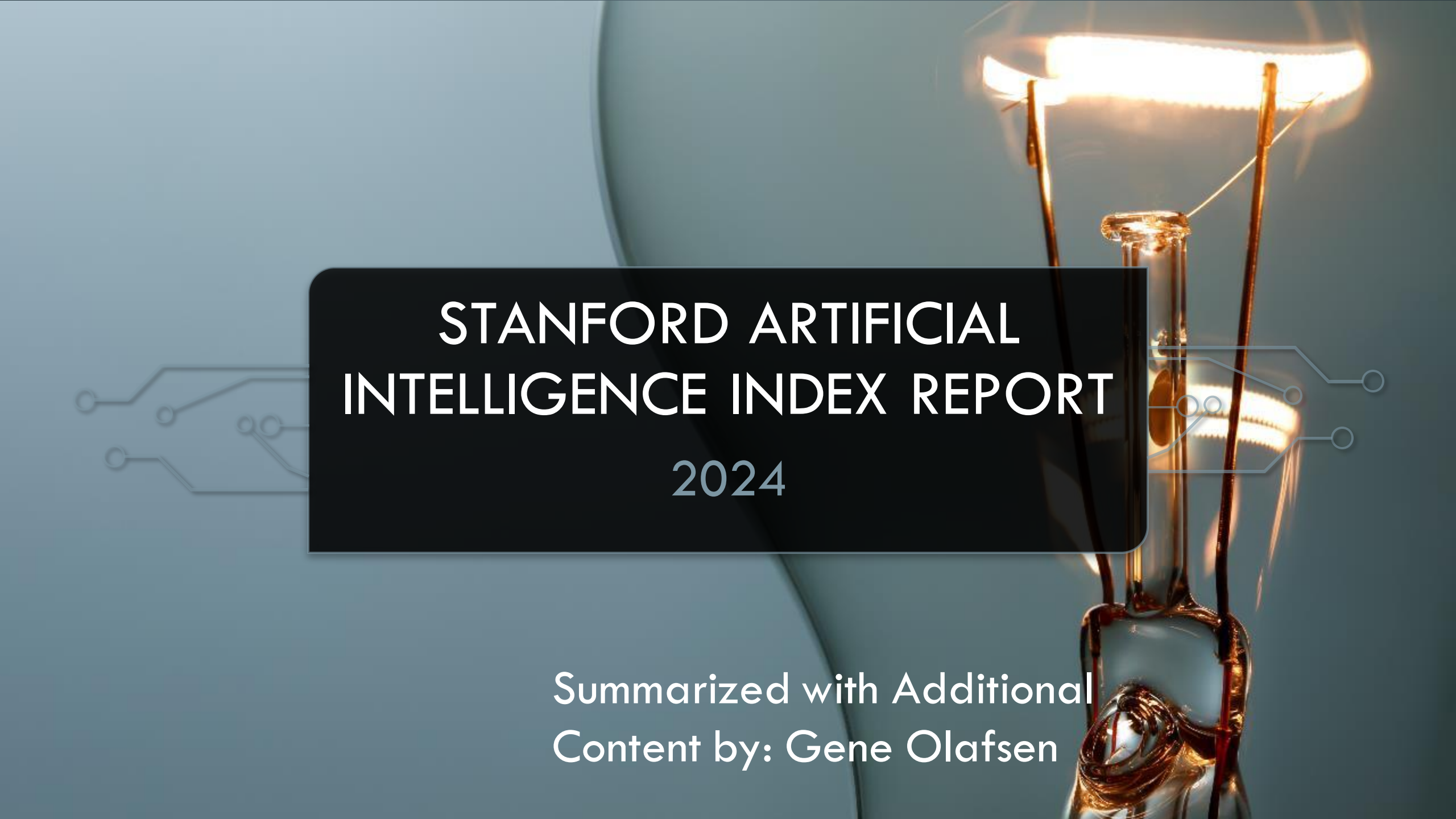

STANFORD ARTIFICIAL INTELLIGENCE INDEX REPORT

2024

Summarized with Additional Content by: Gene Olafsen

REFERENCES

- HAI_AI-Index-Report-2024.pdf (stanford.edu)
- Making an image with generative AI uses as much energy as charging your phone | MIT Technology Review
- AI models are devouring energy. Tools to reduce consumption are here, if data centers will adopt. | MIT Lincoln Laboratory

FIGURE 01

- Figure
- Figure Status Update - OpenAI Speech-to-Speech Reasoning (youtube.com)
- Master Plan:
  - Build a feature-complete electromechanical humanoid.
  - Perform human-like manipulation.
  - Integrate humanoids into the labor force.

AI BEATS HUMANS ON SOME TASKS

- AI has surpassed human performance on several benchmarks, including:
  - some in image classification
  - visual reasoning
  - English understanding.
- Areas that need improvement include more complex tasks like competition-level mathematics, visual commonsense reasoning and planning.

INDUSTRY MODEL COUNTS EXCEED ACADEMIA

- In 2023, industry produced 51 notable machine learning models, while academia contributed only 15. There were also 21 notable models resulting from industry-academia collaborations in 2023, a new high.

PREMIER/FRONTIER MODELS ARE VERY EXPENSIVE

- According to AI Index estimates, the training costs of state-of-the-art AI models have reached unprecedented levels. For example, OpenAI's GPT-4 used an estimated $78 million worth of compute to train, while Google's Gemini Ultra cost $191 million for compute.

THE UNITED STATES CONTINUES TO PRODUCE THE TOP MODELS

- The United States leads China, the EU, and the U.K. as the leading source of top AI models.
- In 2023, 61 notable AI models originated from U.S.-based institutions, far outpacing the European Union's 21 and China's 15.

LACK OF RESPONSIBLE AI BENCHMARKS

- Robust and standardized evaluations for LLM responsibility are seriously lacking.
- New research from the AI Index reveals a significant lack of standardization in responsible AI reporting. Leading developers, including OpenAI, Google, and Anthropic, primarily test their models against different responsible AI benchmarks. This practice complicates efforts to systematically compare the risks and limitations of top AI models.

SUBSTANTIAL INVESTMENT IN GENERATIVE AI

- Despite a decline in overall AI private investment last year, funding for generative AI surged, nearly eight times from 2022 to reach over $25 billion.
- Major players in the generative AI space, reporting substantial fundraising rounds include: OpenAI, Anthropic, Hugging Face, and Inflection.

AI AND PRODUCTIVITY

- Point: AI makes workers more productive and leads to higher quality work. In 2023, several studies assessed AI's impact on labor, suggesting that AI enables workers to complete tasks more quickly and to improve the quality of their output. These studies also demonstrated AI's potential to bridge the skill gap between low- and high-skilled workers.
- Counterpoint: Other studies caution that using AI without proper oversight can lead to diminished performance.

AI ACCELERATES SCIENTIFIC PROGRESS

- In 2022, AI began to advance scientific discovery. 2023, however, saw the launch of even more significant science-related AI applications -- from AlphaDev, which makes algorithmic sorting more efficient, to GNoME, which facilitates the process of materials discovery.

AI REGULATION

- The number of AI regulations in the United States sharply increases. The number of AI related regulations in the U.S. has risen significantly in the past year and over the last five years. In 2023, there were 25 AI-related regulations, up from just one in 2016. Last year alone, the total number of AI-related regulations grew by 56.3%.

AWARENESS OF AI

- People across the globe are more cognizant of AI's potential impact -- and more nervous.
- A survey from Ipsos shows that, over the last year, the proportion of those who think AI will dramatically affect their lives in the next three to five years has increased from 60% to 66%. Moreover, 52% express nervousness toward AI products and services, marking a 13 percentage point rise from 2022. In America, Pew data suggests that 52% of Americans report feeling more concerned than excited about AI, rising from 37% in 2022.

POWERING A REVOLUTION

AI USES A 'SHOCKING' AMOUNT OF ELECTRICITY

- Data centers currently account for about 1 to 1.5 percent of global electricity use, according to the International Energy Agency. And the world's still-exploding boom in artificial intelligence is expected to drive that number up.
- If Google were to service 9 billion search requests with a ChatGPT session, it would consume the same amount of power as Ireland- but would first require a $100 billion dollar hardware investment.

WHERE IS THE ENERGY USED?

- AI model energy use can be divided into two parts:
  - Training
  - Inferencing
- Both phases are very energy-intensive, and it is unknown what the energy ratio is exactly. Historically, with Google, the balance was 60 percent inference, 40 percent training. ChatGPT has changed the calculation — because training ChatGPT took comparatively very little energy consumption, compared with applying the model.

GPT TRAINING

- Training a large language model like GPT-3, for example, is estimated to use just under 1,300 megawatt hours (MWh) of electricity; about as much power as consumed annually by 130 US homes.
- Information simply doesn't exist for the latest models, like ChatGPT and GPT-4
- Huge, popular models like ChatGPT signal a trend of large-scale AI, boosting some forecasts that predict data centers could draw up to 21% of the world's electricity supply by 2030.

ENERGY (CONT.)

- But global data centers, on average, will add 50 percent to the energy cost just to keep the machines cool. There is some evidence that there are data centers that perform even worse than that.
- Making an image with generative AI uses as much energy as charging your phone.
- The more complicated a request, and the longer the servers are working to fulfill it, the more power is consumed.

TECH AND ENERGY

- To accommodate tech companies' pivots to artificial intelligence, tech companies are increasingly investing in ways to power AI's immense electricity needs.
- Most recently, OpenAI CEO Sam Altman invested in Exowatt, a company using solar power to feed data centers, according to the Wall Street Journal.
- That's on the heels of OpenAI partner, Microsoft, working on getting approval for nuclear energy to help power its AI operations.
- Last year Amazon, which is a major investor in AI company Anthropic, said it invested in more than 100 renewable energy projects, making it the "world's largest corporate purchaser of renewable energy for the fourth year in a row."