus that algorithm selection depends on what one is trying to achieve, and which questions are trying to be answered.*

Rothko: *Philps commented that Rothko tended to develop algorithms internally and cited the risks of using off the shelf ML approaches for a long term investment strategy. He explained that the principle risk of using first-generation ML approaches was complexity and it was only by customising approaches and cherry picking the best elements of certain approaches that objectives could be met without undue complexity.*

Regarding AML, Philps commented that it was an interesting area, but its likely successor, Continual Learning (CL) was even more exciting. However, Philps stressed that a focus on algorithms was far less important than on how to gather and pre-process data, which represented 70% of the resources needed to run an AI process.

5. Do you use Deep Learning in your process?

- *The panel commented generically about deep learning and the risks of using these approaches owing to overfit. It was not made clear whether the panellists used deep learning in each of their processes.*

Rothko: *Philps concurred that there were risks involved and made clear Rothko does not directly use deep learning to drive decisions owing to the risks of complexity and overfit. He also commented that deep learning could be indirectly used to learn elements of an investment process.*

6. Q&A

- *Is it wise getting AI to emulate a human decision maker? What if that decision making is flawed?*

Rothko: *The question was mainly directed at Philps' comments that Rothko aims to emulate human decision makers. Philps commented that best practice in the development of an AI system should always start with the best human expert available. He commented that this was the rule of thumb proposed by Prof Geoffrey Hinton as domain knowledge is key to problem solving. Using an expert to help find a starting point for a system was far more sensible than attempting to data mine a starting point.*

- *Can ML be used to predict the next financial crisis?*

The panellists agreed that Machine Learning would not be able to predict the next financial crisis.

Rothko: *Philps commented that more subtly, ML could be used to determine prevailing market conditions, and therefore assist with further aspects of the investment process, e.g. in deciding whether to trade on the portfolio.*

Key Takeaways

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- ◆ **Different tools, different research questions:** Asking the right research questions will be even more important as new resources that make it practical to test multiple model behaviours in a fraction of the time open up many new opportunities.
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Other Points of Note

- ◆ The substantial increase in availability of high quality data, as well as considerable advances in computing power in recent years, has allowed ML and AI techniques to develop rapidly.
- ◆ Machine learning methods may have existed for a long time, but the use of open-source and off-the-shelf algorithms is allowing these techniques to be deployed by a broad set of users. Unfortunately this allows for widespread misapplication of complex approaches.
- ◆ There are many applications of ML and AI techniques in financial markets: to generate alpha signals, enhance existing strategies, or for risk management & execution purposes.
- ◆ Trial and error seems to dictate which machine learning methods are used. Yet, knowing what one wishes to achieve and asking the right questions, seems to be an important part of this puzzle. The key is in understanding the markets and the initial design of any system.

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