



Large Language Model Craze



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Sentiment on AI in News and Online

AI automation could impact 300MM jobs
(Goldman Sachs on CNBC)

Which jobs will be most impacted by ChatGPT? (Visual Capitalist)

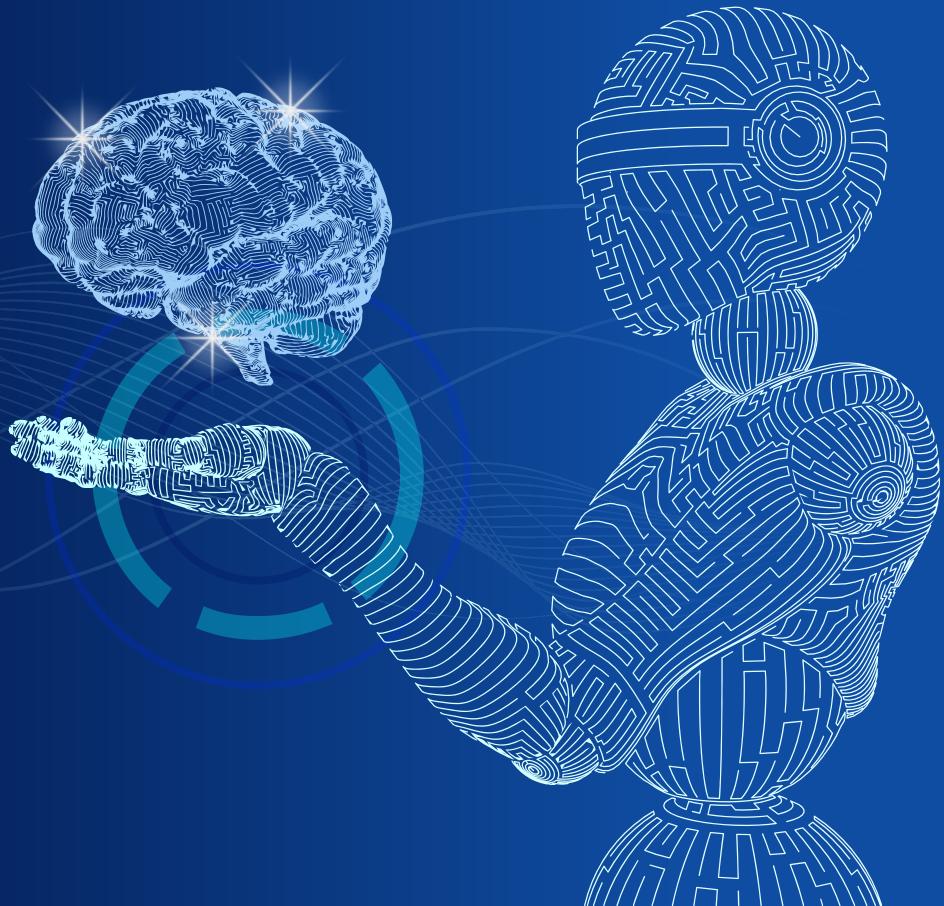
The disruptive economic impact of artificial intelligence
(Forbes)

- AI Subfields
- History of AI
- Large Language Models
- Social Impact



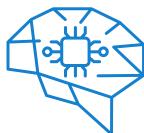
Artificial Intelligence

The term Artificial intelligence (AI) was first coined in 1955 by John McCarthy, which he defined as "**the science and engineering of making intelligent machines**"



AI Subfields

Deep learning and machine learning are subfields of artificial intelligence



Artificial Intelligence (AI)

Any technique that enables machine to mimic human intelligence, using logic, if-then rules, decision trees, and machine learning (including deep learning).



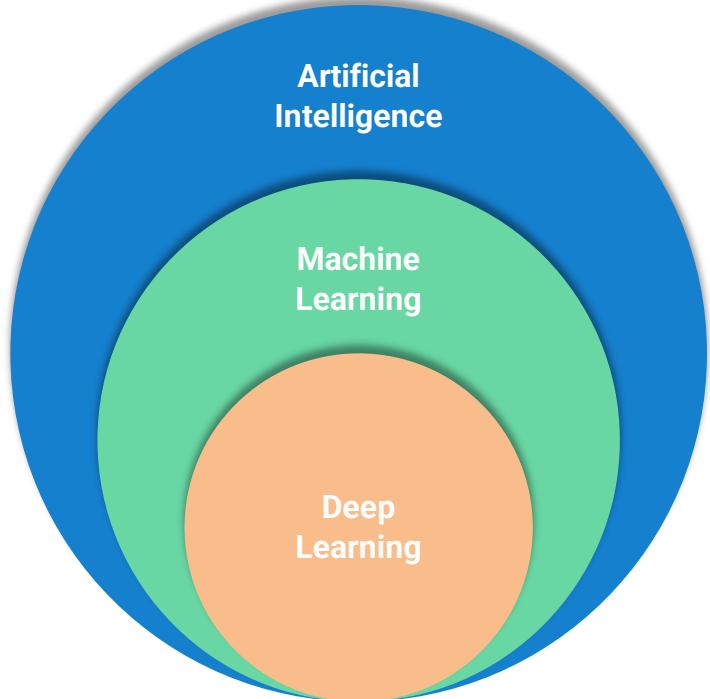
Machine Learning (ML)

A subset of AI that includes statistical techniques that enable machines to improve at tasks with experience.



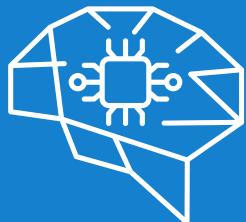
Deep Learning (DL)

A subset of machine learning composed of algorithms that permit software to train itself to perform tasks, like speech and image recognition, by exposing multilayered neural network to vast amounts of data.



Artificial Intelligence (AI)

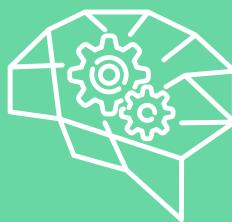
Early artificial intelligence stirs excitement.



"Engineering of making intelligent machines and programs."

Machine Learning (ML)

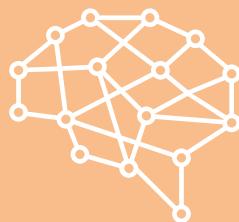
Machine learning begins to flourish.



"Ability to learn without being explicitly programmed."

Deep Learning (DL)

Deep learning breakthroughs drive AI boom.



"Learning based on network."

1950's

1960's

1970's

1980's

1990's

2000's

2010's

2020's

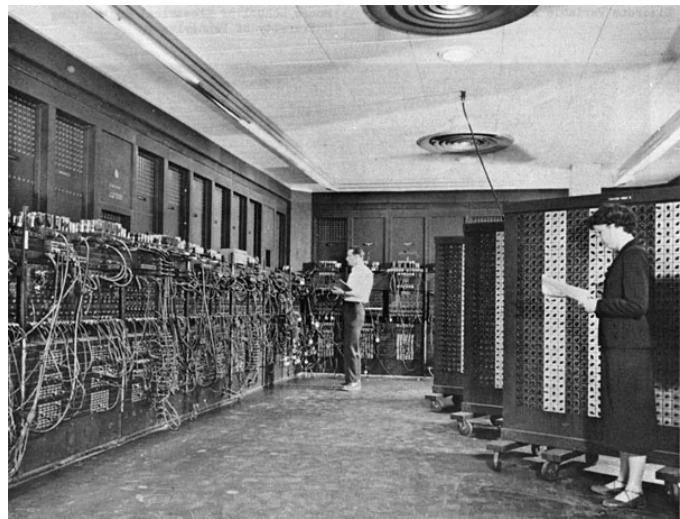
2030's

History of AI

1834: the idea of having a device that could be programmed with punch cards was conceived. However, the machine was never built, but all modern computers rely on its logical structure.

1936: Alan Turing advanced the theory on how a machine can determine and execute a set of instructions.

1945: the first manually operated computer, "ENIAC" (Electronic Numerical Integrator and Computer) was invented, which was the first electronic general-purpose computer.

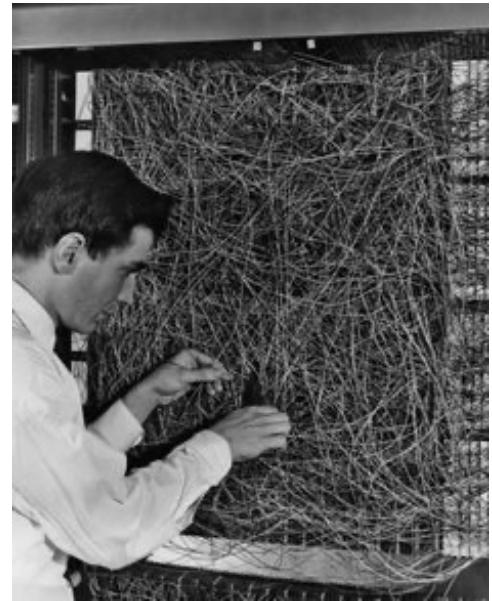


History of AI

1952: Arthur Samuel started working on a program that helped an IBM computer to play a checkers game. It was demonstrated to the public in 1956.

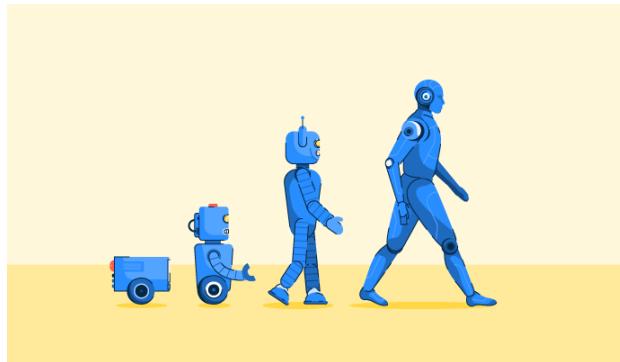
1959: MADALINE (Multiple ADaptive LINear Elements) was the first neural network applied to a real-world problem, being able to eliminate echoes on phone lines.

The years **1974 to 1980** are viewed as tough times for AI and ML researchers. This duration is referred to as the *AI winter*.



History of Neural Networks

1985: Terry Sejnowski and Charles Rosenberg invented a neural network NETtalk, which was able to teach itself how to correctly pronounce 20,000 words in one week.



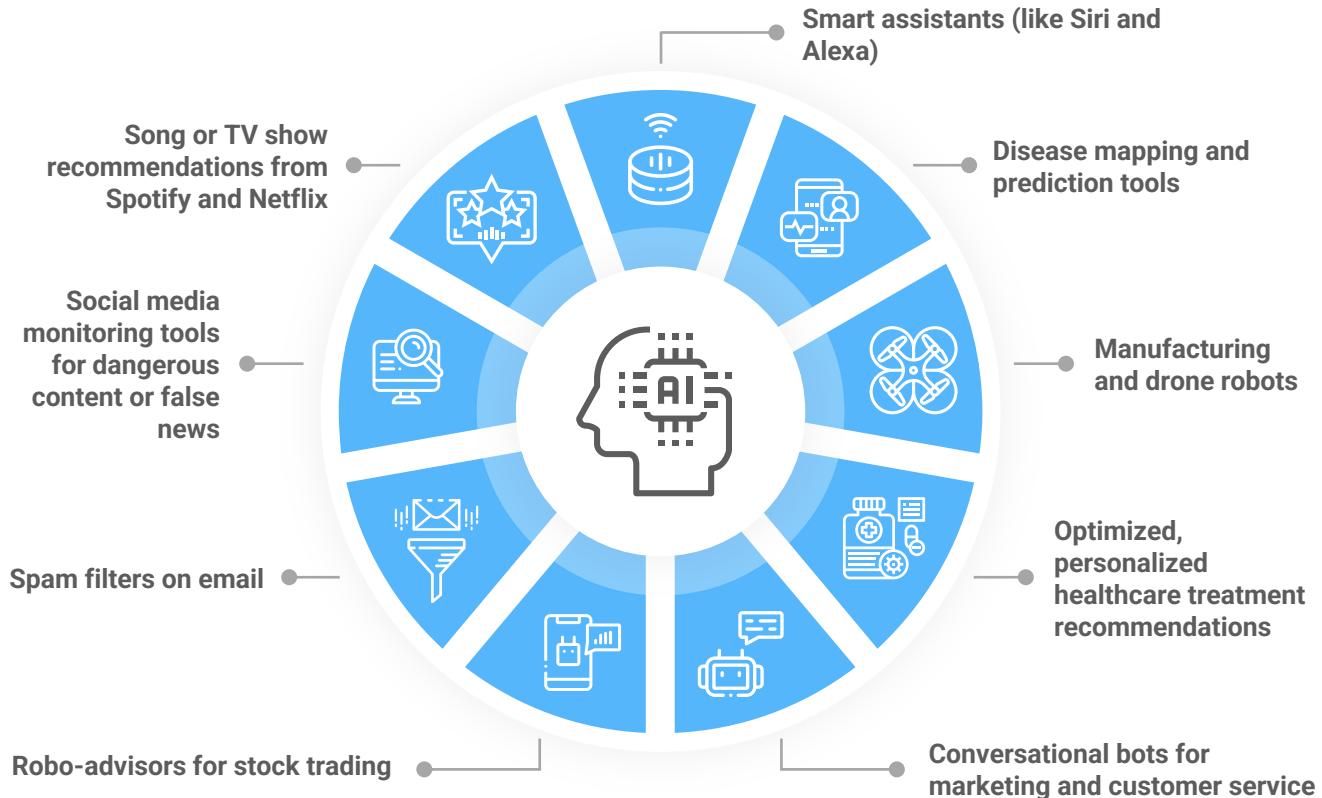
2006: computer scientist Geoffrey Hinton gave a new name to neural net research "deep learning," which has now become one of the most trending technologies.

2012: Google created a deep neural network that learned to recognize the image of humans and cats in YouTube videos.

2014: the Chatbot "Eugene Goostman" cleared the Turing Test. It was the first Chatbot that convinced the 33% of human judges that it was not a machine.

2022: ChatGPT (Chat Generative Pre-trained Transformer), which is a large language model chatbot, was released to public by OpenAI.

Use Cases over the Last Decade



Language Models

A language model is a probabilistic model of natural language that can generate probabilities of a series of words, based on text corpora in one or multiple language (Wikipedia).

$$P(X) = p(x_1)p(x_2|x_1)\dots p(x_T|x_1, \dots, x_{T-1})$$

history (h):

Alice painted her house ?

next element:

$$P_\theta(\text{?} = \text{brown} | h) = 0.2$$

$$P_\theta(\text{?} = \text{beige} | h) = 0.1$$

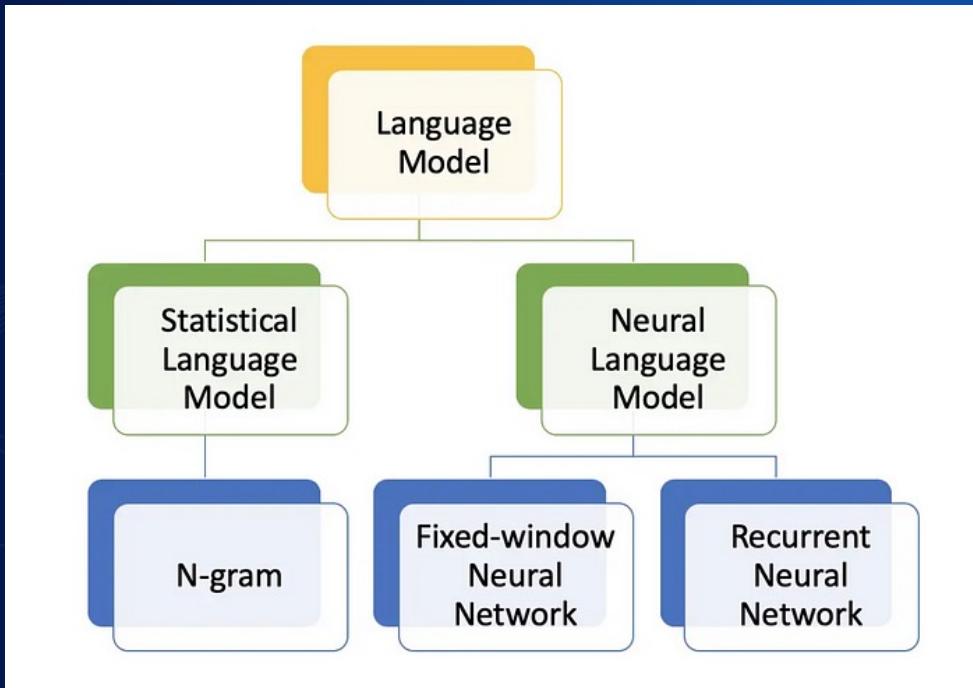
$$P_\theta(\text{?} = \text{red} | h) = 0.05$$

$$P_\theta(\text{?} = \text{because} | h) = 0.09$$

$$P_\theta(\text{?} = \text{with} | h) = 0.08$$

⋮

Types of Language Models

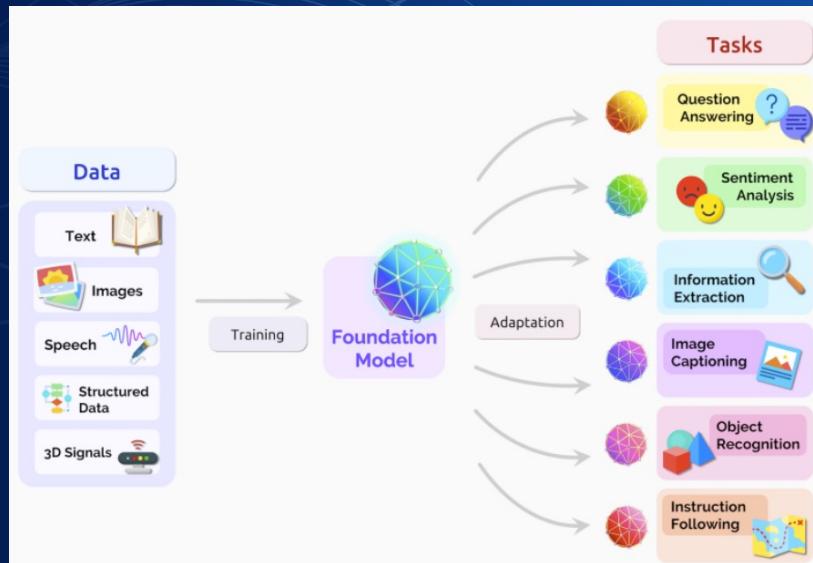


Foundation Models

A large language model (LLM) is a language model characterized by its large size. Their size is enabled by AI accelerators, which are able to process vast amounts of text data, mostly scraped from the internet (Wikipedia). E.g. 100 billion parameters.

Stanford Institute for Human-Centered Artificial Intelligence:

A foundation model is any model that is trained on broad data (generally using self-supervision at scale) that can be adapted (e.g., fine-tuned) to a wide range of downstream tasks.



Pre-Training

(Computationally Expensive)

Fine-Tuning

(Cheaper)



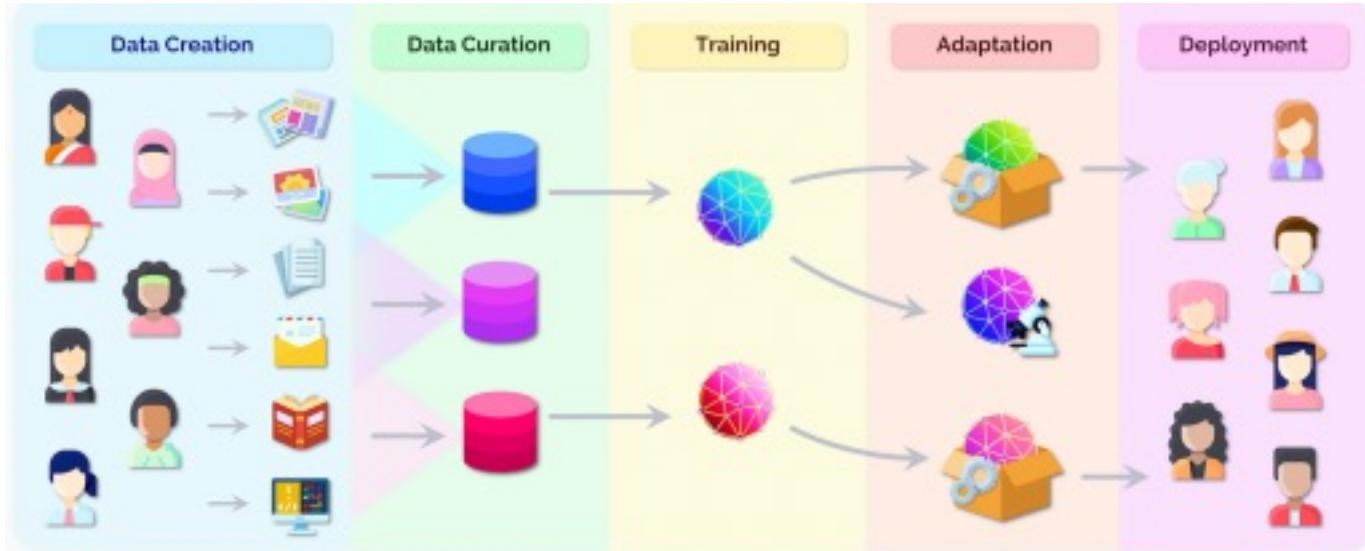
Large
Unlabeled Corpus

Small
Labeled Corpus

Social Impact

- Due to the widespread availability, and relative ease of use, of these models, they have already made their way into many applications.
- These models are changing frequently as more and more companies enter the race.
- The capabilities of these models are not fully understood yet.
- Given this combination, trying to anticipate and address the social and ethical issues that could arise from the use of the foundation models, is not possible.
- We first need to understand the ecosystem of foundation models, so that we can reason about the social impact of these models.

Ecosystem



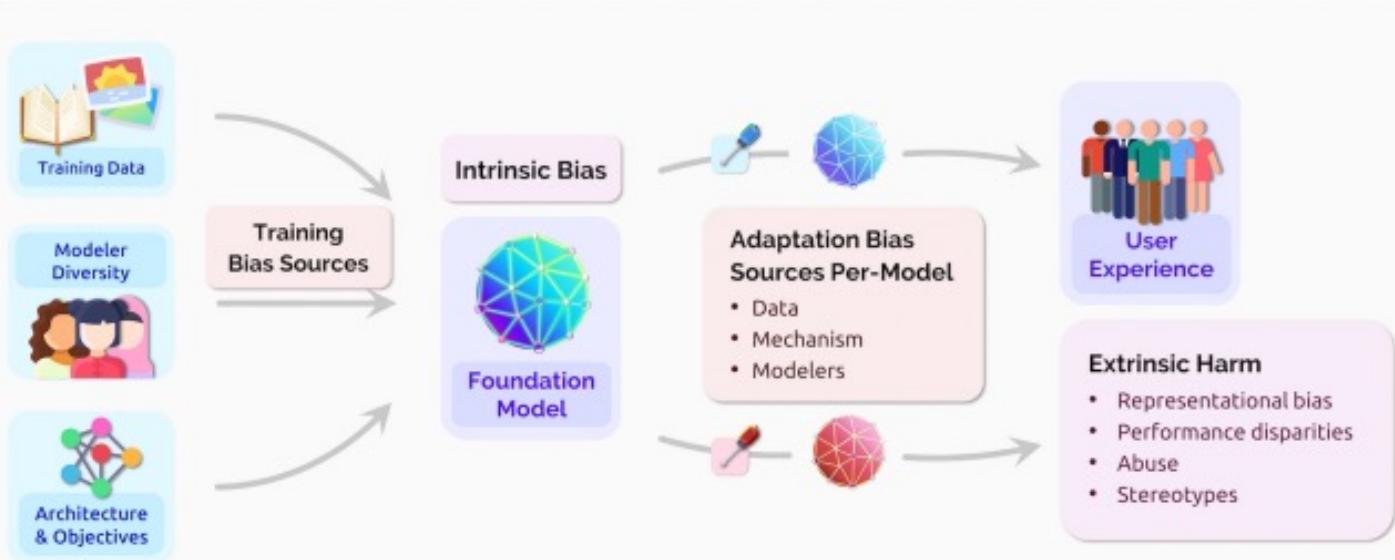
The impact of using the AI systems could come from decisions that are made in each of these sub-parts. This means many organizations/people are involved in the decision making. That is why monitoring, and the social impact discussion, should happen at *all* these stages.

Social Impact Breakdown

- Fairness and Ethics
- Misuse
- Environment
- Economic
- Legal Questions



Fairness and Ethics



Misuse

The foundation models are more accessible to everyone, which makes it easier for people to use them to generate high quality, hard to detect, content at scale.

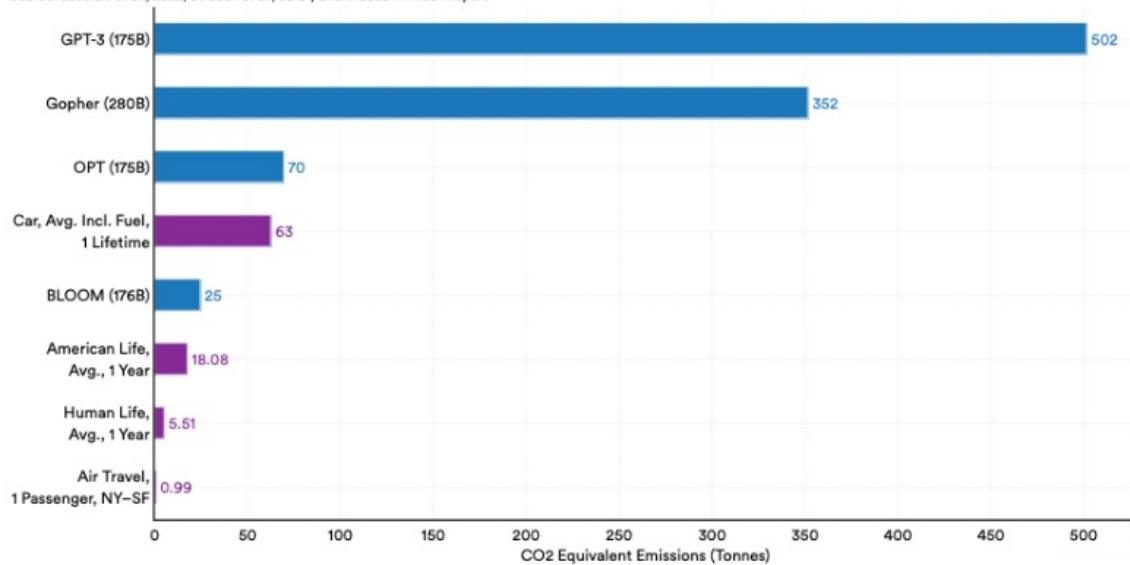


Environment

The training, adaptation, and inference of these large models results in high energy usage, and carbon emissions.

CO2 Equivalent Emissions (Tonnes) by Selected Machine Learning Models and Real Life Examples, 2022

Source: Luccioni et al., 2022; Strubell et al., 2019 | Chart: 2023 AI Index Report



Economics

- The foundation models can increase productivity and efficiency in all economic sectors.
- Use of these models will result in large scale shift in the types of jobs, which could lead to wage inequality.
- Organizations need to put in place appropriate management, operational and governance structures as they start the adoption of AI into their business.

Legal Questions

Some of the legal issues concerning the foundation models are:

- Training datasets are scraped from the web. This data contains copyright protected, and personal data.
- Questions of ownership of the model outputs.
- The questions of liability when the output of these models is used as part of a bigger system for making decisions.



Concluding Thoughts



The impact of AI on the workforce is, and will continue, to be enormous.

AI technologies have the potential to increase productivity of different firms, create new types of jobs, and raise overall standard of living.

At the same time, AI will disrupt large pool of jobs and tasks, that have been strictly the domain of humans.

There will be substantial, and difficult, adjustments for workers as the types of jobs change and require different types of skills.

“While these costs are substantial, they are often not inherent to AI, but very much a product of the choices made in the development and deployment of the technology, meaning that there is a central role for governments in the studying, monitoring, and regulating of AI, as evidenced by the United States [AI Bill of Rights](#) and the [European Commission Artificial Intelligence Act.](#)” *

OpenAI CTO Mira Murati:

“What’s the key ethical or philosophical question that we still need to figure out? It’s important for OpenAI and companies like ours to bring this into the public consciousness in a way that’s controlled and responsible.” *

* <https://www.emergentechbrew.com/stories/2023/05/04/marissa-mayer-ai-yahoo-regrets>

Marissa Mayer:

“I always think it’s better to engage with a problem than to estrange yourself. If you really think there is that much of an issue, the worst thing you can do is to leave.”

“I think that you have to have a particular lens... if you say , look, we have a very clear lens where this is associated to humans, and puts humans in the middle of it, really thinking about, when should we use it on, like, life-and-death situations and other things like that? I think that can [lead to] very good outcomes. I also think that it’s important to realize that it’s got to be compared to reality, not perfection.”*

* <https://www.emergentechbrew.com/stories/2023/05/04/marissa-mayer-ai-yahoo-regrets>

Thank you for your time

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Some good reports/papers/videos for those interested:

- <https://cdn.openai.com/papers/forecasting-misuse.pdf>
- <https://arxiv.org/pdf/2108.07258.pdf>
- The Economic Potential of Generative AI: The next productivity frontier (McKinsey & Company)
- <https://www.youtube.com/watch?v=bZQun8Y4L2A&t=4s>