

Beyond Traditional Methods: Generative AI's Impact on STEM Pedagogy, Research and Innovation

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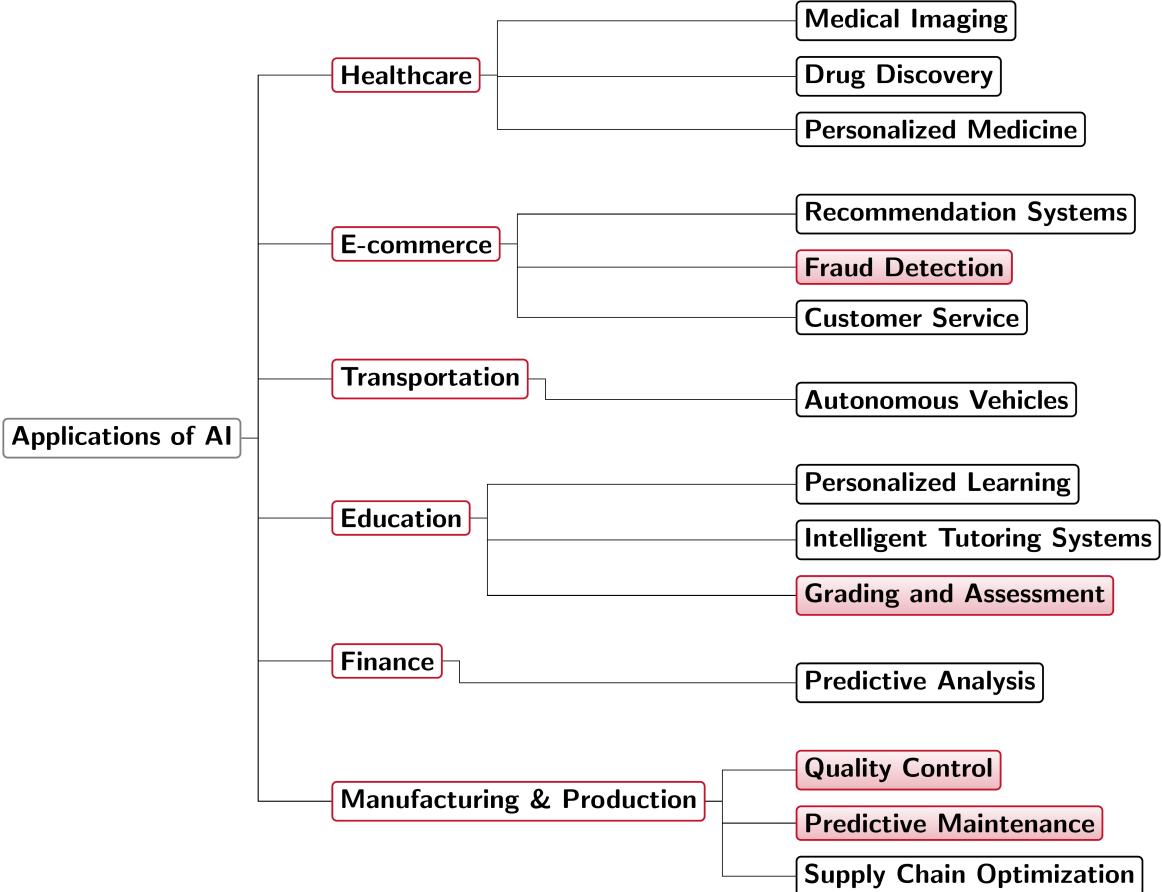
Background: Artificial Intelligence

A working definition for AI

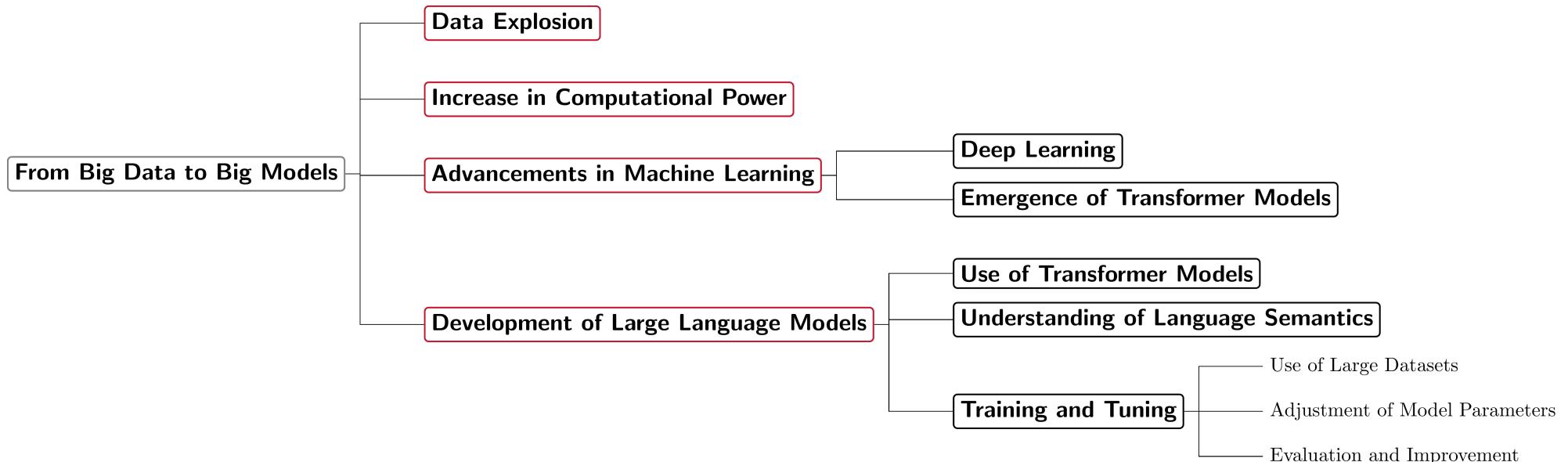
Artificial Intelligence (AI): A system that acts in a way, where people might denote as "intelligent" if another human were to do something similar.

Reported applications of AI span numerous fields

e.g., see a sample applications as generated by ChatGPT in the flowchart to the right.



Background: The Road to Generative AI



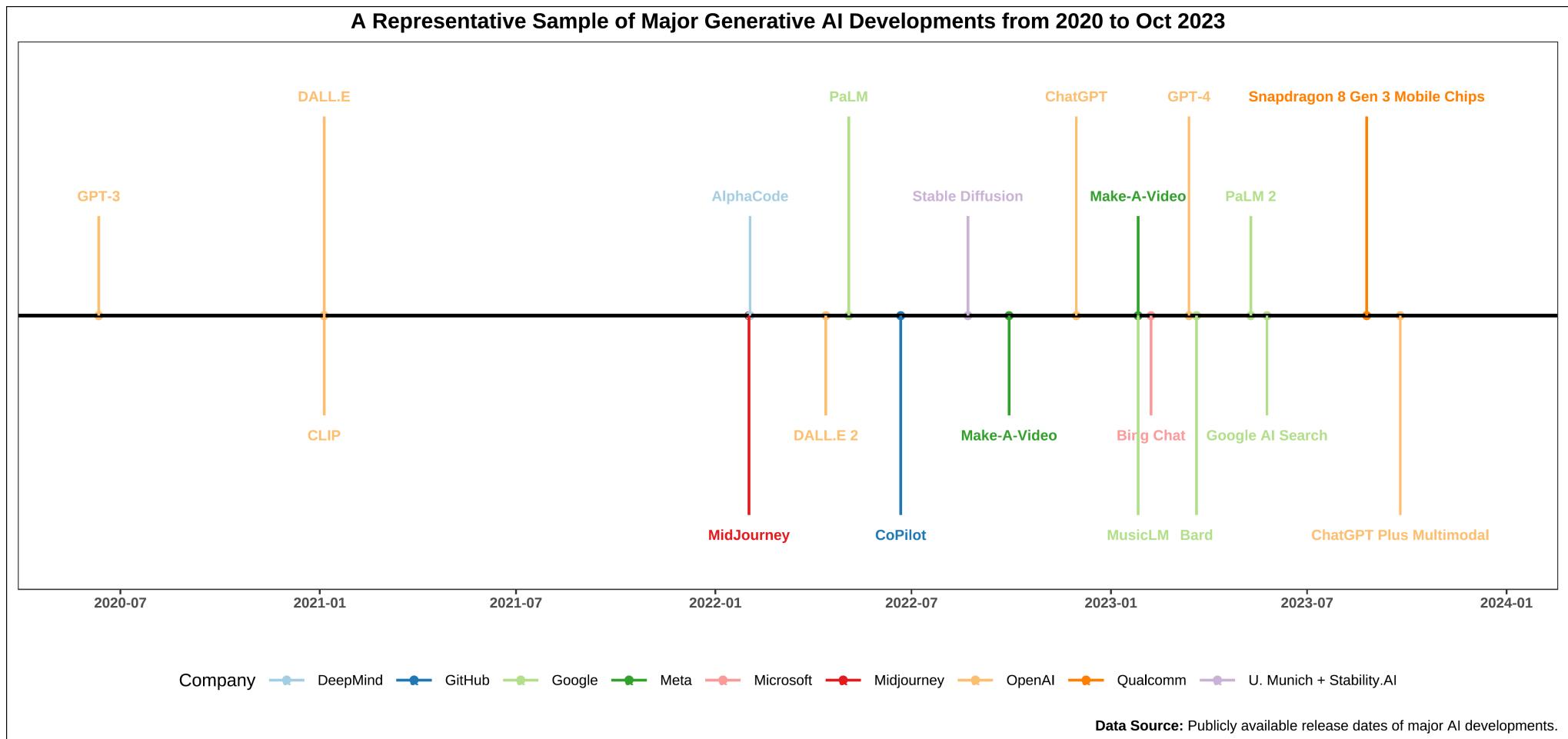
Comment: You have been hearing about **big data** in SPC for over a decade now. For example, my paper titled [Statistical Perspectives on Big Data](#) was published almost exactly 10 years ago in the ISQC Workshop in Sydney. We now have models that can digest and generate answers based on more than 45TB of text.

Background: Generative AI

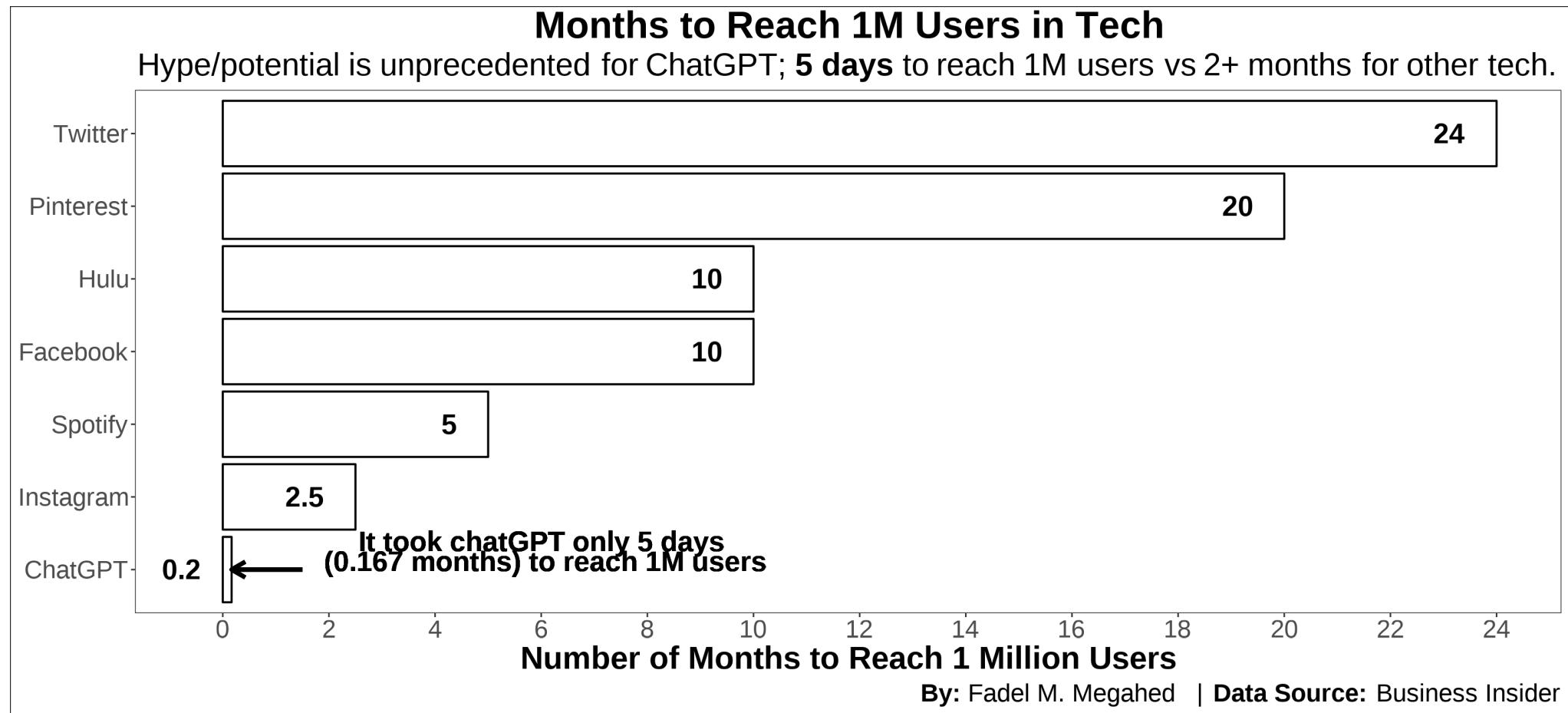
Generative AI: The objective is to generate new content rather than analyze existing data.

- The generated content is based on a **stochastic behavior embedded in generative AI models such that the same input prompts results in different content**.
- State-of-the-art generative AI models can have up to **540 billion parameters** ([PaLM](#)).
- With the increase in model size, researchers have observed the **“emergent abilities”** of LLMs, which were **not explicitly encoded in the training**. Examples include:
 - Multi-step arithmetic,
 - taking college-level exams, and
 - identifying the intended meaning of a word.
- LLMs are **foundation models** (see [Bommasani et al. 2021](#)), large pre-trained AI systems that can be **repurposed with minimal effort across numerous domains and diverse tasks**.

Background: Generative AI Developments



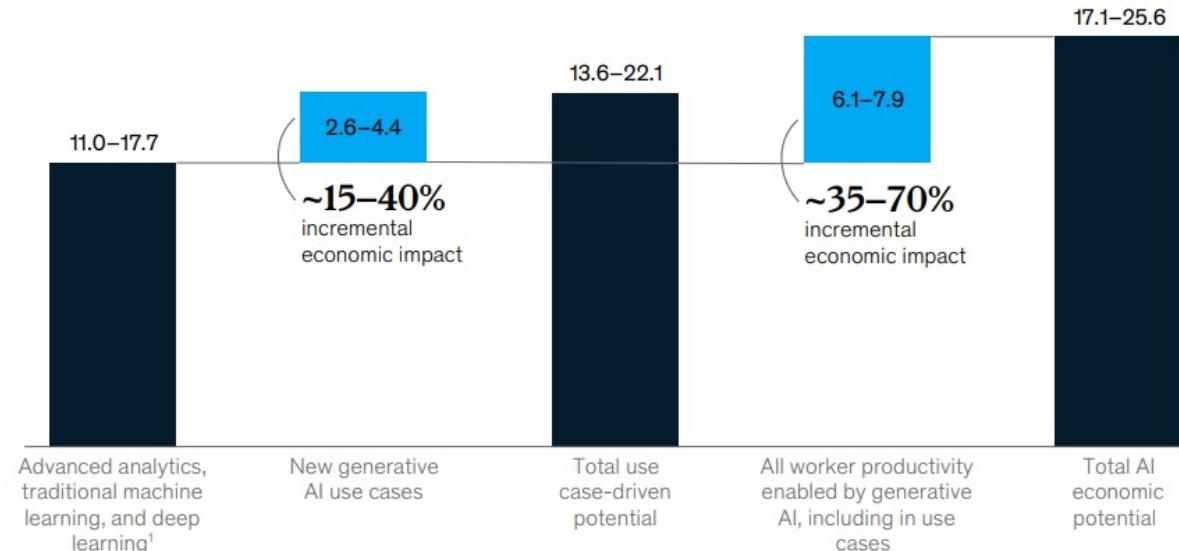
Background: Generative AI Hype



Background: Generative AI Hype

Generative AI could create additional value potential above what could be unlocked by other AI and analytics.

AI's potential impact on the global economy, \$ trillion



¹Updated use case estimates from "Notes from the AI frontier: Applications and value of deep learning," McKinsey Global Institute, April 17, 2018.

Questions to be Discussed by the Panel

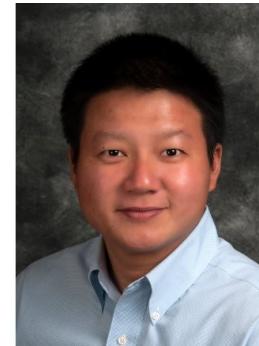
- **Shaping the Classroom:** How is Generative AI transforming the way you teach?
- **Research Frontiers:** How does Generative AI fit into your current research, or are there any groundbreaking projects you're exploring in this domain?
- **The Future of AI:** Imagine the potential of generative AI! How do you envision the capabilities of ChatGPT-7, three to four years down the line?



Joshua Ferris



Rayna Xu



Jay Shan



Fadel Megahed

Ferris: How is Generative AI transforming the way you teach?

More Open and Collaborative Assessment

-  Every student now has a *personal tutor* at their fingertips, ready to answer most questions in **mere seconds**.
Let's embrace this change, not resist it!
-  I'm excited to announce that I'll soon be integrating assessments that encourage the use of GenAI as a coach. Tools like [ChatISA](#)) are revolutionizing how students approach programming assignments and debug them, saving valuable contact time.

Diverse and Dynamic Assessments

- 💡 With the power of *GenAI*, we can swiftly prototype innovative question types and offer a diverse range of questions, ensuring a comprehensive assessment experience!

Ferris: The Future of AI

Boosting Daily Productivity

-  Imagine a day where GenAI takes care of mundane tasks, gifting you more time and freedom. This isn't just about **efficiency** —it's about unleashing your **innovation** and **creativity** to the fullest!

Revolutionizing Data Access

-  If costs can come down (reduced compute power or new hardware), a true revolution in how we **access and search data** could be on the horizon.
-  Think of the *United States Patent and Trademark Office (USPTO)* and how much work it requires to verify a new application against their catalog.

A Predicted Downturn... but a Bright Future Ahead!

-  I see some bumps on the GenAI road. Concerns around data privacy, the environment, and upcoming legislation may cause a brief regression in AI capabilities and availability.
-  Once this turbulence passes, I foresee more advanced models capable of multiple tasks vs the current single focus models (we are somewhat seeing this currently with plugins mostly).

Xu: How is Generative AI transforming the way you teach?

ChatGPT: A Student's Trusty Sidekick

-  ChatGPT is a valuable resource that students can rely on throughout their learning journey, **complementing conventional search engines**.

Mastering Modern Tools

-  It's crucial for students to develop the skill of harnessing such tools effectively for problem-solving.

Accuracy & Validation

-  Responses from ChatGPT may occasionally contain **inaccuracies**, such as erroneous code or incorrect facts. Therefore, it's imperative to **educate students on the importance of cross-validating the information** they receive from ChatGPT to ensure its reliability.

Xu: Impact on Research

ChatGPT: My Manuscript's Second Set of Eyes

- I have been using ChatGPT to proofread my manuscript.

Ongoing Research Projects Related with Generative AI

-  ChatGPT vs. Google: Exploring New Frontiers in Search & Experience  ([impact of generative AI on search](#))
 -  1 – 1:50 pm |  Room ASC 1062

Customized Large Language Models for Banks

- Fine-tune the LLMs using traditional Chinese text in financial context
- Localized implementation to address security and privacy concerns

Xu: The Future of AI

🔍 The Dawn of a **New Search Era** 🔎

📞 Redefining **Customer Services** with **Intelligence** 📞

🤖 **Chit-Chatting Robots:** The Future of Conversation 🤖

👩 AI as Analysts, Accountants, Engineers, & More! 👩

- 💫 "ChatGPT-7" Visions 💫
 - 📚 A vast expanse of data at its fingertips.
 - 🎨🔊🎬 Engaging through pictures, audios, and videos.
 - 🎯 Higher accuracy -- less hallucinations.
 - 🌎 **AGI?**

Shan: How is Generative AI transforming the way you teach?

🎓 Navigating the **Teaching** and **Learning of Programming** 🎓

- ✗ **Homework Helper?** Bad for directly solving homework assignments
- ✓ **Code Explanations:** Good for code explanation and debugging (personal tutor)

🚫 **Exam Rule:** ChatGPT is off-limits.

🤝 **Group Projects Reimagined:**

- Coding is usually the biggest barrier for non-tech-savvy groups
- Co-pilot becomes essential in analytics roles
- ✕ Frees up time for problem solving and ideation
- 📊 Presentation is the primary deliverable

Shan: Impact on Research

Search Capabilities

- Evolves as a new type of search engine.
- Superior summarization capabilities.
- **Limitation:** May not have the most up-to-date information.
- Cannot discern reliability of reference sources.

Data Collection and Analysis

- The co-pilot feature simplifies coding, though it's not flawless.
- Increases efficiency in descriptive analysis.
- **Limitation:** Not suitable for handling confidential data under current settings.

Content Generation

- Aids in refining writing, especially beneficial for non-native English speakers.
- Assists in exploring new research directions.
- Helps articulate complex arguments.

Shan: The Future of AI

🚀 Predicted Innovation in the Age of GAI 🚀

- The integration of GAI will be as ubiquitous in the modern business landscape as personal computers, Windows OS, and iPhones once were.
- It's imperative for higher education to adapt to this changing landscape, equipping students to harness the full potential of GAI.
- However, just as WiFi access once did, the high costs associated with GAI could exacerbate digital inequality.

💡 Empowering the Everyday Learner 💡

- GAI will serve as a catalyst for personal learning, transforming average learners into exceptional ones. - It holds the potential to address and rectify the most significant challenges facing online education and MOOCs.

🌐 ChatGPT-7 and Beyond: 🌐

- Personal AI profiles will offer tailored experiences, but this customization will bring forth privacy challenges.
- As organic data emerges as the new battlefield, we may witness a shift towards more restrictive data ecosystems. The ideal of a free and open internet may be at stake.
- Copyright issues will pave the way for a burgeoning industry focused on green, or ethical, content generation.

Megahed: On Research, Teaching, Learning, and the Future

Let us demo the [ChatSQC](#) app.

Audience Questions and Discussion

💬 Active poll

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Join at
slido.com
#3983 073



What questions do you have for our panelists?