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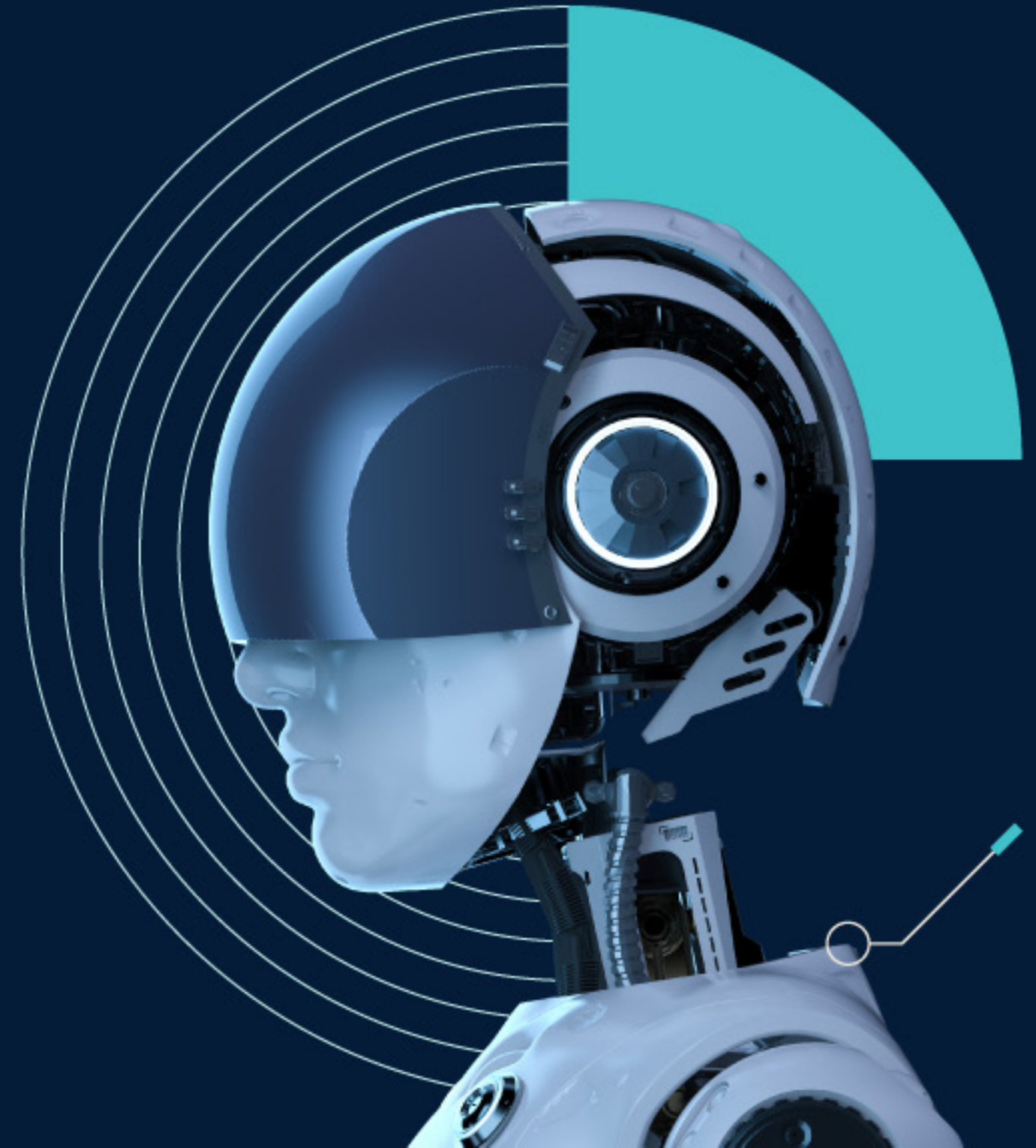
EMERGING TECH RESEARCH

Artificial Intelligence & Machine Learning Report

VC trends and emerging opportunities

Q4
2022

Contents

Institutional Research Group

Analysis

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For previous updates as well as our complete AI & ML research, please see the designated analyst workspace on the PitchBook Platform.
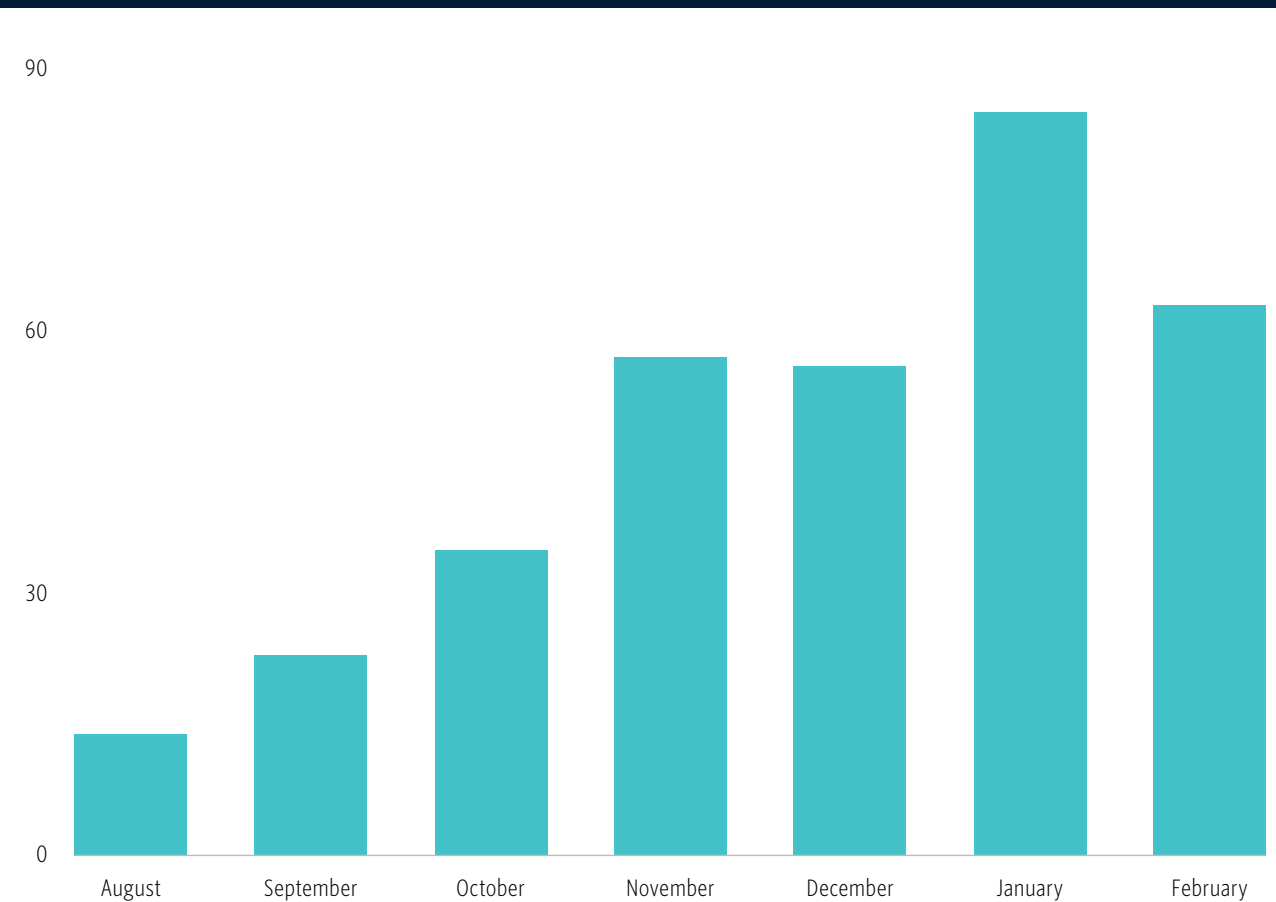
Vertical overview

AI has restored its position as a valuation driver for public and private companies. The public response to OpenAI's ChatGPT question-answering product in November precipitated a high-velocity rush of freeware product announcements and startup funding rounds for consumer applications. Enterprises also raced to incorporate ChatGPT into their products, leading to significant share price gains for downtrodden stocks, including those of Buzzfeed, C3.ai, SoundHound, Veritone, and BigBear.ai, upon announcements of new AI capabilities. While AI has driven share price premiums in the past, companies have not always demonstrated usage of cutting-edge techniques, instead marketing legacy techniques as innovations. The visibility and novelty of ChatGPT shows that state-of-the-art techniques matter for user experience.

Emerging AI techniques risk running headlong into an adoption chasm given continued distrust of AI across enterprise functions. Powerful language processing and image augmentation software have been on the market for years, however deployment challenges have yet to be overcome, resulting in too small of a market to support high-growth companies at scale. Diffusion of AI throughout the enterprise departments remains a goal yet has flatlined in recent years. This current trend is likely to meaningfully increase the number of applications available to consumers and enterprises. AI developers have rapidly begun creating new generative AI applications in Q4, showing the range of options to enterprise users for diverse tasks. The user experience and business value of these tools will ultimately determine whether this wave of AI can be different.
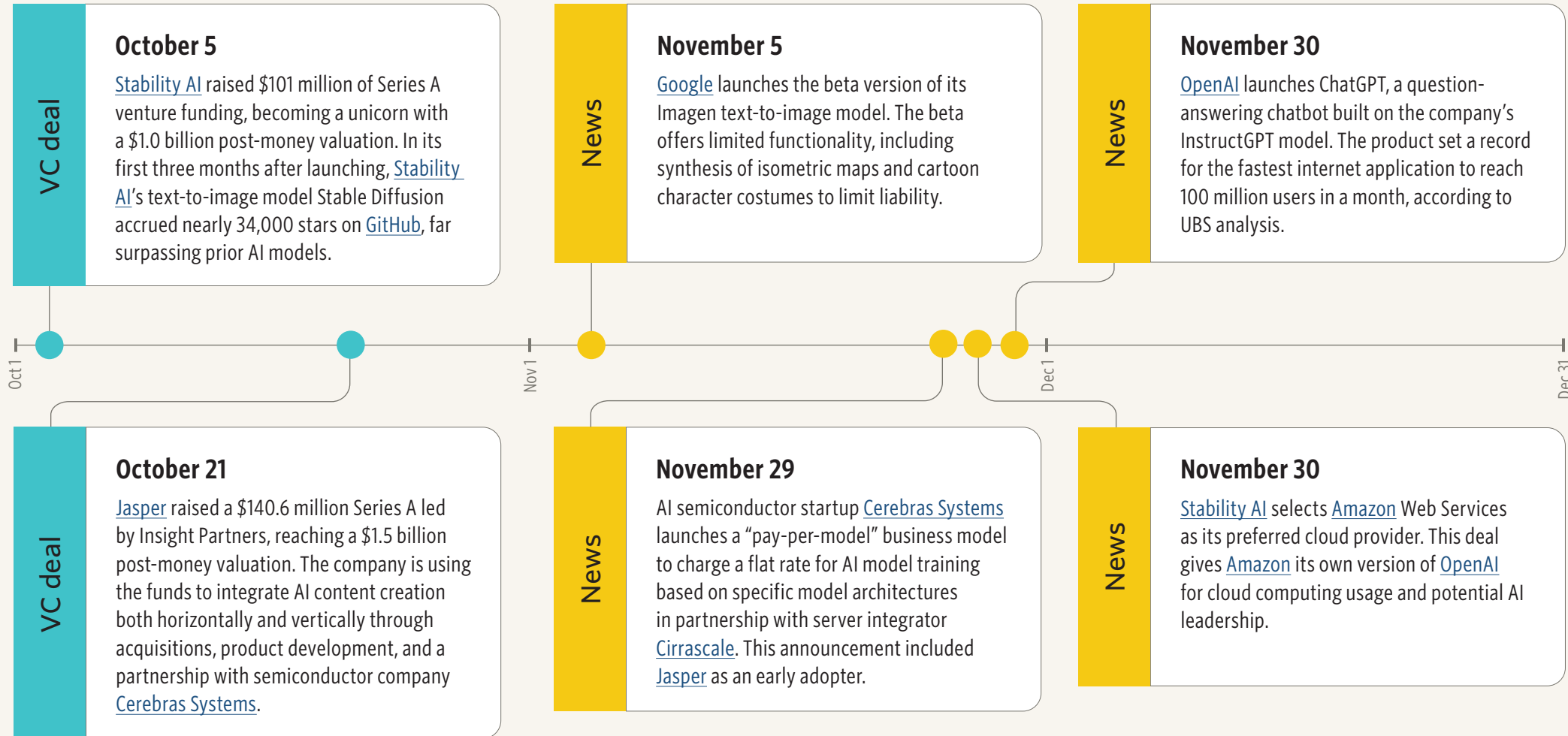
New open-source generative AI web applications launched by month*

Source: There's an AI for That | Geography: Global | *As of March 10, 2023

Q4 2022 timeline

VC deal

October 5

Stability AI raised $101 million of Series A venture funding, becoming a unicorn with a $1.0 billion post-money valuation. In its first three months after launching, Stability AI's text-to-image model Stable Diffusion accrued nearly 34,000 stars on GitHub, far surpassing prior AI models.

News

November 5

Google launches the beta version of its Imagen text-to-image model. The beta offers limited functionality, including synthesis of isometric maps and cartoon character costumes to limit liability.

News

November 30

OpenAI launches ChatGPT, a question-answering chatbot built on the company's InstructGPT model. The product set a record for the fastest internet application to reach 100 million users in a month, according to UBS analysis.

VC deal

October 21

Jasper raised a $140.6 million Series A led by Insight Partners, reaching a $1.5 billion post-money valuation. The company is using the funds to integrate AI content creation both horizontally and vertically through acquisitions, product development, and a partnership with semiconductor company Cerebras Systems.

News

November 29

AI semiconductor startup Cerebras Systems launches a "pay-per-model" business model to charge a flat rate for AI model training based on specific model architectures in partnership with server integrator Cirrascale. This announcement included Jasper as an early adopter.

News

November 30

Stability AI selects Amazon Web Services as its preferred cloud provider. This deal gives Amazon its own version of OpenAI for cloud computing usage and potential AI leadership.

Oct 1 · Nov 1 · Dec 1 · Dec 31

Q4 VC activity

1,405
total deals

-4.9%
deal count growth QoQ

$14.6B
total VC raised

2022 YTD summary

6,727
total deals

-13.2%
deal count growth YoY

$78.0B
total VC raised

AI & ML landscape

1 Horizontal platforms

2 Vertical applications
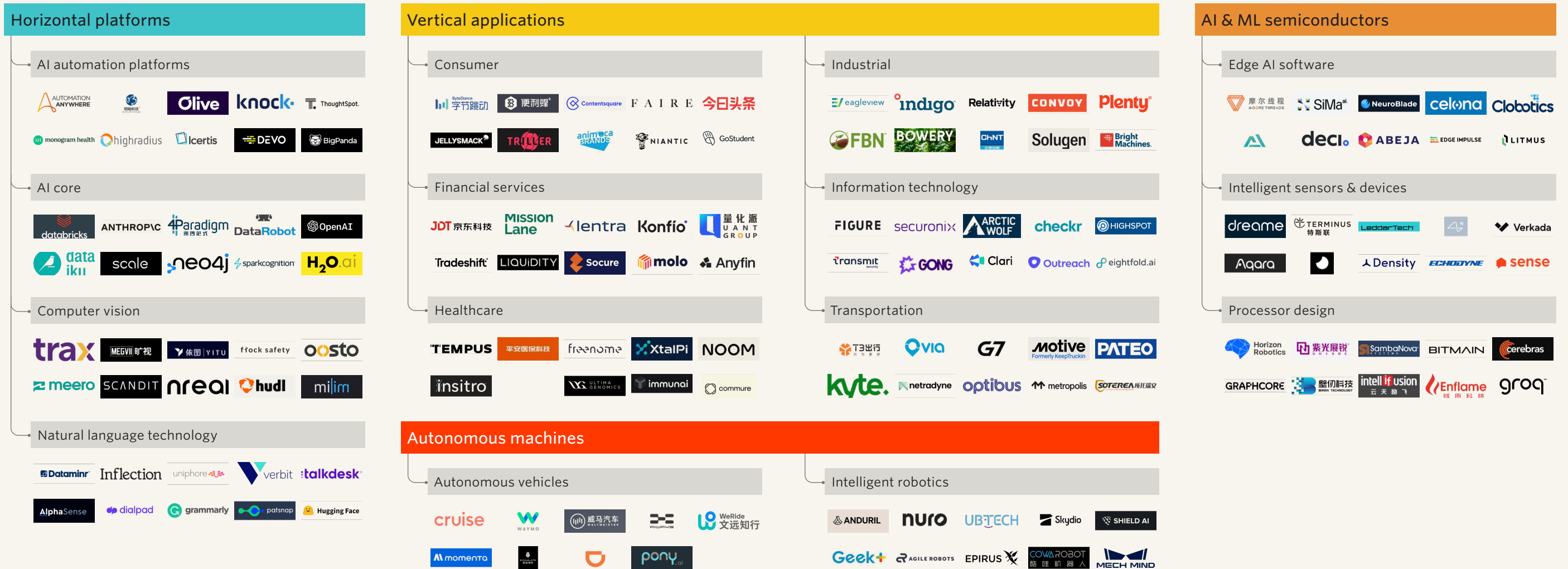
3 Semiconductors

4 Autonomous machines

AI & ML VC ecosystem market map

Click to view the interactive market map on the PitchBook Platform.

Market map is a representative overview of venture-backed or growth-stage providers in each segment. Companies listed have received venture capital or other notable private investments.

Horizontal platforms

AI automation platforms
Automation Anywhere, Olive, knock, ThoughtSpot, monogram health, highradius, Icertis, DEVO, BigPanda

AI core
databricks, ANTHROPIC, 4Paradigm, DataRobot, OpenAI, data iku, scale, neo4j, sparkcognition, H2O.ai

Computer vision
trax, MEGVII, YITU, flock safety, oosto, meero, SCANDIT, nreal, hudl, milim

Natural language technology
Dataminr, Inflection, uniphore, verbit, talkdesk, AlphaSense, dialpad, grammarly, patsnap, Hugging Face

Vertical applications

Consumer
ByteDance, 便利蜂, Contentsquare, FAIRE, 今日头条, JELLYSMACK, TRILLER, animoca BRANDS, NIANTIC, GoStudent

Financial services
JDT 京东科技, MISSION Lane, lentra, Konfío, QUANT GROUP 量化派, Tradeshift, LIQUIDITY, Socure, molo, Anyfin

Healthcare
TEMPUS, 平安医保科技, freenome, XtalPi, NOOM, insitro, ULTIMA GENOMICS, immunai, commure

Industrial
eagleview, indigo, Relativity, CONVOY, Plenty, FBN, BOWERY, CHNT, Solugen, Bright Machines

Information technology
FIGURE, securonix, ARCTIC WOLF, checkr, HIGHSPOT, transmit security, GONG, Clari, Outreach, eightfold.ai

Transportation
T3出行, VIA, G7, Motive Formerly KeepTruckin, PATEO, kyte, netradyne, Optibus, metropolis, SOTEREA

Autonomous machines

Autonomous vehicles
cruise, WAYMO, 威马汽车 WELTMEISTER, PLUS, WeRide 文远知行, momenta, pony.ai

Intelligent robotics
ANDURIL, nuro, UBTECH, Skydio, SHIELD AI, Geek+, AGILE ROBOTS, EPIRUS, COWAROBOT 酷哇机器人, MECH MIND

AI & ML semiconductors

Edge AI software
摩尔线程 MOORE THREADS, SiMa, NeuroBlade, celona, Clobotics, AI, deci, ABEJA, EDGE IMPULSE, LITMUS

Intelligent sensors & devices
dreame, TERMINUS 特斯联, LeddarTech, Verkada, Aqara, Density, ECHODYNE, sense

Processor design
Horizon Robotics, 紫光展锐 UNISOC, SambaNova, BITMAIN, Cerebras, GRAPHCORE, 壁仞科技 BIREN TECHNOLOGY, intellifusion 云天励飞, Enflame 燧原科技, groq

VC activity

2022 challenged the highly funded AI vendors that are unlikely to drive the field's future. VC funding for the vertical declined more than it did for IT overall, falling 34.9% to $78.0 billion in VC deal value. Though, as with global IT overall, AI deal value in 2022 still exceeded 2020's total. AI deal count also declined more than it did for IT overall at 13.2%, as early-stage deal count regressed even as late-stage deal count remained high. Declines of over 50% occurred in 2022 in the autonomous vehicles, processor design, automation platforms, and intelligent sensors segments as investors avoided hardware- and labor-intensive businesses. Consumer AI proved to be the most resilient vertical application, only declining 20.5% in VC funding YoY, as consumer interest in AI applications emerged. This reset accompanying the boom in foundation model development and generative applications shows that a new class of vendors is likely to drive the next wave of large companies in intelligent software.

VC exit count continued to decline in Q4, though deal value rebounded due to significant listings in China. We tracked $7.0 billion in VC exit value in Q4, up from Q3's total, yet the second-lowest value we have tracked since Q2 2020. Exit count has remained above pre-pandemic levels. Among tech giants, active acquirers included Meta, Oracle, and Spotify. PE found opportunities in generative AI with growth equity firm PSG using generative copywriting startup Copywriter AI as a platform to add on two writing startups, Frase and Rytr, forming a new platform called Copyrytr. This platform play gives an early look at the synergies of generative AI startups as they proliferate in different use cases. AI copywriting leader Jasper has also become an acquirer as part of the company's strategy to deliver a unified content suite across formats.

AI & ML VC deal activity
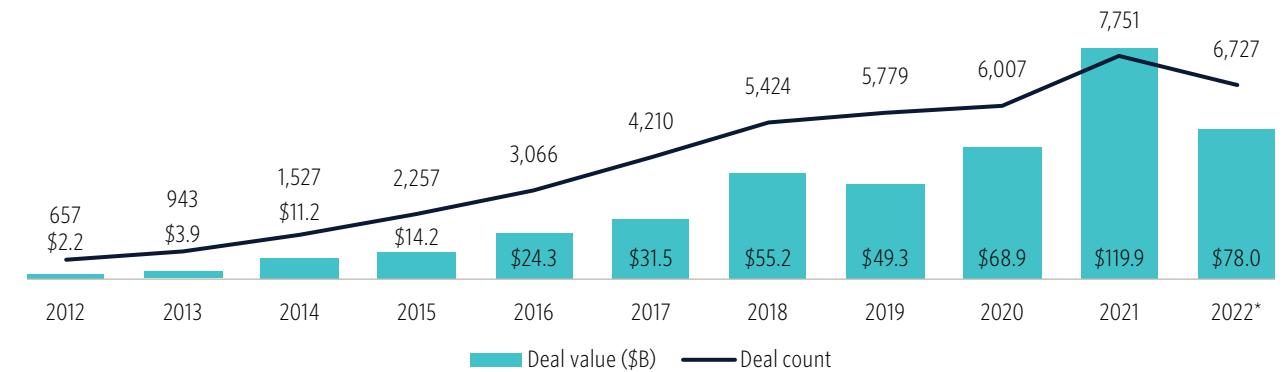
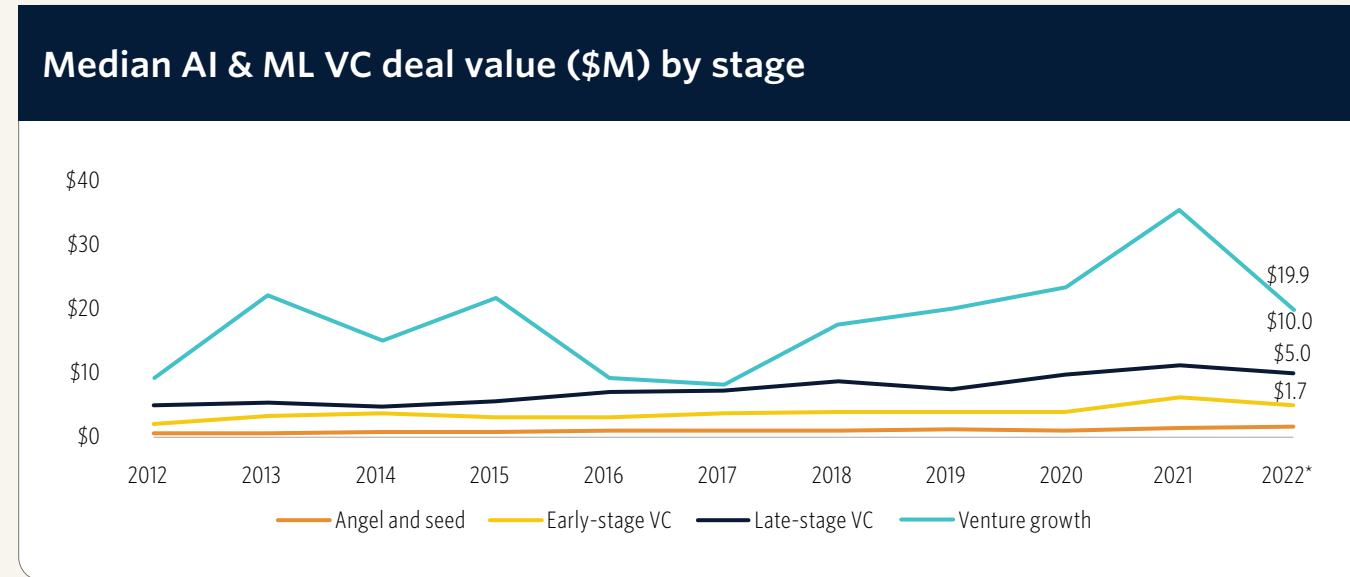Source: PitchBook | Geography: Global | *As of December 31, 2022
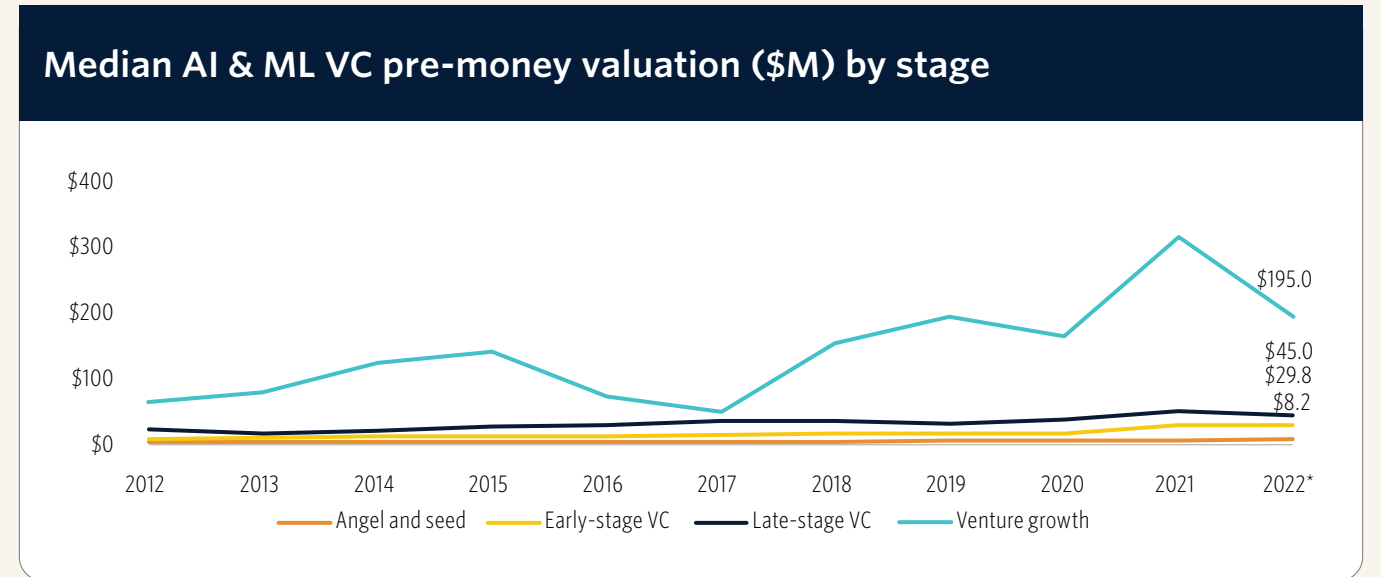
AI & ML VC exit value ($B) by type
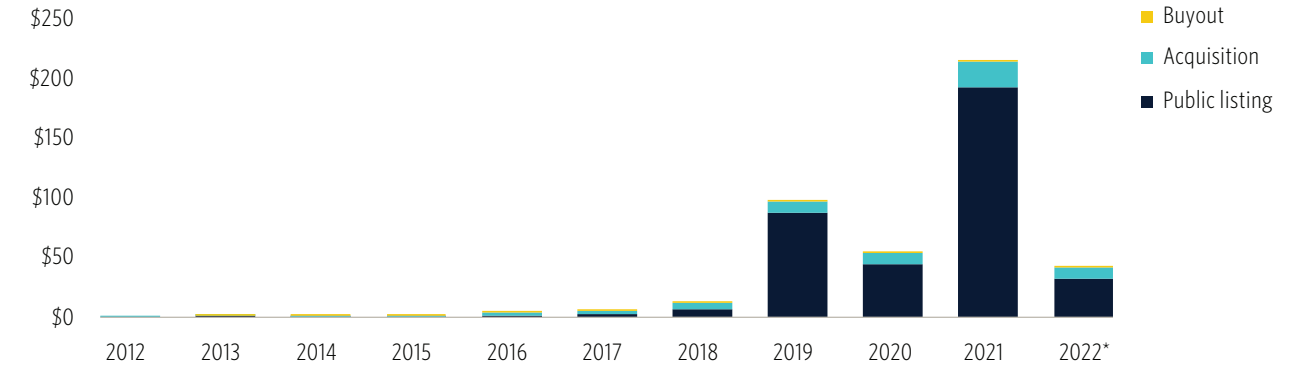
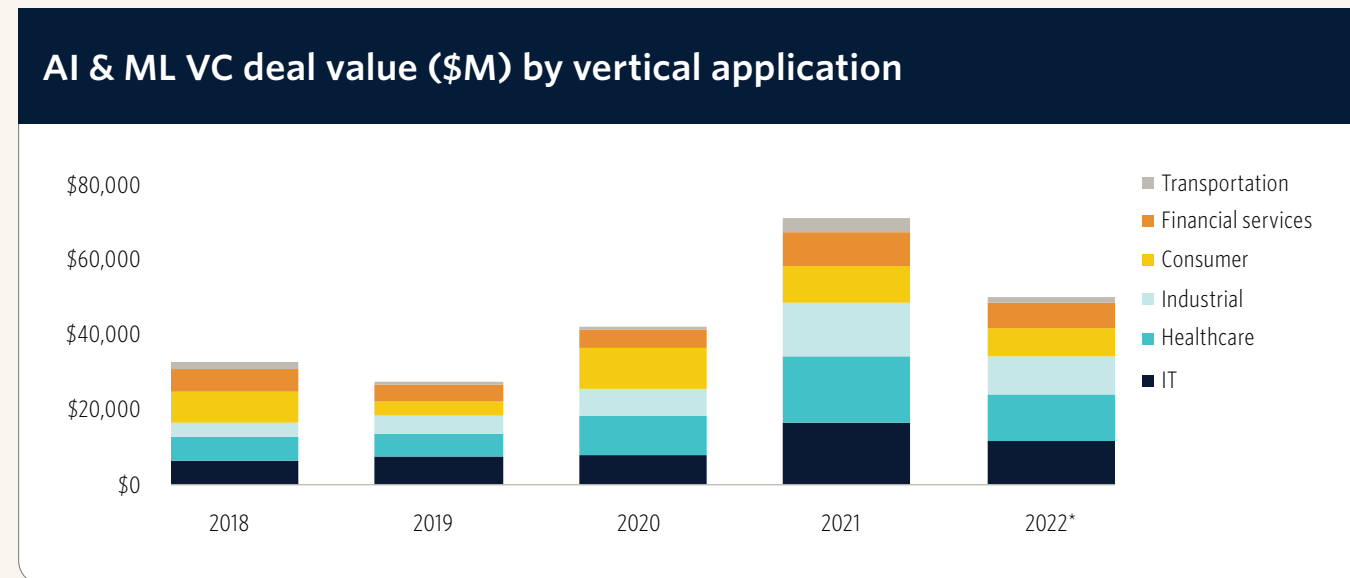Source: PitchBook | Geography: Global | *As of December 31, 2022

Median AI & ML VC deal value ($M) by stage

$19.9
$10.0
$5.0
$1.7

Angel and seed — Early-stage VC — Late-stage VC — Venture growth

Source: PitchBook | Geography: Global | *As of December 31, 2022

Median AI & ML VC pre-money valuation ($M) by stage

$195.0
$45.0
$29.8
$8.2

Angel and seed — Early-stage VC — Late-stage VC — Venture growth

Source: PitchBook | Geography: Global | *As of December 31, 2022

AI & ML VC deal value ($M) by vertical application

■ Transportation
■ Financial services
■ Consumer
■ Industrial
■ Healthcare
■ IT

Source: PitchBook | Geography: Global | *As of December 31, 2022

AI & ML VC exit count by type

■ Buyout
■ Acquisition
■ Public listing
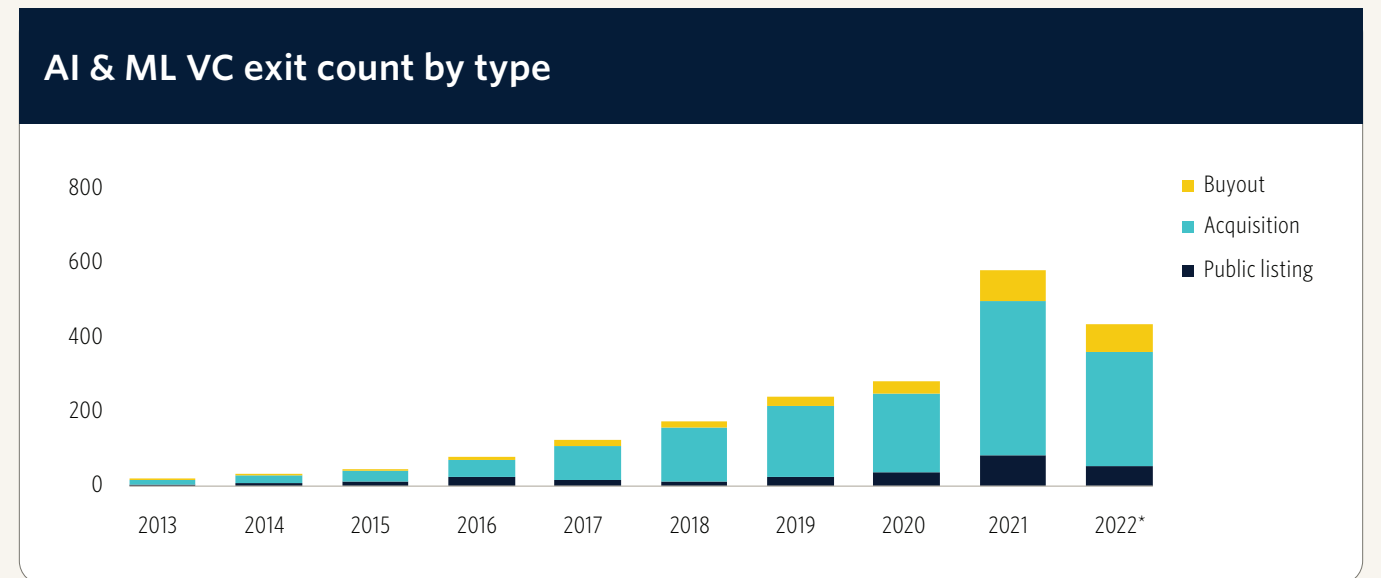
Source: PitchBook | Geography: Global | *As of December 31, 2022

Key AI & ML early-stage VC deals by deal value*

Company	Close date (2022)	Segment	Category	Deal value ($M)	Deal type	Lead investor(s)
bolttech	October 17	Vertical applications	Financial services AI, AI Insurtech	$300.0	Series B	Tokio Marine & Nichido Fire Insurance
Moore Threads	December 23	AI & ML semiconductors	Tiny machine learning	$213.2	Series B	Hexie Health Insurance
Jasper	October 21	Vertical applications	Sales & marketing	$140.6	Series A	Insight Partners
Bright Machines	October 31	Vertical applications	Industrial automation	$132.0	Series B	Eclipse Ventures
Stability.AI	October 5	Horizontal platforms	Foundation models	$101.0	Series A	Coatue Management, Lightspeed Venture Partners, O'Shaughnessy Ventures
Altana AI	October 6	Vertical applications	Supply chain optimization	$100.0	Series B	Activate Capital Partners
Exai Bio	October 10	Vertical applications	Clinical decision support	$70.6	Series A	Casdin Capital, Section 32
SiMa.ai	November 7	AI & ML semiconductors	Tiny machine learning	$67.8	Series B1	Fidelity Management & Research
Montai Health	December 13	Vertical applications	Drug discovery	$50.0	Series A	N/A
Landis	October 18	Vertical applications	Proptech	$40.0	Series B	GV

Source: PitchBook | Geography: Global | *As of December 31, 2022

Key AI & ML late-stage VC deals by deal value*

Company	Close date (2022)	Segment	Stage	Deal value ($M)	Lead investor(s)	Valuation step-up
Novo	November 22	Vertical applications	Series B	$125.0	GGV Capital, Stripes	6.5x
Cellarity	October 4	Vertical applications	Series C	$121.0	Hanwha Impact	1.3x
WeRide	October 1	Autonomous machines	Series D1	$120.0	N/A	1.1x
Morse Micro	November 28	AI & ML semiconductors	Series B	$111.9	MegaChips, Telstra Superannuation Fund	N/A
AMP Robotics	November 2	Autonomous machines	Series C	$91.0	Congruent Ventures, Wellington Management	N/A
Detect	November 18	Vertical applications	Series C1	$90.1	N/A	0.8x
Vesttoo	October 25	Vertical applications	Series C	$80.0	Mouro Capital	7.9x
Contentstack	November 15	Vertical applications	Series C	$80.0	Georgian, Insight Partners	N/A
Stratio	October 13	Horizontal platforms	Series C	$63.8	InfraVia Growth	1.8x
Kingsware	November 1	Horizontal platforms	Series C	$57.0	N/A	N/A

Source: PitchBook | Geography: Global | *As of December 31, 2022

Key recent AI & ML VC exits*

Company	Close date (2022)	Subsegment	Post-money valuation ($M)	Exit value ($M)	Acquirer(s)	MOIC
Almotive	December 22	Autonomous machines	N/A	N/A	Stellantis	N/A
Helpshift	December 7	Horizontal platforms	$75.0	$75.0	Keywords Studios	1.4x
Reposify	November 29	Vertical applications	N/A	N/A	CrowdStrike Holdings	N/A
Tempo	November 23	AI & ML semiconductors	$919.0	$689.0	N/A	N/A
ECARX	November 18	Autonomous machines	$3,820.0	$3,400.0	COVA Acquisition	N/A
Audio Analytic	October 31	Horizontal platforms	N/A	N/A	Meta	N/A
DataJoy	October 19	Vertical applications	N/A	N/A	Databricks	N/A
Frase	October 6	Vertical applications	N/A	N/A	Copysmith Artificial Intelligence, Harmony Venture Labs, PSG	N/A
Rytr	October 6	Vertical applications	N/A	N/A	Copysmith Artificial Intelligence, Harmony Venture Labs, PSG	N/A
Blue Hexagon	October 4	Vertical applications	$10.0	$10.0	Qualys	0.3x

Source: PitchBook | Geography: Global | *As of December 31, 2022

Top strategic acquirers of AI & ML companies since 2017*

Investor	Deal count	Investor type
ServiceNow	5	Corporation
Oracle	5	Corporation
Accenture	5	Corporation
Apple	5	Corporation
International Business Machines	4	Corporation
Meta	4	Corporation
Intel	3	Corporation
Medtronic	2	Corporation
B3	2	Corporation
Copysmith Artificial Intelligence	2	PE-backed company

Investor	Deal count	Investor type
Five9	2	Corporation
Vimeo	2	Corporation
Unity	2	Corporation
Seismic	2	VC-backed company
Automation Anywhere	2	VC-backed company
Amazon	2	Corporation
Capgemini	2	Corporation
Smarsh	2	PE-backed company
Microsoft	2	Corporation
Cisco Systems	2	Corporation

Source: PitchBook | Geography: Global | *As of December 31, 2022

Top VC investors in AI & ML companies since 2017*

Investor	Deal count	Angel and seed	Early-stage VC	Late-stage VC	Venture growth
Alumni Ventures	266	111	79	66	10
Sequoia Capital China	245	24	147	59	15
SOSV	202	91	54	48	9
500 Global	176	81	58	33	4
Enterprise Ireland	174	63	66	40	5
Right Side Capital Management	169	79	79	11	0
Khosla Ventures	168	44	56	53	15
Accel	168	28	68	58	14
Sequoia Capital	167	40	60	45	22
Tiger Global Management	167	3	52	73	39

Source: PitchBook | Geography: Global | *As of December 31, 2022

Top VC- and PE-backed AI & ML companies by total VC raised to date*

Company name	Category	VC raised to date	Most recent VC post-money valuation ($M)	Lead investor(s)
Waymo	Autonomous vehicle design	$5,500.0	$30,750.0	Magna International, Autonation, Silver Lake
Databricks	Database management	$3,497.4	$38,000.0	Counterpoint Global
Anduril	Drones	$2,315.1	$8,480.0	Valor Equity Partners
Nuro	Industrial robots	$2,132.0	$8,600.0	Tiger Global Management
Horizon Robotics	Processor design	$1,900.0	N/A	Chery Automobile
Indigo Agriculture	Crop maximization	$1,701.6	$3,950.0	Empede Capital Partners, 369 Growth Partners, Timon Capital, Molini Besozzi Marzoli
ContentSquare	Ad targeting	$1,412.6	$5,686.4	Sixth Street Partners
SambaNova Systems	Processor design	$1,136.6	$5,000.0	SoftBank Investment Advisers
DataRobot	AIaaS	$1,048.1	$6,300.0	Altimeter Capital Management, Tiger Global Management
OpenAI	AIaaS	$1,010.1	N/A	Microsoft

Source: PitchBook | Geography: Global | *As of December 31, 2022

Emerging opportunities

Foundation models

 The latest foundation models have separated startups from incumbents, and new innovations will likely yield similar commercial results.

Generative audio

Meta, Apple, and Spotify made acquisitions for audio generation, including speech and music generation, over the past 18 months.

Intelligent process automation

AI can learn common language-based workflows for automation of routine tasks.

Foundation models

Overview

Foundation model companies train custom neural networks using extensible techniques that include transformers, diffusion models, and multimodal approaches. For further definitions of foundation model types, see our 2023 Vertical Snapshot: Generative AI. These models can be applied to a range of tasks. Currently, industry benchmarks compare foundational language models based on question answering, information retrieval, summarization, sentiment analysis, toxicity detection, and text classification.[1] Foundation models can also be trained in image generation, audio understanding, and niche sectors, which include biology, software development, and IT domains.

The foundation model market will be determined by the willingness of developers to pay to build applications. We believe that recent momentum around foundation models will lead the AI application development market to surpass market research estimates and accelerate to nearly 40% annual growth rates over the next three years. This market is currently dominated by the AI application services offered by hyperscalers including Google, Microsoft, and Oracle, as evidenced by the foundational partnerships that leading AI application companies have with these infrastructure players. The foundation model market can disrupt the AI platform market that facilitates custom model training while requiring little innovation to the underlying model architecture.

AI application & deployment market size estimate ($B)*
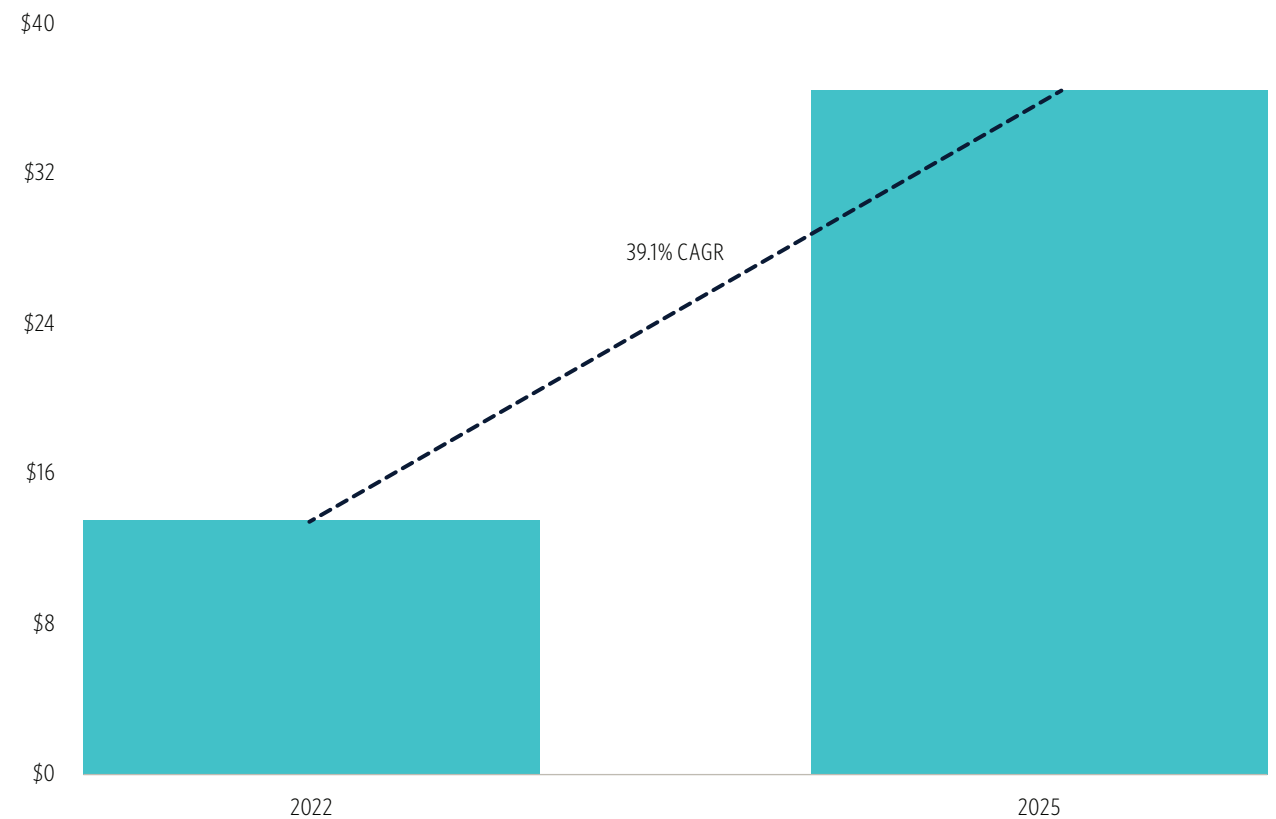
Source: PitchBook Emerging Tech Research estimates, IDC | Geography: Global
*As of December 31, 2022

1: "Holistic Evaluation of Language Models" Stanford Center for Research on Foundation Models, Percy Liang, et al., November 16, 2022.

Market direction

The latest foundation models have separated startups from their competition, and new innovations will likely yield similar commercial results. In 2021, transformer models enabled outstanding growth for language generation startups. In 2022, diffusion models and state-of-the-art large language models yielded impressive results for generative AI companies. The recent release of GPT-4 demonstrates that the future of foundation models is multimodal, since the model can interpret images and shows the ability to write code for visual outputs including simple video games. Social responsibility remains a critical cornerstone of foundation model development as well, given Anthropic's primary contribution in training Claude, a similar model to GPT-4, is training it based on ethical principles. Foundation models can be trained on increasingly multimodal datasets to produce a range of outcomes natively including speech, text, and video.

Research by OpenAI and Nvidia in this area indicates that imitation learning will become part of future foundation models. In June 2022, OpenAI published a paper on imitation learning for the video game Minecraft that learned from keystrokes and mouse movements recorded over 70,000 hours of gameplay.[2] Recently, at leading academic AI conference NeurIPS, an Nvidia research scientist won a conference prize for outstanding datasets and benchmarks with a paper also on Minecraft. The authors' imitation learning model learns from gameplay video along with online forum comments and game-related wiki pages. Players can interact with the bot via natural language to execute tasks, thereby enabling control of intelligent bots without an explicit reward function. The inclusion of natural language augurs a future wherein large language models can be connected to behaviors learned from a vast corpus of internet actions and tutorials.

2: "Learning to Play Minecraft with Video PreTraining (VPT)," OpenAI, June 2022.

Emerging task completion model characteristics

Task completion model	Multimodal data	Training techniques
Cicero by Meta AI	Internet text Automatically annotated Diplomacy games	Transformer-based large language model Reinforcement learning enhanced with imitation learning
MineDojo by Nvidia	YouTube videos and text transcripts Wiki pages Reddit posts	OpenAI CLIP model for text-image processing Reinforcement learning enhanced with a combination of self-imitation learning and on-policy learning
Video Pre-Training by OpenAI	Unlabeled internet video data	Semi-supervised imitation learning

Trending startups

Since Q4, Alphabet's Google has invested $400.0 million in Anthropic and has become the startup's preferred cloud provider through its Google Cloud Platform business. Google's internal language modeling innovation has lagged those of Meta and OpenAI, and the company has already leaned on partnerships with Cohere and other startups via corporate venture capital (CVC) deals after the company's acquisition of Deepmind in 2014. Anthropic has developed a competitive foundation model to OpenAI's GPT-4 and already surpasses all non-OpenAI foundation models in question-answering accuracy, according to Stanford researchers' benchmarks.[3] The model stands out for integrating ethical principles into the training phase, reducing the need for post-training guidance.

Microsoft's recent OpenAI-related product announcements and continued investment support for OpenAI show that the two will be tied at the hip going forward. Microsoft announced a $10.0 billion commitment to OpenAI in the form of cloud credits and financial investment. Based on the exclusive relationship embedded in this deal, OpenAI can serve as a research and development (R&D) lab for Microsoft's future enterprise software products along with the giant's ambitions in search. OpenAI has incurred staggering computing costs for its ChatGPT preview, requiring additional commitments from its cloud partner to support commercial products such as ChatGPT Plus.

3: "Holistic Evaluation of Language Models" Stanford Center for Research on Foundation Models, Percy Liang, et al., November 16, 2022.

Key recent foundation model VC deals*

Company	Close date	Deal value ($M)	Post-money valuation ($M)
Stability.AI	October 5, 2022	$101.0	$1,000.0
AI21 Labs	July 12, 2022	$64.0	$664.0
Anthropic	April 29, 2022	$580.0	$4,000.0
Hugging Face	April 6, 2022	$100.0	$2,000.0
Cohere	December 17, 2021	$125.0	$0.0
Cohere	September 7, 2021	$40.0	$200.0
Aleph Alpha	July 27, 2021	$27.2	$0.0

Source: PitchBook | Geography: Global | *As of December 31, 2022

Generative audio

Overview

Companies in this segment focus on the recording, manipulation, transcription and playback of sound, speech, and music. Applications include human-machine interaction, music production, film and video production, podcasts, audiobooks, and more. Foundation models for audio generation include Whisper from OpenAI, data2vec from Meta, Universal Speech Model from Google, MusicLM from Google Research, and Jukebox from OpenAI.

Categories of audio generation include:

- **Audio editing:** Techniques and tools used to improve the quality, clarity, and overall sound of recorded audio, as well as to edit, mix, and master audio tracks.
- **Music generation:** The use of generative algorithms to create new music, often based on user-specified parameters and musical styles.
- **Speech interaction:** Automated conversion of written text to spoken audio, or spoken audio to written text, using natural language processing and machine learning algorithms. These techniques are used in a variety of applications, including accessibility tools, voice assistants, and automated transcription services.
- **Synthetic voice:** Speech generation for various applications including dubbing, voice alteration, and voice replication.

The audio generation market remains nascent, and distinct market segments have not emerged for music generation and AI audio augmentation. Speech interaction contributes a large portion of the $4.4 billion conversational AI market. Music generation remains a small market today that has not gained significant businesses yet.
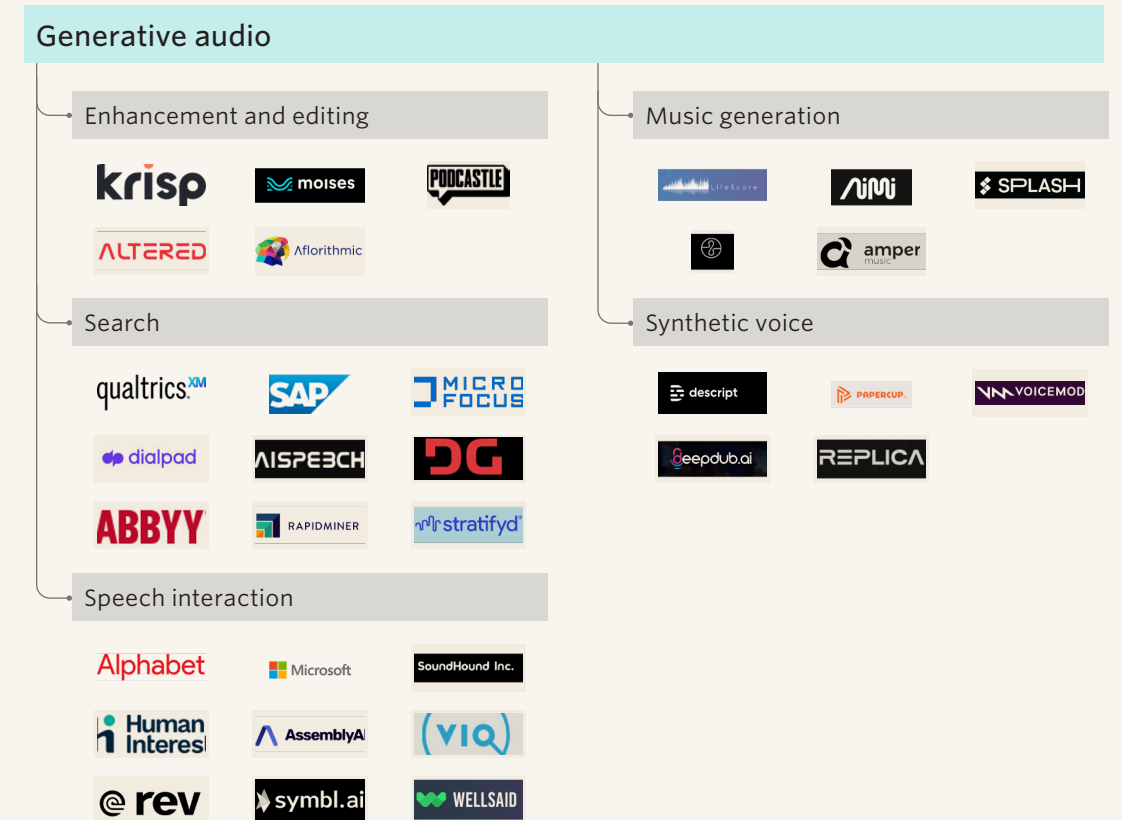
Market direction

While text analytics and image generation are becoming widely available through large language models, audio remains a niche area of innovation with relatively less innovation from leading research labs. OpenAI's Whisper speech recognition models achieved state-of-the-art speech recognition accuracy that has since been surpassed by Google's Universal Speech Model. OpenAI's Whisper API has already been integrated by speech-to-text unicorn Deepgram, despite complaints about the inference time of the algorithm. Music generation was identified as an emergent property of Stable Diffusion by Riffusion's conversion of text prompts to spectrograms that can be converted to audio clips of music. We believe that content generation will require accompanying audio that relies on a comprehensive understanding of the world's languages and the ability to synthesize cinema-quality audio from simple prompts.

Tech giants are looking outside their firms to find more authentic channels to connect with audiences. Audio generated by AI systems including Alexa and Siri have fallen short of conversational goals, and interfaces with popular applications remain tactile. In response to insufficient internal innovation, Meta, Apple, and Spotify made acquisitions for audio generation, including speech and music generation, over the past 18 months. Generative audio products are already being rolled out as a result of these acquisitions. Spotify's acquisition target Sonantic brought AI innovation to text-to-speech, earning two active US patents in speech processing and text-to-speech synthesis. Those patents enable the company to generate uniquely expressive voices that can be used in film and gaming. Spotify can use the technology for products such as its recently announced AI DJ that lets one voice actor describe all of the songs in its library by extrapolating his voice with AI as part of an immersive playlist. Machine-narrated audiobooks can also be generated, expanding the company's media portfolio.

Recent generative audio acquisitions

Company	Close date (2022)	Acquirer
Audio Analytic	October 31	Meta
Sonantic	June 13	Spotify
AI.Music	February 7	Apple

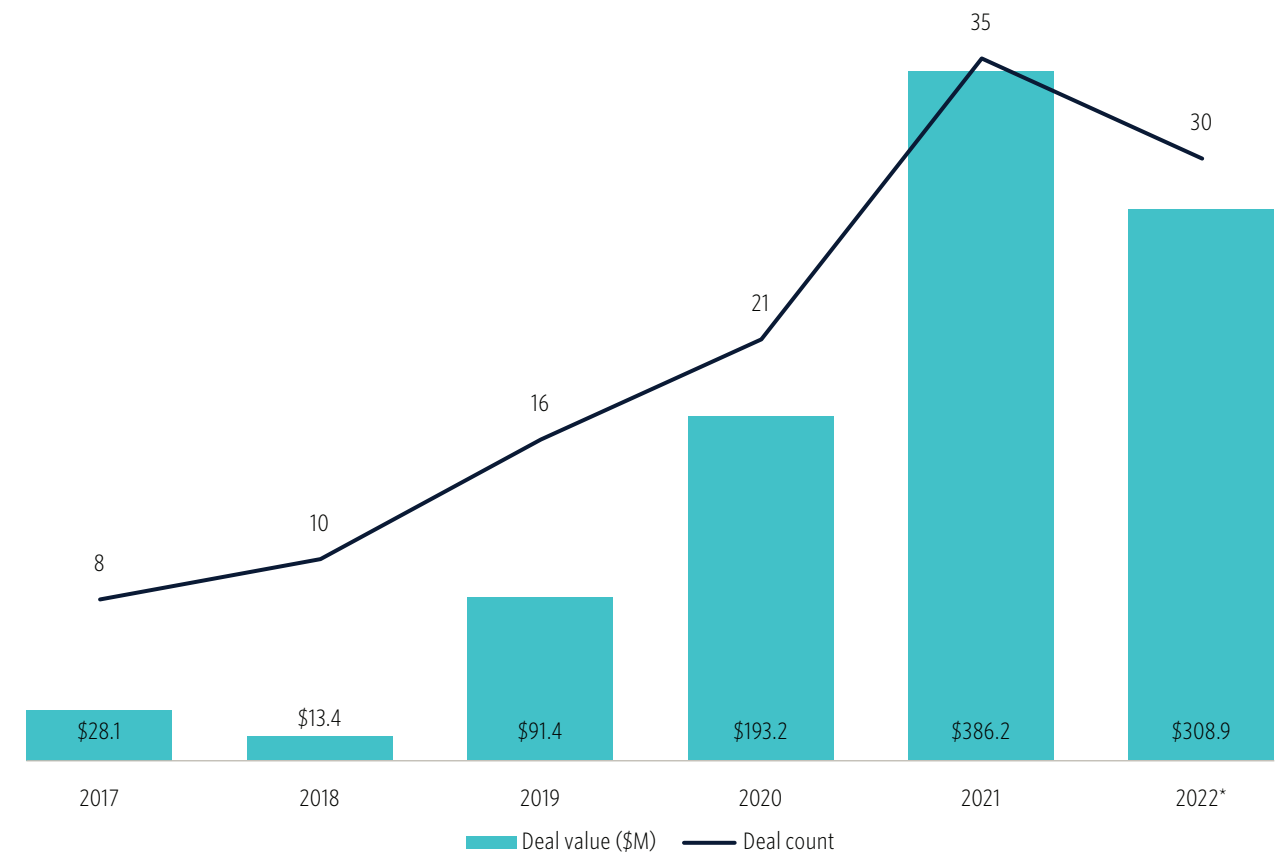Source: PitchBook | Geography: Global | *As of December 31, 2022

Trending startups

Generative audio has grown into a distinct market segment with over $300.0 million invested in 2021 and 2022. In Q4 2022, OpenAI Fund led a $50.0 million Series C for media editing startup Descript, granting the company a 2.0x valuation step-up. Descript uses AI to transcribe videos for editing, enabling video editing based on text. This form of content generation allows creators to edit professional video with similar ease to word processing or slideshow techniques. Descript was one of the four initial investments made by the OpenAI Fund, demonstrating the strategic importance of audio to the future of AI.

At the early stage, Deepdub raised a $20.0 million Series A in Q1 2022 led by Insight Partners with participation from AI-focused VC Swift Ventures and media-focused VC Stardom Ventures. The software can translate movies to other languages in real time using realistic voices for each language translation. The company has reported working with Hollywood studios in addition to an announced partnership with streaming service Topic.[4]

Generative audio VC deal activity

Source: PitchBook | Geography: Global | *As of December 31, 2022

4: "8 Startups Bringing AI Tech to Netflix, Lucasfilm, Marvel, and More Hollywood Studios — and Attracting Millions in VC Funding," Business Insider, Lucia Moses, March 8, 2023.

Intelligent process automation

Overview

Intelligent process automation (IPA) refers to the use of AI to extract insights about enterprise workflows and utilize bot-based scripts to execute previously manual processes. This category moves the robotic process automation (RPA) market forward by applying AI & ML to the identification of user workflows, analysis of documents, and execution of processes. Historically, RPA has been enabled by optical character recognition (OCR) and rules-based scripting bots. Component technologies of IPA today include RPA, computer vision, speech recognition, natural language processing, process mining, and task mining. Leading use cases for IPA include data entry, document processing, and email generation.

This market has grown mature given the presence of leading tech giants including IBM, Salesforce, AWS, and Microsoft. IDC calculates the market will reach $23.4 billion in 2022 and will grow at a 20.5% CAGR over the next three years.[5] This continued high growth at scale owes to the product-market of system-level automation, which focuses on scripting IT processes that required manual review, including database management rules. Labor automation achieves lower growth based on the limited success of RPA in augmenting complex knowledge work. Process mining is also growing quickly given the need for enterprises to learn what processes are employed in their environments.

Intelligent process automation market size estimate*
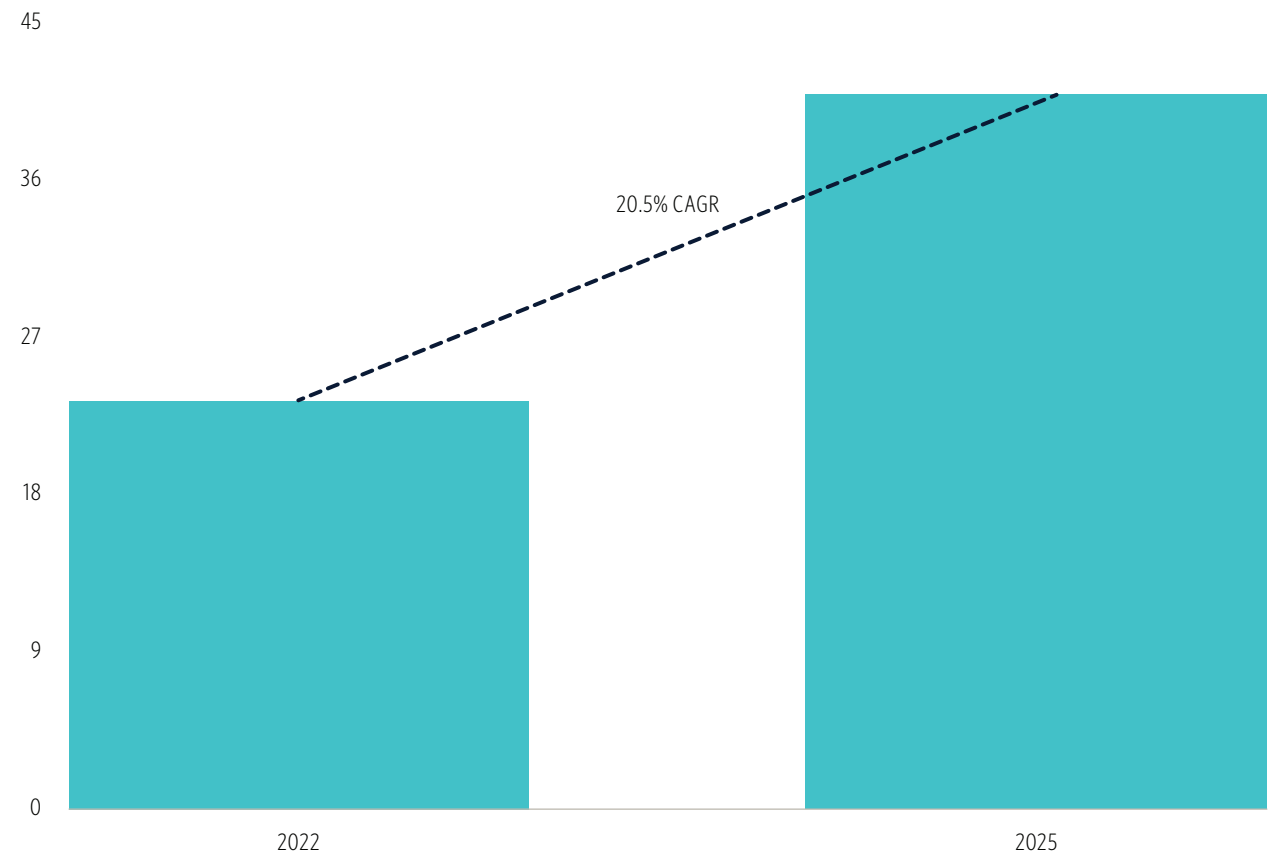
20.5% CAGR

Source: PitchBook Emerging Tech Research estimates, IDC | Geography: Global | *As of December 31, 2022

5: "Worldwide Intelligent Process Automation Software Forecast, 2022-2026," IDC, Maureen Fleming, September 22, 2022.

Market direction

Imitation learning techniques can disrupt the $23.3 billion IPA market. The IPA market has evolved from the conventional robotic process automation market to incorporate processing mining and task mining. The latter two product types track user processes to automate common workflows. Incorporation of machine learning into these products remains limited, with high latency for updating predictive models. General-purpose AI models may be able to apply inferences from foundation models, thus incorporating imitation learning to replicate human actions in near-real-time across a wide domain. Incumbents may find themselves behind in the application of state-of-the-art AI techniques to IPA.

Robotic process automation incumbents use M&A to enhance their AI capabilities for process mining. Over the past two years, process mining acquisitions have been made by Automation Anywhere (acquiring FortressIQ), Appian (acquiring Lana Labs), Pegasystems (acquiring Everflow), Microsoft (acquiring Minit), and UIPath (acquiring Re:Infer). All of these acquirers are among the leaders in robotic process automation. Process mining can benefit from streaming analytics of event data from applications. Process mining remains a small market under $1 billion as a standalone product, yet it is growing quickly and can support new startups as well as growth opportunities for legacy RPA vendors.

Key recent process mining acquisitions*

Company	Close date	AI-enabled?	Acquirer
Re:infer	July 29, 2022	Yes	UIPath
Everflow	May 24, 2022	Yes	Pegasystems
Minit	March 28, 2022	Yes	Microsoft
FortressIQ	December 23, 2021	Yes	Automation Anywhere
Lana Labs	August 11, 2021	Yes	Appian
Process Gold	October 15, 2019	No	UIPath

Source: PitchBook | Geography: Global | *As of December 31, 2022

Trending startups

In Q4, Vic.ai raised a $52.0 million Series C to bring AI to accounts payable automation. The round did not carry a significant valuation step-up, but it showed that AI startups can raise large rounds outside of generative AI. The company addresses the well-established category of invoice processing with advanced computer vision algorithms, displacing the optical character recognition (OCR) technologies used by legacy RPA vendors.

At the early stage, Roots Automation raised a $10.0 million Series A to develop an alternative to robotic process automation. The company has found an early product-market fit in the insurance industry for claims management. Also in Q4, Salesforce invested in AI process mining startup Apromore. The startup finds patterns in Salesforce event logs. Salesforce corporate investment has proven to be a force multiplier for startups given the company's marketplace, suggesting that the startup may have commercial traction ahead of it.

Key recent intelligent process automation VC deals*

Company	Close date (2022)	Deal value ($M)	Valuation step-up (post to pre)
Vic.ai	December 13	$52.0	1.1x
Roots Automation	November 1	$10.0	1.6x
Xembly	October 4	$15.0	1.9x
Fairmarkit	September 1	$36.0	1.6x
SKAEL	February 3	$37.9	16.4x
Element5	May 3	$30.0	2.2x
SuperOps	January 6	$13.8	3.0x

Source: PitchBook | Geography: Global | *As of December 31, 2022

Select company highlights

Founded
2013

4,860 employees
in 25
offices globally

Total raised:
$3.5B

Leader in Gartner Magic
Quadrant for Data Science and
Machine Learning Platforms

Last financing valuation:
$38.0B

Last financing:
Raised $1.6B in a Series H

Lead investors:
Counterpoint Global,
Franklin Templeton
Investments, Andreessen
Horowitz, NEA

Overview

Founded in 2013, Databricks offers a data science platform that includes AI-as-a-service (AIaaS) functionality with a suite of data science tools for data engineering, data warehousing, and ML algorithms. The company grew out of the open-source Apache Spark data science community and created an extensible Unified Data Analytics Platform that can ingest data from enterprise silos and prepare it for cluster-based computing. Once an effective open-source product was in place, the company moved to a closed-source model and rapidly increased revenue beginning in 2016.

Databricks now offers a product suite on top of Apache Spark that includes notebooks for ML model collaboration, a data lake, which integrates unstructured data in a central database for analytics, and data security. In Q3 2022, the company acquired revenue intelligence startup DataJoy, which raised a $6.0 million seed round in 2021. DataJoy uses ML to correlate unstructured data from across revenue operations stacks, including customer relationship management, marketing automation, and spreadsheets. The company also recently announced support for model serving within its data lake, alleviating the need for users to export files in order to train models.

Leadership

Databricks' management has high technical expertise capable of generating product-led growth in addition to increasing public company experience. The company was founded by seven early contributors to Apache Spark, and all the cofounders remain at the company. CEO and co-founder Ali Ghodsi earned a Ph.D. in distributed computing and was VP of engineering before being promoted to CEO at the start of the company's growth phase in 2016. CFO Dave Conte previously took Splunk public in the same role, which suggests Databricks' accounts will be ready for scrutiny by public markets. The board features co-founders and VC investors, including Andreessen Horowitz co-founder Ben Horowitz. In Q2 2022, Databricks hired the general counsel from DocuSign, which will provide public company experience as Databricks pursues a public listing.

Competitors

Databricks stands out in the AI & ML market by supporting machine learning operations (MLOps) atop its data lake, a functionality that distinguishes it from legacy vendors such as SAP, Microsoft, and AWS, while also being more AI-oriented than next-generation data warehouse vendor Snowflake. Because of its ability to support batch processing for ML analytics and other high-value

workloads, Databricks is capturing market share from incumbents such as Alteryx, IBM, Oracle, and SAS. Databricks runs on Microsoft Azure and AWS, although those hyperscalers would likely prefer to natively support their ML workflows and may improve their offerings in the future. The company gains market credit for scaling ML model deployment and management across a variety of compute clusters—a critical problem for data scientists new to ML.

Outlook

Databricks has achieved the necessary scale and growth to realize high performance in public markets. In Q3 2022, the CEO disclosed $1 billion in annual recurring revenue. The company has cut its internal valuation by 10%, according to Ghodsi, suggesting that its valuation is staying relatively resilient as well.[6] The company will need to defend itself against ML-optimized challengers that can carry out more efficient streaming data analysis and in-memory analytics within its database. Furthermore, it will benefit from analytics built on its database becoming essential to high-value industries, including IT and industrial. The company remains innovative and active in future-proofing its business, leading us to believe that, in the long run, Databricks will be valued more highly than relational database incumbents based on the growth opportunities of data lake architecture for streaming data.

6: "What is data management company Databricks really worth?" Fortune, March 8, 2023.

Financing history

Series C	Series D	Series E	Series F	Series G	Series H
December 15, 2016	August 22, 2017	February 5, 2019	October 22, 2019	February 1, 2021	October 7, 2021
Total raised: $60.0M	**Total raised:** $140.0M	**Total raised:** $250.0M	**Total raised:** $400.0M	**Total raised:** $1.0B	**Total raised:** $1.6B
Pre-money valuation: $453.0M	**Pre-money valuation:** $800.0M	**Pre-money valuation:** $2.5B	**Pre-money valuation:** $5.8B	**Pre-money valuation:** $27.0B	**Pre-money valuation:** $36.4B
Investor: NEA	**Investor:** Andreessen Horowitz	**Investor:** Andreessen Horowitz	**Investor:** Andreessen Horowitz	**Investor:** Franklin Templeton Investments	**Investor:** Counterpoint Global

DataRobot
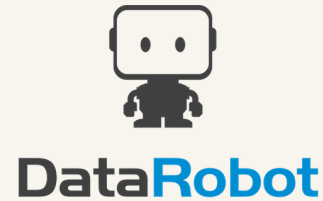
Founded
2012

1,265 employees
in 8
offices globally

Total raised:
$1.1B

March 2021 Visionary in
Gartner Magic Quadrant for
Data Science and Machine
Learning Platforms

Last financing valuation:
$6.3B

Last financing:
Raised $300.0M
in a Series G

Lead investors:
Tiger Global Management,
Altimeter Capital
Management, Sapphire
Ventures, Meritech Capital
Partners, NEA

Overview

DataRobot's Enterprise AI platform offers end-to-end automated machine learning (autoML) tooling, including data preparation, model development, security, and monitoring. The platform is designed for data scientists, software developers, operations teams, business line users, and executives. The platform can train and deploy models across cloud, on-premises, and hybrid production environments. Recent acquisitions in ML deployment (Algorithmia), autoML (Zeff), model management (ParallelM), data visualization (Zepl), and data preparation (Paxata and Zeff) have been integrated to create a data science platform that can compete with hyperscalers.

According to management, the company reached $210.0 million in revenue in 2022.[7] We believe that its revenue growth in 2022 lags behind high-growth expectations, as we estimate the company is growing between 20% and 25%. AutoML has yet to become a large market relative to other enterprise software categories, which potentially constrains DataRobot's achievable scale. Furthermore, the company competes with open-source frameworks, internal data science teams, and hyperscaler cloud platforms. Under new leadership, the company is deepening its relationships with hyperscalers, which included an integration with Google Cloud on data analytics service BigQuery early in Q4 2022.

7: "How DataRobot Hit $210M Revenue with 850 Customers in 2022," GetLatka, 2022.

Leadership

DataRobot has turned over its leadership team as a result of missed revenue results and abuse of stock-based compensation plans. Employees complained of premature stock sales, cronyism, and bloated administrative spending, pushing then-CEO Dan Wright out the door early in Q3 2022. The CFO, Chief Go-To-Market Officer, Chief Product Officer, and Chief People Officer also left. After Wright's departure, the company promoted President and COO Debanjan Saha to interim CEO. Saha formerly managed sales and operations for AWS cloud services and Google's data analytics, preparing him to address customer needs. We believe the company will shift its product strategy from providing a universal platform to providing a suite of cloud-based services under Saha's leadership. The company may also achieve better relationships with cloud providers and superior go-to-market motions. A search for a permanent successor to Wright remains underway.

Competitors

Due to its breadth of features, as well as its best-in-class augmented analytics for nonspecialist users, DataRobot has emerged as a leader in the burgeoning autoML market. Smaller competitors such as H2O.ai lack the MLOps functionality to manage model deployment. Larger competitors,

including Alteryx, Microsoft, and Google, lack the flexibility to customize models across open-source frameworks and production environments. Relative to hyperscalers, DataRobot offers a superior user experience and support for diverse organizational use cases.

Outlook

DataRobot must make strategic choices after missing revenue targets and losing leadership due to stock-based compensation scandals. The company's platform faces competitive pressure from multiple directions and enterprise customers that are wary of shifting all of their valuable data into a separate cloud platform. The valuable components of the platform, including data annotation, MLOps, model search, compliance automation, and model explainability, can be unbundled and integrated with existing systems of record. An open ecosystem approach can build stronger partnerships within the ecosystem and lead to faster sales cycles with opportunities for upselling. We believe that hyperscaler and legacy AI platform partners can benefit from the user experience innovations that DataRobot has brought to market and the leading MLOps assets the company has acquired in Algorithmia and Zeff. As it's currently positioned, the company may be a more likely takeover candidate for PE than an independently large company.

Financing history

Series B	Series C	Series D	Series E	Series F	Series G
June 1, 2016	November 3, 2017	October 25, 2018	September 17, 2019	December 9, 2020	October 7, 2021
Total raised: $33.0M	**Total raised:** $68.0M	**Total raised:** $100.0M	**Total raised:** $206.0M	**Total raised:** $371.0M	**Total raised:** $300.0M
Pre-money valuation: $89.0M	**Pre-money valuation:** $215.0M	**Pre-money valuation:** $625.0M	**Pre-money valuation:** $1.1B	**Pre-money valuation:** $2.5B	**Pre-money valuation:** $6.1B
Investor: NEA	**Investor:** NEA	**Investors:** Meritech Capital Partners, Sapphire Ventures	**Investor:** Sapphire Ventures	**Investor:** Altimeter Capital Management	**Investors:** Altimeter Capital Management, Tiger Global Management

About PitchBook Emerging Tech Research

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Our Emerging Tech Research provides detailed analysis of nascent tech sectors so you can better navigate the changing markets you operate in—and pursue new opportunities with confidence.

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