Artificial Intelligence in Investing

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Agenda

1. A Brief and Broad Review...When We Speak of AI Today (Here and Now), What do We Mean?
2. AI as Tools for Investment Consultants
3. How Managers May Be Using AI in the [Fund] Portfolio
4. AI and Quantitative Investment Strategies
5. How Can You Use AI for Your Fund?

A Brief and Broad Review…When We Speak of AI Today (Here and Now), What Do We Mean?

What Is Artificial Intelligence (AI)

AI is...

Any computing system designed to perform tasks that normally require human intelligence.

VERY simplistically, how does AI work?

Systems ingest large amounts of (training) data, analyze it for patterns (typically via a neural network), then use these patterns to make predictions (via statistical models).

These Technologies Are All *Types* of Artificial Intelligence, High Level

Machine Learning	"Deep Learning"	Natural Language Processing	Generative AI
Algorithms trained to detect patterns and make predictions (*e.g.*, Netflix recommendations)	A type of machine learning that uses neural networks to learn from vast amounts of data for more complex applications (*e.g.*, self-driving cars)	Helps computers understand human language (*e.g.*, Email filters)	Large language model (LLM) based applications that create new text, images, video, and audio. This is the "AI" that garners most of the attention since late 2022

These Technologies Are All *Categories* of Artificial Intelligence, Detailed

Artificial Intelligence

- Automated programming
- Knowledge representation
- Expert systems
- Planning and scheduling
- Speech recognition
- Intelligent robotics
- Visual perception
- Natural language processing (NLP)
- Problem solving and search strategies

Machine Learning

- K-means clustering
- Principal component analysis (PCA)
- Automatic reasoning
- Random forest
- Decision trees
- Ensemble methods
- Naive bayes
- Classification
- Anomaly detection
- Reinforcement learning

Neural Networks

- Radial basis function networks
- Recurrent neural networks (RNN)
- Autoencoders
- Hopfield networks
- Modular neural networks
- Adaptive resonance theory (ART)
- Large language models (LLMs)

Deep Learning

- Convolutional neural networks (CNN)
- Long short-term memory networks (LSTM)
- Deep reinforcement learning
- Generative adversarial networks (GAN)
- Deep belief networks (DBN)

What AI Is NOT

NOT	NOT	NOT	NOT	NOT
Sentient* Generative AI (GenAI) is *still* not self-aware It is not Artificial *General* Intelligence (AGI)	Robotics	*The* problem-solving tool You (the human) still have to know how to formulate a problem to get good results	Interpretive GenAI cannot use common sense or understand nuances like humans can...still	*The* decision-making tool You (the human) still have to apply critical thinking to the output. "Does this make sense?"

* "Roughly speaking, they take huge amounts of data, search for patterns in it and become increasingly proficient at generating statistically probable outputs—such as seemingly *humanlike* language and thought."
Noam Chomsky—New York Times, March 8, 2023

"All models are wrong, some are useful."

–George Box (Statistician)

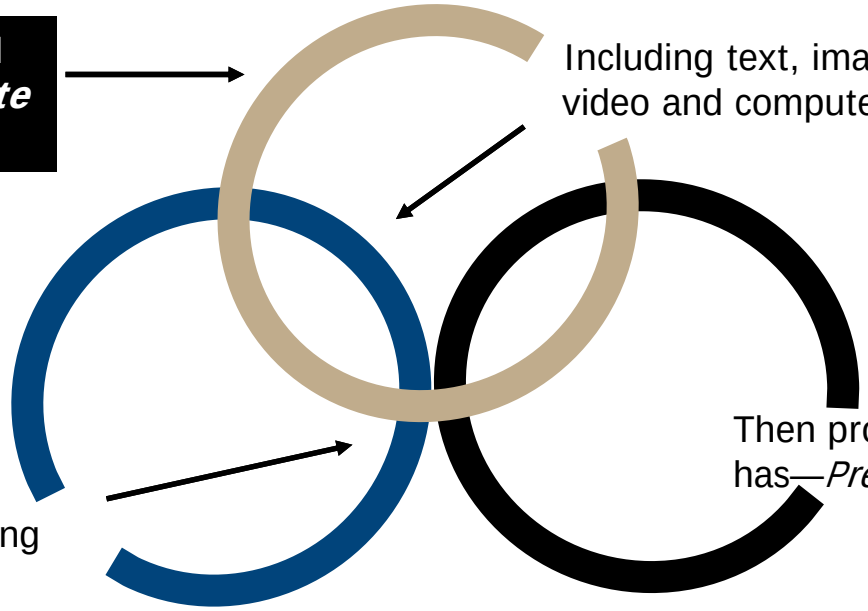
So it is with the large language models (LLMs) underlying generative AI.

They are flawed but useful.

Generative AI Has Captured the Most Public Attention

Generative AI systems *create* content

Including text, images, audio, video and computer code



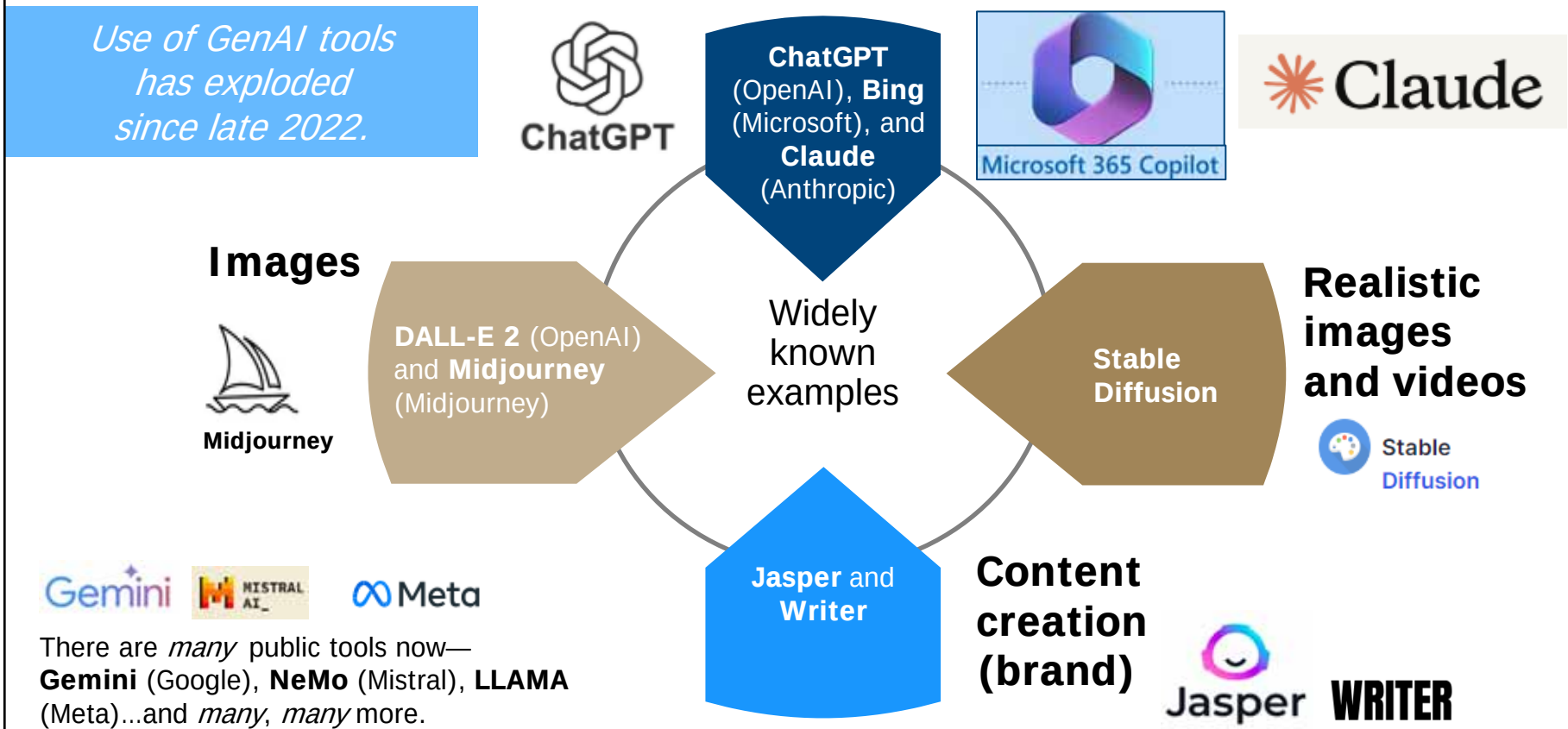
How? By identifying patterns in large quantities of training data

Then producing original material that has—*Predicted*—Similar characteristics

This is a key fact to understand. These systems are generating output based on statistical model-based predictions. There is no actual "computer intelligence" involved.

These Are Illustrative Generative AI Tools

Use of GenAI tools has exploded since late 2022.



Gemini MISTRAL AI_ Meta

There are *many* public tools now—**Gemini** (Google), **NeMo** (Mistral), **LLAMA** (Meta)...and *many*, *many* more.

The Significance of AI In the Workplace

AI, particularly generative AI (GenAI), is set to change the nature of work, impacting productivity, service and quality.

As economist Tyler Cowen notes, we are entering an era of radical technological change, and all organizations need to embrace and adapt to the advancements brought forth by AI.

AI as Tools for Investment Consultants

Investment consultants, are increasingly integrating artificial intelligence (AI) into their operations to enhance efficiency, decision-making, and client services. Humans are still—However—“In the loop”.

But AI in Investing Is Already Here

It is already here!

- Machine learning
- Natural language processing
- Predictive analytics
- Generative pretrained transformers (GPTs)—***New!***

It is used by investment management firms to answer age old questions regarding:

- Company Fundamentals
- Human sentiment(s) about firms
- Macro trends about a sector or the economy, overall

Used to enhance investment firm effectiveness

Used in novel ways to help investors to have a more efficient and better decision-making process

Data Analysis and Insights

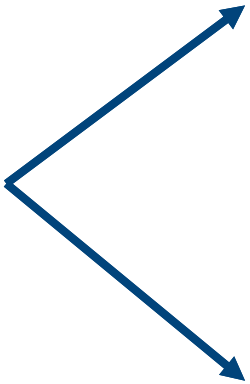
AI technologies enable investment consultants to analyze vast amounts of data quickly and efficiently. This includes:

Automated Data Processing: AI systems can process financial data from multiple sources, such as market trends and economic indicators, significantly reducing the time spent on manual analysis[1] [4]

Enhanced Decision-Making: AI can identify hidden patterns and correlations in data that may not be apparent to human analysts, and due diligence of investment strategies thus improving forecasting models and investment strategies[2][5]

Data Analysis and Insights: Machine Learning

Machine learning algorithms can analyze large amounts of data quickly and accurately, allowing an investor to make informed decisions based on market trends and historical performance.



For example, one could use machine learning algorithms to predict stock prices or identify potential investment opportunities.

However, there is a risk that these models may be prone to overfitting if they are trained on insufficient data or if the underlying assumptions are not validated (*i.e.*, correlation of causation)

Portfolio Management

Investment consultants use AI for optimizing portfolio management through:

Asset Allocation

AI tools can help in fine-tuning asset allocation by providing more accurate risk and return estimates, allowing for highly customized portfolio construction.[2][4]

Risk Mitigation

AI enhances risk analysis by continuously monitoring real-time data and identifying potential risks, which helps in making informed adjustments to investment monitoring and decisions.[1][5]

Operational Efficiency

AI contributes to the efficiency of operational processes in investment consulting:

Automation of Routine Tasks

AI can automate administrative and reporting tasks, such as generating client reports and managing inquiries, freeing up consultants to focus on strategic activities.[1][4]

Improved Client Engagement

AI-powered tools can analyze client behavior and needs, enabling more personalized outreach and service delivery.[4]

Research and Analysis

AI enhances the research capabilities of investment consultants by:

Natural Language Processing (NLP)

This technology allows for the analysis of unstructured data, such as news articles and social media, to extract relevant insights for investment decisions.[3][4]

Predictive Analytics

AI can analyze historical data to predict future trends, assisting consultants in developing proactive investment strategies.[2][5]

Research and Analysis: Natural Language Processing

Natural Language Processing (NLP)—NLP is a powerful tool that allows machines to understand human language. It can help an investor analyze news articles, social media posts, and other unstructured data sources to gain insights into market trends and investor sentiment.

This information can be used to inform investment decisions and identify potential risks.

However, there is a risk that NLP models may not accurately capture the nuances of human language or may be biased if they are trained on data that reflects historical discrimination or prejudice.

Research and Analysis: Generative Pretrained Transformers

Generative Pretrained Transformers(GPTs)—The large language models (LLMs) of GPTs can analyze large amounts of data and generate *novel* insights based on patterns in proprietary and public data.

Example: An investor could use GPTs to identify potential investment opportunities by analyzing market trends and identifying emerging technologies or industries.

Risk: These models may not accurately capture the complexities of human decision-making or may be prone to errors if they are not properly validated. There is not necessarily any creativity or "thinking outside the box."

Hallucinations! *The GPT may just fabricate false information.*

(More on this later.)

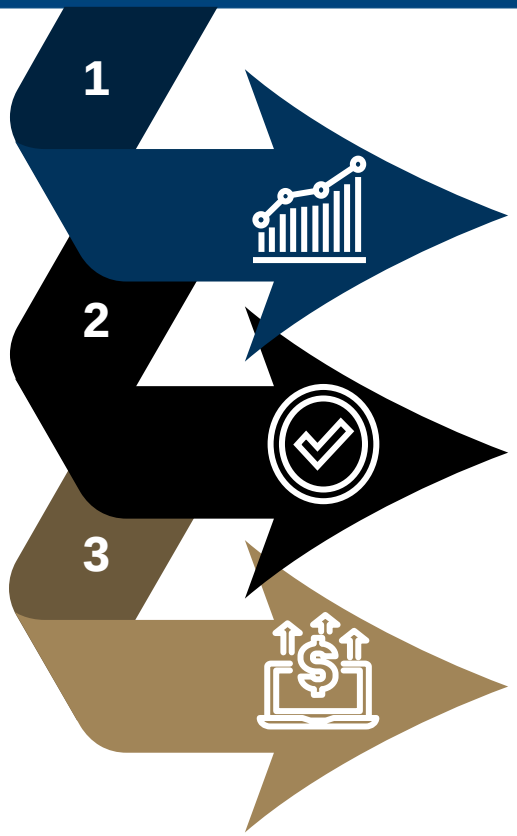
Training and Development

AI can also support the training of investment professionals by:

- Coaching Tools: AI systems can analyze historical investment decisions made by professionals, providing personalized feedback and insights to improve future decision-making.[2][5]

- The integration of AI in investment consulting not only enhances the efficiency and effectiveness of investment strategies but also positions firms to adapt to the rapidly changing financial landscape. As AI technology continues to evolve, its applications in investment management are expected to expand, driving further innovation in the industry.

What Is the Point?



- Investment Firms may use AI to generate “Alpha” (outsized returns) for their investment vehicles
- To make their firms more efficient and effective, and to provide higher quality and service to investors (differentiate themselves)
- To help individual investors

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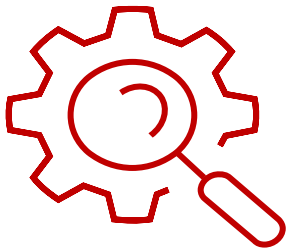
How Managers May be Using AI in the [Fund] Portfolio

Investment managers are increasingly integrating artificial intelligence (AI) into their portfolio management processes to enhance efficiency, decision-making, and risk mitigation. Following are some of the ways AI is being utilized.

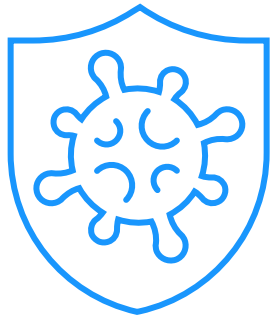
Asset Allocation



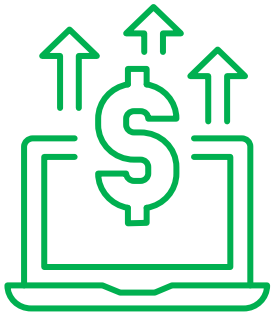
AI algorithms can analyze vast amounts of data, including market trends, economic indicators, and investor preferences, to determine the optimal mix of assets that maximizes returns while minimizing risk.[1][2][3] By continuously monitoring market conditions, AI can dynamically adjust asset allocations to ensure portfolios remain aligned with investment objectives.[3]

Risk Mitigation

AI significantly contributes to managing portfolio risk by utilizing advanced analytics to identify potential risks, such as market fluctuations, credit defaults, and liquidity issues.[1][3] By continuously monitoring portfolios and market conditions, AI provides insights for proactive risk mitigation strategies.[3]



Portfolio Optimization

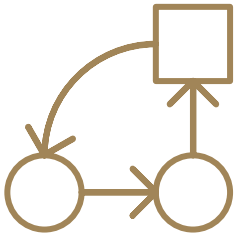


AI-enabled portfolios can automate allocation, rebalancing, and risk management processes.[2] By analyzing historical data and using advanced algorithms, AI can identify the most suitable asset allocation strategy for each investor, helping to maximize returns and minimize potential losses.[2]

Assisted Decision-Making

AI transforms investment managers' decision-making process by enhancing the speed, accuracy, and objectivity of data analysis.[2] The ability to analyze vast amounts of data, identify patterns, and generate actionable insights enables investment managers to make informed decisions in real-time. [2]

Passive Management



AI can help in passive management by optimizing the tracking of indices, automating rebalancing processes, and ensuring that the portfolio remains closely aligned with the chosen benchmark.[3]

Factor Based Management

AI can enhance factor-based management by analyzing factor exposures, predicting their performance, and optimizing the portfolio based on factor signals and historical data.[3]

As AI continues to evolve, investment managers who embrace this technology will be at the forefront of the industry, driving innovation and delivering superior results for their clients.[2]

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AI and Quantitative Investment Strategies

Artificial intelligence (AI) is revolutionizing the world of quantitative investment strategies, enabling fund managers to harness vast amounts of data, identify complex patterns, and make more informed decisions. Following is how AI is impacting various aspects of quantitative investing.

AI and Quantitative Investment Strategies

Asset Allocation and Portfolio Optimization	AI algorithms can analyze massive datasets, including market trends, economic indicators, and investor preferences, to determine the optimal asset allocation that maximizes returns while minimizing risk. By continuously monitoring market conditions, AI can dynamically adjust asset allocations to ensure portfolios remain aligned with investment objectives.[1][2]
Risk Management and Mitigation	AI significantly contributes to managing portfolio risk by utilizing advanced analytics to identify potential risks, such as market fluctuations, credit defaults, and liquidity issues. By continuously monitoring portfolios and market conditions, AI provides insights for proactive risk mitigation strategies.[1][2]
Automated Trading and Execution	AI-powered trading systems can execute trades with speed and precision, taking advantage of fleeting market opportunities. These systems can analyze real-time data, identify patterns, and make split-second decisions to capitalize on market inefficiencies.[1][2]
Alternative Data Analysis	AI-powered trading systems can execute trades with speed and precision, taking advantage of fleeting market opportunities. These systems can analyze real-time data, identify patterns, and make split-second decisions to capitalize on market inefficiencies.[1][2]
Predictive Analytics and Forecasting	AI algorithms can analyze historical data and market patterns to predict future trends and market movements. By incorporating machine learning techniques, these models can continuously adapt and improve their accuracy, providing fund managers with valuable insights for making informed investment decisions.[1][2]
AI Risk (and Its Management)	As AI continues to evolve, fund managers who embrace this technology will be at the forefront of the industry, driving innovation and delivering superior results for their clients. However, the integration of AI also raises concerns about model risk, data quality, and the potential for increased systemic risk, which must be carefully managed.[1][2]

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How Can You Use AI For Your Fund?

As a Board member or executive governing investment consultants and managers on behalf of plan participants or employees, the following are some ways you could leverage AI to enhance oversight and governance.

Monitoring Investment Performance and Risk

Use

AI-powered analytics to continuously monitor portfolio performance, risk metrics, and compliance with investment guidelines across all managers. This allows for proactive identification of any issues or underperformance.

Implement

AI-driven risk management systems to analyze portfolios for concentration risks, liquidity risks, and other potential threats to the overall investment program. This provides an extra layer of risk oversight.

Evaluating Manager Selection and Due Diligence

Utilize	Employ
AI to analyze vast amounts of data on investment managers, including performance, risk, assets under management, personnel changes, and regulatory issues. This enables more robust due diligence in selecting and monitoring managers.	AI-powered natural language processing to assess manager communications, marketing materials, and regulatory filings for any concerning patterns or discrepancies. This augments traditional due diligence.

Enhancing Reporting and Transparency

Leverage

AI to aggregate data from multiple managers and generate consolidated reports on the overall investment program. This provides a holistic view of performance and risk.

Use

AI to create interactive dashboards that allow you to drill down into specific managers, asset classes, or risk factors. This empowers you to conduct more granular oversight.

Optimizing Asset Allocation and Rebalancing

Implement

AI-driven asset allocation models to analyze the overall investment program and recommend optimal allocations based on objectives, risk tolerances, and market conditions. This provides an independent check on manager recommendations. (Of course, within a long-term perspective, for most of you.)

AI to automate rebalancing of the overall portfolio, ensuring adherence to target allocations and minimizing drift. This reduces the risk of human error or oversight.

Utilize

By embracing AI in governing investment consultants and managers, you can enhance oversight, make more informed decisions, and better protect the interests of plan participants or employees. However, it's important to maintain human oversight and not over-rely on AI, as well as to carefully monitor for any biases or errors in the AI models themselves.

Citations

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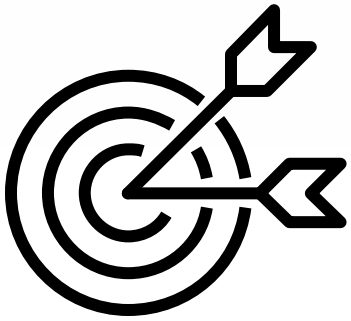
Key Takeaways



- AI and generative AI, particularly, is flawed but potentially useful both generally and in for investment consultants and managers.
- It is a nascent technology ("tech-project" stage), but it is only going to be more impactful to individuals and organizations in the near- and long-term future.
- It is a technology that has been in—some—use already within the investment world, yet it is only going to be used more, and more aggressively by your investment consultants and managers; as fiduciaries you should ask questions about how AI is used for your Funds.

***Proceed with care and caution*, but don't be afraid.**

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Session Evaluation

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