

AI IN RETAIL

IMPACT AND USE CASES FOR RETAIL AND TRADE

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Intro

In the dynamic landscape of retail, trade, and e-commerce, enterprises are continuously in pursuit of inventive ways to enhance customer experiences, streamline operations, and increase sales. Artificial Intelligence (AI) stands out as a transformative force, profoundly altering the industry through its versatile applications and advantages. This report delves into the intriguing realm of AI's practical applications within retail, trade, and e-commerce, providing insights into how this technology is fundamentally shaping the future of shopping and the supply chain behind it.

AI applications are leaving a substantial imprint on the retail sector, spanning from enhancing customer experiences to optimizing supply chain operations. As new advancements and innovations continually emerge, the potential for AI in retail is poised for further expansion in the forthcoming years. AI has already redefined the retail landscape through the provision of advanced capabilities such as personalized recommendations, virtual assistants, and predictive analytics. Retailers are harnessing AI to analyze customer data, enabling tailor-made shopping experiences. In this highly competitive sector, businesses are leveraging AI as a means of differentiation, granting them a competitive edge.

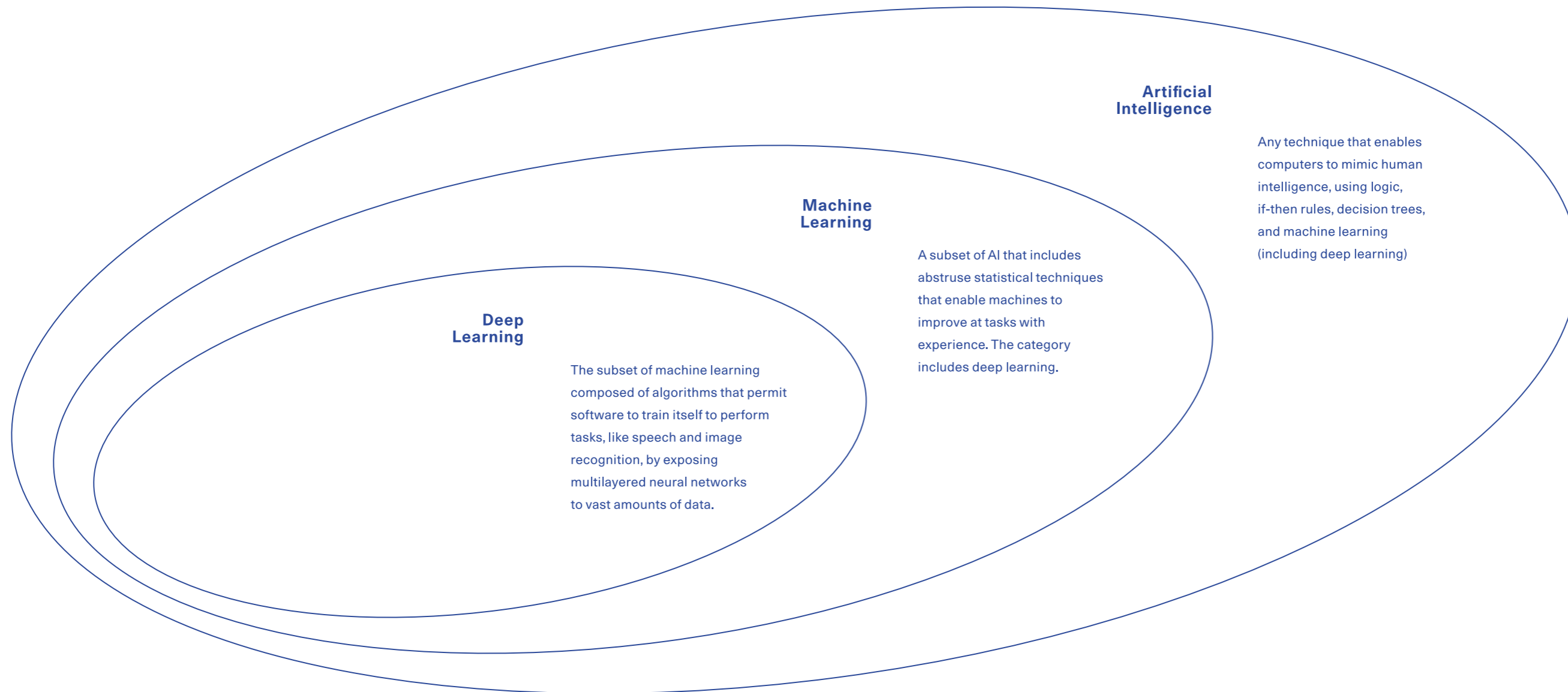
Imagine a world where each customer enjoys a shopping experience customized exclusively for them, physical stores operate with unparalleled efficiency, and businesses anticipate needs before customers even voice them. This transformation is currently unfolding due to the impact of AI in the retail sector. Projections suggest that AI adoption in this industry is set to surpass a remarkable \$127 billion by 2033, exhibiting an impressive 28% growth from 2023 to 2033. This upsurge in AI's influence is fundamentally reshaping this industry, tackling a wide array of challenges and offering innovative solutions.

This report embarks on a comprehensive exploration of the AI landscape within the retail domain, delving into challenges, advantages, practical use cases, real-world examples, and emerging trends. It is intended to inspire retail companies to reimagine their businesses, unlock long-term stability and growth, and raise the industry's aspirations - it is not a step-by-step guide to digital transformation. This report offers use cases and success stories that detail how AI technologies are being used. Furthermore, we give a brief overview of how AI has evolved over the last decades and the current state of AI with the current hype around generative AI and the EU's initiative for the world's first comprehensive regulation of AI.

What is AI?

Artificial Intelligence (AI), is a field of computer science that aims to create machines capable of intelligent behavior, simulating human cognitive functions such as learning, reasoning, and problem-solving. Utilizing algorithms, data, and sometimes mimicking the neural networks of the human brain. AI enables machines to perform tasks that typically require human intelligence, ranging from simple automation to complex decision-making processes. At least this is what ChatGPT tells you if you are asking “What is AI?”.

In the field of AI, Machine Learning (ML) and Deep Learning (DL) stand out as two of the most significant sub-disciplines. ML refers to AI systems that learn from data to predict outcomes with little to no human guidance. Whereas DL is the subset of ML that uses neural networks to make decisions by mimicking the neural and cognitive processes of the human mind. The diagram below illustrates the hierarchy of the different AI domains.



Machine Learning in a Nutshell

Machine Learning (ML) focuses on building systems that learn from data. By identifying patterns and making decisions with minimal human intervention, it enables computers to improve their performance on tasks over time. ML algorithms use historical data as input to predict new output values, and they are used in a variety of applications, from email filtering to recommendation systems and predictive analytics. ML models need structured data to make accurate predictions and decisions. If the data is not labeled and organized, ML models fail to comprehend it accurately.

The availability of gigantic data volumes has made ML an integral component of decision-making. Recommendation engines are the perfect example of ML. Amazon or Netflix use ML to learn your content preferences and suggest similar content based on your search habits and watch history.

Deep Learning in a Nutshell

Machine learning models need human intervention to improve accuracy. On the contrary, Deep learning models improve themselves after each result without human supervision. However, it often requires more detailed and lengthy volumes of data. DL uses neural networks with multiple layers (hidden layers) to simulate human decision-making. This enables the processing of unstructured data such as documents, images, speech, and text by recognizing patterns and features through extensive training. DL models are mainly used for classification and feature extraction.

For instance, deep models feed on a dataset in facial recognition. The model creates multidimensional matrices to memorize each facial feature as pixels. When you ask it to recognize a picture of a person it was not exposed to, it easily recognizes it by matching limited facial features.

Waves of AI

AI has been around for some time. Even if the recent developments and the hype around generative AI suggest that AI has only recently appeared on the scene, the origins of the technology date back decades.

Its previous evolution can be categorized into three distinct waves. And the fourth wave is lying ahead of us - with new challenges and opportunities possibly exceeding our current imagination.

The 1st Wave of AI

1950s – 1990s
Rule-based AI and early Computers



The 2nd Wave of AI

1990s – 2010s
Statistical Learning and the Internet Boom



The 3rd Wave of AI

2010s – 2030s
Neural Networks and the Rise of Big Data



The 4th Wave of AI

2030s – tbd
Autonomous AI and Artificial General Intelligence



The first wave of AI, characterized by rule-based systems and expert systems, coincided with the early development of computers. The first wave of AI “calculated knowledge” was all about logical reasoning, experts devised algorithms and software according to the knowledge that they themselves possessed and tried to provide these programs with logical rules that were deciphered and consolidated throughout human history. This approach led to the creation of chess-playing computers and of deliveries optimization software. Most of the software we’re using today is based on AI of this kind: our Windows operating system, our smartphone apps, and even the traffic lights that allow people to cross the street when they press a button.

The second wave saw the rise of the internet and the digital age. This wave was marked by advancements in Machine Learning (ML) and the ability to process and analyze large amounts of data. The second wave of AI “statistical learning” is very good in perceiving the surrounding world, for example in separating one face or voice from another. They are also very good at learning from datasets (vast amounts of data for learning a new task) however they are not that good at reasoning. New businesses and industries emerged, notably in e-commerce (Amazon), search engines (Google), social media (Facebook), and voice-activated assistants (Amazon's Alexa, Apple's Siri). These companies leveraged AI and especially ML for targeted advertising, personalized recommendations, and data analytics, creating entirely new ways of interacting, shopping and accessing information.

The emergence of neural networks and DL coincided with the era of big data and cloud computing. This wave pushed the boundaries of image and speech recognition, natural language processing, and more. The third wave of AI is about “contextual adaptation”. In this wave, the system itself will build over time the underlying explanatory models for classes and real-world phenomena. Third-wave systems will be able to rely on several different statistical models, to reach a more complete understanding of the world. They’ll be able to train themselves to identify the commonsense rules it should use. Third-wave systems are also able to take information from several different sources to reach a nuanced and well-explained conclusion. These systems, for example, extract data from several of our wearable devices, from our smart home, our car, and surrounding environments to provide augmented information in real-time, for instance. They’ll even be able to program themselves, and potentially develop abstract thinking. New technological applications such as quantum computing, edge AI, and advanced computer vision are evolving. We see new business models emerge in areas like generative AI and advanced robotics.

The fourth wave will be the most monumental – leading to “Autonomous AI”. Integrating all previous waves, autonomous AI gives machines the ability to sense and respond to the world around them, to move intuitively, and to manipulate objects as easily as a human can. Today’s machines can outperform repetitive tasks in structured and even unstructured environments (think Boston Dynamics' humanoid Atlas), but the fourth wave of AI will go beyond. The fourth wave will be characterized by Artificial General Intelligence (AGI). AGI is yet a hypothetical concept, it is expected to produce systems capable of performing any intellectual task a human can perform and even go beyond – being able to adapt to new tasks and environments on their own. With the current pace of investments and developments of AI, nobody can seriously forecast when we will turn into this phase. To say it with the words of Emad Mostaque, founder and CEO of Stability AI, who was recently asked if he could predict where the world will be in 5 to 10 years, he replied “With the current development of AI, I can’t see the next five years – maybe what will come in the next one or two years, not more”.

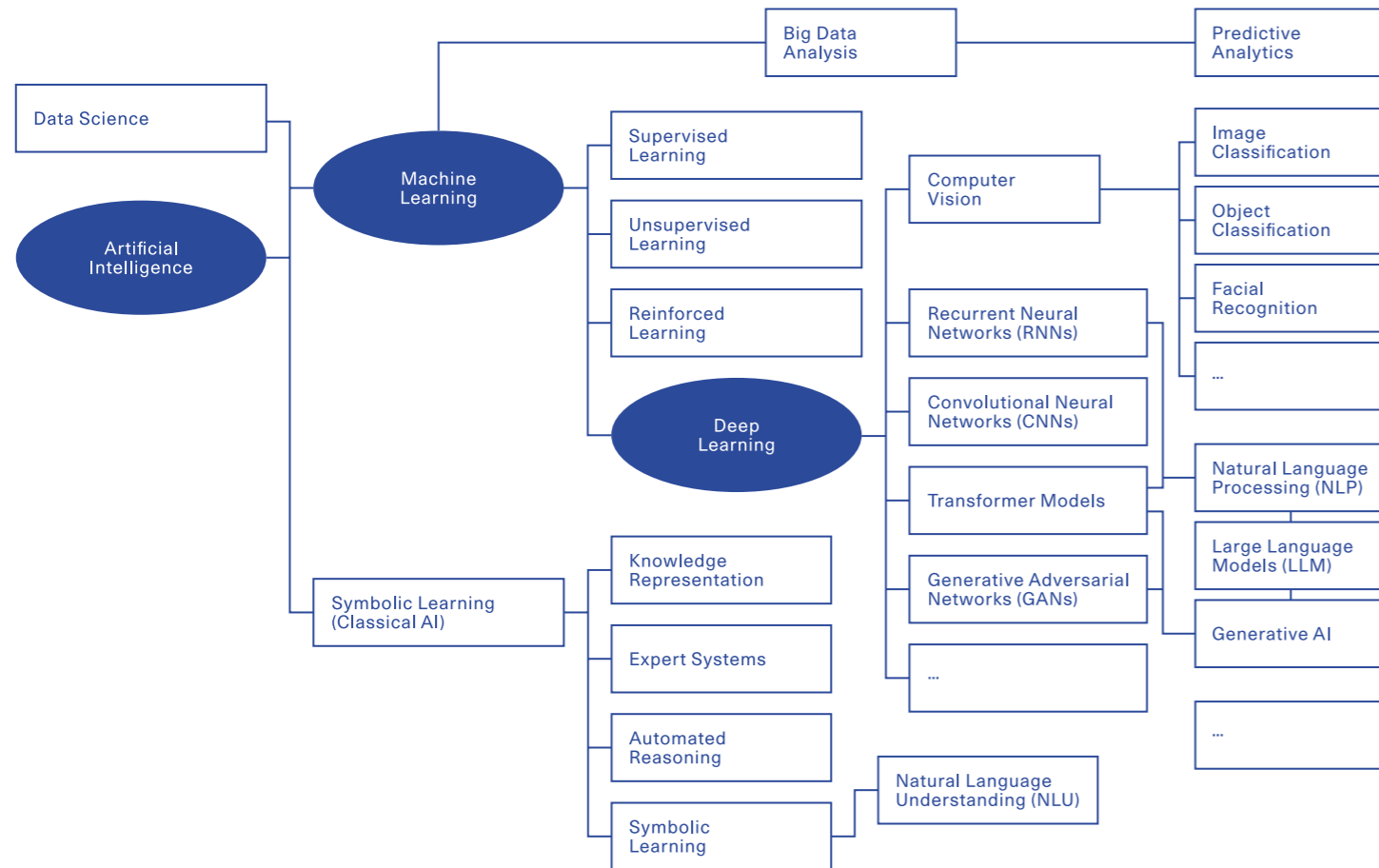
The GenAI Boom

How did we get here? Gradually, then all of a sudden

The technological path of AI is expansive and multifaceted, encompassing a range of subfields and evolving technologies. With generative AI, we are witnessing a transformative era in the realm of AI, marking a significant shift from merely understanding and analyzing data to actively creating and generating new content. The key to this rapid development is multimodality. Large Multimodal Models (LMMs) which are able to combine text, image, and speech have brought AI closer to human intelligence than ever before and set the foundation to go even beyond it. Generative AI applications are typically based on foundation models. These models contain expansive artificial neural networks inspired by the billions of

neurons connected in the human brain and are part of deep learning. In this chapter, we delve into the explosive growth and profound impact of generative AI.

The following chart demonstrates a basic structure of AI's technological evolution to illustrate its various sub-disciplines and their interconnected relationships. Please note that this chart provides only a basic impression of AI's technological path and does not represent a comprehensive overview of all technologies and applications of AI.



VCs race to fund the next big thing

The investments in OpenAI sparked a buying spree among venture capital investors looking to be a part of a credible competitor to ChatGPT. While many VCs have cooled on investments in other tech innovations such as cryptocurrency and blockchain - and with VC funding in general down 53% year over year in Q1 2023 - GenAI is a bright spot.

In the first six months of 2023, VCs plowed \$15.2 billion into GenAI companies globally, according to Pitchbook data. The bulk of this sum comes from Microsoft's \$10 billion investment, announced in

January 2023, in OpenAI, the developer of the popular generative AI chatbot ChatGPT. But even excluding Microsoft's bumper deal, the value of VC investments in generative AI was up by almost 58% compared with the same period in 2022. Besides Microsoft, NVIDIA is among the most active investors when it comes to investing in AI technology.

The following table gives an overview of top deals and fundings worth \$100M+ to generative AI startups in 2022/23.

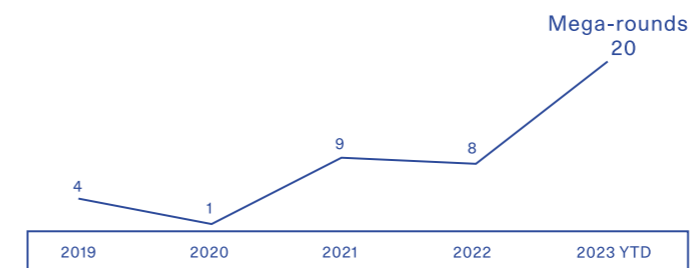
Company	Country	Investment Stage	Total Funding	Top Investors
OpenAI	USA	Series E	11,3B USD	Microsoft, Sequoia Capital, Tiger Global Management, Founders Fund, Peter Thiel, ..
Anthropic	USA	Series C	1,75B USD	Google, Amazon, SK Telecom Ventures, Salesforce Ventures, Microsoft, ..
Inflection	USA	Series E	1,52B USD	Microsoft, NVIDIA, Horizons Ventures, Greylock, Dragoneer Investment Group, ..
Aleph Alpha	Germany	Series B	533M USD	Innovation Park AI (Ipai), Schwarz Gruppe, Robert Bosch Ventures, Sapphire Ventures, Lakestar, ..
Cohere	Canada	Series C	435M USD	NVIDIA, Oracle, Sapphire Ventures, Inovia Capital, Mirae Asset, Salesforce Ventures, ..
Hugging Face	France	Series D	400M USD	Sound Ventures, Salesforce, Google, Amazon, NVIDIA, Intel, AMD, Qualcomm, IBM, ..
Zhipu AI	China	Series B	342M USD	Alibaba Group, Tencent, Ant Group, Legend Capital, Meituan
AI21 Labs	Israel	Series C	283M USD	Google, NVIDIA, Walden Catalyst, Pitango, Samsung NEXT, ..
Jasper	USA	Series A	143M USD	HubSpot, Insight Partners, IVP, Bessemer Venture Partners, Coatue, Foundation Capital, ..
Stability AI	UK	Seed	126M USD	Sound Ventures, Coatue, Lightspeed Venture Partners, OSV
Mistral	France	Seed	113M USD	Lightspeed Venture Partners, Index Ventures, Sofina, Redpoint Ventures, La Famiglia, ..

Fundings worth \$100M+ to generative AI startups in 2022/23

We see a remarkable surge in the number of times, generative AI is mentioned in earnings calls, highlighting the growing executive interest in the field. Starting from virtually no mentions in 2021/22, there's a steep climb to over 2,000 mentions by Q3 of 2023, signaling that generative AI has become a significant point of discussion and strategic interest among companies. This trend underscores the increasing importance of generative AI technologies in the corporate world and their potential impact on future business operations and innovation.

A record number of \$100M+ mega-rounds drive funding surge, with money primarily going to infrastructure layer

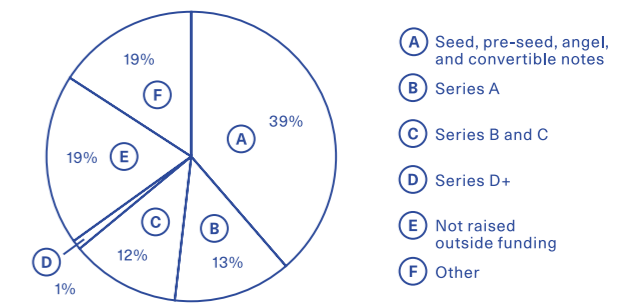
Disclosed \$100M+ GenAI equity deals as of 9/30/2023



There is a clear upward trend in the number of disclosed \$100M+ equity deals in the field of generative AI, with a record-setting 20 mega-rounds occurring in 2023 year to date. This surge, which began with only four such deals in 2019, signifies a growing investor confidence and substantial financial backing in the infrastructure layer of generative AI technology, hinting at its burgeoning significance and the expectations of its pivotal role in the tech landscape.

But we are still in the early days of generative AI startups - 71% are early-stage or haven't raised any funding yet

Percent of companies by latest disclosed round (as of 9/30/2023)



Given that a substantial of around 70% of generative AI startups are still in an early stage or have not yet raised any funding (source: CB Insights as of 9/30/2023), implies that the generative AI industry is just at the beginning. The growing interest in AI from investors, businesses, and the public is likely to lead to increased funding and support for these startups.

The extent of the current hype around generative AI is demonstrated by Mistral, a French startup that raised \$113 million in seed funding before the company had any employees, a business model, or even a product. The deal, announced in June 2023, is Europe's largest-ever seed round.

Despite the enthusiasm, there is a growing concern among investors and industry experts that the current surge in funding may be inflating a bubble, with capital being allocated to firms lacking in profits, innovation, or necessary expertise. Emad Mostaque, founder and CEO of Stability AI, expects the current wave of investments in AI companies to create a 'dot-ai' bubble such as the 'dot-com' bubble of the late 1990s.

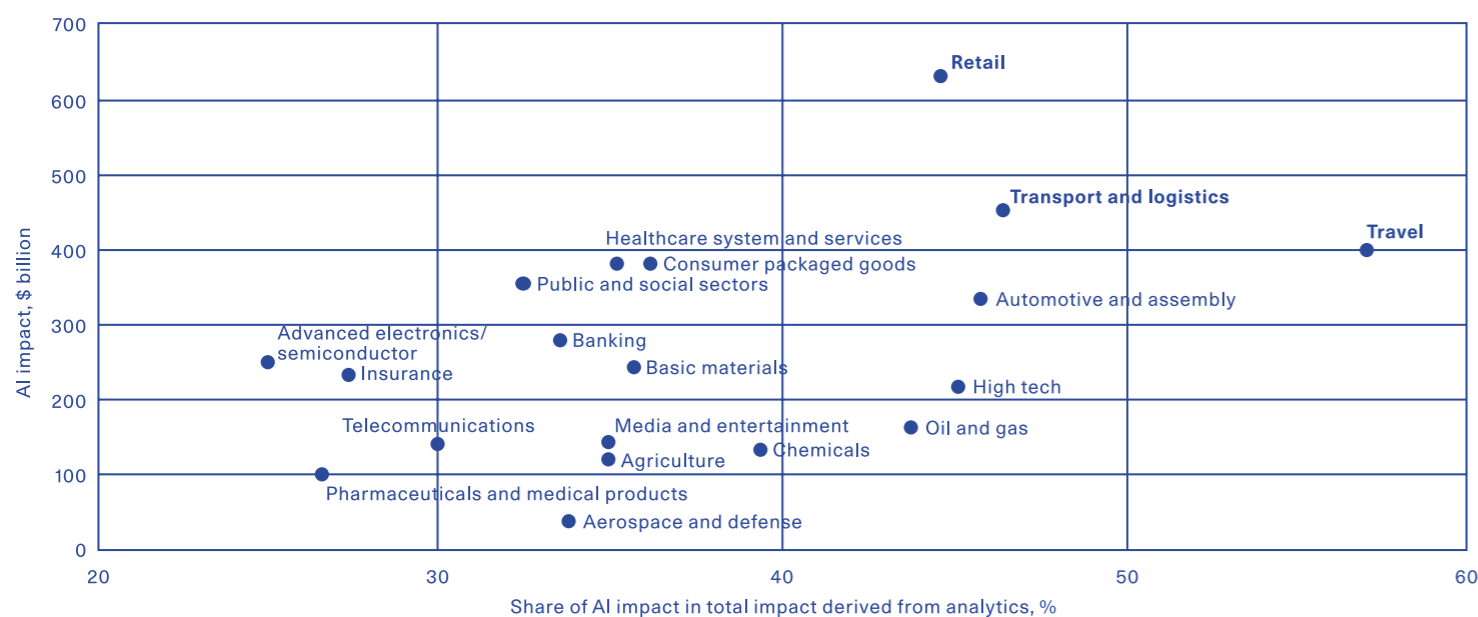
AI's Impact on Retail

Challenges and opportunities ahead

These rapid advances in AI capabilities have made it possible to use machines in a wide range of new domains: When you book a flight, it is often an AI, and no longer a human, that decides what you pay. When you get to the airport, it is an AI system that monitors what you do at the airport. And once you are on the plane, an AI system assists the pilot in flying you to your destination. AI systems help to program the software you use and translate the texts you read. Virtual assistants, operated by speech recognition, have entered many households over the last decade. Now self-driving cars are becoming a reality. In the last few years, AI systems helped to make progress on some of the hardest problems in science. Large AIs called recommender systems determine what you see on social media, which products are shown to you in online shops, and what gets recommended to you on Amazon. Increasingly they are not just recommending the

media we consume but based on their capacity to generate images and texts, they are also creating the media we consume.

AI has not just appeared in recent years. In the retail sector, it has caused a substantial transformation already. AI's impact on retail is multifaceted, influencing the entire value chain, from product design, and supply chain logistics to marketing, sales, and customer service to in-store and online shopping experiences. This chapter explores how AI is reshaping the retail industry, setting new standards for operational excellence, hyper-personalization at scale, and data-driven decision-making. Recent research from McKinsey indicates that the retail and consumer packaged goods sectors are poised to gain immensely from AI, particularly from generative AI, with an anticipated increased value between \$400 to \$660 billion annually.



The chart (based on data from McKinsey) shows that the retail sector will be one of the most affected industries and at the same time is one of the sectors with the biggest growth potential to benefit from AI, followed by the transport and logistics and the travel industry. Retail's heavy reliance on analytics points to vast growth opportunities with increased adoption and investments in AI. Overall, the transformative power of AI could contribute trillions to the global economy, with generative AI alone potentially adding \$2.6 trillion to \$4.4 trillion. This is particularly notable given that global retail sales are projected to surpass \$30 trillion by 2024.

Using AI technology has become essential for retailers that want to remain competitive in today's market landscape. AI systems can analyze massive volumes of customer data and provide organizations with invaluable insights. By using this information, businesses may modify their product offerings, enhance the consumer experience, and improve operational efficiency.

The worldwide AI in the retail industry is expected to reach \$10.76 billion by 2023 thanks to its impressive development trajectory. The rapid rise demonstrates the retail sector's persistent dedication to integrating AI technology as a way to improve consumer experiences, streamline processes, and maintain competitiveness in a constantly changing market.

The long-term estimates indicate that by 2033, the adoption of AI in the retail industry will soar above \$127 billion. The industry has seen AI as a revolutionary force capable of reshaping how retail organizations run, from supply chain management to personalized consumer interactions. According to Future Market Insights, the demand for AI in retail is anticipated to maintain a remarkable compound annual growth rate (CAGR) of 28% between 2023 and 2033. This sustained growth underscores the retail sector's dedication to harnessing the power of AI technology.

Key Benefits of AI for Retail

From improving customer experience to optimizing supply chain operations, AI applications are making their mark on the retail sector in a big way. With new advancements and innovations emerging all the time, the potential for AI in retail is set to grow even further in the coming years. This highly competitive sector

drives businesses to embrace AI for differentiation, offering a competitive edge. AI-powered systems accelerate data analysis, improve decisions, and optimize operations, boosting efficiency and profitability. Here are some of the principal benefits:

Operational Excellence

AI is redefining operational efficiency in retail. AI can automate various retail operations such as checkout processes, pricing optimization, and store layout planning. This automation reduces manual labor, minimizes errors, and increases operational efficiency, leading to cost savings and improved profit margins. Smart inventory systems forecast demand, automated warehouses streamline fulfillment, and AI-powered robots assist in both stocking shelves and guiding customers. These innovations not only cut costs but also free up human employees to focus on more complex, value-added tasks.

Enhanced Customer Satisfaction

AI is transforming retail operations, leading to a notable enhancement in customer satisfaction by streamlining the shopping journey. Intelligent chatbots and virtual assistants are delivering instant customer service, providing round-the-clock assistance. AI makes checkout faster and more efficient. By using AI in this way, businesses show customers that they value their time and are willing to go the extra mile to make sure they have the best possible experience. Additionally, AI can gather and analyze customer feedback across various touchpoints, allowing retailers to swiftly adapt and improve their services in alignment with customer expectations.

Security and Loss Prevention

Data is the currency of our time. This is particularly evident in retail, where data about customers, shopping trends, and sales is invaluable. The challenge is that data leakage can cost businesses a lot. But thanks to advanced technologies based on AI, businesses can analyze and identify unusual data movements in real-time, and then flag risks immediately. And the same systems can protect your employees, your customers, and your money. Using computer vision, cameras spot suspicious activity to detect potential theft, allowing stores to take appropriate action, even sounding an alarm and alerting security guards, employees, or the police.

Personalization at Scale

AI enables retailers to deliver individualized customer experiences by leveraging data and ML. AI analyzes vast datasets to understand customer preferences and behaviors, allowing for the customization of products, services, and marketing to each consumer's unique needs. This hyper-personalization enhances customer engagement and loyalty and drives revenue by delivering the right message, to the right person, at the right time, across multiple channels. AI's capability to process and learn from data in real-time means personalization can happen on a large scale, across millions of consumers, without sacrificing the individual touch.

Data-driven Decision Making

According to a study from AI Multiple, 44% of executives say AI's most important benefit is generating insights they can use to make data-driven decisions. By analyzing data about previous advertising campaigns, promotions, and customer preferences, businesses can draw appropriate conclusions and better plan future actions. In doing so, they remove the guesswork and increase campaign effectiveness. Data also enables better budgeting and the avoidance of misplaced investments.

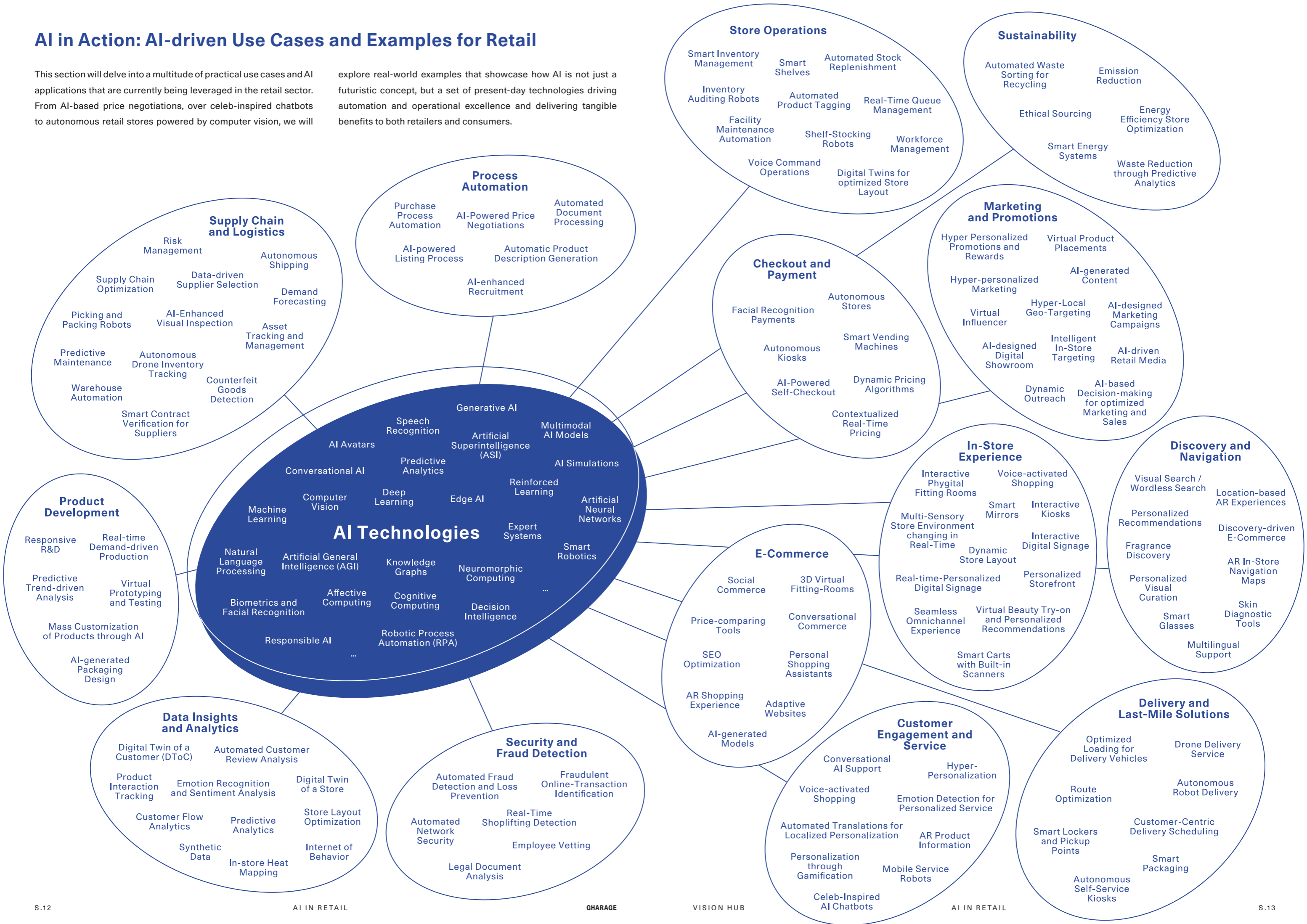
Sustainability

AI can drive sustainability in the retail sector by optimizing supply chains, reducing waste and energy consumption. It enables precise demand forecasting, minimizing overproduction and excess inventory, thus cutting down on resource wastage. AI-driven systems can also manage energy use in stores and warehouses more efficiently, leading to lower carbon emissions. Moreover, by analyzing customer preferences and data, AI can help retailers stock and promote more sustainable products, aligning business practices with environmental consciousness.

AI in Action: AI-driven Use Cases and Examples for Retail

This section will delve into a multitude of practical use cases and AI applications that are currently being leveraged in the retail sector. From AI-based price negotiations, over celeb-inspired chatbots to autonomous retail stores powered by computer vision, we will

explore real-world examples that showcase how AI is not just a futuristic concept, but a set of present-day technologies driving automation and operational excellence and delivering tangible benefits to both retailers and consumers.



AI in Action: AI-driven Use Cases and Examples for Retail

Supply Chain and Logistics

[Warehouse Automation](#)

AI-driven robots and systems can automate picking, packing, and sorting processes in warehouses, increasing efficiency. [Amazon](#) leverages more than 750,000 robots working collaboratively with their employees, taking on highly repetitive tasks and freeing employees up to better deliver for customers. AI-powered robots in its warehouses streamline the sorting and packing process, significantly improving efficiency.

[Autonomous Drone Inventory Tracking](#)

[Verity](#), a Swiss startup is revolutionizing supply chain management with its autonomous indoor drone systems. These automate inventory tracking in warehouses, providing real-time data-driven insights to drive operational efficiency, cost savings, and CO2 reduction.

[Data-Driven Supplier Selection](#)

AI algorithms can analyze vast amounts of data to identify potential suppliers, evaluate their capabilities, and predict their performance leading to more effective and efficient supplier selection processes. US-based [Globality](#) is a market leader in autonomous procurement and sourcing systems, providing an advanced AI-digital toolset that enables companies to identify the most qualified suppliers, provides negotiation insights, and enables data-driven decisions leading to cost savings and improved outcomes.

[Demand Forecasting](#)

[Walmart](#) is using AI to predict demand for products at the store level. This allows them to ensure that they have the right amount of inventory in the right stores, which reduces stockouts and overstocking.

Sustainability

[Ethical Sourcing](#)

AI will play a key role in driving sustainability in retail, from tracking the ethical sourcing of products to reducing the carbon footprint of supply chains. [Unilever](#) employs advanced AI algorithms to assess supplier performance and sustainability practices, ensuring a responsible and cost-effective supply chain.

[Energy Efficiency Optimization](#)

AI systems can analyze energy usage patterns in retail stores to optimize HVAC (Heating, Ventilation, and Air Conditioning) and lighting schedules, reducing energy consumption and costs. German green tech company [Recogizer](#) developed a self-learning AI system that promises to cut carbon emissions and energy consumption of commercial properties by 28% on average.

Process Automation

[AI-based Price Negotiations](#)

AI algorithms conduct real-time price negotiations with suppliers or customers, optimizing costs and pricing strategies. [Walmart](#) uses AI technology from [Pactum AI](#) to negotiate prices with its suppliers. The retailer tells the AI chatbot its budget and priorities, and the chatbot negotiates with a human vendor to finish deals. Three out of four suppliers say they prefer dealing with a robot more than a Walmart negotiator.

[AI-enhanced Recruitment](#)

Companies leverage AI to streamline the recruitment process, efficiently matching candidate profiles with job requirements for better hiring decisions. [Unilever](#) partnered with [Pymetrics](#), an AI recruitment platform using data-driven behavioral insights and audited AI to create a more efficient, effective, and fair hiring process. Around 70,000 person-hours of interviewing and assessing candidates had been cut, thanks to the automated screening system.

Delivery and Last-Mile Solutions

[Autonomous Robot Delivery](#)

AI enables self-driving vehicles to deliver products, reducing delivery times and costs. [Clevon's](#) robot couriers in cooperation with Lithuania's supermarket chain [IKI](#) (part of REWE Group) launched Europe's first fleet of autonomous delivery robots on public roads in June 2023.

[Drone Delivery Services](#)

AI-guided drones deliver small packages, especially in hard-to-reach areas, improving delivery speed, cost savings, and environmental impact. Besides [Amazon Prime Air](#), one of the big retailers that is heavily investing in drone delivery services is [Walmart](#) which recently teamed up with [Wing](#), a provider of lightweight, autonomous delivery drones.

[Route Optimization](#)

AI optimizes delivery routes in real-time based on traffic, weather, and customer availability. [UPS](#) uses its AI-powered ORION system to optimize delivery routes, reducing fuel consumption and improving delivery efficiency. Since ORION's initial deployment, it has saved UPS more than 100 million miles.

Marketing and Promotions

[Intelligent In-Store Targeting](#)

Smart targeting systems provide real-time product recommendations, encouraging customers to increase their purchases by suggesting complementary items. Innovations like [Cooler Screens'](#) dynamic digital displays refresh automatically to present personalized deals to each customer, thereby enhancing sales potential through engaging, interactive in-store experiences.

[Hyper-personalized Marketing](#)

Retailers and brands are leveraging AI automation, hyper-personalized marketing campaigns. AI startup [Anoki](#) uses generative AI to personalize video ads. Its technology can identify the context where ads are being shown and make tweaks so that the ads are more engaging for the intended audience.

[Hyper-Local Geo-Targeting](#)

AI can help retailers pinpoint and target customers within a very specific geographic area using geo-fencing technologies, tailoring marketing to the local context and consumer behavior. [Starbucks](#) uses its mobile app to send push notifications to customers when they are near a store, offering them personalized rewards and discounts.

[AI-designed Marketing Campaigns](#)

AI designs creative elements for marketing campaigns, from visual ads to copywriting, ensuring high relevance and audience engagement. US-based startup [Omneky](#) uses generative AI to create ads based on what type of creative will perform best. It uses a separate predictive model to guide the creation of that content, based on how the design — like the layout, text size, image used — will drive clicks or other performance metrics.

[Virtual Products Placements](#)

[Rembrand](#) uses AI to embed animated virtual products, such as a shampoo bottle playfully moving across the host's desk, into video content. Their generative AI technology blends brands photo-realistically into video content, ensuring viewers' experience remains uninterrupted.

Product Development

[Real-Time Demand-Driven Production](#)

AI enables on-demand production and customization, aligning supply chain processes more closely with customer demand. [SHEIN](#) is disrupting the fast fashion industry by utilizing AI algorithms for real-time trend analysis based on social media interactions, producing clothing that aligns directly with current consumer demand patterns, reducing lead times and overproduction to a minimum.

[Waste Reduction Through Predictive Analytics](#)

Paris-based [Heuritech](#) offers a demand forecasting solution that enables brands and retailers to enhance sell-through rates and adopt sustainable production methods. By analyzing market and consumer data, their platform uses AI to convert social media trends into actionable insights, enabling more accurate trend predictions. Heuritech collaborates with prestigious brands from LVMH to Paco Rabanne.

E-Commerce

[AI-generated Models](#)

Fit issues are a major cause of e-commerce returns. AI offers promising solutions to this prevalent issue, including generative AI models that can simulate clothing fits and AI-driven tools for size recommendations and fitting advice. [Levi's](#) partners with [Lalaland.ai](#), a digital fashion studio that creates realistic AI-generated fashion models.

[Enhanced Visual Search](#)

The use of AI in visual search and recognition will become more advanced, allowing customers to find products more easily using images or augmented reality (AR). [Miros'](#) AI-driven 'wordless search solution' recognizes shoppers' buying intent through their browsing behavior and mirrors their thoughts by surfacing the exact products they're thinking about, giving the impression that their minds are being read.

[Price-Comparing Tools](#)

[Little Birdie](#) is a price-comparing AI browser plugin for online shopping that helps consumers scour the internet for the best deals on products.

AI in Action: AI-driven Use Cases and Examples for Retail

In-Store Experience

[Immersive Multisensory Stores](#)

Brands and retailers are using generative AI in-store, designing environments that are captivating, inviting and grounding. Generative art installations that interact with customer movements or biometric data offer a highly personalized shopping experience, as demonstrated by [H&M](#) at their London flagship store. In collaboration with design agency [Hirsh & Mann](#) and creative coding studio [Variable](#), H&M implemented a large-scale generative artwork that transforms based on customer movement.

[Seamless Omnichannel Experiences](#)

AI will enable a more seamless integration between online and offline channels, providing a consistent and personalized shopping experience across all platforms. [CaratLane](#), an Indian physical and online jewelry retailer, is using AI to personalize products during the online shopping journey based on consumers' browsing behavior. In-store they have a check-in feature that lets consumers stitch the online and offline journey to provide a seamless omnichannel experience.

[Voice-activated Shopping](#)

AI-powered voice apps allow customers to shop and manage their orders hands-free. For instance, the NYC-based US retailer [Bloomingdale](#) offers their customers a voice app where they can ask for store locations, check on open hours, request coupons and deals, and of course, search and order products through the app. Another example is [Walmart](#) which partnered with [Voice AI](#), a leader in multilingual voice technology, to move into connected cars.

[Dynamic Store Layout](#)

With AI and interactive digital displays retailers can dynamically adjust store layouts to create personalized shopping experiences, guiding customers through a curated path of products based on their shopping history and preferences. [HYPERVSN](#), a company specializing in 3D holographic display technology, transformed Harrods into an interactive and engaging space, showcasing new products and special offers, while providing an unforgettable visual merchandising experience, featuring dynamic and immersive visuals for high-end luxury brands.

Store Operations

[Digital Twins for optimized Store Layout](#)

Leading companies are leveraging digital twins and AI-powered simulations to enhance both customer and staff experiences. With [NVIDIA Omniverse](#) retailers can improve store layouts, merchandising strategies, and staff efficiency. Another tech provider is [SymphonyAI](#) which helps retailers employ AI-driven store intelligence, aiming to revolutionize both customer service and operational effectiveness. SymphonyAI's technology offers real-time, comprehensive insights, creating an integrated store ecosystem that equips staff with prioritized tasks on mobile devices to ensure shelves meet layout plans efficiently.

[Inventory Auditing Robots](#)

AI robots can scan shelves to audit inventory in real-time, ensuring stock levels are maintained. [Simbe Robotics](#) developed 'Tally 3.0', which is described as the most advanced autonomous shelf-auditing robot on the market. Tally is designed to perform the laborious task of auditing shelves for out-of-stock items, low-stock items, misplaced items, and pricing errors.

[Fraud Detection and Loss Prevention](#)

AI systems identify potential thefts using anomaly detection in surveillance footage. [Walmart](#), [Target](#), [Lowe's](#), [Kroger](#), [Macy's](#), [CVS](#) and other major US retailers are teaming up with tech providers such as [LPRC](#) (Loss Prevention Research Council) to develop and deploy next-generation AI-powered anti-theft technology like video surveillance systems, facial-recognition cameras, license-plate and vehicle readers, autonomous security robots, RFID tags, smart case locks, and predictive analytic software.

To detect anomalies in online shopping [Forter](#), [Riskified](#), and [Sift](#) among others are some of the currently most innovative startups using cutting-edge AI technology, cyber intelligence, and behavioral analytics to identify legitimate customers and keep them moving toward checkout.

Discovery and Navigation

[Virtual Try-On AR Experiences](#)

AI-powered augmented reality (AR) allows customers to virtually try on products, enhancing engagement and sales. [Nike's](#) AI-powered app provides hyper-accurate shoe-fitting recommendations by scanning your foot using AR technology. Nike recently purchased [Invertex](#), a 3D scanning company to allow a customer-specific e-commerce experience and create mass customization product lines.

[Fragrance Discovery](#)

AI that translates scent to words, word to scents. [KAORIUM](#) by [SCENTMATIC](#) takes an entirely novel approach to fragrance exploration by decoding the enigmatic world of scents and helping to people discover new fragrances intuitively through language.

[Multilingual Support](#)

[Airbnb](#) has replaced the need for translators with a multilingual AI chatbot that assists guests and hosts in booking inquiries and support requests. The easy and accurate interpretability in multiple languages has offered the marketplace of a complete world to Airbnb effortlessly. It has also increased the customer base and built the trust of customers.

Customer Engagement and Service

[AI Avatar Service Chatbots](#)

For customers and agents, AI helpers can provide virtual assistance, language translation, order status, search, product recommendations, email and chat answers. [NVIDIA](#) provides tools to create interactive virtual brand avatars delivering consistent omnichannel customer service.

[Personalization Through Gamification](#)

Studies show that game elements like reward systems increase brand engagement in three ways: emotional, cognitive, and social. Meaning, gamification positively affects consumer engagement. [Yaysay](#), a gamified AI-based shopping app for fashion, combines social media, video games, online ticketing platforms, and dating apps to make off-price shopping an exciting five-minute daily habit.

[Emotion Recognition for enhanced Service](#)

AI can analyze customer emotions and sentiments through facial recognition and voice analysis to adapt customer service based on a customer's mood during interactions. [MorphCast's](#) solution leverages AI and advanced algorithms to assess how viewers non-verbally react to messages, products, and services. Emotion AI startup [Lily AI](#) enables retailers to make emotionally tailored personal recommendations based on understanding individual customers' emotional context.

Checkout and Payment

[Facial Recognition Payments](#)

AI-powered payment systems utilize facial recognition to authenticate transactions, providing a seamless, secure shopping experience that speeds up checkout to cut waiting times. Brazil seems to be a leading market to pilot this technology with [PayFace](#) a Brazilian startup, specialized in facial recognition payments, and [Mastercard](#) that launched a pilot called 'Smile to Pay' in 2022 which allows users to authenticate a payment by showing their face in grocery stores.

[Contextual-based Pricing at POS](#)

AI adjusts prices at the point of sale based on demand, inventory levels, and customer profiles. [Kroger](#) utilizes AI in its 'Kroger EDGE' digital shelving system, which can display different prices based on time of day, stock levels, and customer loyalty.

[Autonomous Stores](#)

AI and computer vision enable cashier-less checkouts where customers can walk out without manual scanning of items. Providers like [AiFi](#), [Trigo](#), [Autonomo](#), and others are pioneering autonomous store technologies to create seamless shopping experiences. They use computer vision, smart sensors, and deep learning to track customer movements, product selections, and in-store interactions, enabling customers to shop and leave without the traditional checkout process. This AI-driven approach not only streamlines the shopping experience but also provides retailers with valuable insights into inventory management and consumer behavior. Despite the current substantial costs associated with equipping stores with autonomous technology, it's expected that these investments will pay off as sales volumes grow over time.

Outro

Undoubtedly, AI will play a crucial role in shaping the retail industry moving forward. AI-enabled technologies will continue to disrupt the traditional retail model as businesses look to harness automation in order to reduce costs while improving efficiency, accuracy, and customer experience. Although AI offers many benefits for retail businesses, it also carries a range of associated challenges and risks. Incorrect data or algorithmic errors, for instance, could result in flawed decisions from automated systems.

Regulations and limitations of AI

The recent developments and advancements in AI systems have raised significant concerns about privacy, job displacement, ethical decision-making, and the potential for AI to perpetuate or amplify biases. In response to these concerns, governments and regulations are working on regulatory frameworks for the development, deployment, and use of AI. The European Union pioneers the regulation of AI with the EU AI Act, aiming to be the world's first comprehensive AI law. It categorizes AI applications according to their risk levels and imposes stricter requirements on high-risk systems, including transparency, accountability, and human oversight. The goal is to ensure that AI systems are safe, transparent, and respect existing laws on privacy and fundamental rights.

A humanist perspective

From a humanist perspective, the primary focus is on preserving human dignity, autonomy, and rights. There's a call for AI to be developed in a way that enhances human capabilities without replacing them. Humanists might argue for a participatory approach in AI development, where diverse groups of people are involved in shaping the technology. Furthermore, AI should be designed to be inclusive, preventing it from exacerbating social inequalities.

The perspectives on AI's future are ambivalent, with some holding an optimistic view of AI's potential to solve complex problems and improve lives. On the other hand, there's caution regarding its unchecked growth. Future developments should aim for sustainable, ethical AI that serves the common good, necessitating ongoing dialogue between technologists, ethicists, policymakers, and the broader public. It's also crucial for education systems to adapt, preparing individuals to work alongside AI and fostering skills that machines cannot replicate.

In conclusion, the integration of AI in the retail sector represents a significant leap forward in enhancing customer experience and operational efficiency. By leveraging the power of AI, retailers are not only optimizing their supply chains and inventory management but are also creating personalized shopping experiences, setting a new standard for innovation and customer satisfaction in the industry.

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