



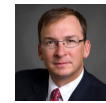
Using Artificial Intelligence to Enhance Our Investment Processes

Driving deliberate innovation with AI tools to boost human decision-making

September 2023

KEY INSIGHTS

- Through our New York Technology Development Center, established six years ago, T. Rowe Price has developed artificial intelligence (AI) tools that seek to enhance client outcomes.
- Our approach focuses on “intelligent augmentation”—AI designed to help deepen the insights of our investment professionals.
- Our Data Insights Group is developing a solution that will incorporate a large language model to help our analysts and portfolio managers gain insights from massive internal and external datasets.



Rob Sharps

Chief Executive Officer and President

The launch of ChatGPT in November 2022 was a watershed moment. It unleashed a huge wave of interest in generative artificial intelligence (AI) and its possibilities. Leaders in virtually every industry across the globe are now evaluating how their businesses may be impacted by AI—and asset management is no exception.

While its popularity is relatively new, AI itself is not new to T. Rowe Price. For the past six years, we have been investing in capabilities around data science and machine learning to support our business and pursue positive outcomes for clients. Throughout this journey, we’ve been exploring how AI can be harnessed to connect our investment professionals to our firm’s wealth of knowledge, which is built on decades of fundamental research and learning.

To this end, our approach is one of “intelligent augmentation” (IA). Rather than automate decision-making, we seek to empower our decision-makers with additional data and insights, bringing new perspectives within the existing investment process. We believe this approach has the potential to transform the ways we work and enhance the outcomes we deliver for clients.

In addition to the benefits offered by generative AI, we believe our powerful, collaborative research approaches help to accelerate the learning process. It brings together senior leaders, portfolio managers, analysts, data scientists, software engineers, and user experience designers in a truly collaborative way. By supporting collective learning, it enables us to effectively navigate the rapidly changing landscape of AI technology.

“The sheer amount of information available on every potential investment we analyze is vast and continues to grow.”

A Model for Intelligent Augmentation

Recently, our Data Insights Group has focused on the potential of large language models (LLMs) to improve the delivery of data and insights to our portfolio managers and analysts. LLMs, of which ChatGPT is the most famous example, are computerized language models that are trained on vast amounts of text to generate human-like responses to queries or prompts.

The ability of LLMs to instantly analyze vast amounts of data could prove invaluable. The sheer amount of information available on every potential investment we analyze is vast and continues to grow. Given the immense amounts of publicly available research and a deep archive of knowledge from our internal research platforms, technologies such as natural language processing (NLP) are becoming a necessity to help analysts retrieve and distill information.

To address this challenge, our Data Insights Group is developing a solution that would incorporate all the data and research we've amassed over many years to make that information significantly more accessible and retrievable by the appropriate investment adviser.

A solution that leverages an LLM and is tailored to the needs of our analysts and portfolio managers has multiple uses, which we classify as the three C's: consumption, characterization, and creation.

Consumption: This involves how data and insights are retrieved for analysis. Consumption offers the biggest potential productivity gains in the near to medium term. An investment analyst might leverage an LLM to help learn more about a potential investment. The LLM facilitates this by rapidly analyzing and summarizing an aggregate set of information sources.

The analyst will then be able to conduct a back-and-forth conversation with the LLM to refine the request. This would enable an analyst to spend more time

focused on evaluating the differentiating factors relating to individual companies that might make good long-term investment prospects—through fundamental analysis, factor analysis, or insights from management interviews.

Characterization: This refers to the ability of AI to analyze unstructured data (such as text or images) to uncover complex but useful patterns that might otherwise be hard to identify. For example, academics in data science have analyzed years of the language used in 10-K reports. They've discovered a correlation between subtle changes in the presence of negative or positive words in those reports and subsequent stock returns. In a similar vein, we see huge potential in AI's ability to review, in seconds, how sentiment on a stock has changed over time and to compare that with multiple data sources.

Creation: This refers to the way an LLM might also be used to draft content, including insights, investment updates, meeting notes, and other written materials. Automating aspects of content creation that were previously manual means that analysts can focus on more value-added analysis and decision-making.

Enhanced, Not Replaced, Human Decision-Making

While AI-powered tools have significant potential to automate tasks and magnify the insights of our portfolio managers and analysts, we are also cognizant of the potential risks and the need for people to monitor and manage them.

One key risk is bias. AI accesses vast amounts of information but cannot determine the reliability of that information. If the data used by an AI-powered tool are biased, the algorithms created using that data will also be biased. Even the way a question is posed to an AI tool, known as a “prompt,” can introduce behavioral bias. For example, a negatively formulated prompt—such as “find holes in my thesis”—increases the risk of a negatively biased response, which may not be supported by the facts.

“Our preferred pathway is to harness AI to improve human decision-making....”

Another risk is around transparency. AI models can be complex and opaque, making it difficult to trace the basis of a response. This will clearly be a focus of regulatory scrutiny as capabilities evolve. We are also cognizant of privacy and security risks, as large volumes of data are consumed in training and using AI models.

Such risks warrant caution in the adoption of AI and the application of its outputs while our teams work to unlock its potential. Ultimately, we believe that investment processes

augmented by AI will require human oversight and governance for successful active management.

Our preferred pathway is to harness AI to improve human decision-making, create more efficient processes, and enable associates in key functions to focus on tasks that generate the most value. The journey we began six years ago, with a collaborative team of data scientists and investment associates, positions us to capitalize on the enormous potential of this rapidly evolving landscape.

Our AI Journey—Built on Collaboration

Our AI journey began in early 2017, when we established a Technology Development Center (TDC) in New York City. We recruited a diverse team of technologists (data scientists, data engineers, application developers, and user experience designers) to build new capabilities for the firm. Led by Jordan Vinarub, our head of the TDC, we created a Data Insights Tech team with a mission to generate data, applications, and insights to support decision-makers across the business.

The team initially partnered with our Marketing and Business Intelligence Groups to leverage the vast amount of data to drive personalized content and offerings for clients. The team focused on building data science and machine learning solutions to empower our clients with more knowledge and ideas.

In late 2018, Vinit Agrawal was appointed to head up a new Investment Data Insights team. Its objective has been to strengthen the investment process through alternative data and data-driven insights. Vinit partners with Jordan to drive our efforts in NLP, alpha generation models, and alternative data.

The onset of the coronavirus pandemic at the start of 2020 provided new opportunities to put their research to work. The investment teams sought additional research, access to alternative data, and new insights based on timely information. Confronted with a dramatic increase in the amount of research generated, the Data Insights Tech team helped create a new platform to showcase insights and promote internal collaboration.

In contending with the remote working environment compelled by the pandemic, innovation and collaboration were essential. The platform they created enabled our insights ecosystem to flourish through shared research, projects, and the continuous generation of thought leadership.

The business and technology teams partnered closely with our quantitative and fundamental investment professionals to address a number of opportunities across the investment platform. This ultimately resulted in new solutions for detecting environmental, social, and governance themes in earnings call transcripts; the NLP analysis of SEC filings; and the derivation of new insights through the use of alternative data.

With the release of OpenAI's ChatGPT in late 2022, its user base rapidly grew to over a billion users in a matter of months. The Data Insights Group was uniquely positioned to respond, conducting research and building proofs of concept to leverage the technology internally. The team continues to collaborate across the firm and operates as the epicenter of our work on AI today.

While AI technology is new and evolving, our approach to realizing its potential in asset management is consistent with a legacy of collaboration and intellectual curiosity that we value at T. Rowe Price. We like to say, “AI is all about the people.” Associates across our firm are engaged in a shared pursuit of solutions to enhance our research ecosystem and support our clients' investment goals.

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