OpenAI: Overview

September 2025

FOR EVERYONE

OpenAI offers generative AI services to individuals on a free and subscription basis. Free offerings include limited access to the flagship ChatGPT-5 and lesser models, while subscription offerings include extended access to more advanced GPT versions and features, increased message capacity, DALL·E image generation, and limited access to Sora video generation.

FOR BUSINESS

OpenAI offers generative AI services to organizations with small to moderate sized teams looking to supercharge their work through the integration of generative AI tools in a collaborative projects and workflows with administrative controls. These work-centered features assist teams with generating code, crafting emails, analyzing data, and brainstorming ideas, among other things.

FOR ENTERPRISES

OpenAI offers generative AI services to large organizations seeking to enable their entire workforce with generative AI tools like GPT-5, DALL·E, web browsing, and data analysis, but which require admin controls, domain verification and other security protocols, customization, scalability, analytics, and a dedicated account team for support.

FOR DEVELOPERS

OpenAI's developer plan provides robust tools, APIs, and frameworks that enable developers to build, deploy, and scale AI applications. It includes access to flagship models (e.g., GPT-5) via its API, support for agentic and tool-integrated workflows, enterprise security features, and continuous updates to reduce costs and improve usability. The plan aims to make AI development more accessible, powerful, and commercially viable for individuals and organizations.

MODELS

ChatGPT

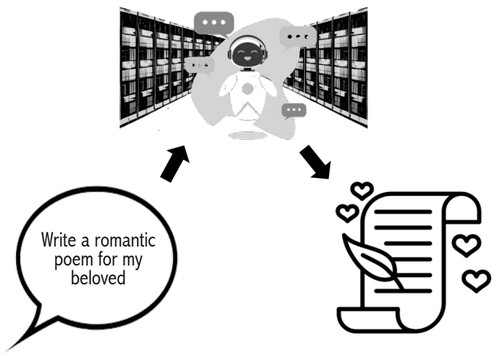
Additional Non-Flagship Models

DALL·E

sora

OpenAI Codex

Text to Text



TTS (text-to-speech)

Embeddings

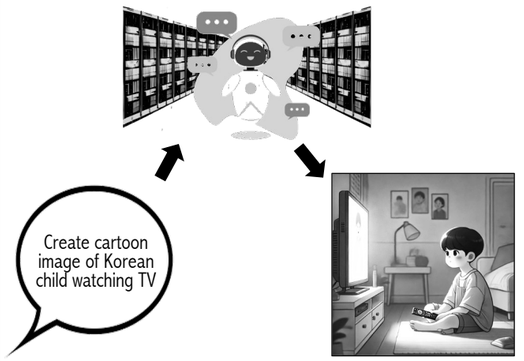
Moderation

Deep Research

Whisper

Deprecated

Text to Image



Text to Video

AI Coding Agent for Software Development

OpenAI: Ecosystem

OpenAI, Inc.
3180 18th Street, Suite 100
San Francisco, CA 94110
Website: openai.com

Outside Relationships (left)

Regulators | Capital | Suppliers | Customers

Key Subjects of Regulation

Intellectual Property ((1) regulation for the creation, promotion, utilization and protection of intellectual property, including the registration, protection, and prevention of infringement of intellectual property rights, such as patents, trademarks, copyrights and designs and (2) because generative AI can create content that may infringe on IP rights of third parties, OpenAI must navigate laws related to copyright, trademarks, and patents or obtain licenses from third parties to ensure its content does not violate existing IP rights)

Privacy and Data Protection Regulators (regulation governing the collection, use, sharing, protection, and retention of personal data, data localization, and cybersecurity)

Risk-Based AI Regulation (obligations on companies providing, distributing, importing, or using AI systems and general-purpose AI models in the European Union)

Prohibitions: AI applications that exploit human vulnerabilities and untargeted scraping of facial images from internet/CCTV footage for facial recognition databases

General Purpose AI Requirements: transparency, vetting, and risk mitigation obligations on developers of foundational general purpose AI models to safeguard against generating illegal content, including the obligation to inform AI system users if the system generates deepfakes or uses emotion recognition or biometric categorization systems

High Risk AI Requirements: for systems used in biometric identification, credit assessments, critical infrastructure management, and employment decisions, strict requirements (risk management, data governance, event logging, human oversight, public database registration) due to potential impact on human rights and safety

California AI law (1) requires deep fakes, (2) requires transparency in training data, (3) protects digital replicas, (4) expands privacy and disclosure rules in healthcare, and (5) requires large AI developers to publicly disclose how they plan to mitigate potentially "catastrophic risks" posed by advanced frontier AI models

Employment and Labor (regulation regarding rights and working conditions of workers, including working hours, equal opportunity, holidays, annual leave, wages, working environment, safety, serious injury reporting, and enforcement of anti-discriminatory laws in hiring, workplace practices and civil rights)

International Trade (regulation (1) imposing restrictions on the export of AI technologies due to national security concerns and (2) regarding international trade activities and sanctions (for example, ChatGPT is blocked in China by the government's firewall, and OpenAI has taken steps in the U.S. to block workarounds through the use of U.S. sourced tools and services))

Consumer Protection Laws (regulations (1) to ensure that products, including AI-generated content, are safe and not misleading, (2) requiring OpenAI to notify consumers that they are communicating with AI technology – robocalls/robotexts, (3) to prevent unfair, deceptive and fraudulent business practices, and (4) regarding enforcement of antitrust and fair-trade laws, and business combination/merger reviews and clearances)

Capital

Commercial Banks (OpenAI estimated trailing twelve-month revenue as of August 2025 is ~$13 billion; the company has not disclosed the financial institutions where it maintains its deposit accounts)

Bank — MIZUHO — JPMorganChase

(Mizuho Bank and JPMorgan Chase Bank (and their syndicates) have agreed to lend $10 billion and $2.3 billion, respectively, to OpenAI and its partners for the Project Stargate data center projects in Abilene, Texas)

Suppliers

Selected Categories of Supply

Cloud Computing

Microsoft (ChatGPT utilizes Microsoft Azure as one of its cloud infrastructure providers in exchange for Microsoft's initial $1 billion investment in OpenAI in 2019. This collaboration allows OpenAI to leverage Azure's computing power to train and deploy large-scale AI models like ChatGPT.) — Microsoft Azure

Oracle (ChatGPT has signed a $300 billion, 5-year contract for Oracle to supply compute infrastructure for OpenAI model training and inference workloads, requiring more than 4 gigawatts of electricity) — ORACLE Cloud Infrastructure

Social Media

Platform Owners (social media companies charge AI companies for access to their data)

reddit (In May 2024, OpenAI announced a partnership with the Reddit messaging company to bring its content to ChatGPT and other OpenAI products; Sam Altman is Reddit's third-largest outside shareholder)

News Media

News Media Organizations (publishers of physical and digital newspapers and periodicals)

NIKKEI (News Corp, the owner of the Wall Street Journal and Nikkei, the owner of Financial Times have established content licensing deals with OpenAI)

Payment Processing

Payment Processing Service Providers (OpenAI uses Stripe's financial infrastructure platform to power payments for the ChatGPT and DALL·E generative AI technologies; Stripe has also incorporated OpenAI's natural language technology/GPTs into its products and services; OpenAI CEO Sam Altman owns an unknown stake in Stripe.)

stripe

Processing Units

Customers

For Everyone Segment Customers

Individuals (those using OpenAI's free plan)

Individual Subscribers (those subscribed to OpenAI's Plus Plan for a monthly fee)

Software Licensees

Microsoft (under a license grant from OpenAI, Microsoft has unfettered access to OpenAI technology, research, and employees, including pre-AGI technologies; Microsoft's AI assistant Copilot, Windows 11 and Bing use OpenAI's models as a mix of GPT-4 and the newer GPT-5; recent reports indicate that Microsoft has also begun using models from other partners, such as Anthropic's Claude, for certain tasks like coding assistance in GitHub Copilot)

Microsoft — Copilot — Windows 11 — Bing

Apple (in June 2024, Apple announced it is integrating ChatGPT into experiences within iOS, iPadOS, and macOS, allowing users to access ChatGPT's capabilities—including image and document understanding—without needing to jump between tools)

iOS — iPadOS — macOS

Other OpenAI Software Licensees (makers of third-party products and services, such as wearable devices like pins and necklaces, and question-and-answer websites have obtained licenses to use OpenAI software or APIs) — Limitless — humane — Quora — Poe

Flows (left side)

- Business Regulation (intellectual property, data protection, AI systems, labor and employment, international trade, and consumer protection)
- Banking and Lending Services (deposit accounts, payment services, commercial cards, working capital financing)
- Licensing of Content for Training Purposes, and Sales of Processors and Cloud Computing Services
- Sales of (1) Paid "For Everyone" Plan Subscriptions and (2) Licenses to Use OpenAI Technologies at No Charge
- Licenses to Use OpenAI's Suite of Technologies

AI Chip Makers (Sam Altman has said the pace of AI progress may be dependent on new chip designs and supply chains; accordingly, OpenAI is (1) designing its own AI chips in-house and plans to begin mass production in 2026. The company is collaborating with Broadcom on the design, and the chips will be manufactured by Taiwan Semiconductor Manufacturing Company (TSMC) and (2) signed agreements with NVIDIA and AMD for GPUs and networking gear requiring 10 GW of power to support OpenAI's buildout of AI data centers) — BROADCOM — tsmc

Images — Image Owners (organizations who own databases of digital images and license their images to OpenAI for purposes of training its DALL·E models, including creative common licenses) — multimedia commons — 100M+ — shutterstock — Wikipedia

(Hosted by Amazon, YFCC100M is the largest publicly and freely usable multimedia collection, containing the metadata of around 99.2 million photos and 0.8 million videos from Flickr, all of which were shared under one of the various Creative Commons licenses.)

Speech — User-Generated Speech (Whisper, OpenAI's automatic speech recognition model, is trained on 680,000 hours of multilingual and multitask supervised data collected from the web)

OpenAI, Inc. (a Delaware corporation)

Governance

Board of Directors

- Bret Taylor (Chair)
- Sam Altman
- Adam D'Angelo
- Dr. Sue Desmond-Hellmann
- Zico Kolter
- Paul M. Nakasone
- Adebayo Ogunlesi
- Nicole Seligman
- Larry Summers

Executive Leadership

- CEO: Sam Altman
- President: Greg Brockman
- Chief Scientist: Jakub Pachocki
- COO: Brad Lightcap
- CFO: Sarah Friar
- Chief Product Officer: Kevin Weil
- Chief People Officer: Julia Villagra
- Chief Research Officer: Mark Chen
- Chief Compliance Officer: Scott Schools
- Chief Global Affairs Officer: Chris Lehane
- Chief Economist: Aaron Chatterji
- CEO of Applications: Fidji Simo

Corporate Matters

Finance and Accounting: Accounting; Tax; Financial Planning & Analysis; Capital Raising; Treasury; Form 990 Financial and Information Reporting

Human Resources: Talent Acquisition, Development, Management, and Retention; Compensation and Benefits; Employee Engagement and Culture; Organizational Planning

Legal: Legislative and Regulatory Affairs; Litigation Management; Privacy; Corporate Governance; Intellectual Property Management and Licensing

Science and Research: Human-Computer Interaction (including user-friendly interface); Data Science; Machine Learning; Deep Learning; Data Engineering; Big Data; Safety Research (from (1) interpretability to real life from human feedback to (2) policy and societal impacts analysis)

IT Infrastructure Management: Kubernetes (allows OpenAI to efficiently manage its IT infrastructure and scale up to 4,000 nodes across multiple cloud providers when needed); Dynamic Scaling; Security and Compliance; Cloud Computing Services (OpenAI's servers are distributed globally on the Microsoft Azure platform and Oracle's Cloud Infrastructure, among others); Predictive Analytics/AI Algorithms (based on usage patterns and workloads); Technical Support

Technology: Robotics/Autonomous Systems; Natural Language Processing; Computer Vision; Speech Synthesis & Recognition; Creative AI; Simulation and Gaming; Inferencing (model application, input processing, output generation, real time/batch processing, evaluation, and fine-tuning); Generative Adversarial Networks

Communications: Community & Audience Development (including talent partnerships/relationships with celebrities, artists, key industry influencers, thought leaders, and strategic partners to keep influential voices energized and connected to OpenAI); Corporate and Employee Communications; External Communications and PR/Media Relations; Product, Go-to-Market and Research Communications (includes design and external-facing functions); Partnership Communications; Government Relations and Public Policy Communications

Product Development: ChatGPT (text to text); DALL·E (text to image); Sora (text to video); Additional Non-Flagship Models (TTS, whisper, embeddings, moderation, deprecated); Codex (translates natural language into code); API Integration (APIs enable developers to integrate OpenAI's models into the developer's own applications, websites, or services); Form Factor (web based and mobile versions of models); Plug-ins/Apps

Sales and Marketing: Pricing (free and paid plans based on customer, usage, and offerings); Chatbot-Based Customer Service; Digital Marketing (blog posts, social media, etc.); Influencers, Thought Leaders, and Joint Webinars; Search Engine Optimization (SEO) Strategy

Data Center Projects: Strategic Planning & Feasibility (IT load requirements, site selection, electrical power and cooling water supplies, natural disaster risk, zoning and environmental regulatory compliance); Design/Engineering (growth planning with scalable, modular layouts, energy efficient power and cooling systems with redundancy, physical (access controls, surveillance) and digital (firewalls, intrusion detection) security); Construction and Commissioning (facility construction, systems installation, integrated systems testing and real-world conditions simulations, commissioning); Operations and Management (monitor capacity, regular and predictive maintenance, security audits, disaster recovery planning, DCIM software for real-time visibility, energy tracking)

Business Structure

Not-for-Profit Business (OpenAI, Inc.) — OpenAI, Inc.'s mission: to ensure that artificial general intelligence benefits all of humanity. The organization aims to develop and promote friendly AI in a way that is safe and aligns with human values, fostering collaboration and transparency in AI research and applications.

Capped-for-Profit Business (OpenAI Global, LLC) — Structured to balance financial sustainability with its mission to benefit humanity. These entities allow for investment and profit generation while placing a limit on returns for investors. This model ensures that a significant portion of any financial success is reinvested into research and initiatives that advance AI safety and accessibility, aligning profit motives with broader social impact.

Open AI Startup Capital Funds — OpenAI Startup Fund

OpenAI-branded venture capital funds invest in "big idea" early-stage startup companies focusing on areas where artificial intelligence can significantly enhance productivity, including healthcare, law, education, energy, and infrastructure. External companies invest in the funds, which are managed by Ian Clay Reid Hathaway (previously Sam Altman). OpenAI does not invest in these funds. However, the funds' investments align with OpenAI's mission and target companies that can enhance the OpenAI ecosystem, including those involved in AI engineering, design, research, and product development.

Sam Altman Family Office/Venture Capital Funds

Sam Altman's personal investment activities are managed through various funds and his direct angel investments, most notably through Hydrazine Capital, a venture capital fund he co-founded with his brother. He has also established Apollo Projects for "moonshot" companies. His portfolio is vast and strategic, with a focus on high-impact, long-term technologies. Major investments include a significant stake in Reddit, where he was a former board member; Helion Energy, a nuclear fusion startup he chairs; and Helion Energy's competitor Oklo which he also chaired until April 2025. He is also a notable investor in pioneering companies like Stripe and Airbnb, and has backed numerous AI and biotechnology startups, including Worldcoin and Retro Biosciences.

reddit — airbnb — HELION — stripe — WORLDCOIN — OKLO — Retro BIOSCIENCES

Operations

For Everyone — OpenAI offers generative AI services to individuals on a free and subscription basis. Free offerings include limited access to the flagship ChatGPT-5 and lesser models, while subscription offerings include extended access to more advanced GPT versions and features, increased message capacity, DALL·E image generation, and limited access to Sora video generation.

Offerings:
- Free Plan: Access to GPT-5 (subject to volume limits) Lesser Models, and Custom GPTs; Assistance with writing, problem solving, research, and brainstorming; Real-time data from the web with search; Limited access to file uploads, data analysis, image generation, and voice mode
- Plus Plan ($20/month): All features available in the Free Plan; DALL·E image generation; Extended access to GPT-5 messaging, file uploads, data analysis, ChatGPT agent access & research preview of Codex agent; Limited access to Sora video generation; Standard & advanced voice mode with video and screen-sharing
- Pro Plan ($200/month): All features available in the Plus Plan; Unlimited access to GPT-5 and access to GPT-5 Pro; Access to OpenAI o3-pro; Extended access to ChatGPT agent; Extended access to Sora video generation; Unlimited access to advanced voice, with higher limits for video & screen-sharing

For Business (also referred to as Teams) — OpenAI offers generative AI services to organizations with small to moderate sized teams looking to supercharge their work through the integration of generative AI tools in a collaborative projects and workflows with administrative controls. Their work-centered features assist teams with generating code, crafting emails, analyzing data, and brainstorming ideas, among other things.

Offerings — Team Plan ($25/month per user, billed annually; or $30 per user / month, billed monthly): Admin console for workspace management; unified billing (centralized management of GPT-based work products and plan use); Create and share GPTs in a secure dedicated space; Access to Codex & ChatGPT agent for reasoning & taking action across your codebase, tools, and codebases; Team data excluded from training by default (i.e., GPT-based product by the team is not used to train GPT models); Unlimited GPT-5 messages, with generous access to GPT-5 thinking, access to GPT-5 pro — plus the flexibility to add credits as needed, tools like DALL·E, web browsing, & data analysis; Compliance support with European General Data Protection Regulation, the California Consumer Privacy Act, and other privacy laws; Connect to apps for more personalized answers – Google Drive, SharePoint, GitHub, Notion; Business features like data analysis, record mode, canvas, projects, tasks, custom workspace GPTs, & deep research

Selected Organizations Using OpenAI's Business/Teams Plan: asana — shopify — Klarna. — RIOT GAMES — zendesk

For Enterprises — OpenAI offers generative AI services to large organizations seeking to enable their entire workforce with generative AI tools like GPT-5, DALL·E, web browsing, and data analysis, but which require admin controls, domain verification and other security protocols, customization, scalability, analytics, and a dedicated account team for support.

Offerings — Enterprise Plan (variable pricing based on the number of seats, usage, and enterprise requirements, with volume discounts, invoicing and ACH billing, and support for unlimited users): Includes all features available in the Business Plan, with an expanded context window that supports longer inputs and larger files; Unlimited, high-speed access to the most powerful models, and expanded context window for processing much longer inputs and files; Enterprise-level security and controls, including user analytics, domain verification, and role-based access controls; advanced data privacy with custom data retention policies, encryption at rest and in transit; Team data excluded from training by default (i.e., GPT-based work product by the team is not used to train GPT models); Dedicated 24/7 priority support, service level agreements, custom legal terms, and access to AI advisors for eligible customers, support for data residency in seven regions; usage analytics, and credits for API usage; Dedicated admin consoles for large-scale deployment (centralized management of GPT-based work products and plan use)

Selected Organizations Using OpenAI's Enterprise Plan: BCG — Genmab — Gates Foundation — ESTĒE LAUDER — Virgin — BAIN & COMPANY — OXFORD — pwc — AMGEN — target — BBVA — moderna — Lowe's — TEXAS

For Developers — OpenAI's developer plan provides robust tools, APIs, and frameworks that enable developers to build, deploy, and scale AI applications. It includes access to flagship models (e.g., GPT-5) via its API, support for agentic and tool-integrated workflows, enterprise security features, and continuous updates to reduce costs and improve usability. The plan aims to make AI development more accessible, powerful, and commercially viable for individuals and organizations.

Offerings — Developers Plan (pay-as-you-go based on token usage; rates vary depending on the model used):
- GPT-5 (Input: $1.25 | Output: $10.00 per 1M tokens) — The best model for coding and agentic tasks across industries — Text & vision; Reasoning capabilities; Support for all built-in tools; 400k context length | 128k max output tokens
- GPT-5 mini (Input: $0.25 | Output: $2.00 per 1M tokens) — A faster, cheaper version of GPT-5 for well-defined tasks — Text & vision; Reasoning capabilities; Support for all built-in tools; 400k context length | 128k max output tokens
- GPT-5 nano (Input: $0.05 | Output: $0.40 per 1M tokens) — The fastest, cheapest version of GPT-5—great for summarization and classification tasks — Text & vision; Reasoning capabilities; Support for all built-in tools; 400k context length | 128k max output tokens

Selected Organizations Using OpenAI's Developers Plan: salesforce — SUPERHUMAN — Harvey. — JETBRAINS — Healthify — Klarna — oscar — duolingo — Morgan Stanley

Models

ChatGPT — ChatGPT is an advanced AI language model capable of understanding and generating human-like text based on the input it receives. OpenAI has undergone a series of significant model and version updates, with its current flagship being the powerful and unified multimodal system, GPT-5, which was released in August 2025. Older models like GPT-4, GPT-4o, and GPT-3.5 are still available but are being phased out or used for specialized tasks. These models are accessible to developers and businesses via a flexible API.

Frontier Models — OpenAI's most advanced models, recommended for most tasks:
- GPT-5: Flagship model for coding, reasoning, and agentic tasks across domains
- GPT-5 nano: Fastest, cheapest version of GPT-5 for summarization and classification tasks.
- GPT-5 mini: A faster, more cost-efficient version of GPT-5 for well-defined tasks and precise prompts.
- GPT-4.1: Excels at instruction following and tool calling, with broad knowledge across domains.

Additional Non-Flagship Models — OpenAI offers several other non-flagship API models with a diverse set of capabilities and price points. These models can also be customized for a user's specific case with fine-tuning tools.
- Text-To-Speech (a set of models that can convert text into natural sounding spoken audio, with options optimized for speed and quality)
- Whisper (a general-purpose speech recognition model that can convert a wide range of audio into text)
- Embeddings (a set of models that can convert text into a numerical form that can measure relatedness between two pieces of text)
- Moderation (a fine-tuned model that can detect whether text and images may be sensitive or unsafe)
- Deep Research (model for deep research, designed to tackle complex, multi-step research tasks)
- Deprecated (a full list of models that have been deprecated along with suggested replacement)

DALL·E — DALL·E, a fusion of Salvador Dalí and Pixar's Wall-E, generates detailed, creative images from text descriptions, combining various concepts, attributes, and styles. It can create entirely new visual content, including scenes, objects, and characters, by interpreting and synthesizing the input it receives. The latest iteration is DALL·E 3. DALL·E is integrated directly into ChatGPT, allowing users to create images as part of their conversations with the language model. It is available to paying users of ChatGPT Plus and ChatGPT Enterprise, as well as via an API for developers who want to build applications on top of OpenAI's technology.
- DALL·E 3 (most recent model that creates images from natural language prompts; it understands significantly more nuance and detail than previous systems and is built natively on ChatGPT for users in the Plus, Pro, and Enterprise tiers)
- DALL·E 2 (previous model released in November 2022 that supports the ability to edit an existing image or create variations of a user-provided image; the 2022 model provides more realistic, accurate, and 4x greater resolution images than the original model; DALL·E 2 is being phased out and is no longer available to new users/subscribers)

sora — Pricing: Included in ChatGPT Plus & Pro — Sora is a video generation model capable of creating videos from text, images, and videos; it allows users to generate content in various formats and resolutions, enhancing creative storytelling.

OpenAI Codex — Pricing: Included in ChatGPT Pro and Enterprise — Codex is a cloud-based AI agent for software development tasks with a coding agent, translating natural language into code; Codex can write code, answer codebase questions, fix bugs, review code, and propose pull requests for review, all within a secure cloud sandbox preloaded with a user's repository.

Competition

Copilot (Owned by Microsoft) — Claude (Owned by ANTHROPIC) — LLaMA by Meta (Backed by Mark Zuckerberg) — amazon — aws — Gemini (Owned by Google) — NVIDIA — perplexity (Backed by Daniel Gross, Jeff Bezos and Others) — SoftBank — YOU (Backed by Richard Socher, Mark Benioff and Others) — Poe — RADICAL — Quora — salesforce ventures — Grok (Owned by xAI and Backed by Elon Musk) — xAI

Customer segments (bottom)

- Sales of Small- and Mid-Size Business Plan Subscriptions → **For Teams Segment Customers**: Nonprofit Organizations; Moderate Businesses and their Teams; Small Businesses and their Teams
- Sales of Enterprise Plan Subscriptions → **For Enterprises Segment Customers**: Large Organizations; Universities; Non-Profit Organizations

Outside Relationships (right)

Customers | Suppliers | Capital | Regulators

Flows (right side)

- Business Regulation (securities offerings, business entity governance, and taxation)
- Equity Capital
- Capped Returns
- Professional Services
- Funding and Logistical Support for Charitable Initiatives and Organizations
- Sales of Developer Plan Subscriptions
- Project Stargate Initiative (Project Stargate seeks to create a total of 10 gigawatts of AI data center capacity to support OpenAI's next-generation AI models)

Customers

Developers (developers leverage OpenAI's developer plan (API, tools, models) to build and deploy intelligent applications across domains—e.g., law and healthcare; common uses include (1) conversational agents and chatbots, (2) content generation (summaries, articles, marketing copy), (3) semantic search, question answering, and knowledge retrieval, (4) code generation, assistance, (5) automating workflows and (6) integrating AI into business systems)

Suppliers

Professional Service Firms

Deloitte & Touche (audit services for the OpenAI Startup Capital Funds) — Deloitte.

Area 17 (assisted OpenAI in crafting a refreshed virtual identity and website to engage users; post its free and commercial products, and demonstrate its commitment to safety) — AREA 17

The Software Alliance; and DLA Piper (lobbying services) — BSA — DLA PIPER

Key Law Firms (legal services) — HARRISON FORESTER (copyright litigation) — LATHAM & WATKINS (copyright litigation) — quinn emanuel (trademark infringement litigation) — Cooley (copyright litigation) — WACHTELL LIPTON ROSEN & KATZ (high profile corporate matters)

Recipients of Philanthropic Support

Charitable Initiatives (comprehensive basic income studies, economic impact research, and education-centered programs such as OpenAI scholars)

Public Charities Focused on Technology, Economic Impact, and Justice (Stanford University Artificial Intelligence Index Fund, Black Girls Code, and the ACLU Foundation) — DONATE — HAI — BLACK GIRLS CODE — ACLU

Capital

Significant Financial Contributors

For-Profit: Microsoft ($14 billion investment; 49% stake in the for-profit subsidiary, OpenAI LP) — Microsoft

Later Stage Investors: Thrive Capital, Sequoia Capital, Andreessen Horowitz, K2 Global, Prince Alwaleed bin Talal, Dragoneer Investment Group — THRIVE CAPITAL — K2 — SEQUOIA — andreessen horowitz — DRAGONEER

Sam Altman (Altman does not own a stake in the OpenAI capped for-profit company)

Non-Profit: Early-Stage Contributors: Khosla Ventures, Infosys, AWS, Reid Hoffman, Peter Thiel, Elon Musk, Jessica Livingston/Y Combinator (December 2015) — khosla ventures — Infosys — aws — Y Combinator

Project Stargate Consortium (through a large-scale, $500 billion initiative called Project Stargate, OpenAI—in partnership with Oracle, MGX and SoftBank—is actively involved in building its own AI infrastructure, including data centers and power generation across Texas, New Mexico, and Ohio in the U.S. to meet the immense computing needs of its models)

OpenAI (operational leadership) — ORACLE (cloud infrastructure partner & investor) — SoftBank — MGX (investors) — NVIDIA (GPU chip/networking gear supplier and investor)

Regulators

Key Subjects of Regulation

U.S. Securities and Exchange Commission (SEC)

Exempt Offering: regulation of offers and sales of securities, including reliance on a private placement exemption by OpenAI's capped profit company and venture capital fund and the filing of Form D with the SEC

Investment Adviser Exemption: exemption from SEC registration under section 203(l) of the Investment Advisers Act of 1940 for advisers that provide advice solely with respect to "venture capital funds," including an "Exempt Reporting Adviser" filing on Form ADV

Investment Company Exclusion: reliance on reliance on exclusion from definition of "Investment Company" in Sections 3(a)(1)(A) as private investment vehicle for venture capital fund to avoid registration under Investment Company Act of 1940

Delaware Secretary of State (administration and enforcement of Delaware corporation, limited liability company and limited partnership law governing business entity formation and dissolution, owners, governance meetings, management duties, financial reporting, charter document amendments, mergers and reorganizations, and compliance penalties for non-compliance)

Taxation and Sanctions (regulation of corporate income, payroll, and withholding taxes, restricted party transactions regulation, anti-money laundering regulation, and economic sanctions) — IRS — HM Revenue & Customs — 국세청 — TAXUD

Key Company Data (as of September 2025)

Business Overview: Founded in 2015, San Francisco, California-based OpenAI is a leading artificial intelligence research organization dedicated to advancing AI for the benefit of humanity. Through groundbreaking research, OpenAI develops cutting-edge AI technologies in areas like natural language processing and robotics. OpenAI focuses on ensuring AI systems are safe, reliable, and ethically deployed across industries including healthcare and finance, aiming to democratize access to AI while addressing societal impact.

Capital

Capital Raising: Raising prodigious amounts of capital is critical for Altman's goal to create artificial general intelligence, which his company defines as autonomous systems that can out-perform humans at most economically viable tasks. Such technological leaps require huge volumes of data processed in warehouses outfitted with supercomputers using expensive, power-hungry chips.

Recent Valuation: $300 Billion — According to Tech Funding News, in August 2025, OpenAI secured $8.3 billion in its latest funding round. Dragoneer Investment Group invested $2.8 billion and attracted major other investors including Blackstone, TPG, T. Rowe Price, Andreessen Horowitz, Sequoia Capital, Tiger Global, and Thrive Capital.

Cost to Build GPT-5: $500 Million? (According to The Wall Street Journal, the cost of a single training run for OpenAI's next model can exceed $500 million.)

Resources and Developments

- Employees: 6,900 (August 2025)
- Headquarters: San Francisco, CA
- CEO Sam Altman Annual Salary: $65,000
- Mission: to ensure that artificial general intelligence benefits all of humanity
- Weekly Active Users: 780 million

Litigation: Since the launch of ChatGPT, DALL·E, and other OpenAI models, the company has faced a slew of legal complaints, threats and investigations from media companies and authors (copyright infringement), Elon Musk (alleges that a partnership between Apple and OpenAI harms competition), and wrongful death (alleges that ChatGPT provided dangerous information and encouragement to a teenage user that led to his suicide).

The New York Times — Authors Guild

September 2025

OpenAI: Supplement

September 2025

GLOSSARY

AGI: AGI, or Artificial General Intelligence, refers to a theoretical form of AI that possesses the ability to understand, learn, and apply knowledge across a wide range of tasks at a level comparable to human intelligence. Unlike narrow AI, which is specialized for specific tasks, AGI would be capable of generalizing knowledge and reasoning, allowing it to perform any intellectual task that a human can do.

AI: Refers to "artificial intelligence," which is the simulation of the human brain by machines or computer systems to enable problem solving. Specific applications of AI include expert systems, natural language processing, speech recognition, and machine vision.

AI Chatbot: An AI chatbot refers to a type of AI-powered program capable of generating written content from a user's input prompt. AI chatbots can write anything from a rap song to an essay upon a user's request. The extent of what each chatbot can write about depends on its capabilities, including whether it is connected to a search engine. At the user's command, AI chatbots can write code, compose emails, draft a report, generate art, write Excel formulas, and much more.

AI Writer: The main difference between an AI chatbot and an AI writer is the type of output they generate and their primary function.

In the past, an AI writer was used specifically to generate written content, such as articles, stories, or poetry, based on a given prompt or input. An AI writer outputs text that mimics human-like language and structure. On the other hand, an AI chatbot is designed to conduct real-time conversations with users in text or voice-based interactions. The primary function of an AI chatbot is to answer questions, provide recommendations, or even perform simple tasks, and its output is in the form of text-based conversations.

While the terms AI chatbot and AI writer are now used interchangeably by some, the original distinction was that an AI writer was used for generating static written content, while an AI chatbot was used for conversational purposes. However, with the introduction of more advanced AI technology, such as ChatGPT, the line between the two has become increasingly blurred. Many AI chatbots are now capable of generating text-based responses that mimic human-like language and structure, similar to an AI writer.

Algorithm: An AI algorithm refers to a mathematical model or set of computational rules that enables machines to learn from data, make predictions, or perform specific tasks. These algorithms can range from simple decision trees to complex neural networks, and they are foundational in areas like machine learning, natural language processing, and computer vision.

API: An API, or Application Programming Interface, is a set of rules and protocols that allows different software applications to communicate and interact with each other. It defines the methods and data formats that programs use to request and exchange information. APIs enable developers to integrate third-party services and functionalities into their applications without needing to understand the underlying code.

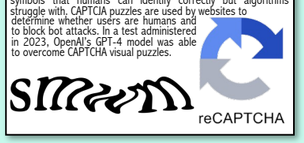
Selected examples of how APIs are used to facilitate communication between different software applications are:

- *Data Retrieval*: APIs allow applications to fetch data from external sources, such as weather information, financial data, or social media feeds.
- *Integration of Services*: APIs enable different services to work together, such as integrating payment gateways (e.g., PayPal, *Stripe) into e-commerce platforms.*
- *Accessing Functionality:* Applications can use APIs to access specific functionalities of other software, like sending emails through an email service API (e.g., Sendgrid).
- *Mobile and Web Applications:* APIs power mobile and web applications by allowing them to communicate with back-end servers for data processing and storage.
- *Automation:* APIs can automate workflows by connecting different applications. For example, an API can trigger an action in one application when a specific event occurs in another.
- *Third-party Services*: Many platforms offer APIs to allow developers to extend their services, such as integrating with customer relationship management (CRM(systems, analytics tools, or social media platforms.

Overall, APIs play a crucial role in enhancing interoperability, enabling developers to build more flexible, powerful, and interconnected applications.

Big Data: Big data refers to extremely large and complex datasets that cannot be easily managed, processed, or analyzed using traditional data processing tools. The processing of big data involves the use of advanced technologies and methodologies to capture, store, analyze, and derive insights from vast amounts of structured and unstructured data, often in real-time, to support decision-making and uncover trends.

CAPTCHA: CAPTCHA is the acronym for Completely Automated Public Turing test to tell Computers and Humans apart. They typically consist of a string of twisted letters or other visual symbols that humans can identify correctly but algorithms struggle with. CAPTCIA puzzles are used by websites to determine whether users are humans and to block bot attacks. In a test administered in 2023, OpenAI's GPT-4 model was able to overcome CAPTCHA visual puzzles.

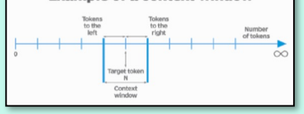


Chatbot: A chatbot is a software application designed to simulate conversation with human users, typically through text or voice interactions. Chatbots can be integrated into websites, messaging platforms, or mobile apps, and they utilize natural language processing (NLP) and artificial intelligence (AI) to understand and respond to user inquiries. They can provide information, assist with customer service, automate tasks, and enhance user engagement by offering instant responses and 24/7 availability. Chatbots vary in complexity, from simple rule-based systems to advanced AI-driven conversational agents, such as ChatGPT.

Cloud: Refers to servers that are accessed over the Internet, and the software and databases that run on those servers. Cloud servers are located in data centers all over the world. By using cloud computing, users and companies do not have to manage physical servers themselves or run software applications on their own machines.

Computer Vision: A field of artificial intelligence that enables computers to interpret and understand visual information from the world, such as images and videos. It involves developing algorithms and models that can analyze and make decisions based on visual input, facilitating tasks like object recognition, image classification, and scene understanding. By simulating human vision, computer vision applications are used in areas such as autonomous vehicles, facial recognition, and medical imaging.

Context Window: A context window refers to the amount of text or data that a language model, such as an LLM, can consider at once when generating or analyzing text. It defines the range of input that the model can use to understand the current situation, make predictions, or generate coherent responses. The size of the context window is typically measured in tokens, which can be words, parts of words, or symbols, and a larger context window allows the model to maintain a better understanding of long passages, complex instructions, or intricate conversations.



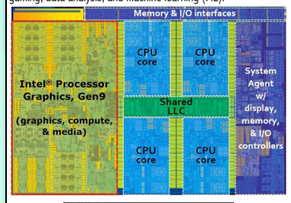
Copyright: Copyright is a legal protection granted to the creators of original works, including literary, musical, and artistic creations, giving them exclusive rights to use, distribute, and profit from their work. This protection typically lasts for a set period, after which the work enters the public domain, allowing others to use it freely. Copyright laws aim to balance the creator's rights with the public's interest in accessing and building upon creative works.

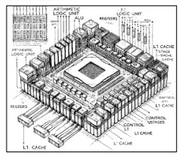
CPU: Refers to "central processing unit," which is a chip that functions as the brains of computing devices. Also called the central processor, main processor or processor, the CPU is made up of a set of electronic circuits that execute instructions comprising a computer program to perform basic arithmetic, logic, controlling, and I/O (input/output) operations specified in a computer program.

Creative AI: Creative AI refers to artificial intelligence systems designed to produce original and innovative content, such as art, music, writing, or design, by mimicking human creativity. These systems use machine learning algorithms, often trained on vast datasets, to generate new ideas, solve complex problems, and assist in creative processes. Creative AI has the potential to augment human creativity, offering new tools and perspectives in various artistic and creative fields.

Cybersecurity: Cybersecurity is the practice of protecting computers, networks, data, and systems from digital attacks, unauthorized access, damage, or theft. It involves implementing measures like firewalls, encryption, and intrusion detection systems, as well as educating users on safe practices, to safeguard sensitive information and ensure the integrity, confidentiality, and availability of digital assets.

Cores: Cores are individual processing units within a CPU or GPU that execute instructions. Each core can independently perform tasks, allowing for parallel processing and improved performance. More cores enable a chip to handle multiple tasks simultaneously, enhancing multitasking capabilities and overall efficiency. Cores are essential for running applications more quickly and efficiently, particularly in modern computing environments that require high processing power for tasks like gaming, data analysis, and machine learning (ML).



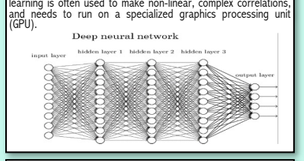


Data Engineering: Data engineering is the practice of designing, building, and maintaining the infrastructure and systems that enable the collection, storage, and processing of large volumes of data. It involves creating data pipelines, managing databases, and ensuring data is clean, accessible, and ready for analysis, supporting data scientists and analysts in their work to extract insights and make data-driven decisions.

Data Science: Data science is an interdisciplinary field that combines statistical analysis, machine learning, and domain expertise to extract insights and knowledge from structured and unstructured data. It involves collecting, processing, analyzing, and interpreting large datasets to inform decision-making and solve complex problems across various industries.

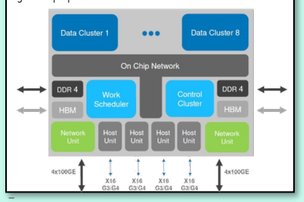
Deepfake: Deepfake technology uses artificial intelligence (AI) to create or manipulate audiovisual content, often replacing faces or voices in videos to make them appear authentic but are actually synthetic.

Deep Learning: A subset of machine learning, deep learning is a computer science approach where neural networks (1) are trained to recognize patters from massive amounts of data (in the form of images, sounds and text), often better than humans, and in turn (2) provide predictions in a production process. Deep learning is often used to make non-linear, complex correlations, and needs to run on a specialized graphics processing unit (GPU).

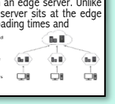


DevOps: DevOps is a set of practices that combines software development (Dev) and IT operations (Ops) to shorten the software development lifecycle and deliver high-quality software more reliably. It emphasizes collaboration, automation, continuous integration, and continuous delivery (CI/CD), enabling teams to deploy updates and new features quickly and efficiently while maintaining system stability.

DPU: Data Processing Unit, which is a programmable computer processor designed to efficiently handle data-centric workloads, such as data transfer, reduction, security, compression, analytics and encryption, at scale in data centers. A DPU tightly integrates a general-purpose CPU with network interface hardware.



Edge Server: Edge servers are servers that run the processing at an edge location. In a centralized network, client devices are connected to one server whose job is to process the information requested by the users and hand it back to them. While a centralized network is good enough to interact with simpler websites, companies have found that complex projects involving a great bank of customers work better with an edge server. Unlike a centralized network, because an edge server sits at the edge of a network, improves latency, reduces loading times and removes the load from the origin server. Instead of sending unprocessed data to the data center, edge servers process it themselves and send it back to the client machines.



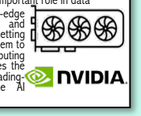
Fair Use Doctrine: The Fair Use Doctrine is a legal principle that allows limited use of copyrighted material without the owner's permission under certain circumstances. It typically applies to uses for purposes such as criticism, commentary, news reporting, teaching, scholarship, or research. Fair use is determined by considering factors like the purpose and character of the use, the nature of the copyrighted work, the amount used, and the effect on the market value of the original work. This doctrine seeks to balance the rights of creators with the need for freedom of expression and access to information.

FPGA: Refers to Field-Programmable Gate Array, an integrated circuit designed to be configured by a customer or a designer after manufacturing—hence "field-programmable." FPGAs contain an array of programmable logic blocks and a hierarchy of reconfigurable interconnects, allowing the blocks to be wired together to perform complex combinational and sequential logic functions. This flexibility makes FPGAs highly valuable in applications that require parallel processing, high-speed data handling, and real-time processing, such as digital signal processing, aerospace, defense systems, and increasingly in data centers and artificial intelligence (AI) applications. Unlike fixed-function application-specific integrated circuits (ASICs), FPGAs can be reprogrammed to adapt to changing requirements, offering a cost-effective and versatile solution for many industries.

GANs: Generative Adversarial Networks (GANs) are a type of artificial intelligence framework consisting of two neural networks—the generator and the discriminator—competing against each other to create realistic data. The generator creates fake data, such as images or text, while the discriminator evaluates their authenticity, distinguishing between real and generated data. Over time, this adversarial process improves the generator's ability to produce increasingly convincing outputs, making GANs powerful tools for generating high-quality synthetic content in fields like art, design, and deepfake technology.

GPT: GPT stands for "Generative Pre-trained Transformer," a type of language model developed by OpenAI that uses deep learning techniques to generate human-like text based on the input it receives. The "Generative" aspect indicates its ability to produce text, "Pre-trained" means it is initially trained on a large corpus of text data before being fine-tuned for specific tasks, and "Transformer" refers to the underlying architecture that enables it to process and understand language effectively.

GPU: Refers to "graphics processing unit," a type of microprocessor capable of rendering graphics display on an electronic device, such as a gaming console or vehicle infotainment system. GPUs also have application for video editing and content creation. As a result, GPUs are also known as "video cards" or "graphics cards." However, GPUs are the backbone of machine and deep learning and artificial intelligence (AI) processing, playing an increasingly important role in data centers. As they provide cutting-edge performance for AI training and inferencing, GPUs are whetting companies' appetites and driving them to invest in new storage and computing capacities. Nvidia (NVDA) dominates the artificial intelligence market with leading-edge GPUs now powering the AI revolution.



Hallucination: An AI hallucination is when an AI model produces inaccurate, misleading, or biased information. This can happen when AI models generate content that is not based on real-world data, but rather on the model's own imagination.

Human-Computer Interaction (HCI): Human-Computer Interaction (HCI) is the study and design of how people interact with computers and technology, focusing on creating user-friendly and efficient interfaces. It involves understanding user behavior, designing intuitive interfaces, and evaluating usability to enhance the overall user experience with digital products and systems.

Inferencing: AI inferencing refers to the process of applying a trained machine learning model to new, unseen data to make predictions or decisions. It involves using the learned patterns and relationships encoded in the model to process input data and produce an output. In practical terms, inferencing is where an AI system takes input, applies what it has learned during training, and generates a response or outcome, such as classifying an image, translating text, or recommending a product.

Input Processing: Input processing refers to the method by which raw data or user inputs are received, interpreted, and prepared for further analysis or action by a system. This involves various steps, such as data cleaning, normalization, feature extraction, and transformation, to convert the inputs into a format that the system can effectively utilize. Effective input processing is crucial for ensuring accurate, efficient, and meaningful outputs in tasks like machine learning, natural language processing, and other automated systems.

Intellectual Property (IP): A category of property that includes intangible creations of the human intellect. There are many types of intellectual property, and some countries recognize more than others. The best-known types are patents, copyrights, trademarks, and trade secrets.

Licensing: Licensing of intellectual property involves a legal agreement between two parties - the IP rights owner (licensor) and another party (licensee) who is authorized to use those rights for contractually agreed purposes.

LLM: A Large Language Model (LLM) is an advanced type of artificial intelligence model designed to understand and generate human-like text based on vast amounts of training data. These models use deep learning techniques, particularly transformers, to analyze and predict text, making them capable of performing a wide range of language-related tasks such as translation, summarization, and conversation. This is in contrast to models designed to generate speech, sounds, or images.

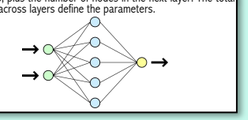
Machine Learning: Machine learning, or ML, is a branch of artificial intelligence that enables systems to learn from data, identify patterns, and make decisions with minimal human intervention. It involves training algorithms on datasets to improve their performance over time in tasks such as prediction, classification, and optimization. In other words, ML is an application of AI where machines/computer programs are given access to data and then use algorithms to find patterns in data (i.e., learn from the data). ML applications are often used to make simple, linear correlations, and can run on a CPU instead of a GPU that excels at running many smaller tasks at once.

With ML, a machine can automatically learn new information and improve itself from experience without having to be programmed in a certain way since the machine will be able to teach itself new forms of information. However, the machines are not sentient (yet) and must be (1) told when they get something wrong or (2) given new data to figure out what the correct answer is. If new data or feedback is not given to the machine, it will not organically "learn" from its mistakes and adjust accordingly. As a result, ML does not provide "feedback"; it needs to be told explicitly how to fix a problem. AI, on the other hand, operates off a feedback loop. By contrast to ML where new data must be input to make corrections, AI is able to seek out new sources of data on its own and rebuild itself based on those feedbacks.

Model Application: A model application refers to the practical use of a trained machine learning or AI model to solve real-world problems or perform specific tasks. This involves integrating the model into software systems or platforms where it can analyze data, make predictions, automate decisions, or generate content based on its training. Model applications span a wide range of industries, including healthcare, finance, marketing, and technology, where they are used for tasks like diagnosing diseases, predicting market trends, personalizing customer experiences, and optimizing business operations.

Natural Language Processing (NLP): A field of artificial intelligence focused on the interaction between computers and human language. It involves developing algorithms and models that enable machines to understand, interpret, and generate human language in a way that is both meaningful and useful. NLP applications include tasks such as language translation, sentiment analysis, and text summarization.

Neural Network: The Neural Network conducts correlation analysis on all tokens, characterized by the number of nodes and layers. Nodes in one layer connect to nodes in another layer, with connections represented by lines. Weights and bias terms are assigned to these connections. The bias term is calculated as the number of nodes in the layer multiplied by the number of connections, plus the number of nodes in the next layer. The total bias terms across layers define the parameters.



Nodes: Nodes are individual devices or points that participate in a network or system. In data structures, nodes represent fundamental elements that hold data and may link to other nodes, forming structures like trees or graphs. Nodes play a critical role in organizing and managing information, facilitating communication, and executing processes within systems.

NPU: Refers to "neural processing unit," also known as a neural processor, tensor processing unit, or AI accelerator. The NPU is a specialized processor that implements all necessary control and arithmetic logic necessary to execute machine learning (ML) algorithms, typically by operating on predictive models such as artificial neural networks or random forests.
In short, NPUs, such as the M4 chip used in latest versions of Apple's laptops and tablets, specialize in the acceleration of ML algorithms (10,000 times less time than a GPU).

Output Generation: Output generation refers to the process by which a system produces a response or result based on the processed inputs and underlying algorithms. In AI and computing, this could involve generating text, images, predictions, or actions that align with the intended goal of the application. Output generation is the final step in a data processing pipeline, where the system's internal decisions or computations are translated into a form that is understandable or usable by humans or other systems.

Patent: A type of intellectual property that gives its owner the legal right to exclude others from making, using, or selling an invention for a limited period of time in exchange for publishing an enabling disclosure of the invention. The patent period in the U.S. is 20 years from the date of filing in the case of utility patents, and 15 years from the date of grant in the case of design patents.

Parameters: Parameters are variables or values passed into functions, methods, or procedures to influence their behavior or output. They define the specific details or data that a function or algorithm needs to operate correctly. Parameters allow for customization and flexibility, enabling the same function to be used in different contexts with varying inputs.

Real-time and Batch Processing: Real-time and batch processing are two approaches to handling and processing data within computing systems. Real-time processing involves the immediate processing of data as it is received, enabling systems to provide instant responses or updates. This is essential in applications like online transactions, live monitoring systems, and interactive applications where time-sensitive decisions or actions are required. Batch processing refers to the processing of large volumes of data in groups or batches at scheduled intervals. It is typically used for tasks that do not require immediate results, such as payroll processing, end-of-day reports, or data backups, allowing for efficient handling of large datasets over time.

Robotics and Autonomous Systems: Robotics and autonomous systems involve the design and development of machines that can perform tasks independently, with minimal or no human intervention. Robotics focuses on creating physical robots capable of interacting with the environment, often equipped with sensors, actuators, and AI to carry out complex tasks. Autonomous systems extend this concept by enabling these robots or software agents to make decisions, adapt to new situations, and operate in dynamic environments, from manufacturing and logistics to exploration and healthcare.

Semiconductors: Also known as chips or processors, semiconductors are made by imprinting a network of electronic circuits/components onto a wafer that partially conducts electricity, which can then perform various functions—e.g., (a) processing, amplifying and selectively filtering electronic signals (b) controlling, electronic system functions, and (c) storing and transmitting data.

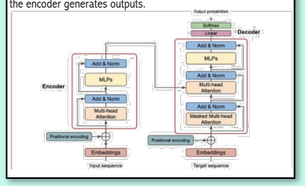
Simulation and Gaming: A field of artificial intelligence that utilizes generative AI for creating virtual environments, game characters, procedural content generation, and interactive simulations.

Software Development: Software development is the process of designing, coding, testing, and maintaining applications, frameworks, or other software components. It involves various stages, including requirement analysis, system design, programming, testing, and deployment, to create functional and reliable software that meets user needs and business goals.

Speech Synthesis and Recognition: Speech Synthesis is the technology that converts text into spoken language, enabling machines to generate human-like voice outputs. Speech Recognition, on the other hand, involves processing and interpreting spoken language to convert it into text or actionable commands. Together, these technologies enable applications such as virtual assistants, voice-controlled devices, and automated transcription services.

Tokens: Tokens refer to individual units of text, such as words or characters, that a model processes during training or inference. These tokens serve as the basic building blocks for understanding and generating human language.

Transformer Architecture: The LLM undergoes pre-training with a substantial amount of information or documents within a context window. The Transformer Architecture serves as the foundational structure for language processing, encompassing both decoding and encoding components. The decoder interprets inputs, while the encoder generates outputs.



LANGUAGE MODEL TRAINING PROCESS

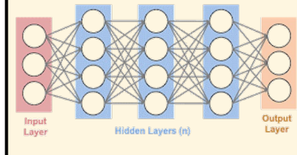
Step 1: Establish a Goal

The first step in training an AI system is to establish an "objective function." Most LLMs will have the same objective function or goal: given a sequence of text, guess which words come next.

Step 2: Collect/Tokenize Data

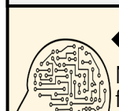
To train an LLM effectively, a massive amount of data will be required. Once data are collected, they will be broken down or subdivided into units called tokens. These subdivisions will help the model analyze it more easily.

Step 3: Build the Neural Network



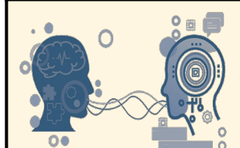
After the data have been collected and tokenized, the next step is to create the model's neural network. The neural network (consisting of layer upon layer of logic and decision trees) serves as the foundational structure for language processing.

Step 4: Train the Neural Network



Next, the tokenized data are fed into the neural network in a step called "training the model." The model trains by identifying patterns and relationships in the data.

Step 5: Fine-Tune the Model



Once the model is trained, it will be fine-tuned with human feedback (or reinforcement learning). For example, humans could rate a model's initial responses and feed the ratings back into the model until it improves to an acceptable level.

Step 6: Launch and Monitor

After the model has been fine-tuned, it is ready to be launched. However, because AI systems can hallucinate or be erratic and unpredictable, the developer will monitor the system and follow up with additional rounds of changes as needed before the model is fully functional.