

NQINTEL™: Intelligently Guiding Investors in the AI Theme

Nasdaq CTA Artificial Intelligence™ Index

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Introduction

The Nasdaq CTA Artificial Intelligence Index (NQINTEL™) is one of Nasdaq's thematic technology indexes that tracks companies involved in artificial intelligence (AI) globally and was launched on October 29, 2018. This particular index was jointly developed by Nasdaq and CTA – the Consumer Technology Association – to provide investors a differentiated solution to tracking the AI theme. CTA has partnered with Nasdaq to develop thematic indexes for more than a decade, covering a variety of technology-driven sectors. Nasdaq brings its substantial financial, quantitative, and regulatory expertise into the construction of its portfolio of indexes. Nasdaq conducts all financial evaluations of securities within an index such as liquidity and trading volume checks, develops quantitative methodologies for index weighting, and interfaces with regulatory bodies for index launches among other responsibilities. CTA relies on its established research presence to provide qualitative insights around the evolution of growth technology themes throughout the index development and maintenance life cycle. More specifically, CTA applies its stringent approach, set of standards, and research capabilities to evaluate and recommend companies for inclusion into a prospective thematic universe such as artificial intelligence. This centers on human-driven analysis of a variety of factors that demonstrate overarching technology and innovation trends. For investors interested in tracking the AI theme, NQINTEL offers a unique approach to both selecting and weighting companies that have a high degree of thematic relevance.

Industry Outlook

This year will be a defining one for AI, following the release and exploding popularity of generative AI platforms such as OpenAI's ChatGPT, Google's Bard, and Dall-E beginning in late 2022. This multifaceted, disruptive technology is already embedded in the inner workings of many industries and will continue to revolutionize what we call work today. Generative AI is an adaptable technology that has countless use cases applicable to a multitude of industries, such as minimizing the cost and time of the drug discovery process, creating synthetic materials with specified physical properties, and reducing human involvement as well as the overall timeline of semiconductor chip design and manufacturing. Generative AI is also capable of generating synthetic data to assist in research and can be applied towards optimizing manufacturing methods across numerous industries. Specifically, Gartner predicts generative AI will be used to develop a systematic approach for discovery that will be used for uncovering more than 30% of new drugs and materials by 2025.¹ Bloomberg Intelligence also reports that \$280 billion of incremental revenue growth for the software industry will be driven by generative AI products, with the majority relating to specialized assistants, new infrastructure, and coding copilots. Overall, the market for generative AI products and services could grow to as much as \$1.3 trillion

¹ <https://www.gartner.com/en/articles/beyond-chatgpt-the-future-of-generative-ai-for-enterprises>

over the next 10 years, implying a compound annual growth rate of 42% vs. the level of spending in 2022, which totaled \$40 billion.²

Generative AI is a type of AI that provides an output in the form of text, image, code, audio, animation, or other data types as a response to an input. Generative AI is already capable of automating tasks that take up between 60% to 70% of an individual worker's day.³ With this tool, people will have more time to invest in tasks that earlier forms of AI are not capable of fully replicating, like creative thinking and problem-solving. It is important to remember that AI is an augmentation of human intelligence and is meant to serve as a building block in the workplace. It is not intended to fully replace individuals in their occupations, but rather to assist human workers with some of their tasks, in order to free up time to be spent for higher value-added work.

Based on the money being poured into the research and development of AI, it is safe to say that AI is not just a new, hype sensation. In 2022 alone, venture capitalists invested \$4.5 billion across 269 deals in generative AI. Venture capitalist fundraising activity for generative AI in 2023 is already well ahead of the previous year's investments, running several times ahead with over \$15 billion in venture capitalist funding year-to-date.⁴ There has also been a massive increase in other investments into generative AI companies by a number of corporates, led by Microsoft's investment in OpenAI.

With the exponential growth that companies have seen and their ongoing investments in the technology, we can expect the next set of advancements within AI to take place on an even more profound level. IBM reports that deep learning will continue to play a significant role with neural networks, but the next step of augmenting human intelligence involves equipping machines with reasoning capabilities, potentially in the next five to ten years. Smaller datasets and unsupervised learning will transform deep learning by removing human involvement, and will result in time and cost efficiency, and reduced biases. The next set of models will fall somewhere between supervised and unsupervised learning, as additional research and development is needed before solely implementing an unsupervised learning technique. Potential scaling opportunities may be found with reinforcement learning, transfer learning, and active learning, though these techniques require human supervision. Regarding hardware, we may see neuromorphic chips or quantum computing systems being used with graphics processing units (GPUs).⁵

Methodology Summary

The Nasdaq CTA Artificial Intelligence Index (NQINTEL) is a modified equal-weighted global index that was designed to monitor the performance of companies involved in the growth and support of AI in the technology, industrial, medical, and other economic sectors. The Consumer Technology Association (CTA) classifies and selects companies for NQINTEL eligibility. NQINTEL is rebalanced and reconstituted semi-annually in March and September. Each constituent is classified and weighted by CTA into one of three categories – Enabler, Engager, and Enhancer. CTA also assigns each constituent an Intensity Rating that reflects the company's level of involvement in the theme.

Eligibility Criteria

- Minimum market cap of \$250M
- Minimum 3-Month average daily dollar volume of \$3M
- Minimum free float of 20%
- CTA classified AI company.
- Classification Category Weights:
 - Enabler: 40%
 - Engager: 50%
 - Enhancer: 10%

² <https://www.bloomberg.com/company/press/generative-ai-to-become-a-1-3-trillion-market-by-2032-research-finds/>

³ <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/te-economic-potential-of-generative-ai-the-next-productivity-frontier#key-insights>

⁴ Source: CTA, PitchBook

⁵ <https://www.ibm.com/watson/advantage-reports/future-of-artificial-intelligence/ai-innovation-equation.html>

Enablers are companies whose involvement in AI is limited to developing building blocks that will further the development of the technology, such as advanced machinery, autonomous systems/self-driving vehicles, semiconductors, and machine learning databases. These companies provide support products, software, and systems.

Engagers are companies that are dedicated to designing, creating, integrating, or delivering AI in forms of products, software, or systems. These companies are fully immersed in the artificial intelligence realm of technology.

Enhancers are companies that offer non-artificial intelligence products or services as their main offerings, but also provide their own value-added services within AI.

This index selects the top 15 ranked securities by CTA Intensity Rating within each of the three classification categories, allowing for ties which results in more than 45 constituents included in the portfolio; today there are 62 index constituents. Constituents are initially equally-weighted within their category such that if, for example, there are 20 Enablers, their aggregate weighting requirement of 40% implies each constituent receives a starting weight of 2%.

The individual constituent weights are then adjusted to comply with the following constraints:

- No Index Security weight may exceed 25% of the ratio between the security's three-month median daily traded value and \$100 million (USD).
- No Index Security weight may exceed 4.5%
- Classification group weights are only adjusted if security-level constraints necessitate.

[Click here](#) for further information regarding the NQINTEL Index Methodology.

Corporate Actions – New Additions

Within the last year there have been five new constituents added, and 11 deleted, during NQINTEL's reconstitution process. A few notable additions include Illumina (ILMN), Mobileye Global (MBLY), and SentinelOne (S).

Illumina (ILMN), a global leader in the Biotechnology industry, focuses on large-scale analysis of genetic variation and function by developing, manufacturing, and marketing life science tools and integrated systems. Illumina recently reported on their new AI software called PrimateAI-3D, which detects and predicts disease-inducing genetic mutations in patients.⁶ The deep neural networks of this unique algorithm are trained on genome sequences and use natural selection to fill any unknown gaps of the human genome with great accuracy, as the algorithm, "has been shown to identify disease-causing variants with superior accuracy in all six clinical cohorts that were tested and provide individualized predictions of genetic disease risk that have been validated in a cohort of nearly half a million people."⁷

Mobileye Global (MBLY) is a software company that develops advanced driver assistance systems (ADAS) and autonomous driving technologies. Mobileye has invested heavily in the research and development of autonomous

⁶ <https://www.illumina.com/company/about-us/fact-sheet.html>

⁷ <https://www.illumina.com/company/news-center/press-releases/press-release-details.html?newsid=b067ea3b-be0e-4318-a910-6bd659e0d232>

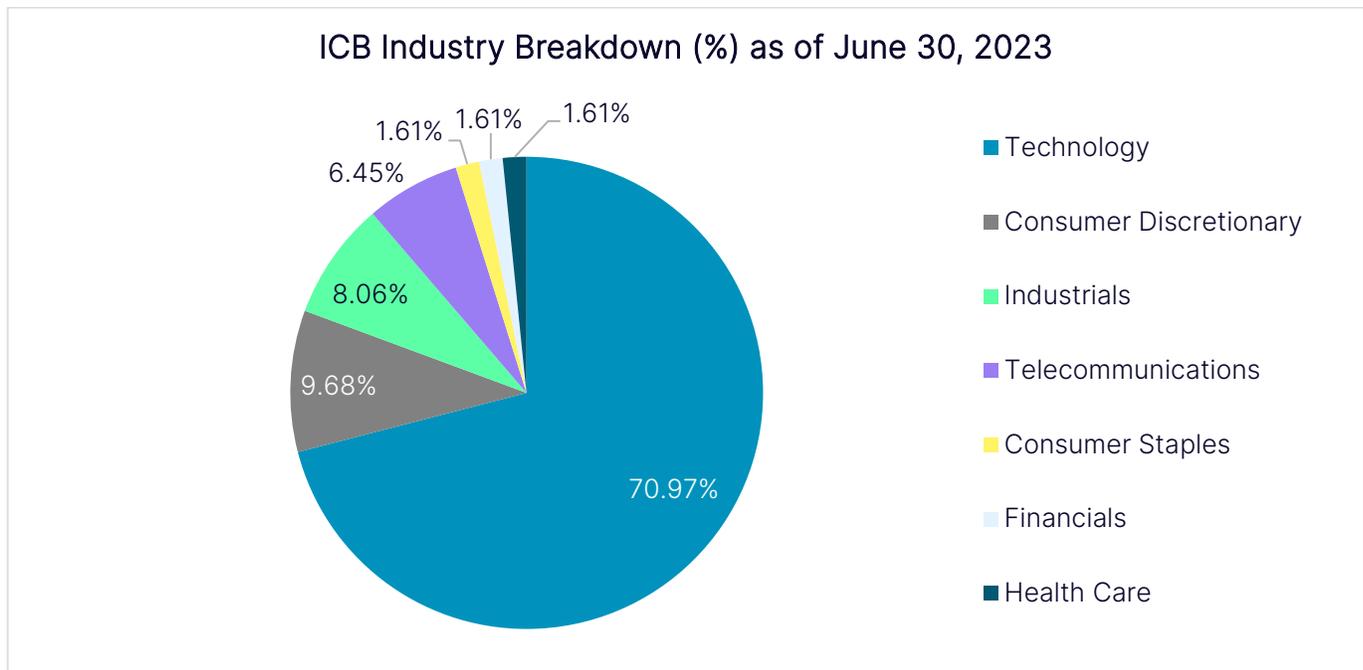
vehicles and “has revealed a production ready L4 robotaxi with commercial deployments in Israel and Germany in 2022 and is performing AV testing on three continents.”⁸

SentinelOne (S), a cybersecurity company, creates endpoint security software to protect its clients from cyberattacks on any computing device. Many cyberattacks today are done using AI, so it only made sense for SentinelOne to utilize AI to combat these same attacks. “A first-of-its-kind offering, the SentinelOne threat-hunting platform seamlessly fuses real-time, embedded neural networks and a large language model (LLM)-based natural language interface, supercharging users with AI to monitor and operate all security data and boost their productivity and scale their operations.”⁹

The distinct business profiles of just these three constituents speaks to the diversity of the NQINTEL portfolio. Illumina, Mobileye, and SentinelOne, classified by CTA as Engagers of AI, are all deeply involved in the AI ecosystem, and are committed to providing industry-leading AI products and systems in their respective sectors.

Looking at recent deletions, there were eight deletions in March of this year, somewhat higher than a typical reconstitution. Of these eight constituents, four failed the criteria for minimum 3-month ADDTV, three dropped down in their respective category’s intensity score rankings, and one failed the index’s ESG eligibility criteria around prohibited areas of business involvement.

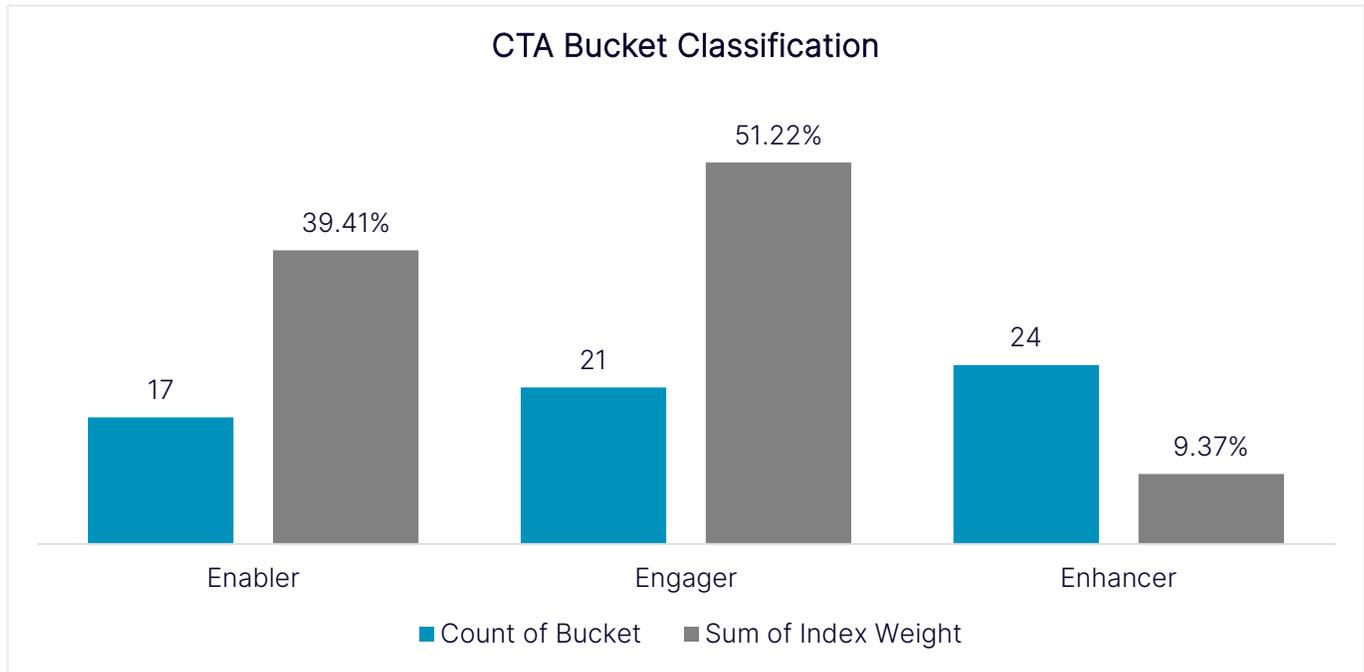
Index Composition



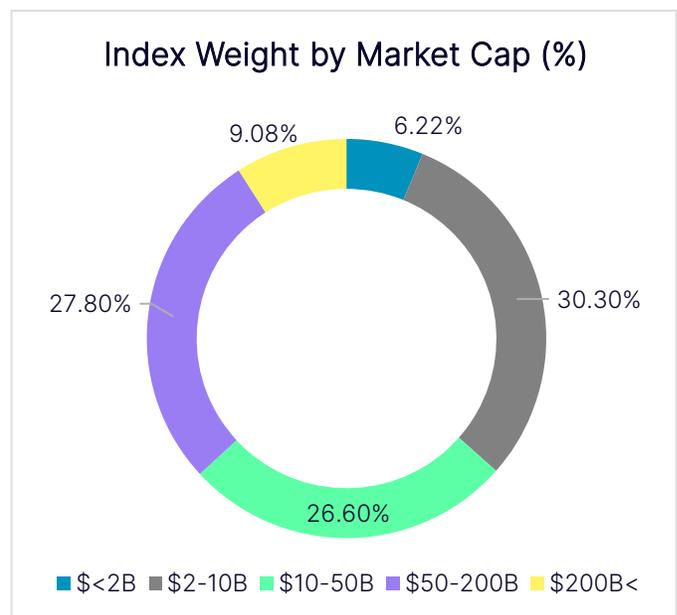
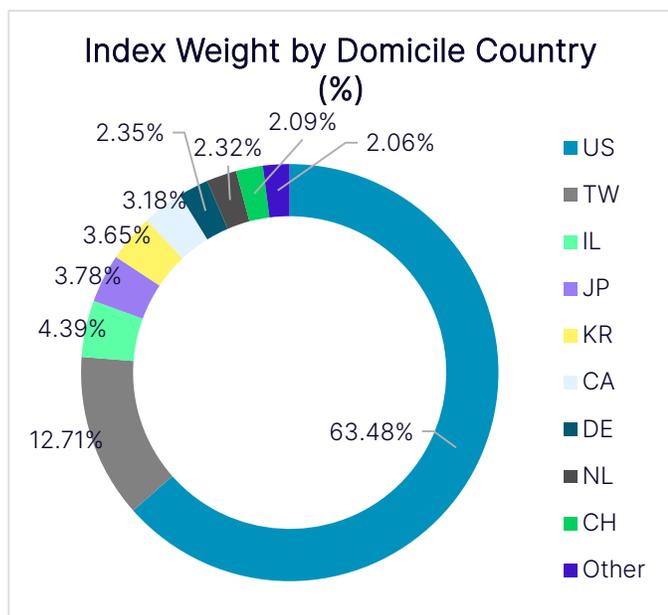
The Industry Classification Benchmark (ICB) taxonomy is a tiered structure that categorizes companies into 11 Industries, 20 Supersectors, 45 Sectors, and 173 Subsectors. As per the ICB, NQINTEL continues to be dominated by the Technology Industry, contributing 71% of the index weight. While not surprising that Tech is the largest sector allocation given the thematic nature of this index, it is noteworthy that nearly a third of the index weight comes from other sectors outside of Technology. Aside from the ICB Industry breakdown, the diversification of NQINTEL is further highlighted by the categorization of these Artificial Intelligence companies as Enablers, Engagers, or Enhancers, as previously mentioned.

⁸ <https://www.mobileye.com/about/>

⁹ https://www.sentinelone.com/press/sentinelone-unveils-revolutionary-ai-platform-for-cybersecurity/?utm_medium=PANTHEON_STRIPPED&utm_source=PANTHEON_STRIPPED&utm_campaign=PANTHEON_STRIPPED&gclid=EAlaIqobChMli8n72LaJgAMVrkhHAR0NIgzXEAAAYASAAEgK1nfd_BwE

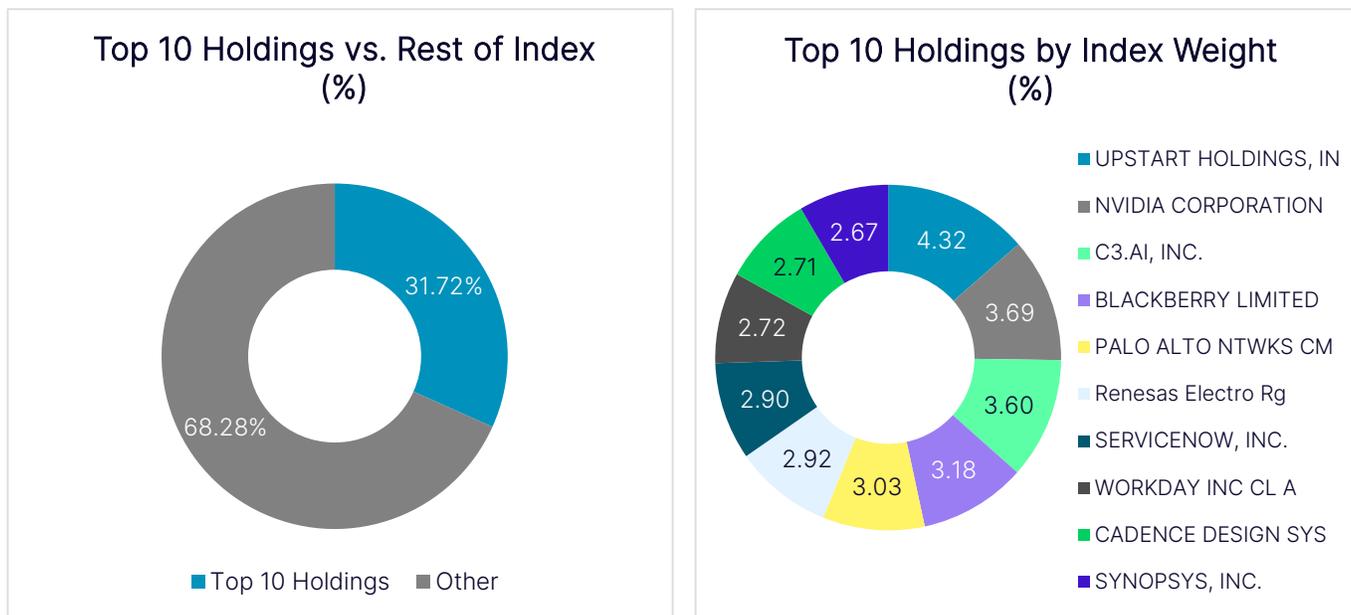


From the CTA Bucket Classification standpoint, we see the biggest slice of the index is made up of Engagers, as these are the companies that are fully engrossed in the AI ecosystem and are considered the most thematically relevant, closely followed by the Enablers. STMicroelectronics, Infineon Technologies, Taiwan Semiconductor, and NVIDIA are all major semiconductor companies classified as Enablers. While these constituents all have varying intensity ratings, their centrality to the evolution of AI as a technology is evident as every AI model requires massive amounts of computational power for training and deployment. Blackberry, C3.AI, UiPath, and Workday are all classified as Engagers, due to their heavy involvement in the theme as AI-driven software companies. Amazon, Apple, Microsoft, and Tesla are some of the world’s largest companies, known to every household for the wide range of products they provide. These constituents are classified as Enhancers, as they contribute to the AI space but do not leverage the technology in their main product offerings. As a result, they garner some of the smallest weightings in the index.



NQINTEL is primarily made up of companies based out of the United States, representing over 63% of the index weight. The next sizable portion of the index consists of companies from Taiwan at approximately 13%. The remainder of the index is divided into smaller allocations, with approximately 4% of the weight each coming from companies based in Israel, Japan, and South Korea, just over 3% from Canada, just over 2% each from Germany, the Netherlands, and Switzerland, and the remaining 2% from three different countries. Looking at market cap, NQINTEL is dominated by two tiers of large-cap companies: 26.6% from \$10 to \$50 billion and 27.8% from \$50 to \$200 billion. Mid-cap companies also account for under a third of the index weight at 30.3%. The remainder of the index is split between small-cap and mega-cap companies at 6.22% and 9.08%, respectively.

Top 10 Holdings – Performance Drivers



The top 10 holdings by index weight account for just under 32% of the index weight, and surprisingly enough, not all of these constituents are categorized as Engagers.

NVIDIA, with 3.69% of index weight, is an American semiconductor company that designs integrated circuits and GPUs for consumer and enterprise applications. They call themselves “The Engine of AI”, as providers of both the chips and software for AI-enabled factories, AI software developers, datacenters engaged in AI computing, and a multitude of varied AI-focused startups and other companies in the ecosystem.¹⁰ They offer an end-to-end enterprise AI platform called NVIDIA AI to support over 35,000 companies with customizable cloud services in advancing generative AI.¹¹

Renesas Electronics accounts for 2.92% of index weight and is a semiconductor manufacturing company based out of Japan. They deliver microcontrollers, analog, power, and SoC products tailored towards providing solutions for a multitude of applications surrounding automation, industrial, home electronics, office automation, and information communication. Renesas is also using integrated AI systems to run analytics on their core MCUs/MPUs, but their main product offerings are the various tools they provide for Engager companies to capitalize on for developing AI.¹²

¹⁰ <https://www.nvidia.com/en-us/about-nvidia/#slide-15-7ce00052>

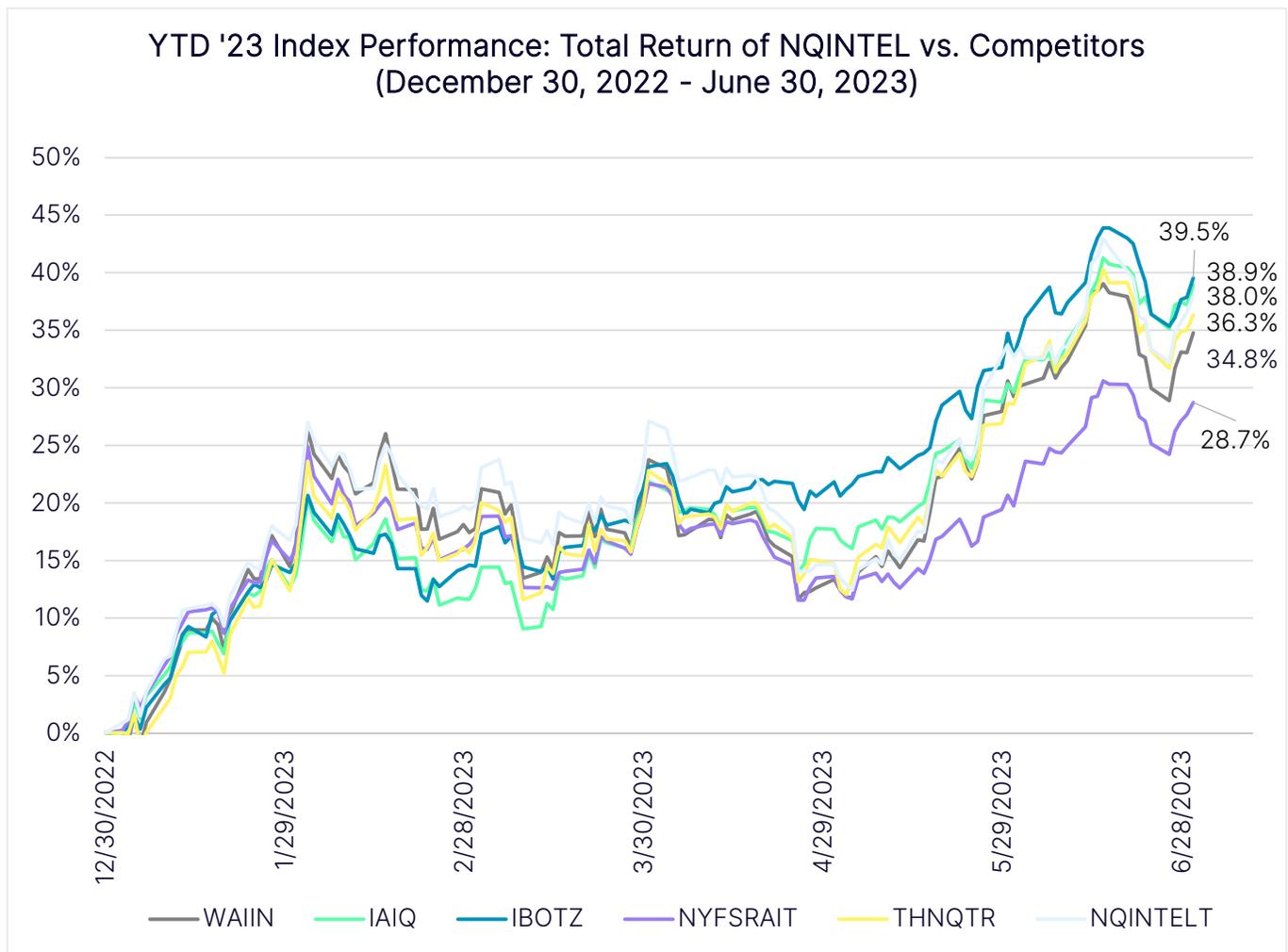
¹¹ <https://www.nvidia.com/en-us/ai-data-science/>

¹² <https://www.renesas.com/us/en/about>

As Enablers, NVIDIA and Renesas create the hardware required by Engagers to continue innovating their AI offerings. Both of these companies are leading AI beneficiaries with prominent work in creating and delivering AI tools, driving their recent outperformance and thus placing them in the top 10 holdings by index weight.

The top constituent by index weight is Upstart, a consumer lending company, at 4.32%. Upstart provides an AI lending platform to over 2.7 million customers, such as banks and credit unions. Their AI models and cloud applications are used to provide a variety of loans, more efficiently and accurately. Using machine learning algorithms, Upstart trained their models on over 70 billion pieces of data. The platform also offers AI verification and fraud detection, as well as macroeconomic tracking capabilities. Upstart is one of the top Engagers in NQINTEL, with an intensity rating of 100%.¹³

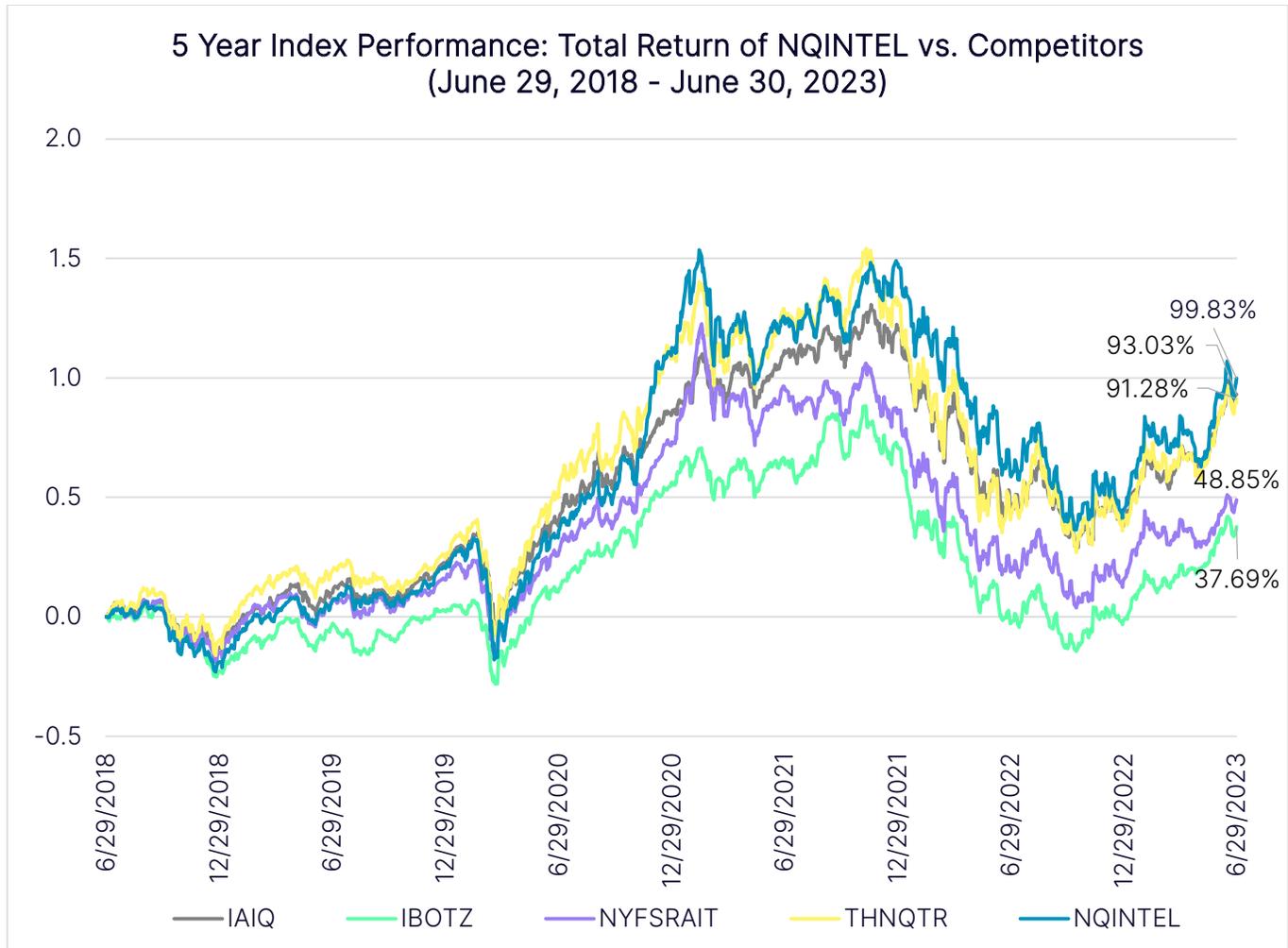
Competitor Analysis



NQINTEL and its competitors have achieved impressive positive returns year-to-date. This reflects the accelerated integration of AI and continued expansion of use cases in many facets across a multitude of

¹³ <https://www.upstart.com/our-story>

industries. Compared to its competitors, NQINTEL performed above average at 38.0% YTD as of June 30, 2023. NQINTEL performed in-line with a few competitors, gaining 1.5% less than the Indxx Global Robotics & AI Thematic Index (IBOTZ) and 0.9% less than the Indxx AI & Big Data Index (IAIQ). However, NQINTEL achieved higher returns compared to the ROBO Global AI Index (THNQTR), WisdomTree AI & Innovation Index (WAIIN), and the NYSE FactSet Global Robotics & AI Index (NYFSRAIT), beating them by 1.7%, 3.2%, and 9.3%, respectively.



On a longer time horizon, we see similarly impressive performance from NQINTEL and a few of its top competitors. NQINTEL has consistently stayed towards the higher end in the range of its competitors, closely tracking THNQTR and IAIQ and ultimately outperforming all four competitors with its trailing five-year total return of 99.83% as of June 30, 2023. NQINTEL significantly outperformed NYFSRAIT and IBOTZ by around 51% and 62%, respectively. It's remarkable that the index performed so well, given the mega-cap technology companies that generally drive market performance, such as Google (index weight: 0.48%) and Amazon (index weight: 0.47%), are weighted relatively low in this index as Enhancer companies that provide value to the AI industry but have not historically offered AI as their main product and/or service.

Competitor ETF/Index	NQINTEL Overlap – Count	NQINTEL Overlap – Weight	Competitor Total – Count	Competitor Unique – Count	Competitor Overlap – Weight
WTAI / WAIIN	30	48.0	77	47	44.3
IRBO / NYFSRAIT	16	19.2	113	97	14.7
BOTZ / IBOTZ	9	25.8	42	33	28.2
AIQ / IAIQ	23	35.4	87	64	45.4
THNQ / THNQTR	21	30.6	66	45	34.4

It should thus come as no surprise, given some of the significant dispersion in performance across indexes, that NQINTEL's composition is highly differentiated as a function of its unique methodology. Only about 20 constituents overlap with its five competitors, on average, representing just under one-third of NQINTEL's index weight.

Conclusion

2023 was a momentous year for the AI industry and it looks like the momentum will carry through to upcoming years. We are expecting to see new training techniques, hardware, and applications, as well as plenty of growth in AI investments from venture capital firms and established technology companies alike. Nasdaq and CTA partnered to offer this differentiated index solution that provides exposure to a variety of companies developing, enabling, or otherwise leveraging the underlying technologies of AI with a high degree of thematic purity. NQINTEL is unparalleled, for the three category classification and weighting system it follows to best track which companies are playing key roles in the AI space.

ETFs currently tracking NQINTEL include the WisdomTree Artificial Intelligence UCITS ETF (London: WTAI).

Sources: Nasdaq, CTA, FactSet, Bloomberg

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