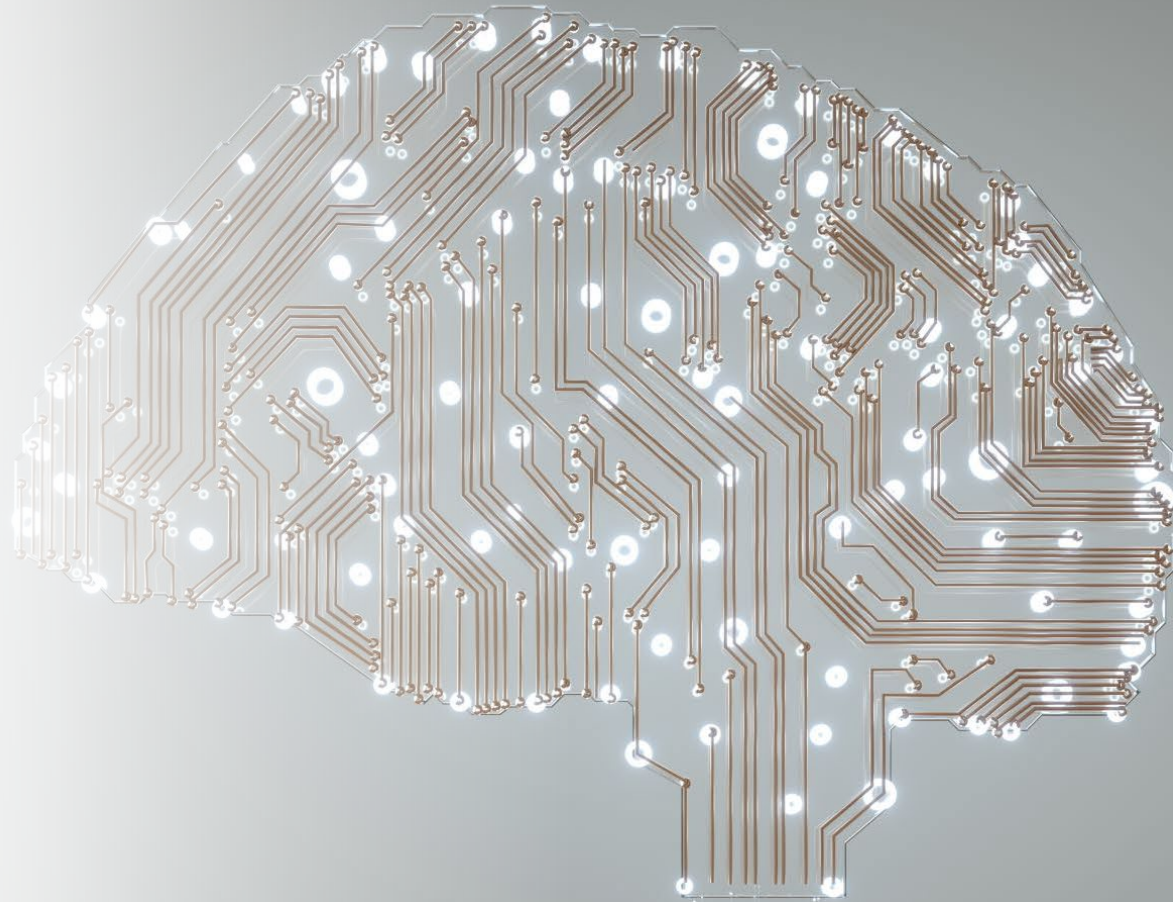


Artificial Intelligence From ChatGPT to Autonomous Agents and Multimodal Possibilities

Dr. Raymond Uzwysyn
Associate Dean, Collections
Management and Strategy
Mississippi State University
Libraries, 2024



AI Histories

Begins in the 1950's, mostly US and Britain. Main Figures, Alan Turing (Turing Test), John McCarthy Dartmouth Conference (Artificial Intelligence name is coined), Marvin Minsky

1950's

1960's

1980's -
1990's

1990's-
2000's

2010's

AI winter, Expert Systems, IBM's Deep Blue (1997) beats Kasparov in Chess

Deep Learning/Neural Net Renaissance Ilya Sutskevar (U Toronto, AlexNet, Images), Yoshua Benjio, Yann LeCun Google Deep Mind (Demis Hassabis, Cambridge, UC London, Deep Mind/Google, Lee Sedol, Alpha Go)

Continues in 1960's Josef Weizenbaum (Eliza, First Chatbot), Marvin Minsky, Neural Nets Introduced (processing power issues)

(Geoffrey Hinton, U Toronto), Push Singh (MIT), Chris Mckinstry, Deb Roy (Waterloo, MIT, Early Voice Recognition)

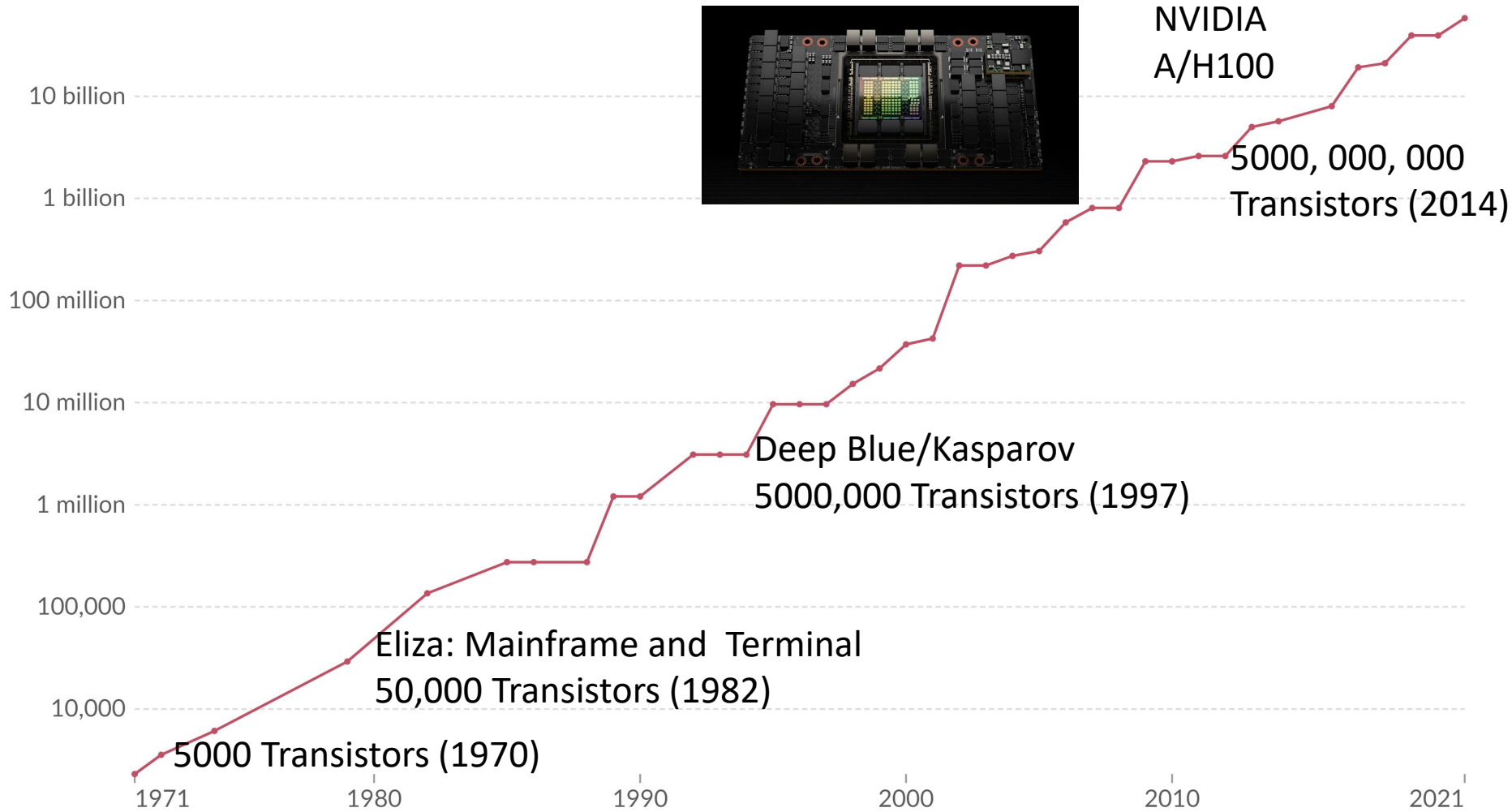


Moore's law: The number of transistors per microprocessor

The number of transistors that fit into a microprocessor. The observation that the number of transistors on an integrated circuit doubles approximately every two years is called Moore's law¹.

Moore's Law, (Processing Power and AI)

Number of
Transistors on an
Integrated
Circuits Doubles
Every 2 years



Data source: Karl Rupp, Microprocessor Trend Data (2022)

OurWorldInData.org/technological-change | CC BY

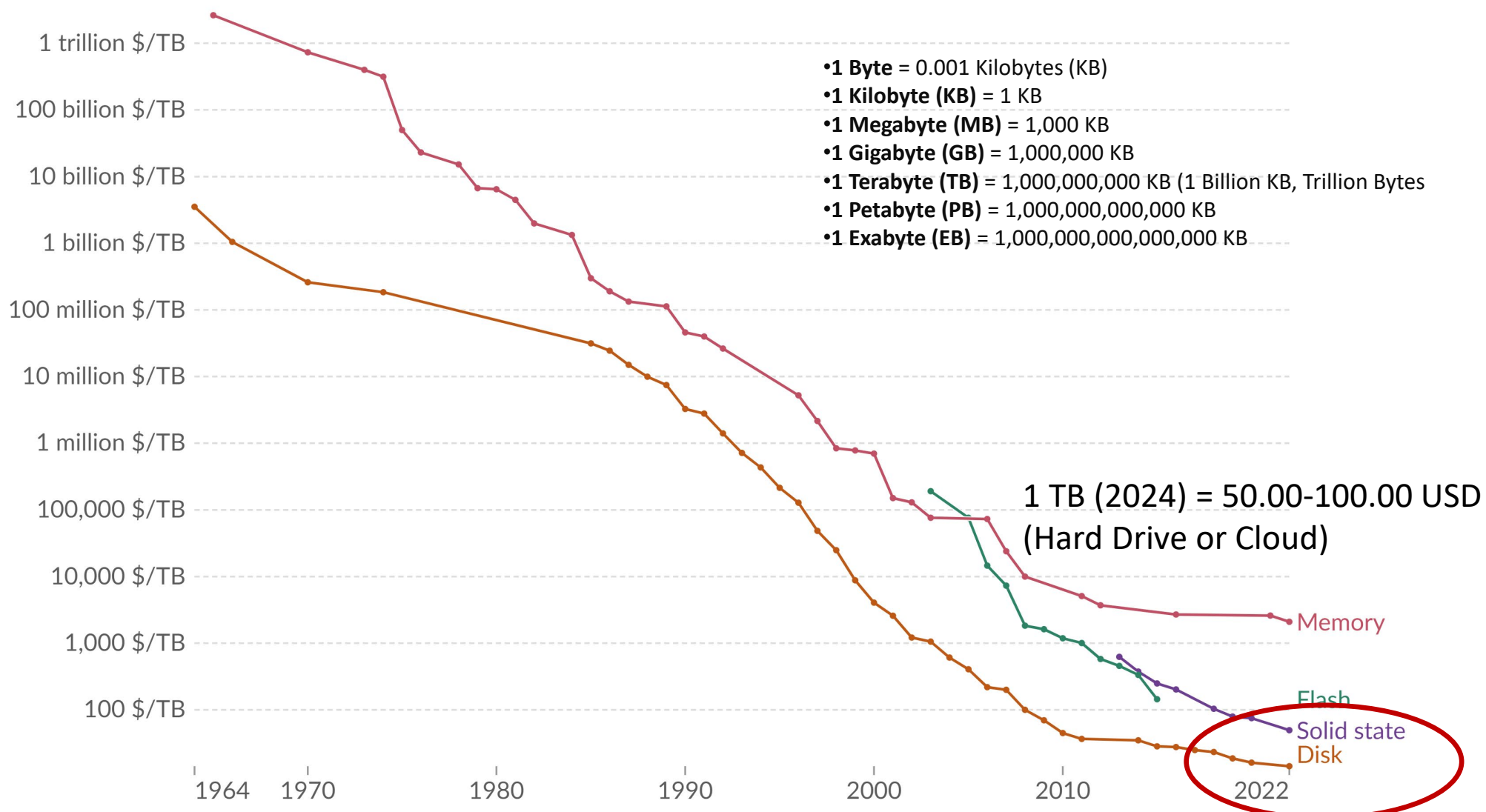
1. Moore's law: Moore's law is the observation that the number of transistors in a dense integrated circuit doubles about every two years, because of improvements in production. Read more: [What is Moore's Law?](#)

Historical cost of computer memory and storage

This data is expressed in US dollars per terabyte (TB). It is not adjusted for inflation.

Data Storage, Memory and AI Cost/TB

(AI Requires Massive Datasets For Training Neural Nets)



Data source: John C. McCallum (2022)

OurWorldInData.org/technological-change | CC BY

Note: For each year, the time series shows the cheapest historical price recorded until that year.

AI Requires: Processing Power (Microprocessor) + Data + Storage (Memory) + Global Networks



Texas State University Dataverse
A platform for publishing and archiving Texas State University's research data.

Dataverse

TEXAS STATE
UNIVERSITY LIBRARIES



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Search the Texas Data Repository

Search... **FIND**



Add a Dataset



Create a Dataverse



Explore Data
Repository



Learn More

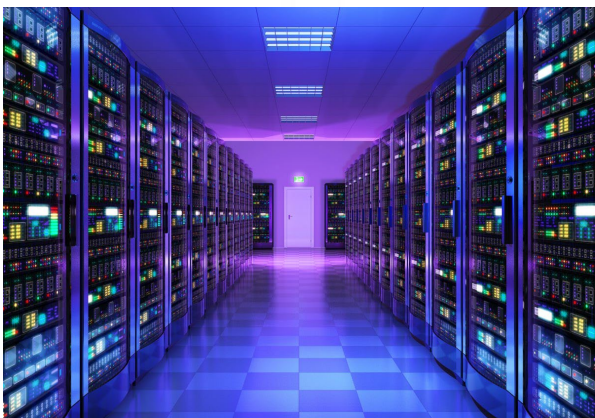


Get Help

Publish and Track Your Data, Discover and Reuse Others' Data!



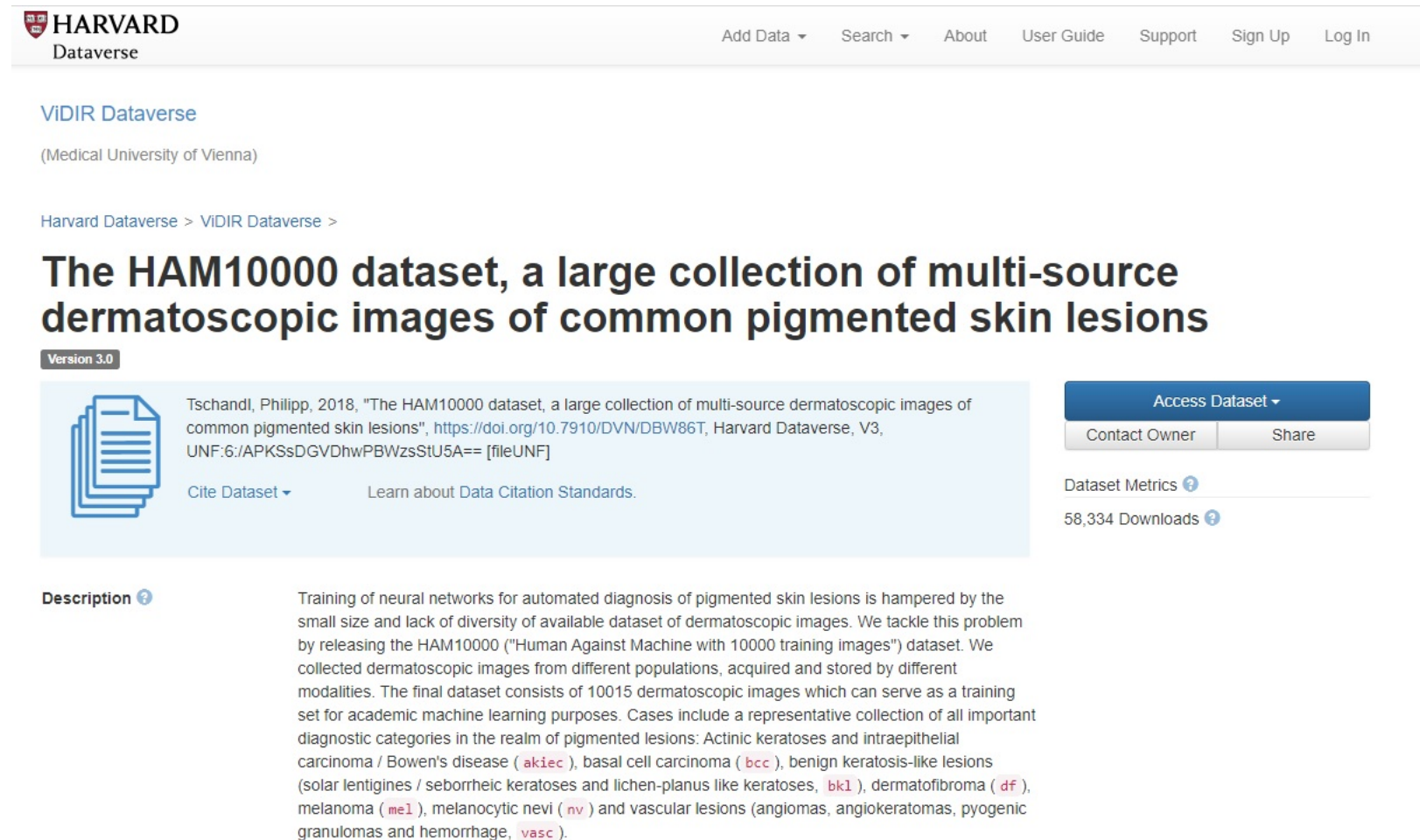
2014-2017, Texas Data Research Repository, Data Sharing, Collaboration, Data Visualization, Tableau, Discovery and Insights, Artificial Intelligence



Dataverse Data Research Repository Metadata

Dermatology Image Dataset,
Dr. Philip Tschandl, Viennese
Dermatologist

- Great Example of Open Science & Metadata
- <https://dataverse.harvard.edu/dataset.xhtml?persistentId=doi:10.7910/DVN/DBW86T>



The screenshot shows the Harvard Dataverse website interface. At the top, the Harvard Dataverse logo is on the left, and navigation links for 'Add Data', 'Search', 'About', 'User Guide', 'Support', 'Sign Up', and 'Log In' are on the right. Below the header, the page title is 'ViDIR Dataverse (Medical University of Vienna)'. A breadcrumb trail shows 'Harvard Dataverse > ViDIR Dataverse >'. The main heading is 'The HAM10000 dataset, a large collection of multi-source dermatoscopic images of common pigmented skin lesions', with a 'Version 3.0' badge. A light blue box contains a document icon, the citation text: 'Tschandl, Philipp, 2018, "The HAM10000 dataset, a large collection of multi-source dermatoscopic images of common pigmented skin lesions", https://doi.org/10.7910/DVN/DBW86T, Harvard Dataverse, V3, UNF:6:APKSsDGVDhwPBWzsStU5A== [fileUNF]', and links for 'Cite Dataset' and 'Learn about Data Citation Standards.'. To the right of this box are buttons for 'Access Dataset', 'Contact Owner', and 'Share'. Below the box, the 'Description' section starts with 'Training of neural networks for automated diagnosis of pigmented skin lesions is hampered by the small size and lack of diversity of available dataset of dermatoscopic images. We tackle this problem by releasing the HAM10000 ("Human Against Machine with 10000 training images") dataset. We collected dermatoscopic images from different populations, acquired and stored by different modalities. The final dataset consists of 10015 dermatoscopic images which can serve as a training set for academic machine learning purposes. Cases include a representative collection of all important diagnostic categories in the realm of pigmented lesions: Actinic keratoses and intraepithelial carcinoma / Bowen's disease (akiec), basal cell carcinoma (bcc), benign keratosis-like lesions (solar lentigines / seborrheic keratoses and lichen-planus like keratoses, bk1), dermatofibroma (df), melanoma (mel), melanocytic nevi (nv) and vascular lesions (angiomas, angiokeratomas, pyogenic granulomas and hemorrhage, vasc).' On the far right, 'Dataset Metrics' shows '58,334 Downloads'.

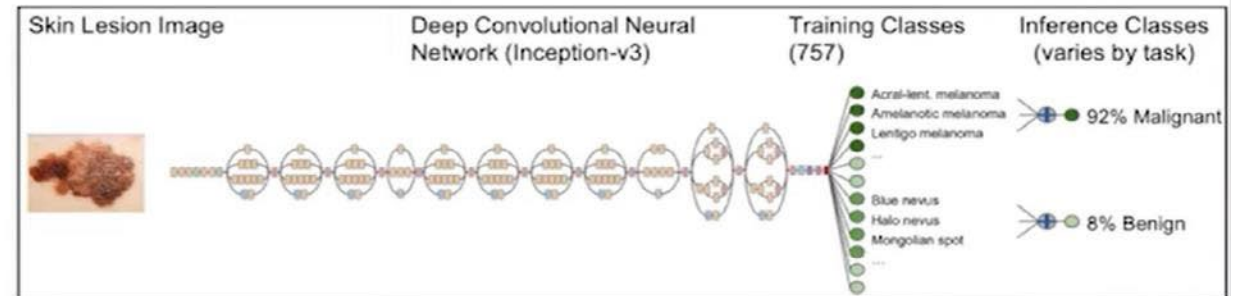
Dermatologist-level Classification of Skin Cancer with Deep Neural Networks,

Nature 2017, Andre Esteva, Brett Kupress, Sebastian Thrun et al.

Labeled Medical Data from Image Data Archives to Training AI Models (Deep Learning), Convolutional Neural Nets,

Skin Cancer Diagnosis:

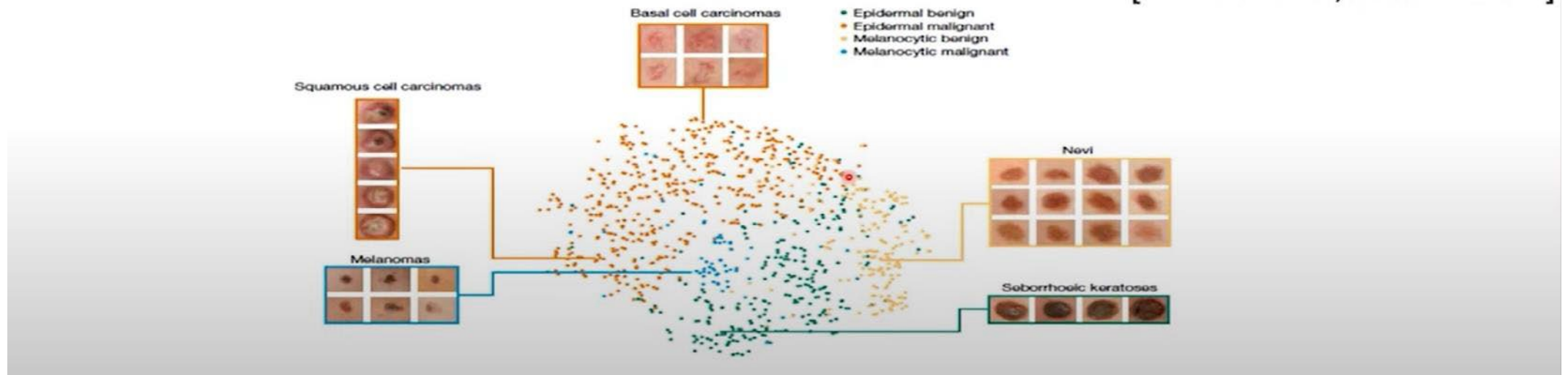
Trained on 1.4 M standard photographs
Retrained on 129,450 skin images
Deep net Inception v3 architecture
Outperforms doctors



[Esteva et al., *Nature* 2017]

[Video](#)

[Stanford
Overview](#)

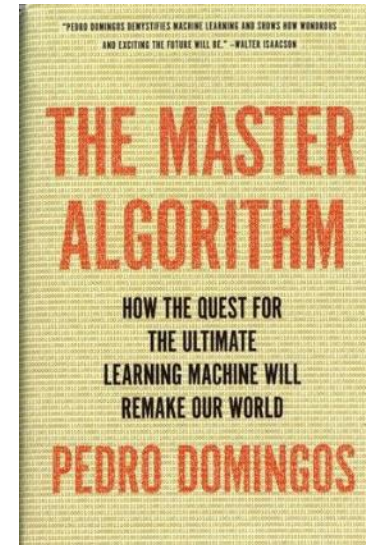


Open Science, Data Research Repositories, Discovery, Reuse and AI

AI Has Many Paradigms and Origins

Algorithms, Suitable Problem and Solution Methods,
Dr. Pedro Domingos, University of Washington

AI Paradigm	Origin	Algorithm	Problem	Solution
Deep Learning Machine Learning	Neuroscience (Neural Nets)	Back Propagation Neural Nets	Complex Tasks, Hidden Patterns	Back propagation
Symbolic AI	Logic, Philosophy	Inverse Deduction	Knowledge Composition	Inverse Deduction
Bayesian Inference	Statistics, Probability Theory	Probabilistic Inference	Uncertainty	Probabilistic Inference
Evolutionary Computation	Evolutionary Biology (Complexity Theory)	Genetic Algorithms	Structure Discovery	Genetic Programming
Reasoning by Analogy	Psychology	Kernel Machines (Support Vector Machines)	Similarity	Kernel Machines

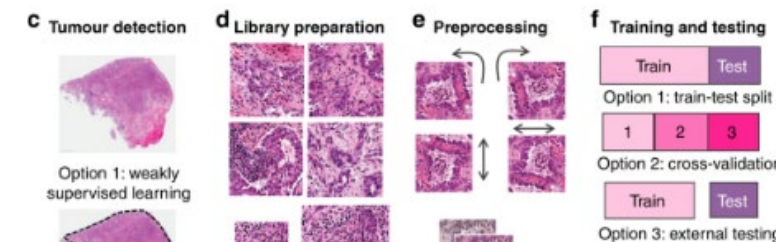
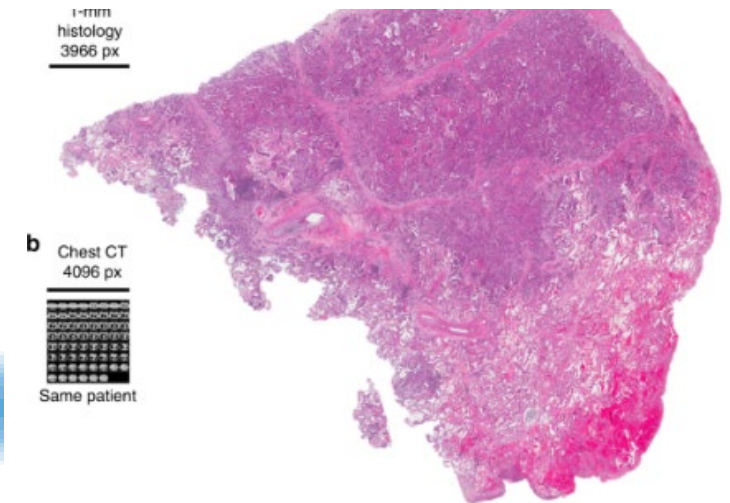
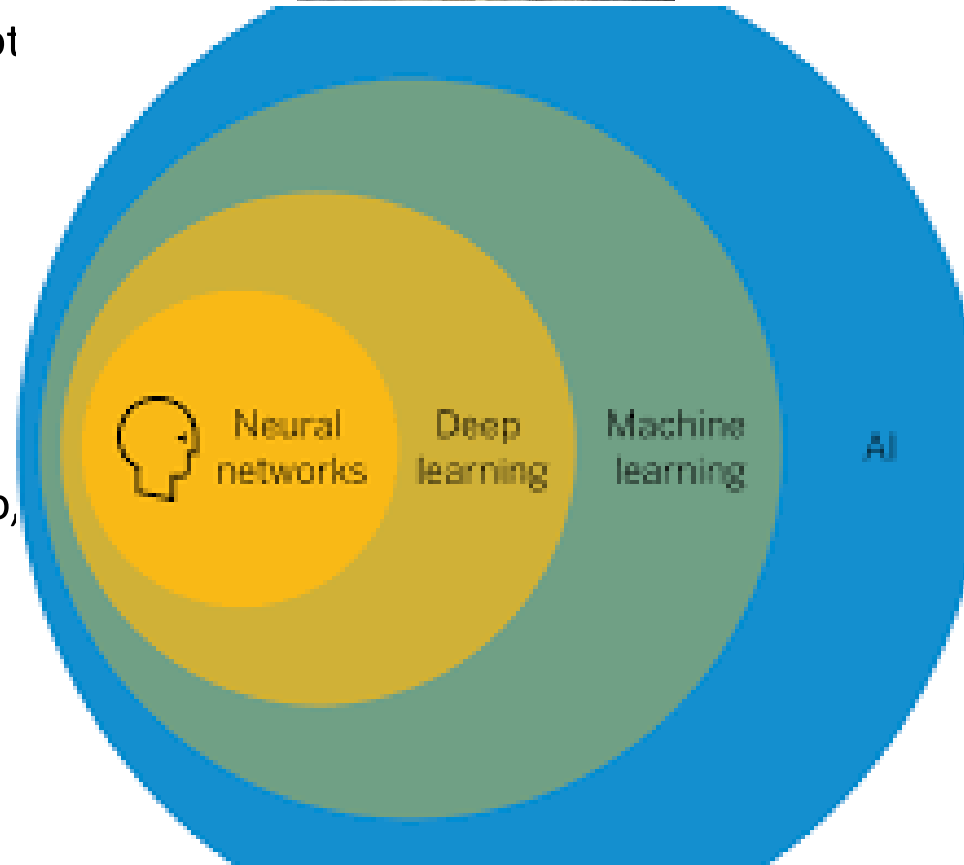


2015, 2018

Last Ten Years 2014-2024 Amazing Progress of AI

AI (Machine Learning (Deep Learning)) =
Better Algorithms + Greater Computing Power +
Large Data Sets + Good Metadata (Labeling)

- GPT's, Conversational Chatbot & Robotic Agents
- Natural Language Processing (Speech to Text, Next Word Translation)
- Computer Vision Cancer Cell Detection (Alexnet) (Facial + Object Recognition)
- Strategic Reasoning (AlphaGo, 2015-2017)
- Fraud Detection & Cybersecurity



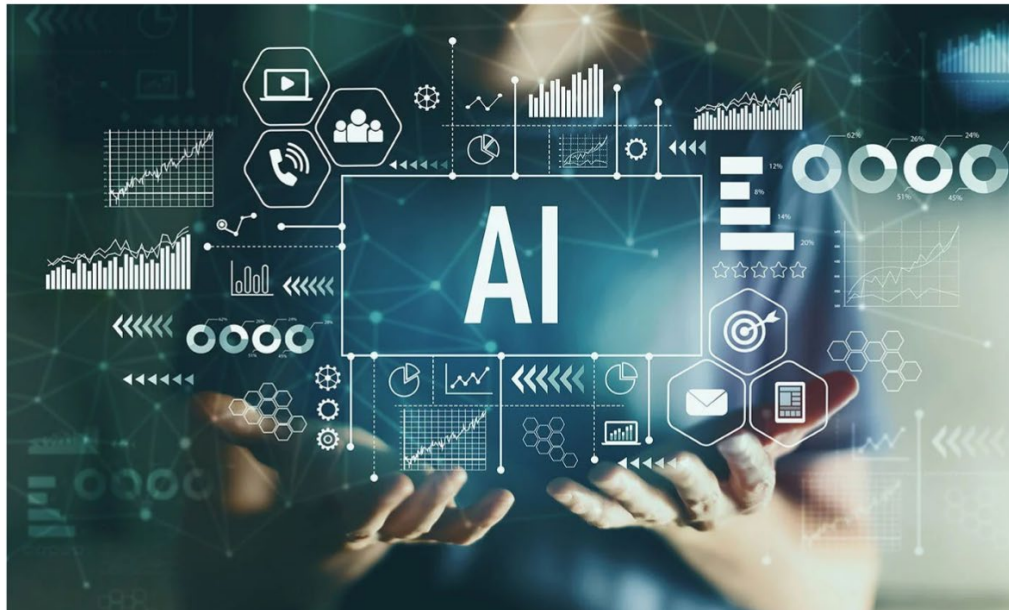
AI, Large Language Models (LLM's) and GPT's

Generative Pretrained Transformers, January 2022, Trends and Issues In Library Technology

Editorial Overview

Introduction: Artificial Intelligence in Libraries

Ray Uzwyshyn, ruzwyshyn@txstate.edu
Texas State University Libraries



AI in Libraries and Education, Tierney, Courtesy Adobe Stock

Introduction

The world is changing, and technological paradigms of AI are quickly being adopted in the world of libraries and information management. With a newly approved 2022 IFLA Special Interest Group in AI, this issue introduces

Conversion to BIBFRAME triples is also contextualized and detailed. National library perspectives can act as a gateway towards helping semantic web-linking and future AI harnessing possibilities. Complex AI-related projects

Spanish Language Models

A repository part of the MarIA project.

Corpora

Corpora	Number of documents	Number of tokens	Size (GB)
BNE	201,080,084	135,733,450,668	570GB

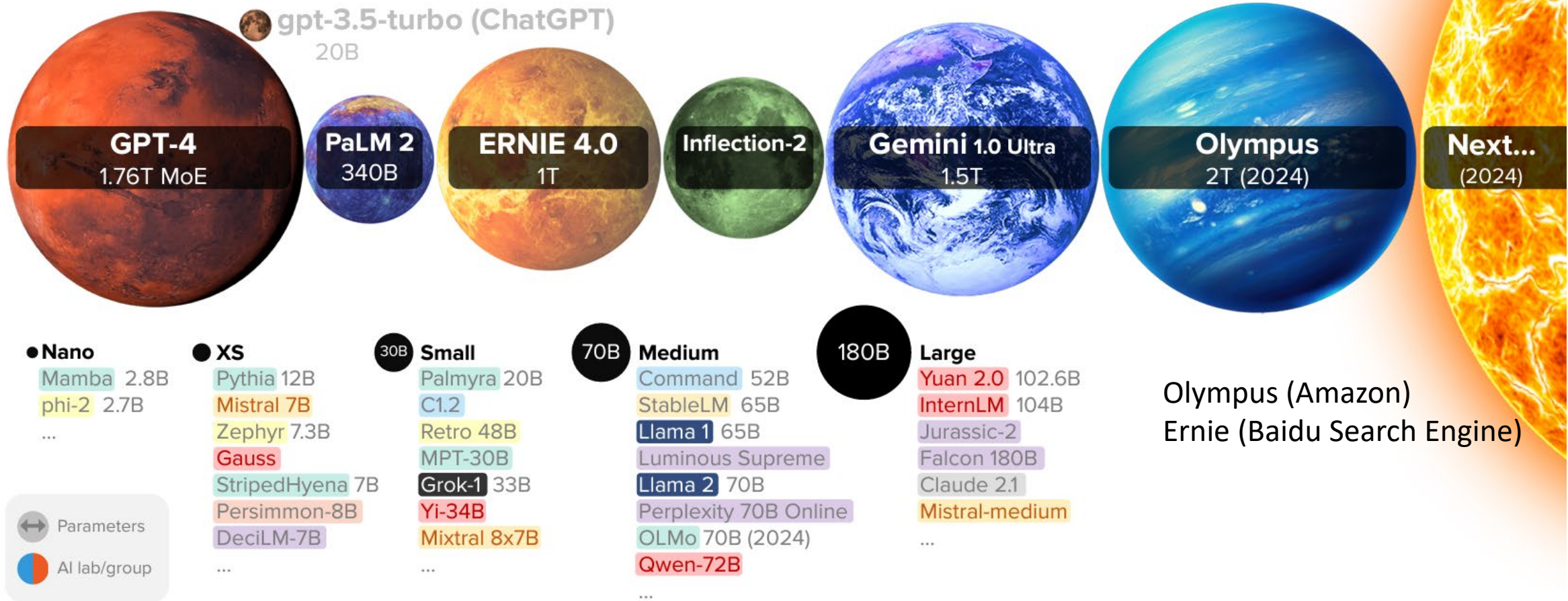
Models

- RoBERTa-base BNE: <https://huggingface.co/PlanTL-GOB-ES/roberta-base-bne>
- RoBERTa-large BNE: <https://huggingface.co/PlanTL-GOB-ES/roberta-large-bne>
- GPT2-base BNE: <https://huggingface.co/PlanTL-GOB-ES/gpt2-base-bne>
- GPT2-large BNE: <https://huggingface.co/PlanTL-GOB-ES/gpt2-large-bne>
- Other models: (WIP)

Fine-tuned models    

Digital Transformation, Data Reuse and Heritage Collections
At the National Library of Spain, Supercomputing Center
Partnership, Mare Nostrum, June 2022

LARGE LANGUAGE MODEL HIGHLIGHTS (DEC/2023)



Olympus (Amazon)
Ernie (Baidu Search Engine)

Sizes linear to scale. Selected highlights only. All models are available. All models are Chinchilla-aligned (20:1 tokens:parameters) <https://lilearchitect.ai/chinchilla/> All 200+ models: <https://lilearchitect.ai/models-table/> Alan D. Thompson. 2023.

GPT-4's Mixture of Experts Model (MoE model) is believed to house 16 expert models, each with around 111 billion parameters each. The Mixture of Experts (MoE) is offering a unique approach to efficiently scaling models while maintaining, or even improving, their performance. Traditionally, the trade-off in model training has been between size and computational resources

Large Language Models (LLM's)

GPT1, GPT2, GPT3, GPT3.5 and GPT4
 GPT – Generative Pretrained Transformers

Characteristics

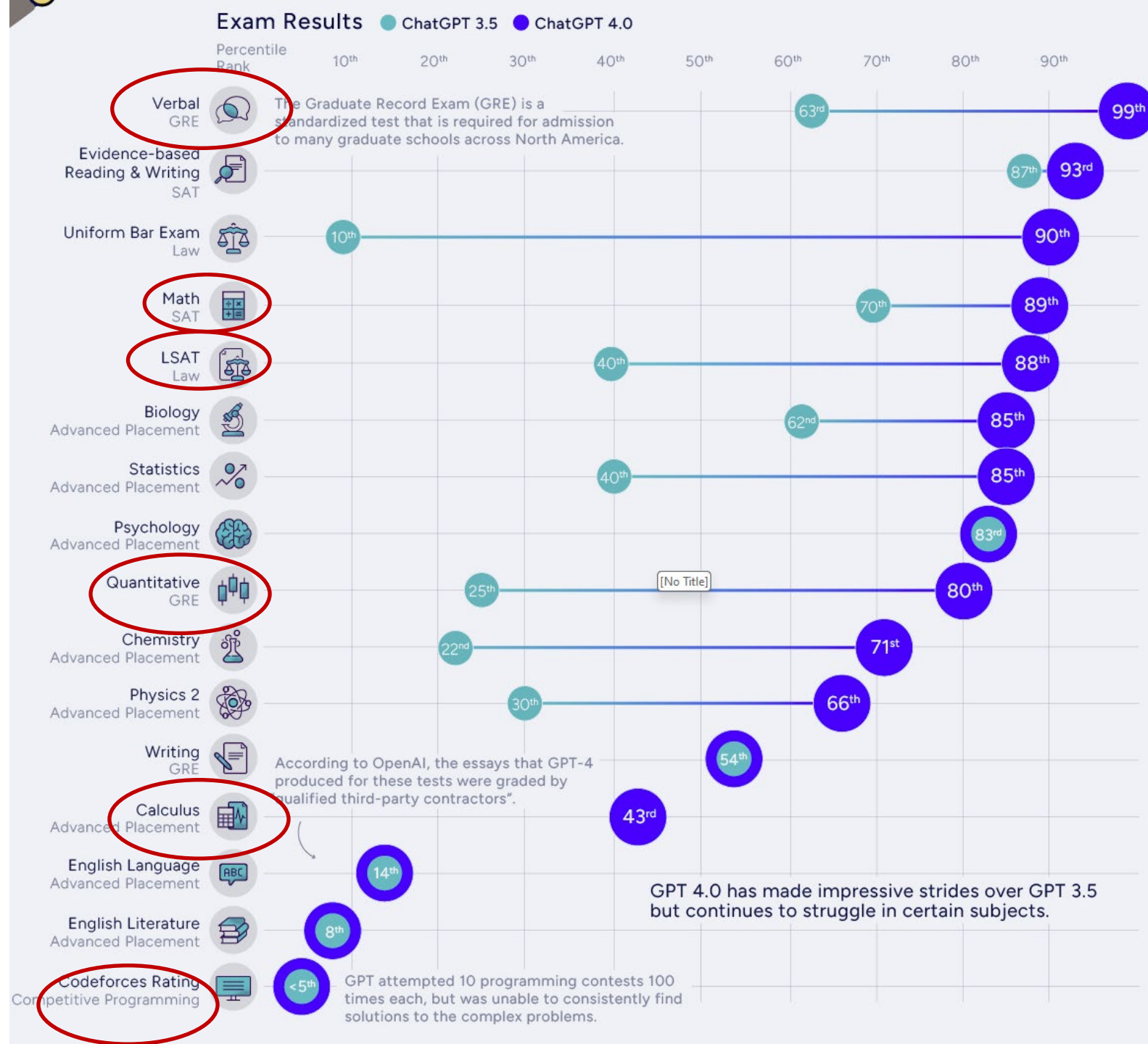
- **GPT-4 Model:** Advanced AI language model, 175 trillion parameters.
- **Mixture of Experts (MoE):** Architecture using specialized networks for varied tasks.
- **Parameters Defined:** Components in the model learned and adjusted from data. Used for next word prediction/understanding
- **Training Data:** Diverse textual sources, books, web content, language styles and information
- **Number of Tokens:** Trillions of text pieces, words, or characters.
- **Adaptive Learning:** Appears contextually responsive, but doesn't learn post-training.
- **Task Versatility:** Handles translation, answering, summarization, and creative tasks.
- **Ethical Considerations :** Trained on addressing bias and misuse

Searchunify.com

	GPT 1 2018	GPT 2 2019	GPT 3 2020	GPT 3.5 2022	GPT 4 2023
Basis of Distinction	GPT 1	GPT 2	GPT 3	GPT 3.5	GPT 4
Parameters	117 million	1.5 billion	175 billion	1.5 billion	1.7 trillion
Context Length	Up to 1024 tokens	Up to 2048 tokens	Up to 2048 tokens	Up to 4000 tokens	Up to 32000 tokens
Transformer Layers	12	48	96	96	120
Multilingual Capabilities	Only understands English	Only understands English	Understands several languages with proficiency in English	Understands several languages with proficiency in English	Proficient in multiple languages like Polish and German
Performance	Basic tasks like summarization	Large number of NLP tasks with high precision, along with the ability to have human-like conversations	Large number of NLP tasks with high precision, along with the ability to have human-like conversations	Highly coherent conversations, with the ability to perform tasks accurately with little to no training	Can perform various tasks with the highest precision in GPT models so far
Internet Access	None	None	None	None	Can access the internet through third-party browsers
Modality	Textual	Textual	Textual	Textual	Texts & Images

ChatGPT 3.5 and ChatGPT 4.0

on several well recognized Human intelligence tests
Visualcapitalist.com



R&D, Academic Technology Conferences and Learning, 2018-2022



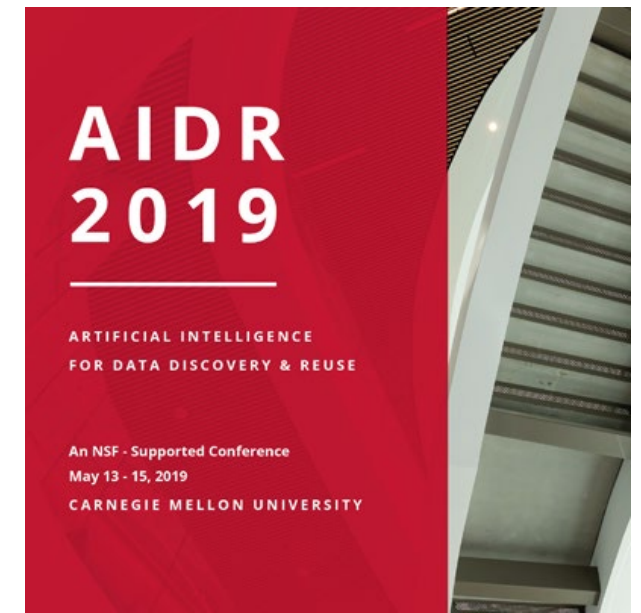
Coalition for Networked Information (D.C.) ,
Yale Art History Project ,Pixplot (Image Categorization), 2018, Peter Leonard (Neural Nets)



Artificial Intelligence for Data Discovery & ReUse & Open Science Symposium (2020), Carnegie Mellon, Pittsburgh



Fantastic Futures
2nd International Conference on AI for Libraries, Archives and Museums
Stanford Libraries (2019)



Texas Conference on Digital Libraries,
Patrice Andre Prud'homme (TCDL) Oklahoma State (2019),

R&D & Learning, Area 1: Digital and Web Services

Deep Learning Models and Convolutional Neural Nets

(2019 Begun, Early 2022 Presented, TCDL, Galway, National University of Ireland, IFLA Dublin, IR)

- **University Archives**

San Marcos Public
Newspaper Image Negatives
90 years of digitization 800, 000 images

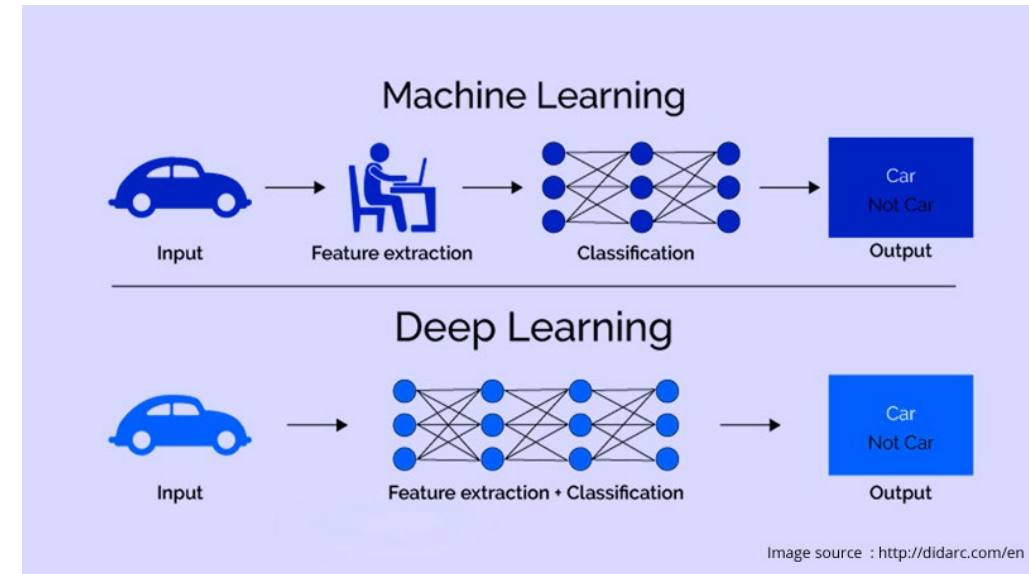
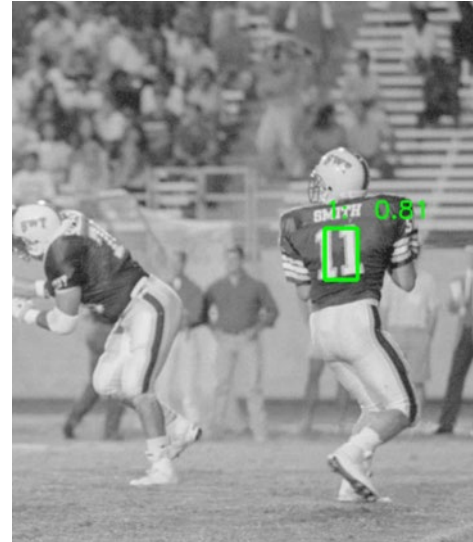
- **Processing Power
(Compute)**

- **Python**

- **Video Cards
(NVIDIA GPU's)**

- **Pretrained Models**

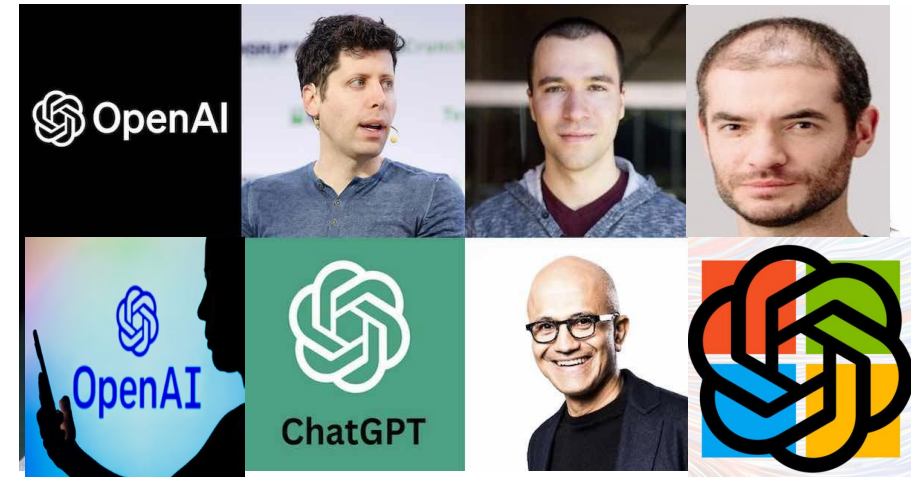
- **ResNet, YOLO, COCO
(200k labeled images, 80 categories)**



Open AI, November 2022, Chat GPT3.5 Release

Chatbot version of the Language Model GPT3, Current Release GPT4.0

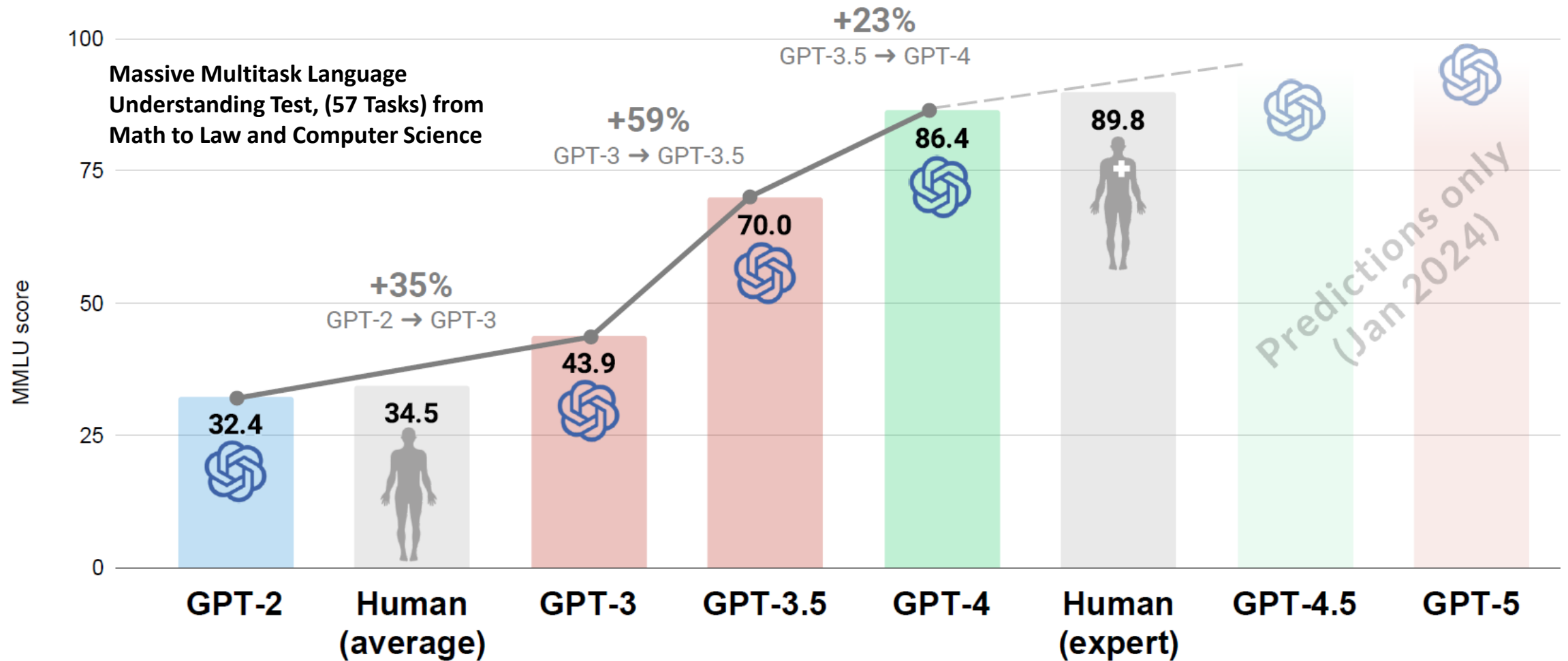
- **Generates Human-like Text:** Writes and chats naturally. Next word model extended. Probabilistic Language Model
- **Based on Transformer Model + Neural Nets:** Efficient, smart text processing. Trained on over 175 Billion Parameter (massive learning capacity)
- **Uses Attention Mechanism:** Focuses on relevant information. and Transformers (**Query**, **Key**(words), **Value** model)
- **Trained on Massive Amount Text and Can Perform multiple tasks:** Understands massive amount of topics to Answer questions translate, create (synthesize new knowledge)
- **Makes Predictions:** Infers answers from data, language, words
- **Context-Aware Responses:** Understands conversation history.
- **Handles Complex Instructions:** Understands nuanced requests.
- **Availability:** Through Bing (Microsoft, Free) and OpenAI (Paid, 20.00/month, Android/Apple (App Download))



Sam Altman, CEO, Ilya Sutskever, Chief Scientist, Satya Nadella, Microsoft CEO, Greg Brockman, President

Main other Competing Models
Gemini Pro/Ultra (2024)
Claude 2 Anthropic
Mixtral

LLMS: SMARTER THAN WE THINK (JAN/2024)



MMLU (Massive Multitask Language Understanding) benchmark features 57 tasks including mathematics, US history, computer science, law, and more. % increases rounded. <https://lifearchitct.ai/gpt-4-5/> Alan D. Thompson. 2024.



How Intelligent is GPT 4?

Standardized High School and University Tests

(GPT3.5 & GPT4.0 Humans vs. Artificial Intelligence



ChatGPT AI Use Case Scenarios

Shift in Knowledge Seeking from Search Engine Search to Direct Answers and Outcomes

- **General Knowledge Seeking**, Language Translation, Knowledge Synthesis
- **Business**: Business Development, Marketing, Analysis, Decision Making, Customer Support/Service, Troubleshooting, Business Plans
- **Education and Learning**: Tutoring, language learning, homework, K-12, Undergraduates and Graduates
- **Content Creation**: Articles, stories, administrative help and documents, creative ideas, poetry, scripts
- **Data Analysis**: Summarization, analyzing data, generating reports, business analysis
- **Wellness and Mental Health**: empathetic and professional responses
- **Personal Assistant**: Managing Schedules, organizing reminders



Open AI's GPT Store

Memberships but Apps are free

- Featured and Trending
- Dalle (Multimodal Based)
- Writing Related
- Research and Analysis
- Programming
- Education
- Video Making, Marketing Related

The screenshot displays the OpenAI GPT Store interface. At the top, there is a search bar labeled "Search public GPTs". Below the search bar, a horizontal menu lists various categories: "Top Picks", "DALL-E", "Writing", "Productivity", "Research & Analysis", "Programming", "Education", and "Lifestyle". The "Top Picks" category is currently selected.

The "Featured" section is titled "Featured" and includes the subtitle "Curated top picks from this week". It contains four app cards:

- KAYAK - Flights, Hotels & Cars**: "Your travel planning assistant for flights, hotels, & cars. By kayak.com".
- Diagrams: Show Me**: "Create Diagrams, Architecture Visualisations, Flow-Charts, Mind Map, Schemes and more. Great fo... By helpful.dev".
- Canva**: "Effortlessly design anything: presentations, logos, social media posts and more. By canva.com".
- CK-12 Flexi**: "The world's most powerful math and science AI Tutor for middle and high school students. By flexi.org".

The "Trending" section is titled "Trending" and includes the subtitle "Most popular GPTs by our community". It shows a list of trending apps, with the top two being:

- 1 Canva**: "Effortlessly design anything: presentations, logos, social media posts and more. By canva.com".
- 2 Logo Creator**: "Use me to generate professional logo designs and app icons! By Chase Lean".

Research & Analysis GPT 4.0

Research & Analysis

Find, evaluate, interpret, and visualize information

1



Consensus

Your AI Research Assistant. Search 200M academic papers from Consensus, get science-based answers, and draft content...

By consensus.app

2



AskYourPDF Research Assistant

Automate your research with AI, Chat multiple files (Unlimited PDFs), Generate articles/essays with valid citations,...

By askyourpdf.com

3



ScholarAI

AI Scientist - generate new hypotheses, analyze text, figures, and tables from 200M+ research papers and books

By scholarai.io

4



Scholar GPT

Enhance research with 200M+ resources and built-in critical reading skills. Access Google Scholar, PubMed, JSTOR, Arxiv, an...

By awesomegpts.ai

5



Finance Wizard

I predict future stock market prices. If you get an error, say "try again" or download historical data manually and upload here...

By titantrades.com

6



SEO

Enter any URL and keyword and get an On-Page SEO analysis & insights!

By orrenprunckun.com

Education, GPT 4.0

Education

Explore new ideas, revisit existing skills

1



CK-12 Flexi

The world's most powerful math and science AI Tutor for middle and high school students.

By flexi.org

2



Universal Primer

The fastest way to learn everything about anything

By runway.com

3



Math Solver

Your advanced math solver and AI Tutor, offers step-by-step answers, and helps you learn math and even all academic subject...

By studyx.ai

4



Code Tutor

Let's code together! I'm Khanmigo Lite, by Khan Academy. I won't write the code for you, but I'll help you work things out. Can...

By khanacademy.org

5



AlphaNotes GPT

Transform YouTube videos or web articles into your personal study guide or study aids, making learning efficient and...

By davideai.dev

6



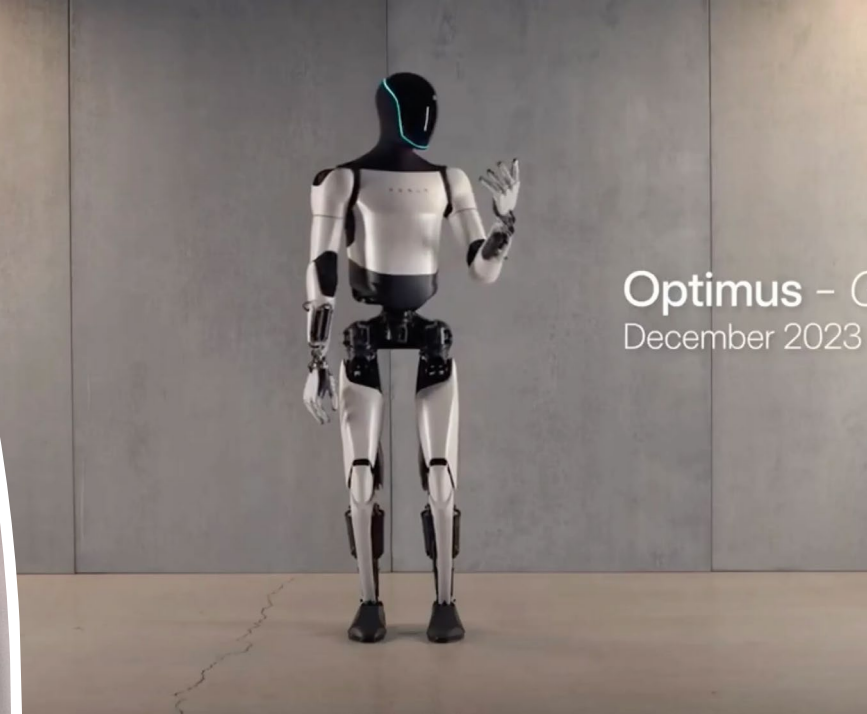
AI Tutor

An AI tutor skilled in guiding students through their academic queries 🧑🏫📖

By techwithanirudh.com

Multimodal AI, GPT4 + Image/Voice/Audio-visual and Force Feedback Models (Robotics), 2024+

- **Image Generators**
Dalle-3, Midjourney Stable Diffusion
Text to Image and Image to Video Models
- **Video Generators:**
Runway, PIKA, Stable Diffusion Video,
Lumiere,
Image to Video, Text to Video, Video to
Video
- **Device Integration & Robots:**
Optimus (Tesla Bot), Boston Dynamics,
NVIDIA, Meta's Rayban Glasses AI + XR
Smart Phone Integration
- **Use Case Scenarios:** Powerpoint to Essay,
Natural Human Instructions:
No code movement, PDF to Image
Augmenting the Senses:
XR (Extended Mixed Media Reality + AI
Artificial Intelligence

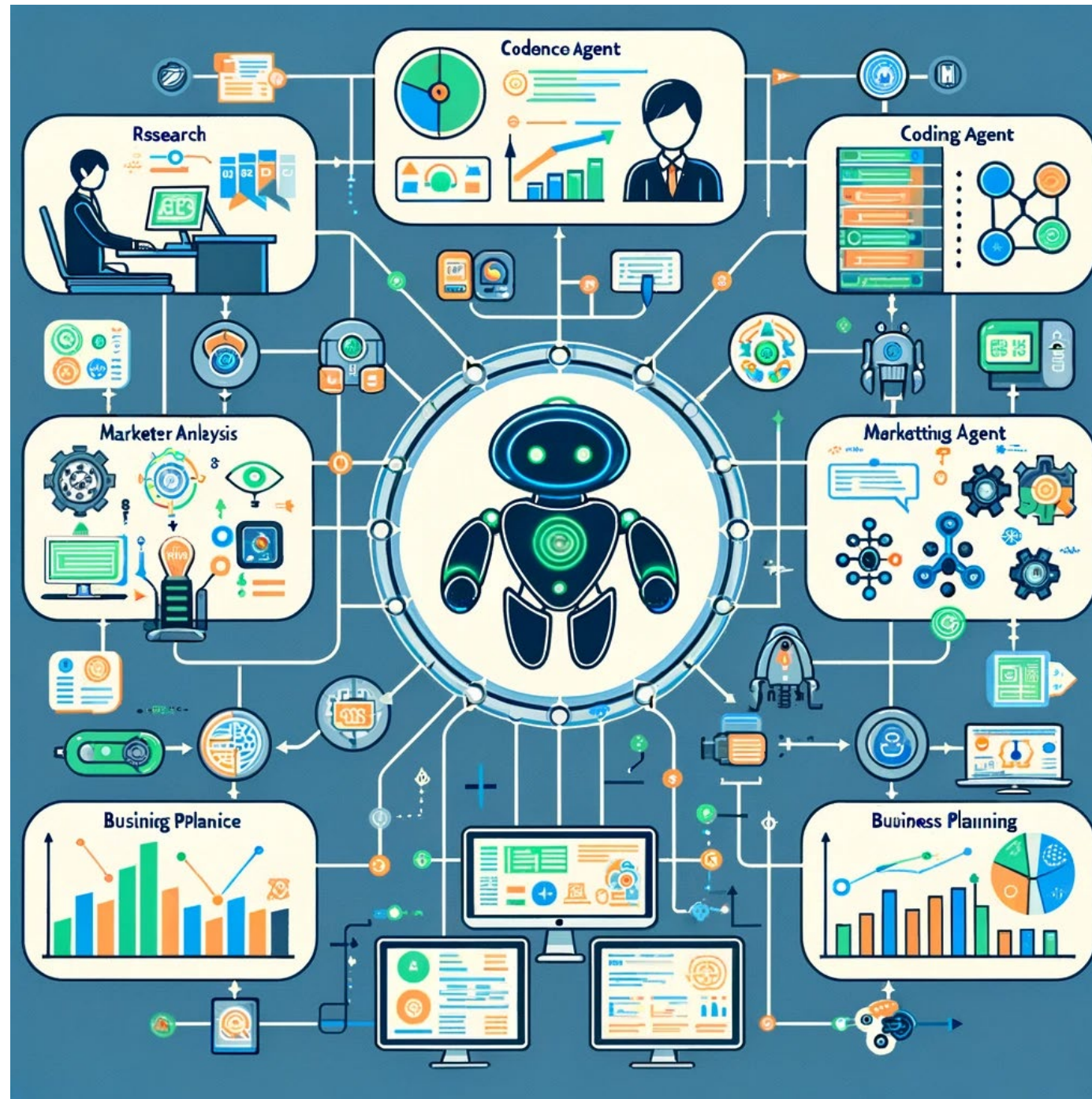


Autonomous Agents 2024

Linked AI's working together

Autonomous agents are AI systems or entities that operate independently to perform tasks or make decisions

- **Autonomy:** Operates independently without human intervention.
- **Adaptability:** Learns and adapts to new environments and experiences.
- **Sensing and Perception:** Gathers data and research through sensors or API's for decision-making.
- **Goal-Oriented:** Designed to achieve specific objectives or tasks.
- **Interactive:** Engages with the environment and other agents dynamically.
- **Examples** Autogen, Agent GPT, OpenAI GPT Store
List: <https://toplist-central.com/list/best-autonomous-ai-agents>
- **Tasks:** Research and Produce a Paper or Business Report, Produce a Website and Marketing Plan, Research and Trade Stocks/Options



AI Ethics, Safety, Alignment, Accuracy and Precision

- AI Hallucination (False Comments, Made up Results)
- Bias and Data (Began 2017)
- Neural Nets and Complexity
- Ethics and Censorship
- Ethics and Law
- Alignment: Alignment with Human Values
- Deep Fakes and Elections, Manipulation, Propaganda, Information Literacy
- Constitution (Anthropic)
- New Horizons for AI in Libraries (De Gruyter)



AI, Artificial General Intelligence AGI and ASI (Artificial Superintelligence)

AGI (Artificial General Intelligence):

A form of AI that equals average human intelligence, capable of performing any intellectual task that a human being can.

- **ASI (Artificial Super Intelligence):**

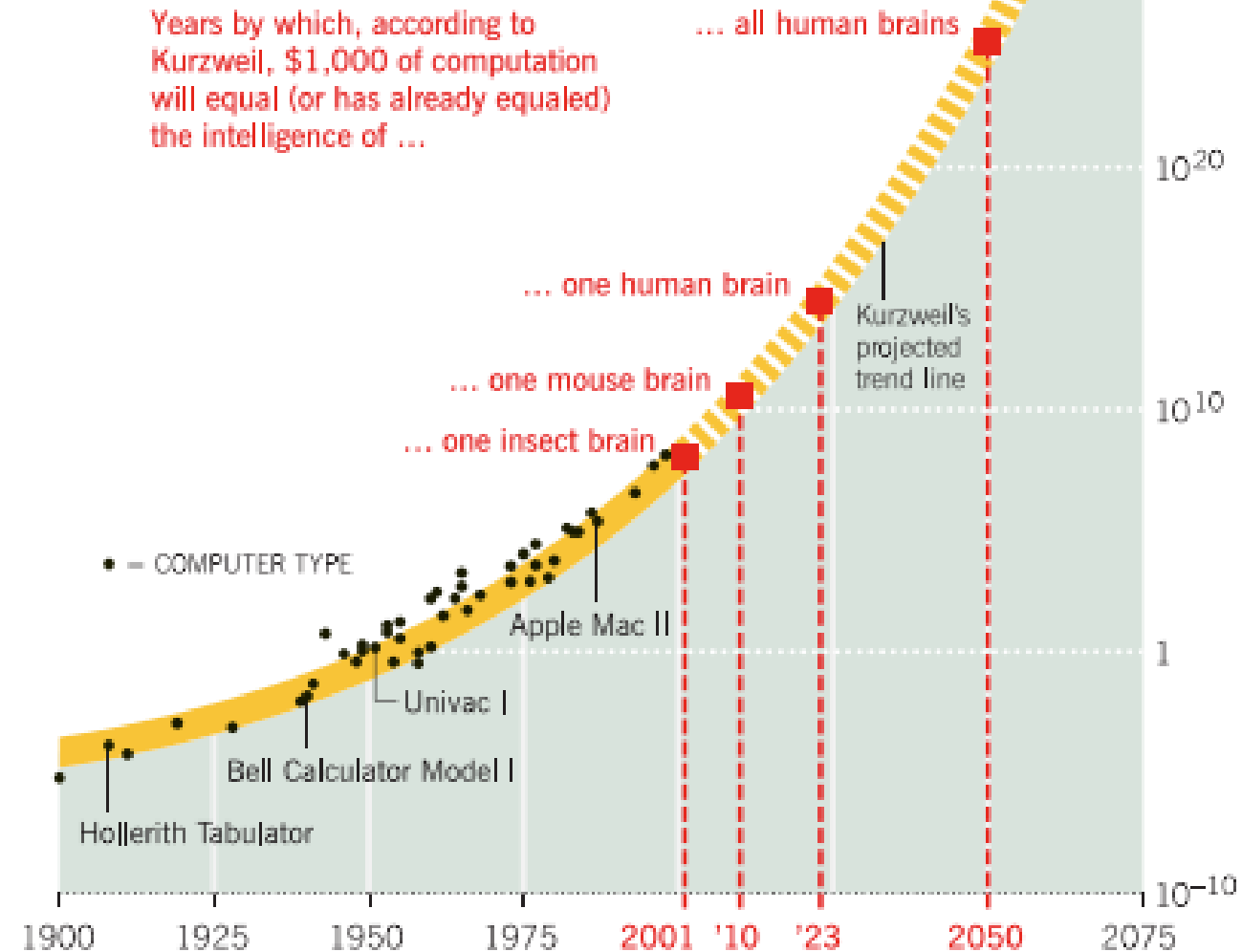
An AI that surpasses human intelligence across all areas, including creativity, general wisdom, and problem-solving.

THE KURZWEIL CURVE

Moore's Law is just the beginning: The power of technology will keep growing exponentially, says Kurzweil. By 2050, you'll be able to buy a device with the computational capacity of all mankind for the price of a nice refrigerator today.

Computer performance

Plotted by number of calculations per second per \$1,000



SOURCE: DATA FROM RAY KURZWEIL

Select Bibliography, Further Sources, February 2024

Language Models

[GPT 4: Open AI](#) (Dalle-3, Multimodal, GPT Store, 20.00\$)

[Gemini Ultra \(2024\)](#)

[Mixtral](#) (More Technical Knowledge Needed, Open Source)

[Microsoft Copilot](#) (GPT4, Dalle, Free, Limited Horizons on Knowledge)

Image and Video Generators

[Dalle-3 \(Open AI\)](#), [Midjourney](#)

[PIKA Labs](#), [Runway](#)

Lumiere (2024)

Autonomous Agents Top Lists

[Top 5](#)

[Top 11](#)

AI Websites and Youtube AI News

[Wes Roth](#): General AI News

[MattVidPro AI](#): Uniniversity Millenial Perspectives

[Matthew Berman](#): Programming and AI

[The AI Grid](#) (Good British AI News Site, Ph.D. Candidate)

Academic

[ResearchGate](#), [Dr Raymond Uzwyshyn](#), Papers, Presentations, Projects

[Dr. Alan Thompson](#): Human/AI Benchmarking

[Two Minute Papers](#), [Dr. Karoly Zsolnai-Feher](#)

Presentation

<https://www.researchgate.net/profile/Raymond-Uzwyshyn/research>

Questions and Comments?

Marshall McLuhan: Extensions of Man

