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A practical approach to evaluating AI applications in investment processes

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In 1965, the Financial Mail launched a subscription service providing basic financial metrics for companies listed on the JSE, printed on cards and mailed to subscribers. The data included balance sheet figures, dividends, earnings per share and five years of historical financial summary metrics. These accurate and timely updates from the Financial Mail would have been a huge advantage for investors compared to those who were trying to compile the data themselves.

Data that provides an information edge can be a material advantage for investors. This was true in 1965 and is even more so today. It is thus unsurprising that the adoption of AI and machine learning in the investments industry globally has been quite rapid over the past three years. This has been driven by the proliferation and cheaper storage of data, an exponential increase in compute power and the development of tools for the large-scale processing and interpretation of data.

Since 2016, the CFA Institute has been surveying institutions to gauge the take-up of data science techniques across the investment value chain. In 2019, the survey showed that 10% of portfolio managers were using AI or machine learning techniques. By 2020, this number had almost doubled. In addition, there was a further 7% of portfolio managers that were in the process of implementing AI in their investment strategies. In a short space of three years (assuming the 7% implementing their AI strategies were completed during 2021), around 25% of global investment managers are likely using AI in their investment processes. This is likely to increase.

We think it is vital for the South African investment industry to increase awareness around these techniques and the technology required for successful implementation. This is not to say that every investor should buy into the hype, mindlessly. However, we do think that some investment firms can generate strong alpha by adopting AI technologies. Indeed, investors who have a sound understanding of these technologies and analytical methods will be in a good position to unlock these potential sources of alpha.

It is important to differentiate investment strategies from investment tools

Before diving into the practical issues, we emphasize that AI and machine learning techniques are investment tools and not a substitute for an investment strategy. There is a perception that AI models are only useful in identifying technical, short-term trading opportunities. Furthermore, there is a more worrying perception that there is some kind of sentience in the manner that these models make predictions. This is possibly because one of the common machine learning techniques, called neural networks, tends to exaggerate comparisons to human intelligence. Such perceptions tend to confuse AI as an investment strategy or a substitute for a portfolio manager, as opposed to a tool deployed in effecting an investment strategy.

Just as a hammer requires its user to direct it toward a nail, AI tools need to be guided by a clear investment strategy to ensure that they provide useful answers to meaningful questions. Machine learning is therefore not a substitute for an investment manager. Instead, it requires that investment professionals have a sound understanding of the nature and drivers of the mispricing that they wish to exploit and use this knowledge to build effective machine learning models.

AI and machine learning – a tool for fundamental strategies and technical strategies

In our conversations with many experienced investors, particularly those that favour fundamental active investing, there is generally an aversion to quantitative techniques, especially AI and machine learning. This is because there is an assumption that the use of machine learning is akin to using technical analysis, whereby opaque price patterns are identified by algorithms to predict stock prices. This is not actually an aversion to AI. Rather, the issue here is that the investment philosophy guiding the deployment of the AI is effectively charting/technical analysis.

We must emphasise that AI techniques can also be used in fundamental investment processes. For example, fundamental bottom-up research would involve the following:

- classification of stocks into various categories that may explain future performance;
- identification of key themes driving narratives and potentially the current market valuation;
- identification of anomalous market valuation based on fundamental data inputs; and
- identifying changes in management tone and strategy.

These are menial tasks that require limited judgement. AI techniques may be useful in tackling these and can be easily scaled across thousands of stocks.

AI techniques have been quite successful for tasks that are relatively easy, but time-consuming for humans to perform. For example, the sentiment in a company management outlook statement is fairly simple to identify, but the task is challenging when it has to be done for hundreds of stocks by humans in real time.

The following table shows the results of a CFA Institute survey that asked portfolio managers how they have used AI. This gives a good sense of some practical applications and perhaps why some stakeholders see AI as a technical trading tool.

Technique	% portfolio managers responding yes
Arriving at 'buy' or 'sell' decisions based on macro, fundamentals, or market input variables using classification	15%
Building signals (e.g., carry signals, value signals, technical signals, microstructure signals)	14%
Examining the entire set of asset returns to identify relationships (e.g., using unsupervised machine learning)	12%
Determining sentiment via natural language processing of news, Twitter, transcripts, etc. (e.g., by counting positive or negative words)	10%
Determining market trend or regime (e.g., using a Hidden Markov Model supervised classification)	9%
Predicting short-term asset price direction (e.g., using lasso, k-nearest neighbour, or ridge regression)	9%
Predicting short-term asset price direction based on macro data (e.g., using gradient boosting)	9%
Finding the most profitable trading strategies (e.g., using reinforcement unsupervised, deep learning)	8%
Identifying prevailing factors driving the market (e.g., using unsupervised machine learning, such as principal component analysis, to determine the best representation of the data)	8%
Predicting asset price direction or finding signals from noisy data (e.g., using support vector machines to do supervised classification)	6%

Source: CFA Institute, *AI Pioneers in Investment Management Survey, 2020*

About half of the techniques described above are based on technical trading strategies. There is no doubt that long-term fundamental investors and asset allocators would have problems with technical strategies. However, we hope that we have provided some clarity to help separate the tools and applications from the underlying investment strategy. Thus, investors and other stakeholders can be more precise about any reservations regarding machine learning and AI.

We can now discuss why AI and machine learning are potential solutions in efficiently processing the vast amounts of complex data that investors are faced with in modern markets.

The data mining challenge in today's markets

The amount and complexity of data that investors must deal with has increased tremendously since the Financial Mail's innovation in 1965. This is partly a function of technology gains making it easier and cheaper to store and retrieve complex data sets. Furthermore, regulators have pressured companies to provide vastly more sophisticated reports and disclosures. These have evolved from basic financial statements to comprehensive reporting suites that encompass financial performance, strategy and vision, management performance appraisal and ESG reporting.

Even if your investment philosophy is rooted in Ben Graham's Intelligent Investor, it is undeniable that alternative and proprietary datasets and superior data processing and evaluating techniques can give you a competitive edge in determining the stocks that fit your investment criteria.

Here are two ways to go about addressing the data challenge:

- Hire more people in your research divisions
- Implement technology solutions that enable your current team to efficiently collect and process information

Note that both options are not cheap. While it may be obvious that highly skilled research analysts and portfolio managers are expensive, technology solutions can be costly as well. The foremost advantage is the scalability of technology-driven approaches.

Technology solutions will require experienced, rare technology skills. In our experience, highly skilled technology professionals (developers, engineers and data scientists) in South Africa can earn more than most investment professionals. After all, many developers and data scientists are used to working for loss-making businesses funded by equity investors who do not mind losses in pursuit of hyperscale. This may sound tongue-in-cheek, but examples abound. Just have a look at the willingness of large firm such as Prosus, Uber and Tesla that are throwing massive sums of cash into technology businesses that are currently loss -making or barely profitable.

The critical reasons why a technology-driven approach would have an advantage over human research teams in certain tasks are:

- Consistency and massive scalability. Machines can process data all the time, and are not prone to errors due to fatigue.
- The use of technology is likely to allow the research and investment team to remain at a size where the skills and calibre of the individuals allow continued alpha generation. It can be challenging to assemble large research teams that are better than the market average.

Appraising the use of machine learning and AI in investments

In our opinion there are three critical considerations:

- **The underlying investment strategy and process – how relevant are the AI/machine learning models in executing the strategy?** For example, if the investment strategy is based on market microstructure, it would be important for individuals with strong knowledge of this domain (e.g., dealers and traders) to provide input into the modelling process.
- **The experience and skills of data science professionals in the team.** It is important to have a mix of both data scientists (who generally specialise in the statistical and machine learning models) as well as data engineers (who specialise in the data provision and IT architecture to support the data scientists). As these are both fairly new professions, it is important to assess the qualifications and technical capabilities of the individuals in these teams. This is quite different to other investment professionals that might have a professional body vetting their skills (e.g., CFA, CA or FIA)

- **IT architecture.** It is important to have an IT architecture that supports the volume and complexity of the data and that facilitates the deployment and continuous evaluation of the AI models. For example, in the market microstructure case, it is important to understand the architecture that will be used to stream live market data, store tick data and how this architecture will support consistent training, testing and deployment of models

Conclusion

In summary, AI technologies are becoming more widely adopted in asset managers across the globe. AI and machine learning provide an alternative to large research teams and may provide a cost-effective edge in processing large, complex datasets.

It is important for stakeholders to realise that AI and machine learning are tools and not strategies. Investors will therefore need to have a clear understanding of the underlying investment strategy so that they can use their AI toolbox to implement the strategy and achieve a competitive edge.

Investors and stakeholders will also need to improve their knowledge in this field to make informed decisions on whether these tools will be useful in achieving their investment objectives. There is a need for increased knowledge of data science techniques as well as the technology supporting the modelling process.

Finally, we are grateful to Muitheri Wahome for her valuable insights. The example on the Financial Mail subscription service was taken from her recent book, *Building Capital: A History of Asset Management in South Africa*.

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