[Korean University Student Bio · AI Program]
From Amazon AI to Cancer Diagnostics - Building a Life at the Intersection of AI and Biology

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About Speaker

- *Co-Founder & CTO @ Erudio Bio, Inc., San Jose & Novato, CA, USA* 2023 ∼
- *Co-Founder & CEO @ Erudio Bio Korea, Inc., Korea* 2025 ∼
- *Co-Founder, Leader, and Chair of Silicon Valley AI Nexus, USA* 2024 ∼
- *Advisor to Korean American Semiconductor Professional Alliance (KASPA)* 2026 ∼
- *CGO / Global Managing Partner @ LULUMEDIC, Seoul, Korea* 2025 ∼
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- *Adjunct Professor, EE Department @ Sogang University, Seoul, Korea* 2020 ∼
- *Advisory Professor, EECS Department @ DGIST, Korea* 2020 ∼
- *AI-Korean Medicine Integration Initiative Task Force Member @ The Association of Korean Medicine, Seoul, Korea* 2025 ∼
- *Director of AI Semiconductor @ K-BioX, CA, USA* 2025 ∼
- Global Advisory Board Member @ Innovative Future Brain-Inspired Intelligence System Semiconductor of Sogang University, Korea 2020 ∼
- Technology Consultant @ Gerson Lehrman Gruop (GLG), NY, USA 2022 ∼
- Advisor @ CryptoLab, Inc., Seoul, Korea 2025 ∼

- Co-Founder & CTO / Head of Global R&D / Chief Applied Scientist / Senior Fellow @ Gauss Labs, Inc., Palo Alto, CA, USA 2020 $\sim$ 2023
- Senior Applied Scientist @ Amazon.com, Inc., Vancouver, BC, Canada 2017 $\sim$ 2020
- Principal Engineer @ Software R&D Center, Samsung Electronics 2016 $\sim$ 2017
- Principal Engineer @ Strategic Marketing & Sales, Memory Business 2015 $\sim$ 2016
- Principal Engineer @ DT Team, DRAM Development, Samsung 2012 $\sim$ 2015
- Senior Engineer @ CAE Team, Memory Business, Samsung, Korea 2005 $\sim$ 2012
- PhD - Electrical Engineering @ Stanford University, CA, USA 2001 $\sim$ 2004
- Development Engineer @ Voyan, Santa Clara, CA, USA 2000 $\sim$ 2001
- MS - Electrical Engineering @ Stanford University, CA, USA 1998 $\sim$ 1999
- BS - Electrical & Computer Engineering @ Seoul National University 1994 $\sim$ 1998

Highlight of Career Journey

- BS in Electrical Engineering (EE) @ Seoul National University
- MS & PhD in Electronics Engineering (EE) @ Stanford University
  - *Convex Optimization - Theory, Algorithms & Software*
  - advisor - *Prof. Stephen P. Boyd*
- Principal Engineer @ Samsung Semiconductor, Inc.
  - *AI & Convex Optimization*
  - collaboration with *DRAM/NAND Design/Manufacturing/Test Teams*
- Senior Applied Scientist @ Amazon.com, Inc.
  - *e-Commerce AIs* - anomaly detection, deep RL, and recommender system
  - *Jeff Bezos's project - drove $200M* in sales via Amazon Mobile Shopping App
- *Co-Founder & CTO / Global R&D Head & Chief Applied Scientist* @ Gauss Labs, Inc.
- *Co-Founder & CTO* @ Erudio Bio, Inc.
- *Co-Founder & CEO* @ Erudio Bio Korea, Inc.

Unpacking AI for Korean Students

- Artificial Intelligence - 5
  - AI history & recent significant achievements
  - market indicators
- AI Agents - 22
  - big data → ML/DL → LLM & genAI → agentic AI
  - LLM as highly effective knowledge-transfer representation learner
- Erudio Bio - 38
  - versatile smart assay (VSA) / bioTCAD - $1M Gates Foundation Grant
- Silicon Valley's Cultural Engine of Innovation and Disruption - **??**
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  - AI in biology & AlphaFold 3 / Emerging Trends in Biotech
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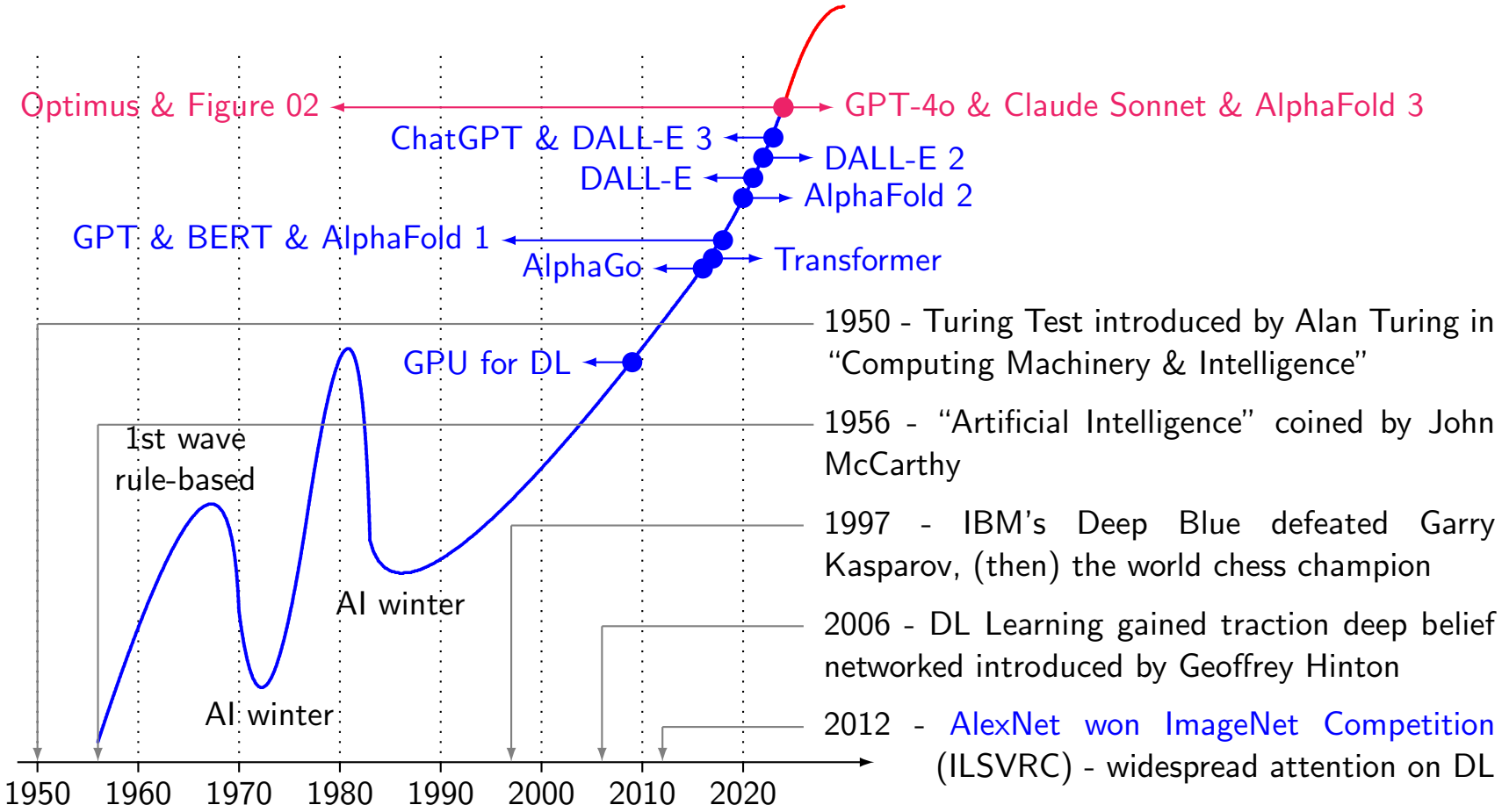
Artificial Intelligence

AI History

History



1950 - Turing Test introduced by Alan Turing in "Computing Machinery & Intelligence"

1956 - "Artificial Intelligence" coined by John McCarthy

1997 - IBM's Deep Blue defeated Garry Kasparov, (then) the world chess champion

2006 - DL Learning gained traction deep belief networked introduced by Geoffrey Hinton

2012 - AlexNet won ImageNet Competition (ILSVRC) - widespread attention on DL

Significant AI Achievements - 2014 – 2025

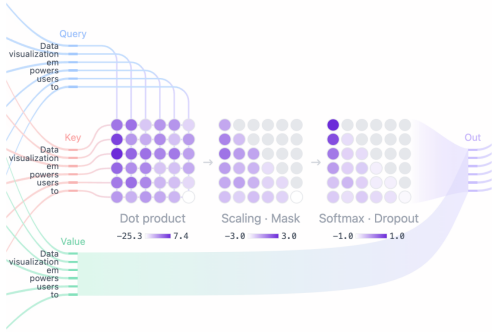
Deep learning revolution

- 2012 – 2015 - DL revolution[1]
  - CNNs demonstrated exceptional performance in image recognition, $e.g.$, *AlexNet's victory in ImageNet competition*
  - widespread adoption of DL learning in CV transforming industries
- 2016 - AlphaGo defeats human Go champion
  - DeepMind's AlphaGo defeated world champion in Go, extremely complex game *believed to be beyond AI's reach*
  - significant milestone in RL - AI's potential in solving complex & strategic problems

[1] CV: computer vision, NN: neural network, CNN: convolutional NN, RL: reinforcement learning

Transformer changes everything

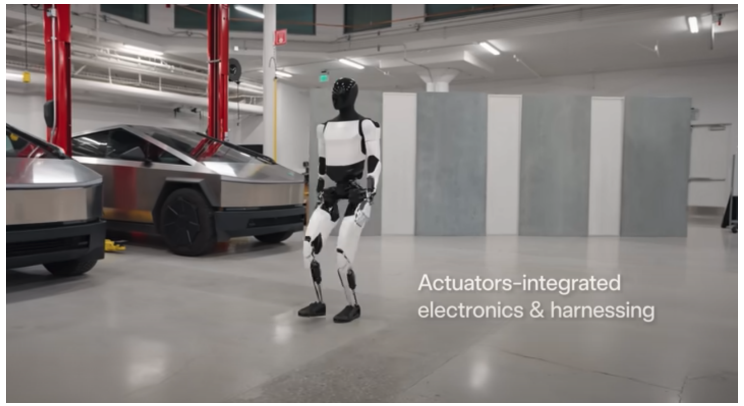
- 2017 – 2018 - Transformers & NLP breakthroughs[2]
  - *Transformer (e.g., BERT & GPT) revolutionized NLP*
  - major advancements in, *e.g.*, machine translation & chatbots
- 2020 - AI in healthcare – AlphaFold & beyond
  - DeepMind's *AlphaFold solves 50-year-old protein folding problem* predicting 3D protein structures with remarkable accuracy
  - accelerates drug discovery and personalized medicine - offering new insights into diseases and potential treatments



[2]NLP: natural language processing, GPT: generative pre-trained transformer

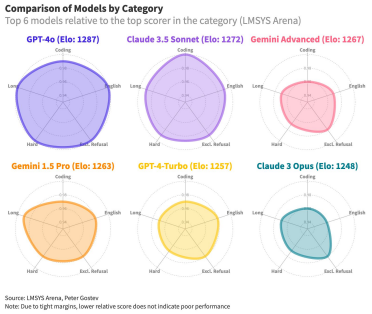
Lots of breakthroughs in AI technology and applications in 2024

- proliferation of advanced AI models
  - GPT-4o, Claude Sonnet, Claude 3 series, Llama 3, Sora, Gemini
  - *transforming industries* such as content creation, customer service, education, $etc.$
- breakthroughs in specialized AI applications
  - Figure 02, Optimus, AlphaFold 3
  - driving unprecedented advancements in automation, drug discovery, scientific understanding - *profoundly affecting healthcare, manufacturing, scientific research*



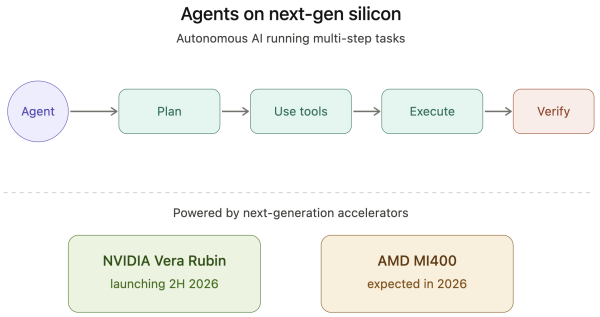
Major AI Breakthroughs in 2025

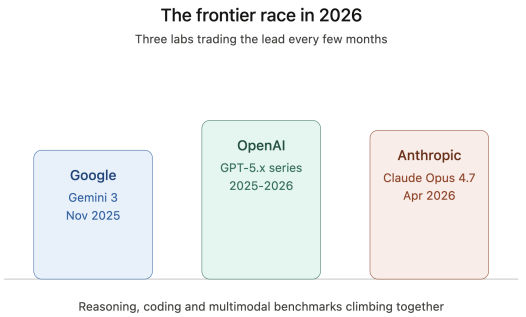
- next-generation foundation models
  - GPT-5 (Aug 2025) and Claude 4 demonstrate strong reasoning abilities
  - open-source models (Llama, DeepSeek, Qwen) closing the gap
- hardware innovations
  - NVIDIA Blackwell Ultra (B300) shipped in late 2025, with Rubin announced for 2026
  - AMD's MI350 series accelerators challenging NVIDIA's market dominance
- AI-human collaboration systems
  - agentic AI going mainstream – systems autonomously executing multi-step tasks
  - multimodal interfaces enabling more natural human-AI collaboration
  - AI systems increasingly explaining their (reasoning) and recommendations



Where AI Is Heading in 2026 (as of May 2026)

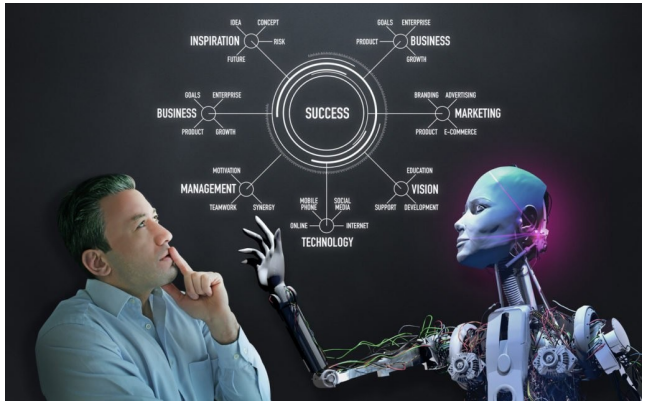
- frontier models reaching new performance ceilings
  - Gemini 3, GPT-5.2 / 5.x series, Claude Opus 4.7 → multimodal benchmarks higher
  - intensifying competition among Google, OpenAI, and Anthropic
- hardware scaling and diversification
  - NVIDIA's Vera Rubin platform launching in 2H claiming ∼5x faster than Blackwell
  - AMD MI400 series expected in 2026, continuing to challenge NVIDIA's dominance
- agentic AI going mainstream
  - AI agents autonomously executing long-horizon, multi-step tasks
  - expected expansion into enterprise workflows across software, finance, and research
  - growing focus on AI safety, reliability, and self-verification as capabilities scale

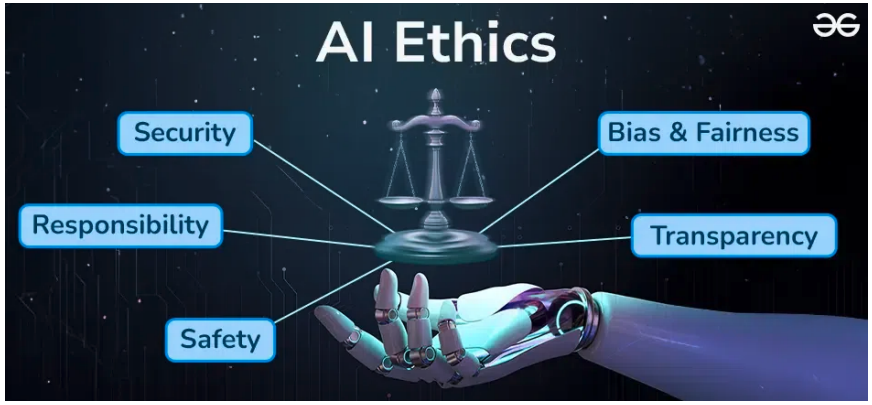




Transformative impact of AI - reshaping industries, work & society

- accelerating human-AI collaboration
  - not only reshaping industries but *altering how humans interact with technology*
  - AI's role as collaborator and augmentor redefines productivity, creativity, the way we address global challenges, $e.g.$, *sustainability & healthcare*
- AI-driven automation *transforms workforce dynamics* - creating new opportunities while challenging traditional job roles
- *ethical AI considerations* becoming central not only to business strategy, but to society as a whole - *influencing regulations, corporate responsibility & public trust*

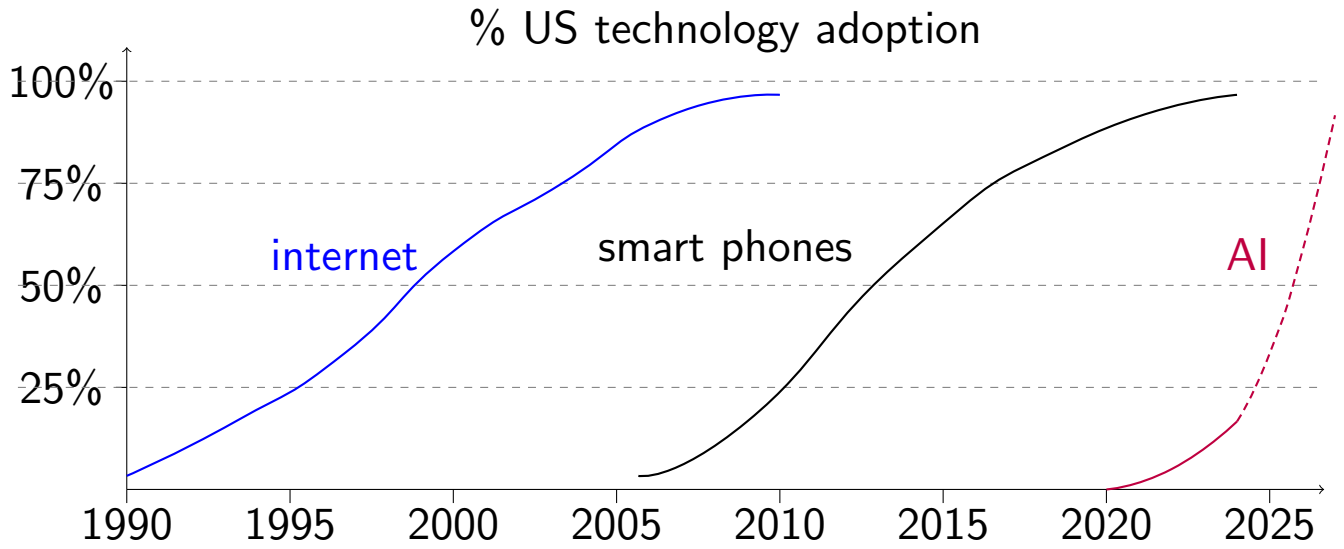




Measuring AI's Ascent

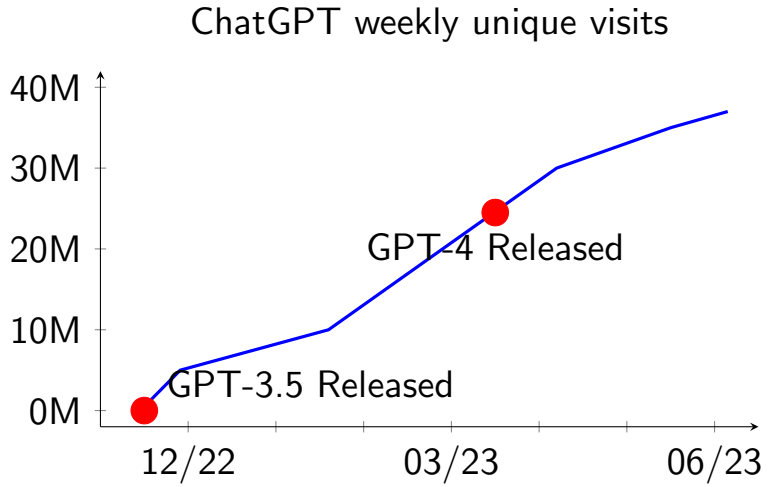
Where are we in AI today?

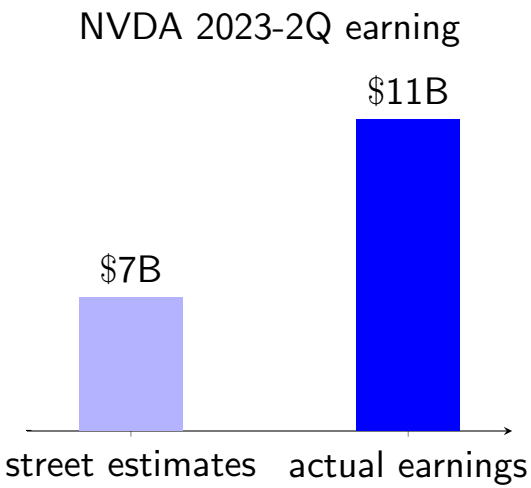
- sunrise phase - currently experiencing dawn of AI era with significant advancements and increasing adoption across various industries
- early adoption - in early stages of AI lifecycle with widespread adoption and innovation across sectors marking significant shift in technology's role in society



Explosion of AI ecosystems - ChatGPT & NVIDIA

- took only *5 months for ChatGPT users to reach 35M*
- NVDIA 2023 Q2 earning exceeds market expectation by big margin - $7B vs $13.5B
  - surprisingly, *101% year-to-year growth*
  - even more surprisingly *gross margin was 71.2%* - up from 43.5% in previous year[3]



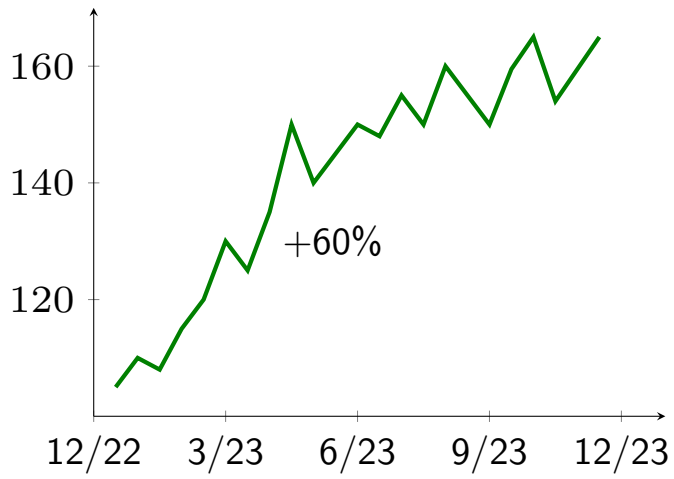


[3] source - Bloomberg

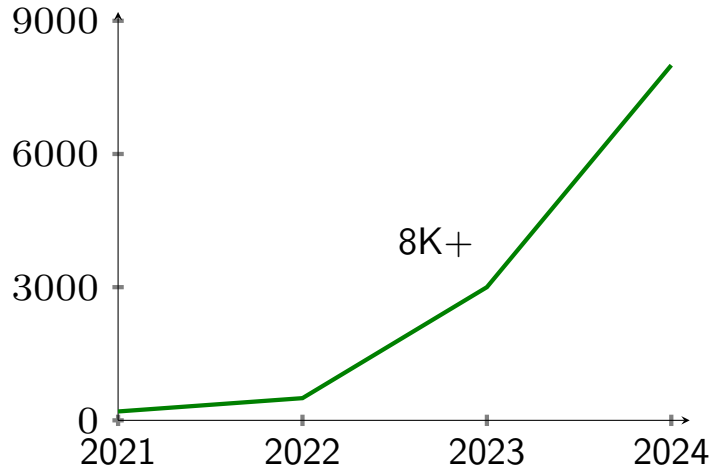
Explosion of AI ecosystems - AI stock market

- *AI investment surge in 2023 - portfolio performance soars by 60%*
  - AI-focused stocks significantly outpaced traditional market indices
- *over 8,000 new AI applications* developed in last 3 years
  - applications span from healthcare and finance to manufacturing and entertainment

AI basket performance - 2023

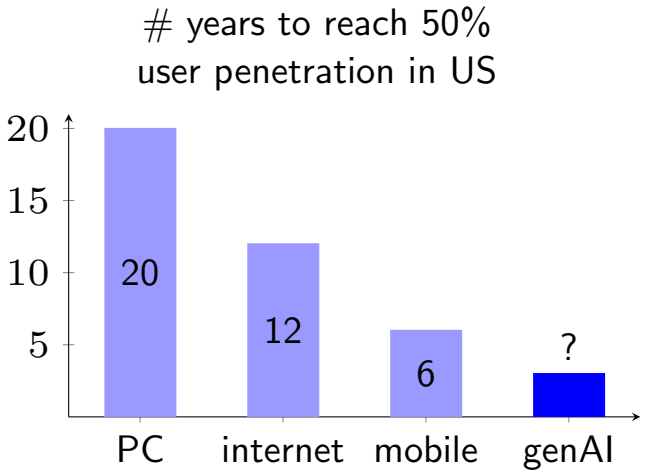


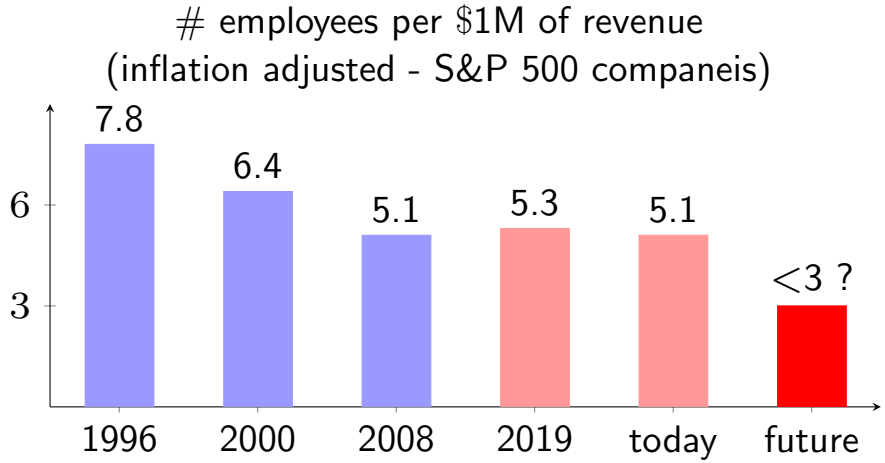
new AI applications over time



AI's transformative impact - adoption speed & economic potential

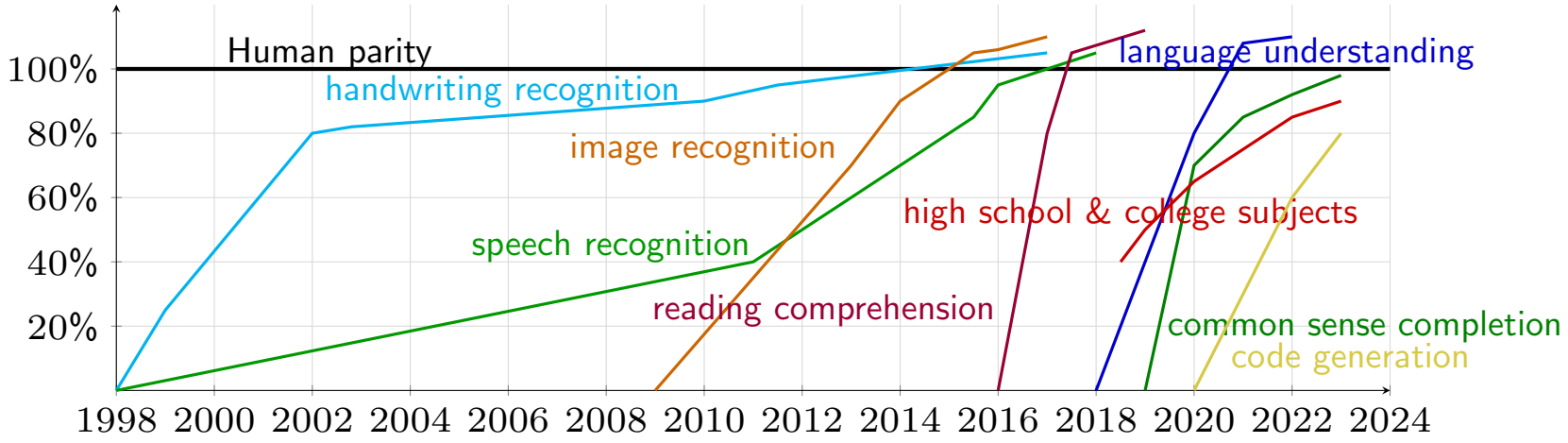
- adoption - has been twice as fast with platform shifts suggesting
  - increasing demand and readiness for new technology improved user experience & accessibility
- AI's potential to drive economy for years to come
  - 35% improvement in productivity driven by introduction of PCs and internet
  - greater gains expected with AI proliferation





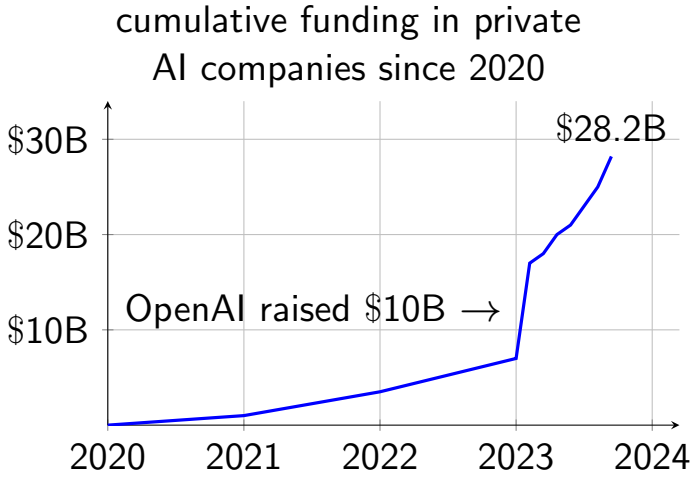
AI getting more & more faster

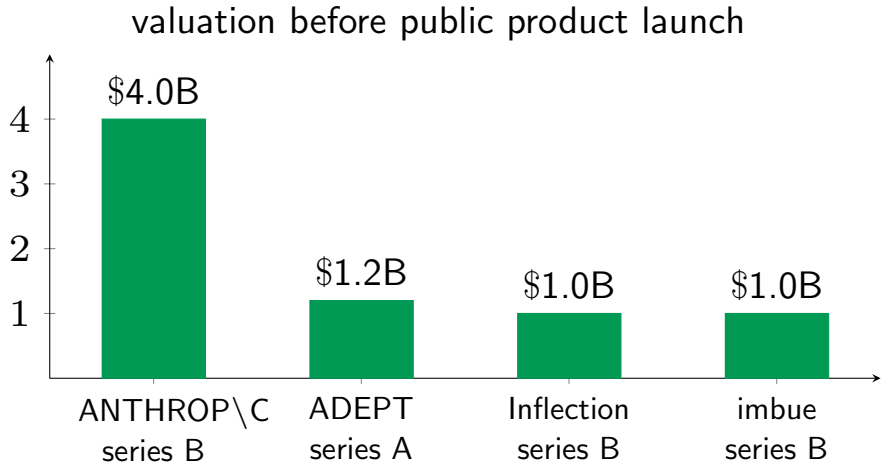
- steep upward slopes of AI capabilities highlight accelerating pace of AI development
  - period of exponential growth with AI potentially mastering new skills and surpassing human capabilities at ever-increasing rate
- closing gap to human parity - some capabilities approaching or arguably reached human parity, while others having still way to go
  - achieving truly human-like capabilities in broad range remains a challenge



Massive investment in AI

- *explosive growth* - cumulative funding skyrocketed reaching staggering $28.2B
- OpenAI - significant fundraising (=$10B) fueled rapid growth
- *valuation surge* - substantial valuations even before public products for stella companies
- *fierce competition for capital* among AI startups driving innovation & accelerating development
- massive investment indicates *strong belief in & optimistic outlook for potential of AI* to revolutionize industries & drive economic growth

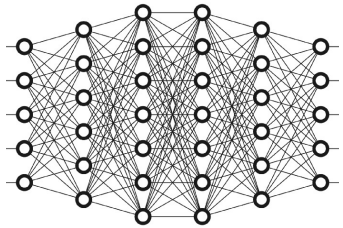


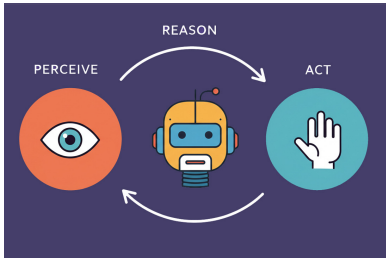


AI Agents

AI progress in 21st century in keywords

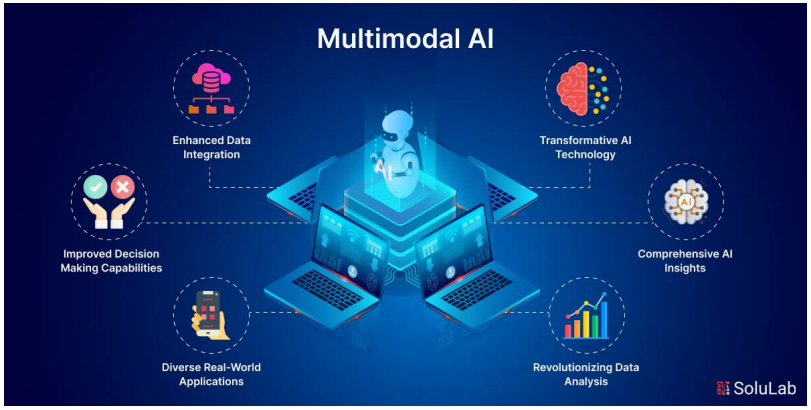
- 2010 $\sim$ Big Data
- 2012 $\sim$ Deep Learning
- 2017 $\sim$ Transformer - Attention is All you need!
- 2022 $\sim$ LLM & genAI
- 2024 $\sim$ AI Agent (Agentic AI)

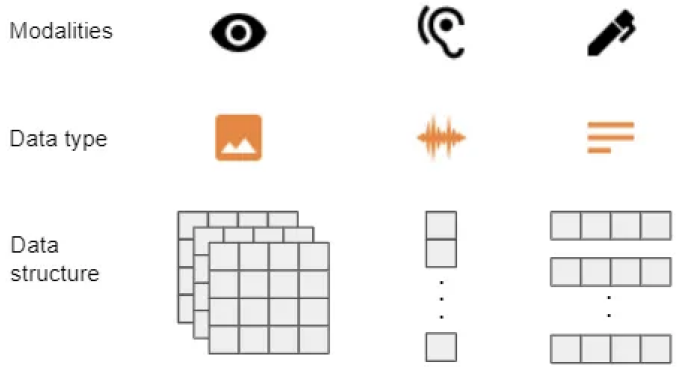




Multimodal learning

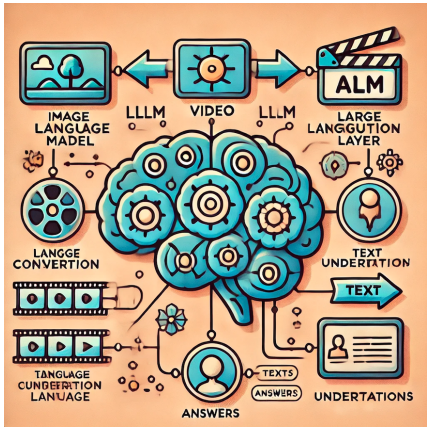
- understand information from multiple modalities, $e.g.$, text, images, audio, video
- representation learning methods
  - combine multiple representations or learn multimodal representations simultaneously
- applications
  - images from text prompt, videos with narration, musics with lyrics
- collaboration among different modalities
  - understand image world (open system) using language (closed system)





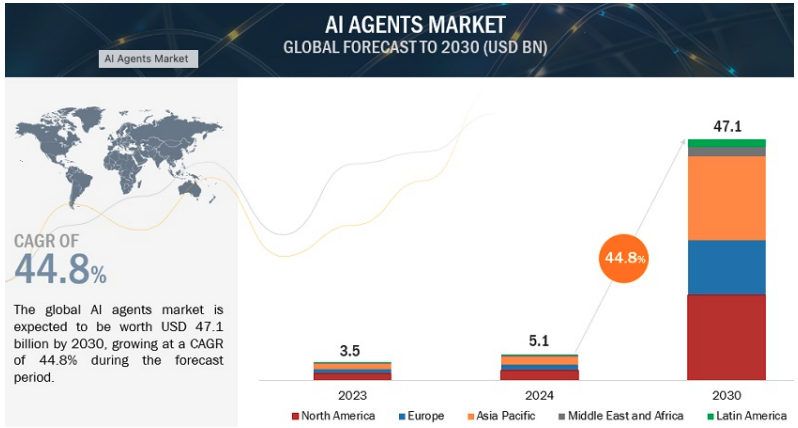
Implications of success of LLMs

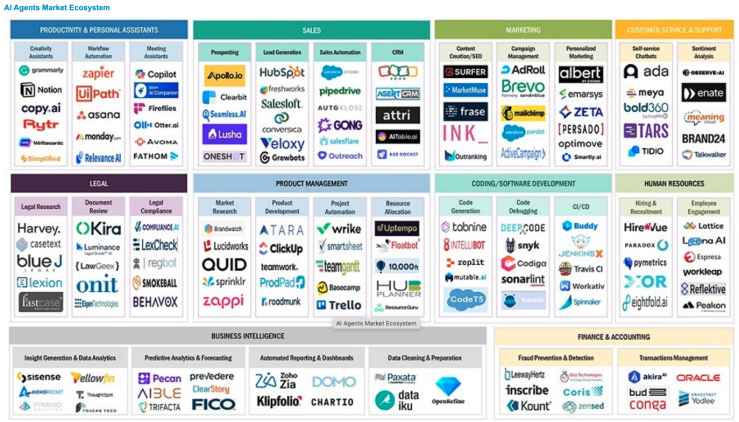
- many researchers change gears towards LLM
  - from computer vision (CV), speach, music, video, even reinforcement learning
- *LLM is not only about NLP . . .* humans have . . .
  - evolved to optimize natural language structures for eons
  - handed down knowledge using *this natural languages* for thousands of years
  - internal structure (or equivalently, representation) of natural languages optimized via *thousands of generation by evolution*
- LLM *connects non-linguistic world (open system) via natural languages (closed system)*



Multimodal AI (mmAI)

- mmAI - systems processing & integrating data from multiple sources & modalities, to generate unified response / decision
- 1990s – 2000s - early systems - initial research combining basic text & image data
- 2010s - CNNs & RNNs enabling more sophisticated handling of multimodality
- 2020s - modern multimodal models - Transformer-based architectures handling complex multi-source data at highly advanced level
- mmAI *mimics human cognitive ability* to interpret and integrate information from various sources, leading to holistic decision-making



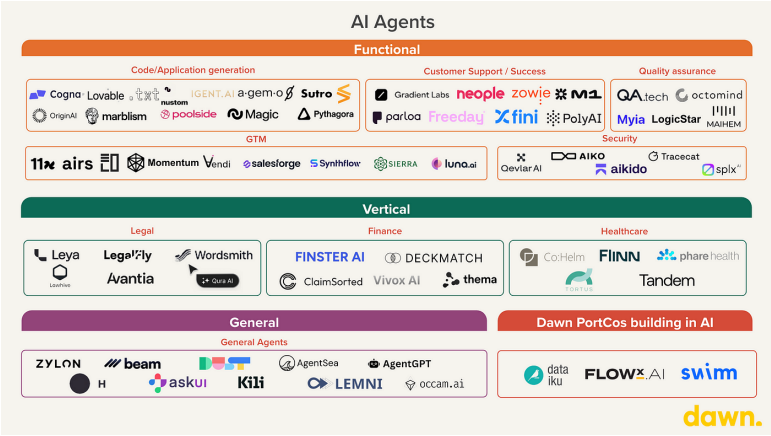


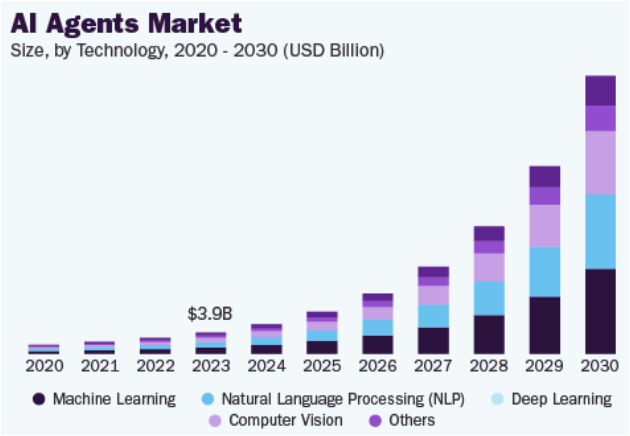
mmAI Technology

- core components
  - data preprocessing - images, text, audio & video
  - architectures - unified Transformer-based ($e.g.$, ViT) & cross-attention mechanisms / hybrid architectures ($e.g.$, CNNs + LLMs)
  - integration layers - fusion methods for combining data representations from different modalities
- technical challenges
  - data alignment - accurate alignment of multimodal data
  - computational demand - high-resource requirements for training and inferencing
  - diverse data quality - manage variations in data quality across modalities
- advancements
  - multimodal embeddings - shared feature spaces interaction between modalities
  - self-supervised learning - leverage unlabeled data to learn representations across modalities

AI agents powered by multimodal LLMs

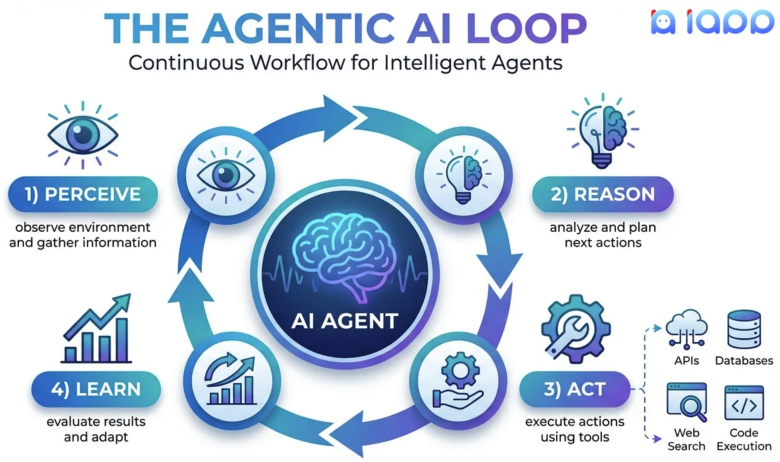
- foundation
  - integrate multimodal AI capabilities for enhanced interaction & decision-making
- components
  - perceive environment through multiple modalities (visual, audio, text), process using LLM technology, generate contextual responses & take actions
- capabilities
  - understand complex environments, reason across modalities, engage in natural interactions, adapt behavior based on context & feedback





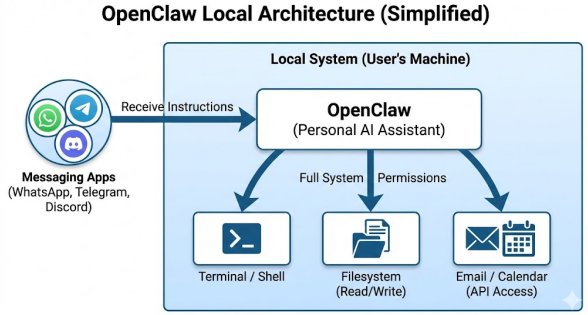
What makes AI "Agentic"?

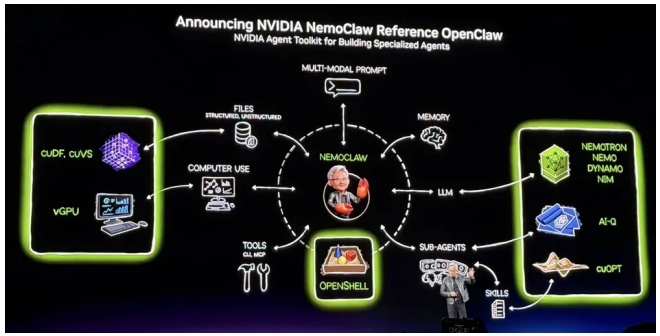
- old AI responds to prompt; agentic AI *pursues goal*
- core loop
  - perceive → plan → (reason) → act → observe → repeat
- four traits - autonomy, tool use, memory/state, long-horizon planning
- enablers
  - tool/function calling, retrieval, code execution, multi-agent orchestration
- shift - *"answer my question" → "accomplish my objective"*



Cutting-edge AI agent tools - open source

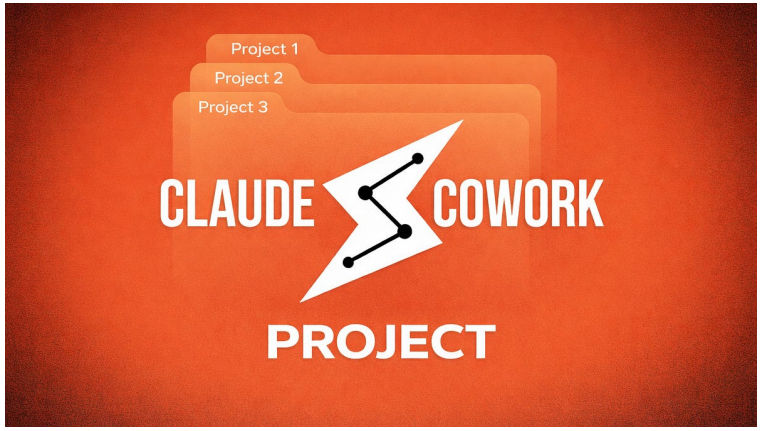
- OpenClaw (Peter Steinberger) - open-source, runs locally, connects LLMs to real software
  - reads/writes files, runs shell commands, browses web, sends email, controls APIs
  - 350k+ GitHub stars (by May 2026) — most-starred GitHub software project
  - skill-based architecture - SKILL.md folders, shareable on ClawHub
  - works through chat apps - Slack, Telegram, WhatsApp, Discord, iMessage, *etc.*
  - model-agnostic - Claude, GPT, Gemini, or local via Ollama
- NVIDIA NemoClaw - security/privacy layer on top of OpenClaw
  - one-command install of Nemotron models + OpenShell secure runtime
  - network & filesystem isolation, local inference so no data leaves the device KKR

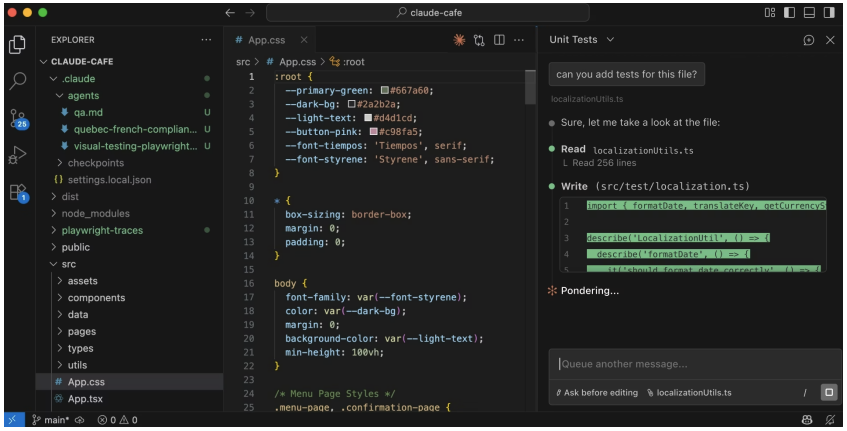




Cutting-edge AI agent tools - Anthropic

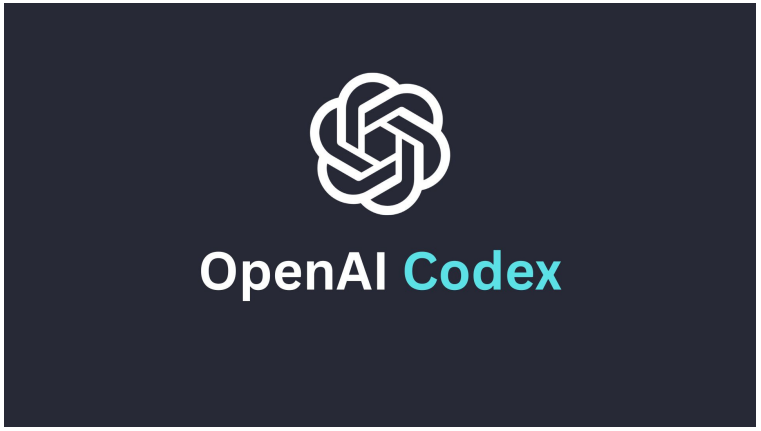
- Claude code
  - CLI/IDE coding agent; subagents, hooks, plugins, auto mode, routines
- Claude cowork
  - desktop tab; file-system access, scheduled recurring tasks, plugin marketplace
- managed agents
  - multi-agent orchestration; cloud-deployable agent templates TrendForce
- vertical bundles already shipping
  - legal, small business, marketing ops, finance

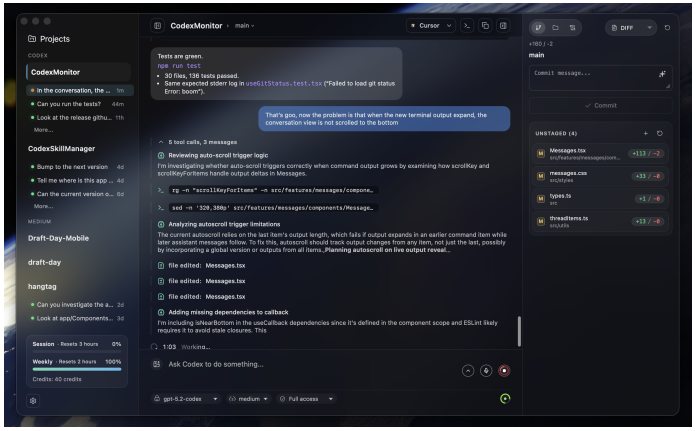




Cutting-edge AI agent tools - OpenAI

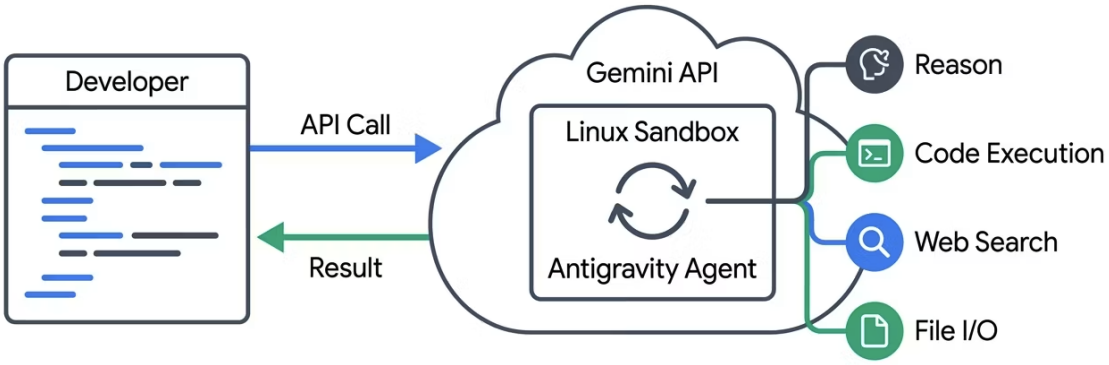
- OpenAI Codex
  - agentic coding tool - CLI, IDE, ChatGPT, desktop & now mobile
  - 2026 shift - from code editor → full "agent workspace"
  - multi-agent parallelism - runs several tasks in separate sandboxes while you review
  - powered by GPT-5.5 - tightly coupled, not model-agnostic (unlike Claude Code / OpenClaw) InfoQ
- Codex Security
  - dedicated agent that finds & fixes vulnerabilities





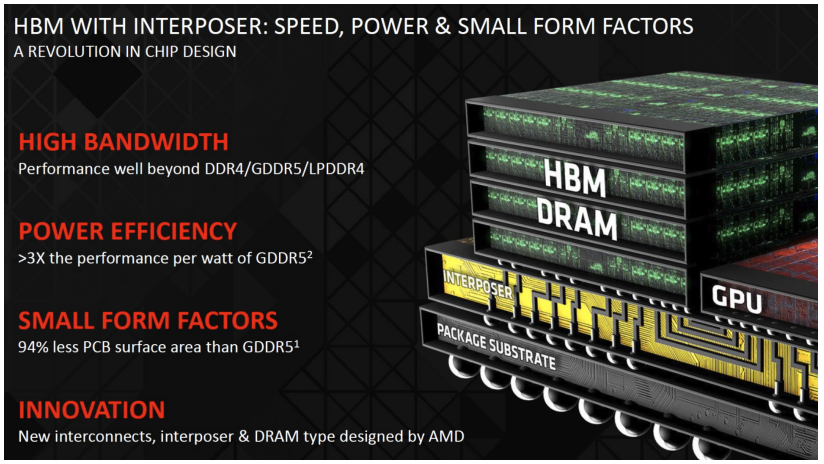
Cutting-edge AI agent tools - Google

- Antigravity 2.0
  - agent-first development platform; desktop app + CLI + SDK NVIDIA
- Gemini API Managed Agents
  - one API call spins up agent that reasons, uses tools, executes code
- Jules
  - AI agent for GitHub - debugging, pull-request prep NVIDIA Newsroom
- Gemini Spark
  - 24/7 personal agent on Gemini 3.5 Flash, wrapped in Antigravity
  - connects to Canva, OpenTable, Instacart, Workspace via MCP NVIDIA Blog



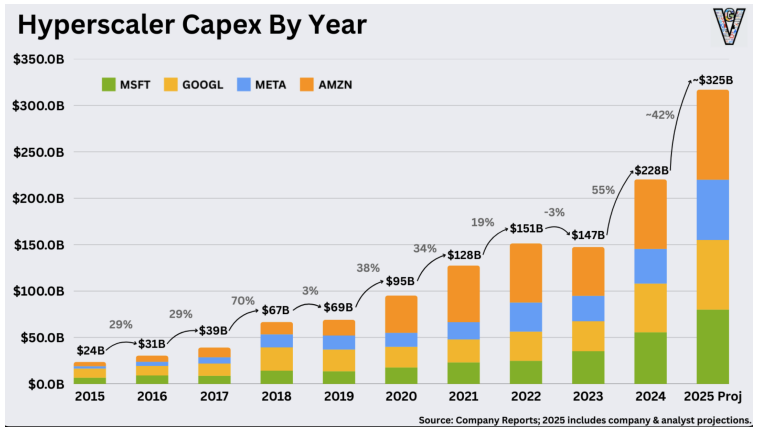
Agentic stack - LLM is engine, but not whole system

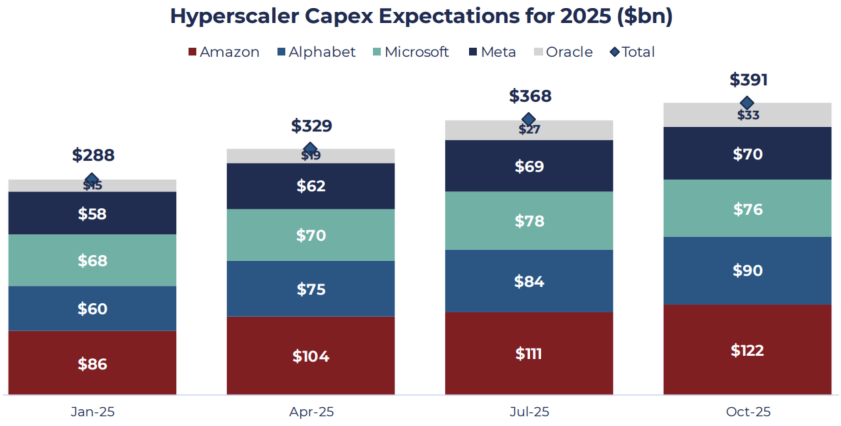
- *LLM - reasoning engine, not the system*
- stack
  - planner/orchestrator, memory (short/long-term), tools/APIs, environment interface
- patterns
  - ReAct, reflection/self-critique, planner–executor, multi-agent
- interoperability protocols emerging, $e.g.$, MCP, agent-to-agent
- *value migrating from model → system design*



Trillion-dollar gravity well - capital, talent, geopolitics

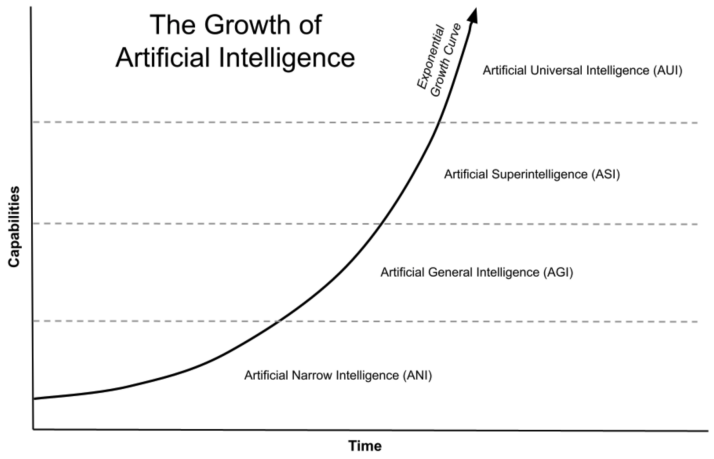
- big 5 hyperscalers $\sim$ \$725B AI capex in 2026 $\sim$ Switzerland's GDP
- trajectory - \$256B (2024) $\rightarrow$ \$443B (2025) $\rightarrow$ \$725B (2026)
- *2026 is the first trillion-dollar year of compute capex in history*
- \$6.7T global data-center capex by 2030 ($\sim$70% AI) (McKinsey forecasting)
- *geopolitics*
  - export controls, chip sovereignty, national AI budgets

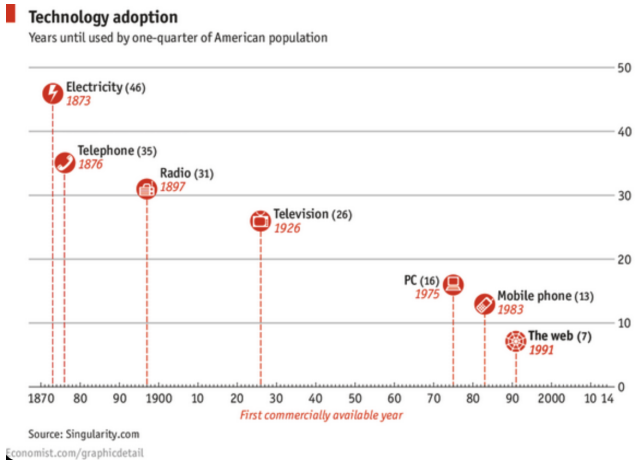




What took decades now takes months

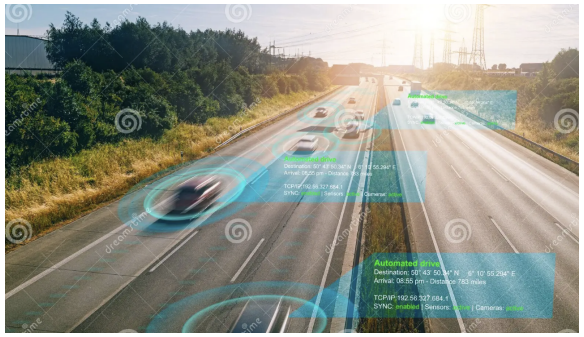
- AlexNet (DL) → AlphaGo → Transformer → GPT (LLM) → Agentic in a decade
- adoption collapsing too
  - genAI penetration in fraction of PC/internet time
- *frontier you train on today will move by graduation*
- durable skill ≠ any one tool - it's relearning the frontier
- *what previously took decades now compresses into months!*





AI agents - present & future

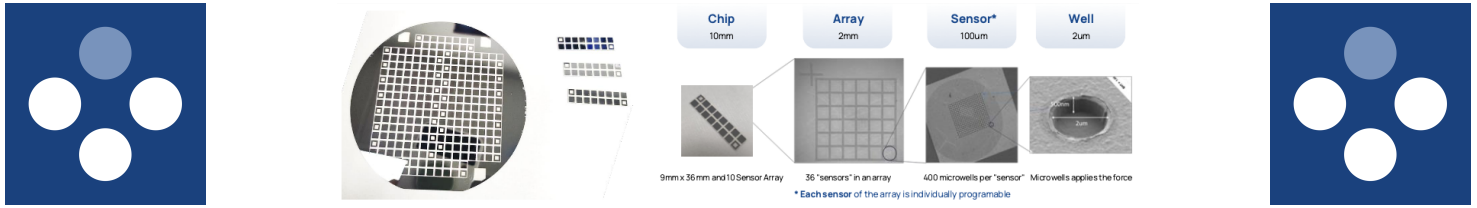
- emerging applications
  - scientific research - agents analyzing & running experiments & generating hypotheses
  - creative collaboration - AI partners in design & art combining multiple mediums
  - environmental monitoring - processing satellite sensor data for climate analysis
  - healthcare - enhanced diagnostic combining imaging, $e.g.$, MRI, with patient history
  - customer experience - virtual assistants understanding spoken language & visual cues
  - autonomous vehicles - integration of visual, radar & audio data
- future
  - ubiquitous AI agents - seamless integration into everyday devices
  - highly tailored personalized experience - in education, entertainment & healthcare



Erudio Bio

Powering AI-driven medicine with ground-truth binding data

- problems we solve
  - 90% of drugs fail in clinical trials due to poor early-stage prediction
  - multiplexed diagnostics suffer from false positives and cross-reactivity
- *Erudio Bio's Innovation*
  - *VSA* platform uses patented *"dynamic force spectroscopy"* to generate 1000x more high-quality binding data from single sample ($\sim 10\mu$L)
  - measuring not just presence, but *strength* and *kinetics* of molecular interactions
- *dual business model*
  - diagnostics - *multi-cancer biomarker detection* with clinical institutions & hospitals
  - *drug discovery - bioTCAD$^{\mathrm{TM}}$ platform* providing ground-truth labels to train & validate pharma AI models, reducing preclinical cycles



Validated technology, proven team, clear path to market

- validated impact
  - *$1M Gates Foundation Grant* (2025) to democratize drug development for global health
  - partnerships with top research institutions (KRIBB, KAIST)
- unique team - *Stanford-trained founders* combining
  - semiconductor TCAD expertise & force spectroscopy innovation (20+ years)
  - AI & optimization leadership (Samsung, Amazon, SK hynix, Gauss Labs)
- market entry
  - *Korea → (Asia hub &) US* strategy with 2026 regulatory milestones
  - expanding *pharma partnerships and B2G*

Gates Foundation

Biological assays struggle with scale & accuracy

Data is expensive

- so we make decisions with *incomplete* picture
- status quo
  - limited, small-scale testing confirms diagnosis
  - outcome only as good as doctor's ability to determine which tests, limiting the picture
  - cross reactivity prevents larger scale testing
- Erudio creates
  - *comprehensive, large-scale* testing will drive diagnosis without assumptions
  - increased scale enables enhanced scientific discovery leading to
    - *better patient care*
    - *reduced time to diagnosis*
    - *cost reduction*



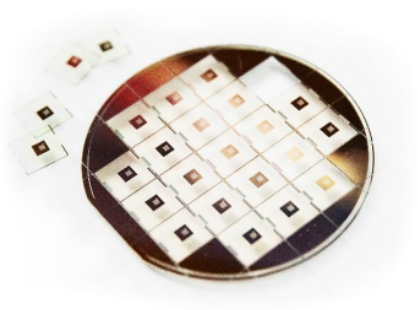

Erudio Bio starts revolution with Gates Foundation's support

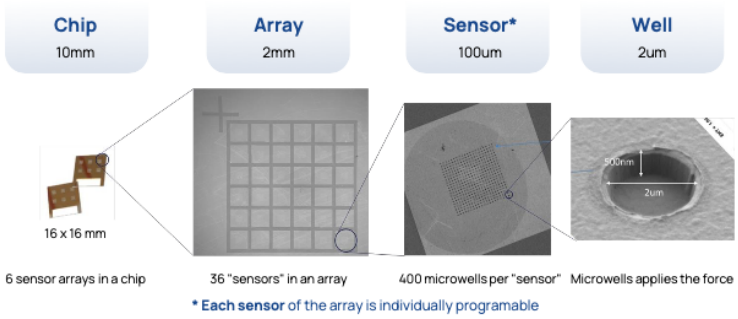
- more data
  - comprehensive data from *single biological sample*
  - *multiplexed analysis* of nucleic acid, protein, cells, and more!
  - *multi-omic platform*
- actionable data
  - combined quality score from all data sources for comprehensive & conclusive assessment
- earlier data
  - complete data early to drive accurate decision making



Versatile Smart Assay (VSA) Platform

VSA technology

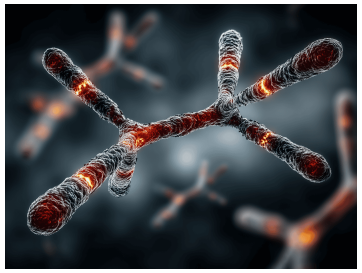




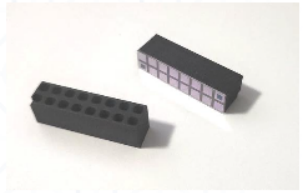
- generates *1000x more data* than the prevailing technology
  - scalable multi-omic microarray sensor
- *21 patents* in US, Canada, EU, and China
- indicates how good the data is in real time
  - patented "dynamic force spectroscopy" and "powerful Bayesian inference" method provides our data *quality score* to know their accuracy for actionable data
- AI software extracts a detailed, interpretable picture for quick diagnosis
  - leads to *AI knowledge discovery* resulting in *data-driven diagnosis*

Enabling comprehensive data acquisition

- antibodies - versatile tools in biology
  - can engineer to target virtually *anything* we want
  - problem
    - indiscriminate interactions severely limits use of antibodies – *cross-reactivity*
    - error-prone results due to *non-specific binding*
- solution - comprehensive data with *dynamic force spectroscopy*
  - comprehensive binding strength to distinguish specific from non-specific binding
  - *quality score* discerns noise from useful data to enable multiplexing

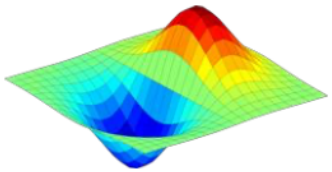
VSA's business models



Consumable chip & flowcell

Instrument

Consumable reagent kit



Software AI/ML & SaaS

- VSA platform
  - instrument - recurring revenue with high margin
  - modular licensable software - AI based data interpretation and feature extraction
- SaaS
  - subscription based pre-validation of reagent database
  - AI feature extraction and knowledge discovery

When Erudio's VSA meets AI - Gates Foundation Grant

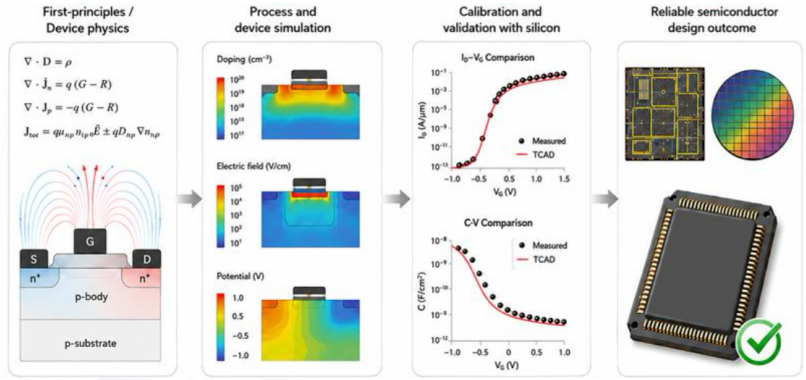
Erudio Bio wins $1M Gates Foundation Grant - scaling bioTCAD

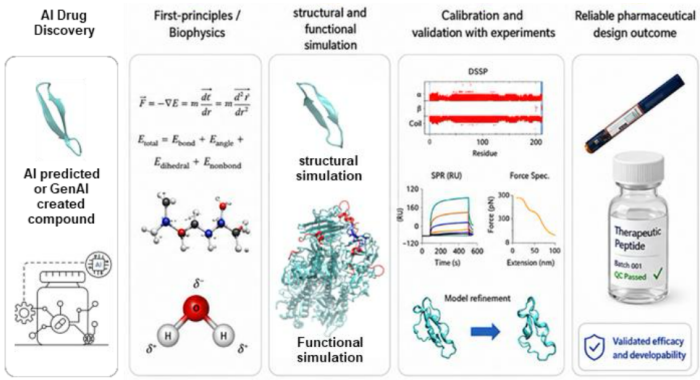
Gates Foundation

- *$1M Grant Award (2025)*
  - Gates Foundation recognizes Erudio Bio's potential to transform drug development for global health
- mission alignment - democratizing medicine by making preclinical drug design faster, yet reliable & accessible
  - lowering development costs for diseases affecting LMICs
  - addressing the 90% clinical trial failure rate that drives up drug costs
- funded project - develop *bioTCAD$^{\mathrm{TM}}$ platform for lead optimization of drug discovery*
  - expand force spectroscopy measurements across high-burden disease targets
  - train AI models with kinetics-resolved binding data (on/off rates, unbinding forces)
  - *enable pharma/biotech to prioritize candidates earlier with higher confidence*

bioTCAD - hybrid AI & physics-based drug development

- (old school) AI/ML excels at pattern recognition across large chemical libraries
  - identifying candidate hits at scale – valuable role established and growing
- AI alone *cannot reliably explain binding physics or predict behavior in unexplored and novel chemical space* – *capability and credibility gap*
- bioTCAD combines *AI and measurement-backed, physics-grounded simulation*
- applies *the* principle that made semiconductor TCAD trustworthy
  - validate model parameters to YOUR experimental measurements to be reliably right





Erudio Bio's Business Models

Erudio Bio Applications

- drug development
- clinical diagnostic
  - medicine is already 20% of the world's economy and growing at 5% per year
- biodefense
  - GWOT to great power competition
  - need to defend against near-peer adversaries
  - flexible, efficient solution needed from CBRND to readiness

Teams

Team & advisory board

- team
  - Kee-Hyun Paik, Ph.D. (CEO) - chip, microfluidics, instrumentation
  - Sunghee Yun, Ph.D. (CTO) - AI, optimization, business development, software
  - Susanne Baumhueter, Ph.D. - biology, immunology, project management
- advisory board
  - Michael Cola - CEO of AEVI Genomic Medicine ($62B sales to Takeda)
  - Tim Germann - CCO of Carterra Bio
  - Karyn Eliot - retired CIA Sr. Executive
  - Phil Ferro - virologist, formerly DoD, DoS, HHS and White house
  - Bill Chen - Former hedge fund and VC professional with national security, FFRDC
  - Ronald W. Davis - Director of Stanford Genome Tech Center ($15B+ exits)
  - Michael Snyder - Prof. Genetics, Dir. Stanford Human Genome Center
  - William J. Greenleaf - Prof. Genetics and Applied Physics, Stanford University


SAMSUNG
ELECTRONICS


amazon


SK hynix

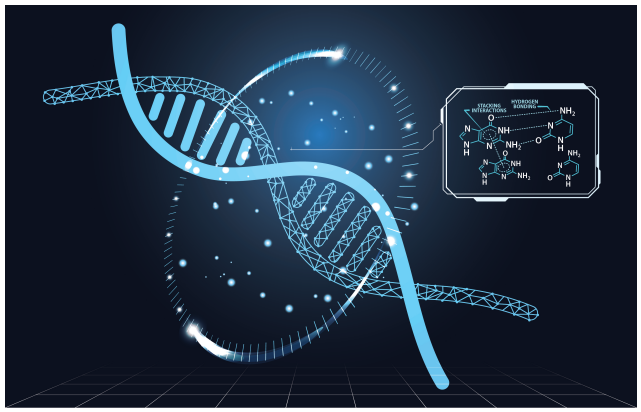

Stanford
Computer Science

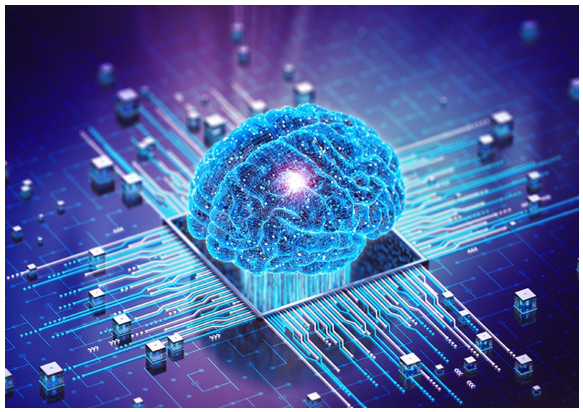
Appendix

AI & Biotech

AI in biology

- AI has been used in biological sciences, and science in general
- AI's ability to process large amounts of raw, unstructured data ($e.g.$, DNA sequence data)
  - reduces time and cost to conduct experiments in biology
  - enables others types of experiments that previously were unattainable
  - contributes to broader field of engineering biology or biotechnology
- AI increases human ability to make direct changes at cellular level and create novel genetic material ($e.g.$, DNA and RNA) to obtain specific functions





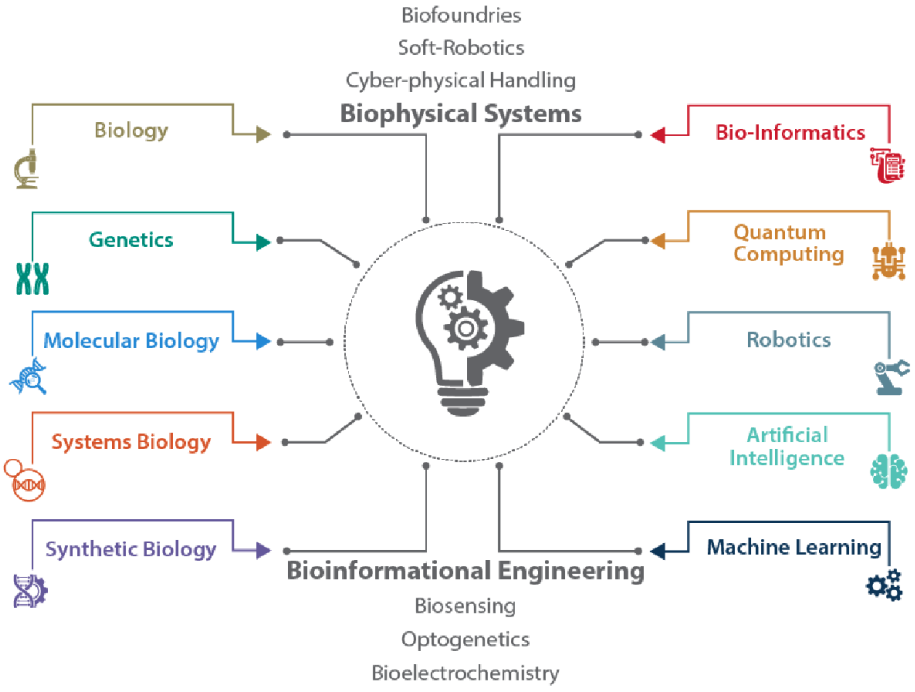
Biotech

Biotech

- biotechnology
  - is multidisciplinary field leveraging broad set of sciences and technologies
  - relies on and builds upon advances in other fields such as nanotechnology & robotics, and, increasingly, AI
  - enables researchers to read and write DNA
    - sequencing technologies "read" DNA while gene synthesis technologies take sequence data and "write" DNA turning data into physical material
- 2018 National Defense Strategy & Senior US Defense and Intelligence Officials identified emerging technologies that could have disruptive impact on US national security [Say21]
  - *AI*, lethal autonomous weapons, hypersonic weapons, directed energy weapons, *biotechnology,* quantum technology
- other names for biotechnology are engineering biology, synthetic biology, biological science (when discussed in context of AI)

Biotech - multidisciplinary field

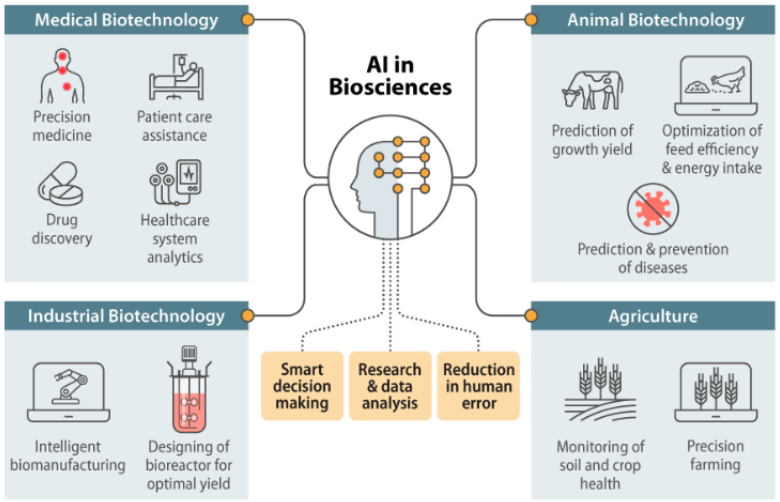
- sciences and technologies enabling biotechnology include (but not limited to)
  - (molecular) biology, genetics, systems biology, synthetic biology, bio-informatics, quantum computing, robotics [DFJ22]



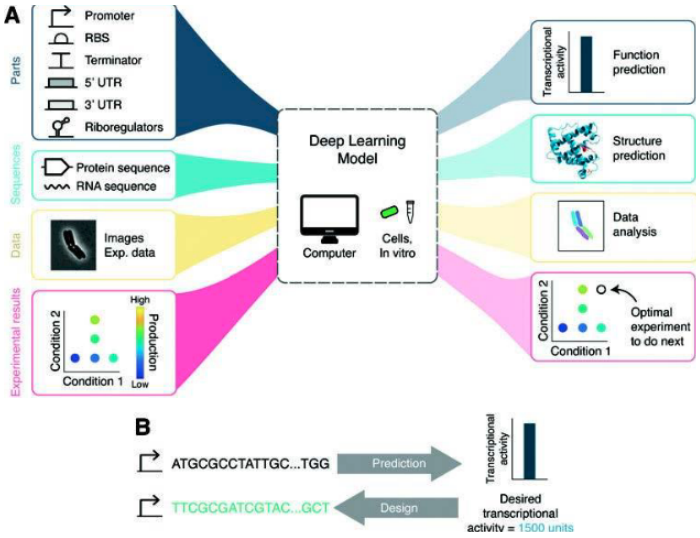
Convergence of AI and biological design

- AI & biological sciences converging [BKP22]
  - each building upon the other's capabilities for new research and development across multiple areas
- Demis Hassabis, CEO & cofounder of DeepMind, said of biology [Toe23]

  > ". . . biology can be thought of as information processing system, albeit extraordinarily complex and dynamic one . . . just as mathematics turned out to be the right description language for physics, biology may turn out to be *the perfect type of regime for the application of AI!*"
- both AI & biotech rely on and build upon advances in other scientific disciplines and technology fields, such as nanotechnology, robotics, and increasingly big data ($e.g.$, genetic sequence data)
  - each of these fields itself convergence of multiple sciences and technologies
- so *their impacts can combine to create new capabilities*



Multi-source genetic sequence data



- AI, essential to analyzing exponential growth of genetic sequence data

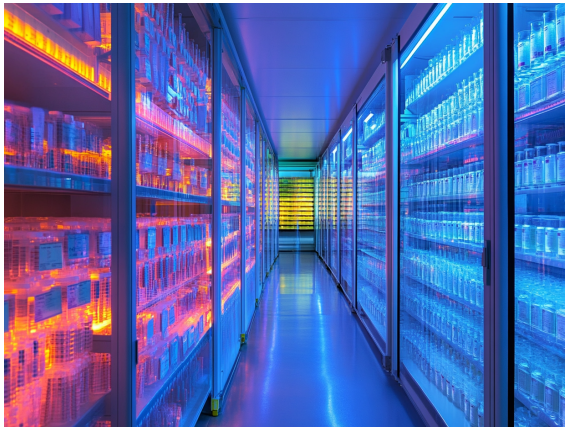
  "AI will be essential to fully understanding how genetic code interacts with biological processes" - US National Security Commission on Artificial Intelligence (NSCAI)

  – process huge amounts of biological data, $e.g.$, genetic sequence data, coming from different biological sources for understanding complex biological systems
    - sequence data, molecular structure data, image data, time-series, omics data

- $e.g.$, analyze genomic data sets to determine the genetic basis of particular trait and potentially uncover genetic markers linked with that trait

Quality & quantity of biological data

- limiting factor, however, is *quality and quantity* of biological data, $e.g.$, DNA sequences, that AI is trained on
  - $e.g.$, accurate identification of particular species based on DNA requires reference sequences of *sufficient quality* to exist and be available
- databases have varying standards - access, type, and quality of information
- design, management, quality standards, and data protocols for reference databases can affect utility of particular DNA sequence



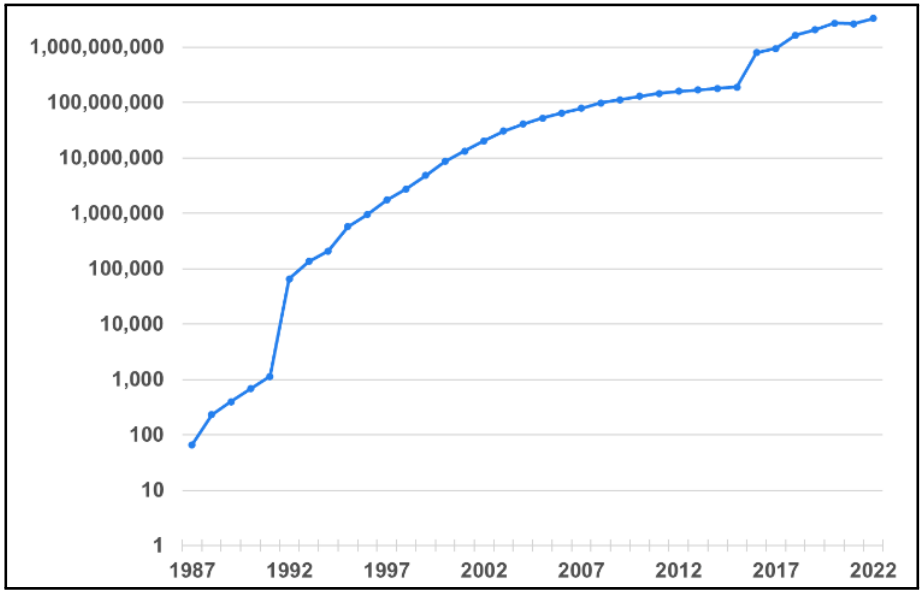
Rapid growth of biological data

- volume of genetic sequence data grown exponentially as sequencing technology evolved
- more than 1,700 databases incorporating data on genomics, protein sequences, protein structures, plants, metabolic pathways, $etc.$, $e.g.$
  - open-source public database
    - Protein Data Bank, US-funded data center - more than *terabyte of three-dimensional structure data* for biological molecules, $e.g.$, proteins, DNA, RNA
  - proprietary database
    - Gingko Bioworks - more than *2B protein sequences*
  - public research groups
    - Broad Institute - produces roughly *500 terabases of genomic data per month*
- great potential value in aggregate volume of genetic datasets that can be collectively mined to discover and characterize relationships among genes

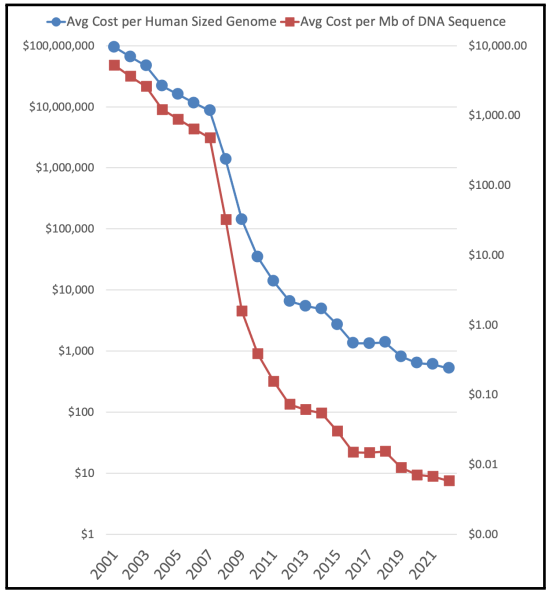
Volume and sequencing cost of DNA over time

- volume of DNA sequences & DNA sequencing cost
  - data source: National Human Genome Research Institute (NHGRI) [Wet23] & International Nucleotide Sequence Database Collaboration (INSDC)
- *more dramatic than Moore's law!*

sequences in INSDC



DNA sequencing cost



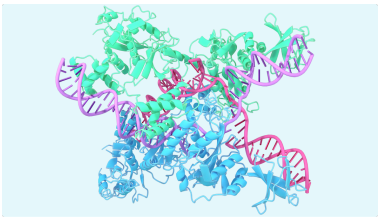
Bio data availability and bias

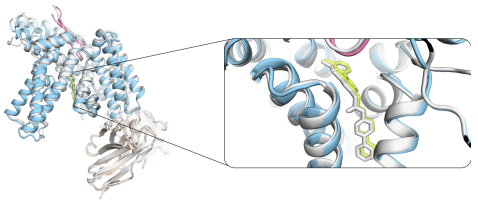
- US National Security Commission on Artificial Intelligence (NSCAI) recommends
  - US fund and prioritize development of a biobank containing *"wide range of high-quality biological and genetic data sets securely accessible by researchers"*
  - establishment of database of broad range of human, animal, and plant genomes would
    - *enhance and democratize biotechnology innovations*
    - *facilitate new levels of AI-enabled analysis of genetic data*
- bias - availability of genetic data & decisions about selection of genetic data can introduce bias, $e.g.$
  - training AI model on datasets emphasizing or omitting certain genetic traits can affect how information is used and types of applications developed - *potentially privileging or disadvantaging certain populations*
  - access to data and to AI models themselves may impact communities of differing socioeconomic status or other factors unequally

Emerging Trends in Biotech

AlphaFold

- solving 50-year-old protein folding problem, *"one of biology's grand challenges"*
  - definition - given amino acid sequence, predict how it folds into a 3D structure
  - proteins fold in microseconds, but predicting computationally nearly impossible
- AlphaFold 1 (2018) - DL + physics-based energy functions → AlphaFold 2 (2020) - attention-based NN solving protein folding "in principle" → AlphaFold 3 (2024) - diffusion-based DL, drug-protein interactions, protein complexes
- AlphaFold protein structure database
  - >200MM protein structures - nearly every known protein, used by >2MM researchers
- Applications & implications
  - drug discovery - target identification, lead optimization, side effect prediction
  - enzyme engineering, agriculture, environmental, vaccine development





AlphaGo

- Go board marked with 19×19 grid - $(19 \times 19)! = 361! \approx 1.44 \times 10^{768}$
  1437923258884890654832362511499863354754907538644755876127282765299227795534389618856841908003141196
  0714137944348905859683839682333043216077138088370565578796691924861827097800358990211005794501073330
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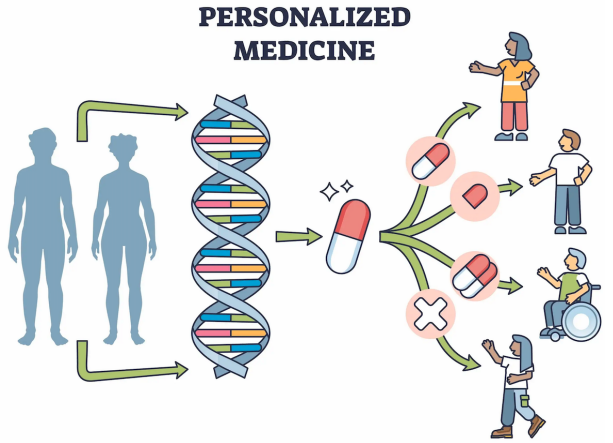
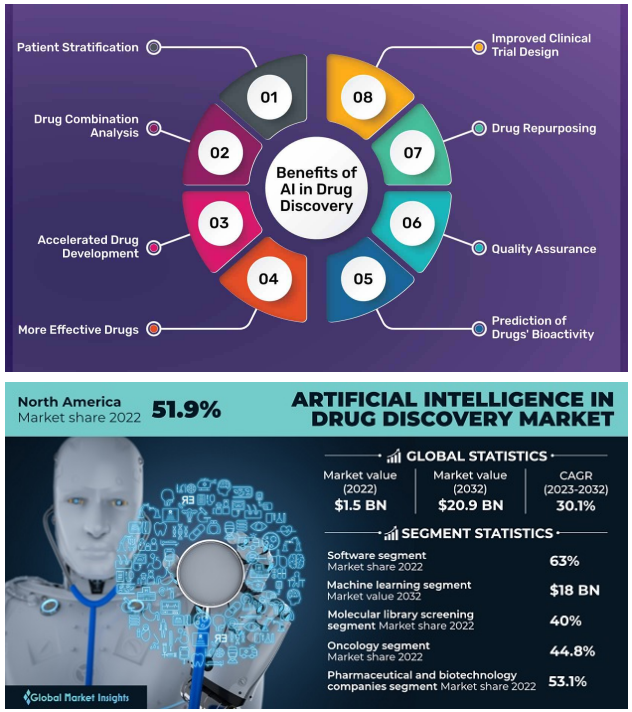
  9917299937133680728459000034496420337066440853337001284286412654394495050773954560000000000000000000
  0000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000000
- deep reinforcement learning with Monte Carlo tree search
  - trained on thousands of years of Go game history
  - AlphaGo Zero learns by playing against itself
- development experience, insight, knowledge, know-how transferred to AlphaFold

Personalized medicine

- *shift from one-size-fits-all approach to tailored treatments*
- based on individual genetic profiles, lifestyles & environments
- AI enables analysis of vast data to predict patient responses to treatments, thus enhancing efficacy and reducing adverse effects
- $e.g.$
  - custom cancer therapies
  - personalized treatment plans for rare diseases
  - precision pharmacogenomics
- companies - Tempus, Foundation Medicine, $etc.$



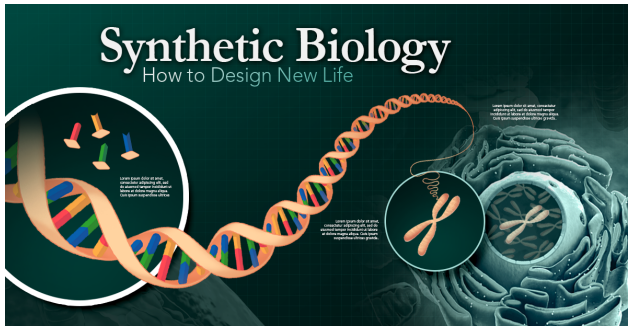
AI-driven drug discovery

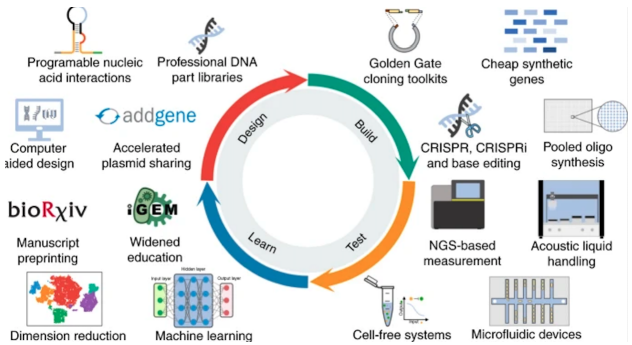


- traditional drug discovery process - time-consuming and costly often taking decades and billions of dollars
- AI streamlines this process by predicting the efficacy and safety of potential compounds with more speed and accuracy
- AI models analyze chemical databases to identify new drug candidates or repurpose existing drugs for new therapeutic uses
- companies - Insilco Medicine, Atomwise.

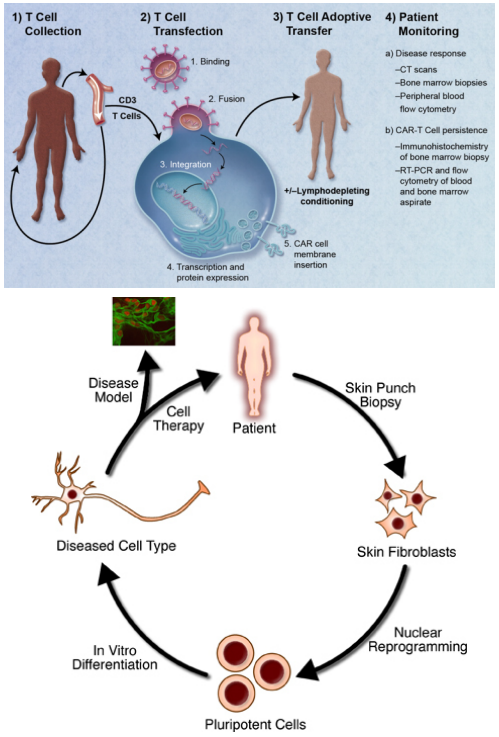
Synthetic biology

- use AI for gene editing, biomaterial production and synthetic pathways
- combine principles of biology and engineering to design and construct new biological entities
- AI optimizes synthetic biology processes from designing genetic circuits to scaling up production
- company - Ginkgo Bioworks uses AI to design custom microorganisms for applications ranging from pharmaceuticals to industrial chemicals





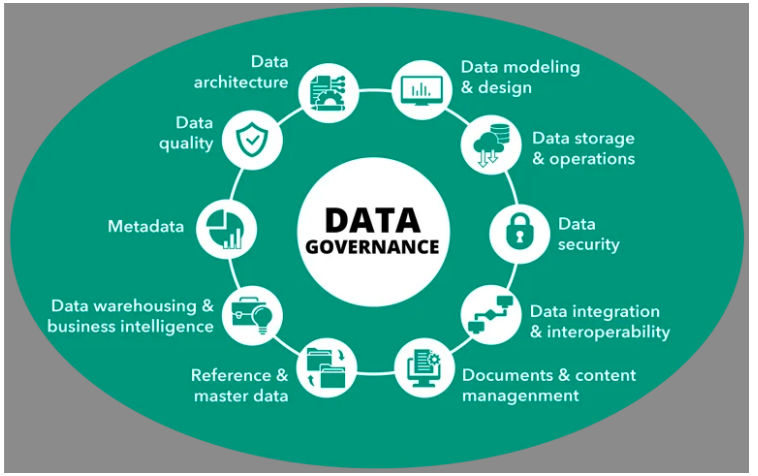
Regenerative medicine



- AI advances development of stem cell therapies & tissue engineering
- AI algorithms assist in identifying optimal cell types, predicting cell behavior & personalized treatments
- particularly for conditions such as neurodegenerative diseases, heart failure and orthopedic injuries
- company - Organovo leverages AI to potentially improve the efficacy and scalability of regenerative therapies, developing next-generation treatments

Bio data integration

- integration of disparate data sources, including genomic, proteomic & clinical data - one of biggest challenges in biotech & healthcare
- AI delivers meaningful insights *only when* seamless data integration and interoperability realized
- developing platforms facilitating comprehensive, longitudinal patient data analysis - vital enablers of AI in biotech
- company - Flatiron Health working on integrating diverse datasets to provide holistic view of patient health



Silicon Valley AI Nexus

Silicon Valley AI Nexus (or just AI Nexus)

- pioneering community of professionals dedicated to building privacy-preserving AI solutions, products, and systems
- comprehensive expertise across AI domains
  - biotechnology, healthcare, and medical research
  - industrial applications and data centers
  - cloud infrastructure, storage solutions, mobile technologies
  - customer service platforms, multi-agent systems
  - RAG implementations, vector databases, agentic AI frameworks
- vision
  - *shaping future where AI innovation and privacy protection go hand in hand*
- active community with homepage & KakaoTalk collaboration platform for members

Our journey - forum history

- Nov-Dec 2024 - "The AI Strikes Back" & "Free Your Data"
  - Prof. Jung Hee Cheon (homomorphic encryption revolution)
- Jan 2025 - "The AI Knight Rises"
  - Sunghee Yun @ Erudio Bio on deep learning to flourishing societies
- Feb 2025 - "Silicon Citadel"
  - Chanik Park @ MangoBoost on AI data infrastructure
- Mar 2025 - "Blockchain Awakens"
  - Daejun Park @ a16z crypto on decentralized AI
- Apr 2025 - "Advancing Humanity"
  - Stanford Medicine team on bio/medical AI
  - co-hosting with K-BioX
- May 2025 - "The Autonomous Alliance"
  - Microsoft, GitHub, Uclone, SK Hynix on AI agents

Our journey - forum history

- Jun 2025 - "Silicon Companions"
  - Altos Ventures on robotics & smart devices
- Aug 2025 - "The Human-Centric AI Revolution"
  - address legal and ethical issues related to AI
- Nov 2025 - "The AI Silicon Race"
  - Korea-US Innovation Leadership at K·ASIC

Strategic partnerships & ecosystem

- *Perpetual Partnership with KOTRA Silicon Valley as Strategic Alliance*
- 2026 co-hosting partners
  - K·ASIC (Korea AI & IC Innovation Center)
  - K-BioX (biotech innovation)
  - KOTRA Silicon Valley (trade & investment)
  - Consulate General of the Republic of Korea at San Francisco (diplomatic support)
  - KABANC (Korean American Bar Association of Northern California - legal expertise)
- building bridges between Silicon Valley innovation and Korean institutional networks
- creating comprehensive support ecosystem: technical, legal, business, diplomatic

Community & engagement

- membership requirements
  - attend one! AI Nexus event!
- member benefits
  - networking with AI professionals across all domains
  - knowledge sharing and collaboration opportunities
  - direct access to world-class speakers and experts
- forum format - 5pm-8pm, typically Wednesdays at premier Silicon Valley venues
- venues - Stanford, KOTRA, SK Hynix, Altos Ventures, K·ASIC, and more
- active community engagement and professional development

Three Core Tenets

- *Explore & Lead*
  - world-class forums, the AI & Humanity Council, and thought leadership shaping AI's most consequential questions
- *Elevate Community*
  - mentorship, startup showcases, professional connections, and leadership opportunities that amplify every voice
- *Give Back to Society*
  - policy engagement, academic partnerships, and public discourse ensuring AI's benefits reach beyond Silicon Valley

AI Nexus encourages and embraces Interest Groups

- Bio / Medical / Data Group (7)
  - Chanik Insuk Jeff Jongmin Minha Mitch Sunghee led by Chanik
- Karaoke Group (4)
  - Hayden Jeff Sunghee Yeseul led by Sunghee
- AI Hands-on Group (5)
  - Chanik James Kyoung Whan Minha Sunghee led by Minha
- East Bay Group (7)
  - Daniel Eugene Hyunjung Linda MiSook MJ Sunghee led by Hyunjung

Collaboration with Institutions & Universities

- MOUs
  - SNU
    - *AI Nexus × SNU College of Engineering Silicon Valley Immersion Program*
    - *Winter Internship 2026*
  - asked by
    - KIC SV
    - SVreboot
    - XL8
    - KASPA
    - Korea Univ.
    - Sungkyunkwan Univ.
    - KAIST
    - Korean American Semiconductor Professional Alliance (KASPA)
    - *etc.*

Collaboration with Institutions & Universities

- Co-hosting with
  - K-BioX
  - KOTRA SV
  - KIC SV
  - K-ASIC
  - Korea-America Student Conference (KASC)
  - Consulate General of the Republic of Korea at San Francisco
  - Korean American Bar Association of Northern California (KABANC)
  - $etc.$

AI Nexus Committee

- Board of Directors
  - *Sunghee Yun* - Co-Founder & Char
  - *Minha Hwang* - Co-Founder & AI Master
  - *Sue Kim* - Co-Founder & Marketing Leader
  - *Youngwook (Hayden) Song* - Co-Founder & Legal Affairs Advisor
  - *Bo Hyoung (Jeff) Lee* - Co-Founder & Legal Affairs Advisor
  - *MiSook Chung* - Co-Founder & Community Engagement Chair
- Vision & Principles Committee
- Tech & Social Media Committee
- Program & Content Committee
- the full list of committees can be found here!

Selected References & Sources

Selected references & sources

- Robert H. Kane "Quest for Meaning: Values, Ethics, and the Modern Experience" 2013
- Michael J. Sandel "Justice: What's the Right Thing to Do?" 2009
- Daniel Kahneman "Thinking, Fast and Slow" 2011
- Yuval Noah Harari "Sapiens: A Brief History of Humankind" 2014
- M. Shanahan "Talking About Large Language Models" 2022
- A.Y. Halevry, P. Norvig, and F. Pereira "Unreasonable Effectiveness of Data" 2009
- A. Vaswani, et al. "Attention is all you need" @ NeurIPS 2017
- S. Yin, et. al. "A Survey on Multimodal LLMs" 2023
- Chris Miller "Chip War: The Fight for the World's Most Critical Technology" 2022

- CEOs, CTOs, CFOs, COOs, CMOs & CCOs @ startup companies in Silicon Valley
- VCs on Sand Hill Road - Palo Alto, Menlo Park, Woodside in California, USA

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Thank You


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Leader / Global Managing Partner @ LULU...