Lecture 4a
Generative AI in Economics

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Data Science for Economics

Note: Materials for this lecture are drawn from Anton Korinek's Generative AI for Economics website and materials

Agenda

1. What is generative AI?
2. Large Language Models/Chatbots
3. Applications of generative AI in economics
    1. Emphasis on Chatbots

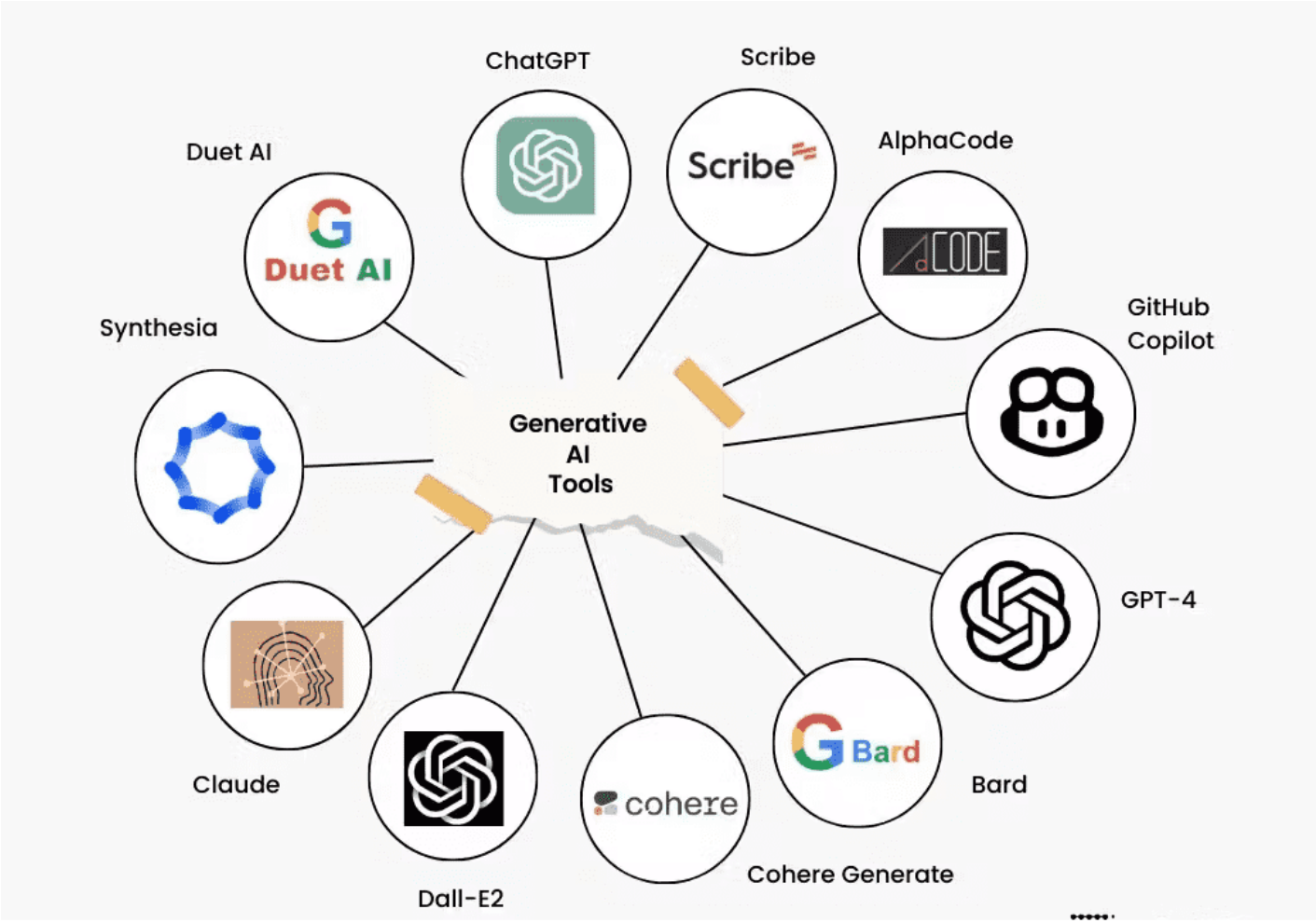
What is Generative AI?

Generative AI refers to artificial intelligence models designed to create new content, such as text, images, audio, or code, by learning patterns and structures from existing data.

- How It Works:
  - Trains on large datasets to understand and mimic data patterns.
  - Generates outputs based on prompts or input data, often using advanced neural networks like transformers.
- Applications:
  - Text generation, image synthesis, coding assistance, and more.

Examples of current Generative AI tools

- **Text Generation**:
  - OpenAI's ChatGPT, GPT-4
  - Google Bard
  - Anthropic's Claude
- **Image and Video Generation**:
  - DALL·E (OpenAI)
  - MidJourney
  - Stable Diffusion
  - RunwayML (for video)
- **Code Assistance**:
  - GitHub Copilot
  - Tabnine
- **Audio and Music Generation**:
  - OpenAI's Jukebox
  - AIVA (AI music composition)



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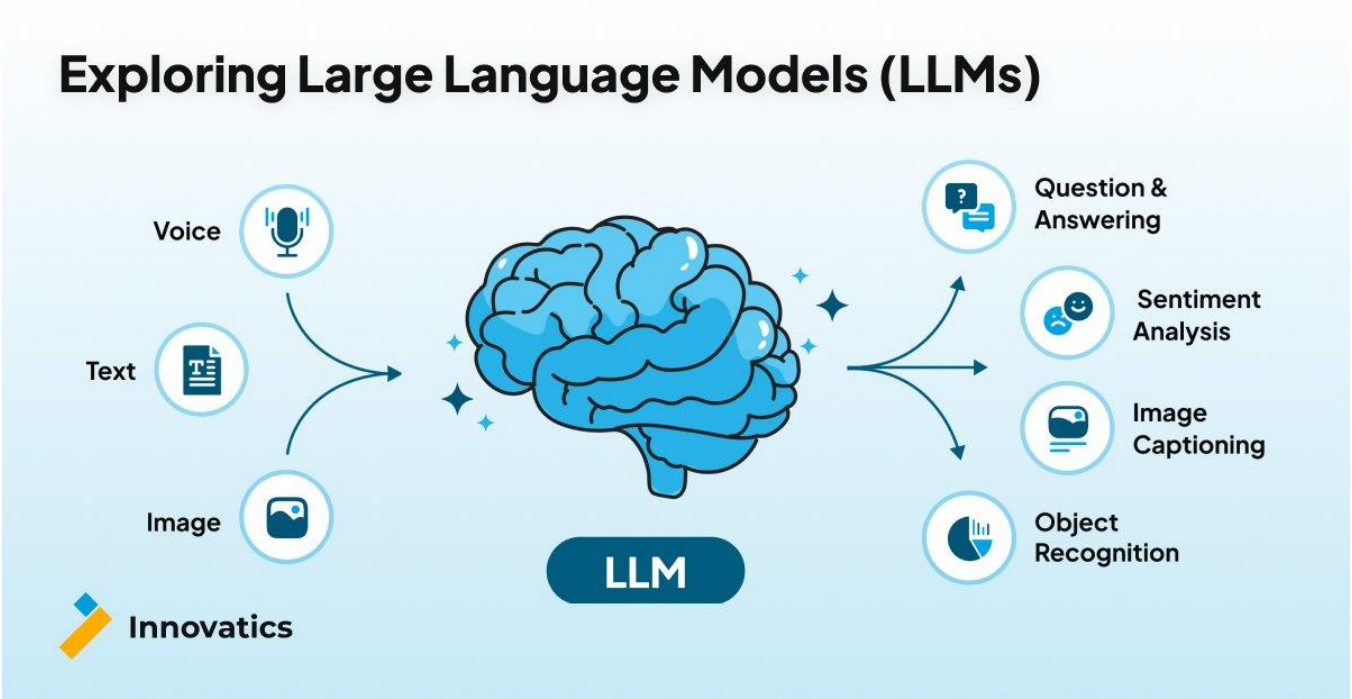
Many applications for researchers

- Writing code
- Editing writing
- Generating hypotheses
- Background research (be careful!)
- Summarizing and repackaging results
- Producing podcasts
- And more!

Focus today on use of text generation tools: LLMs.

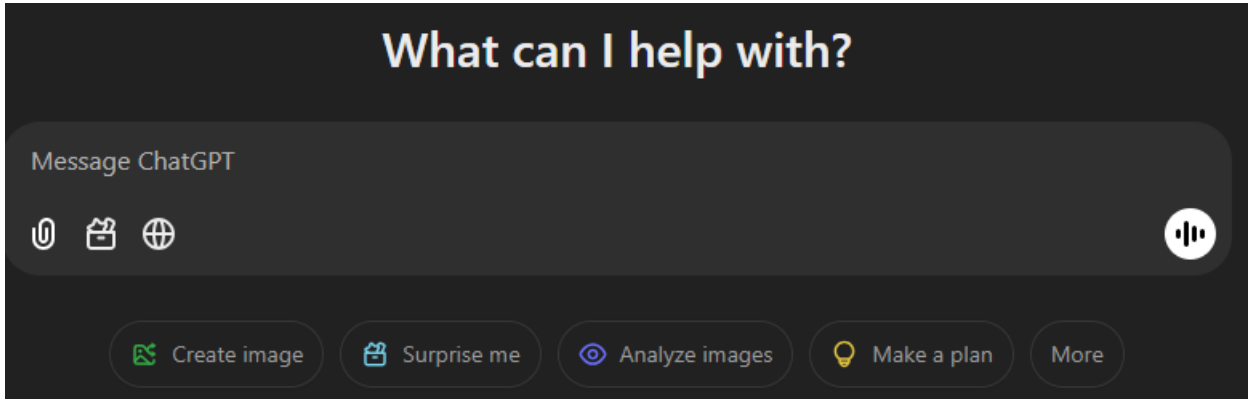
Large Language Models (LLMs)

- LLMs are advanced AI systems trained on vast amounts of text data to understand, generate, and interact in natural language.
- Examples: GPT-4, Claude, LLaMA (Meta), Google's PaLM.



Main ways to access LLMs

- Chatbots (main way)
- Interactive voice assistant (app on phone or desktop)
- Interactive workspaces (Canvas, Artifact, Copilot)
- Web-based experimentation platforms



Getting started with Chatbots

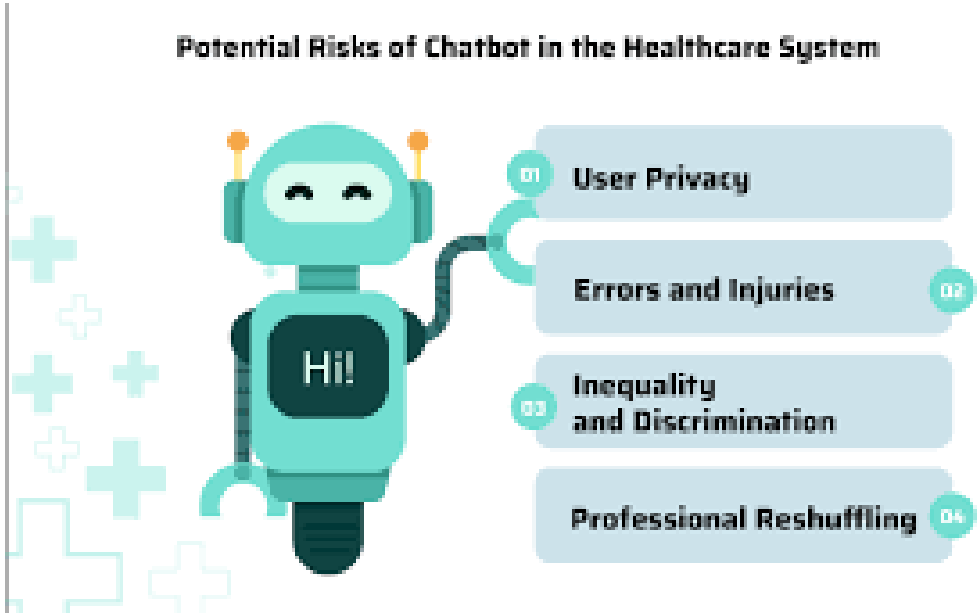
- Sign up a for an account
  - Free account gives access to basic models
  - Paid account gives access to latest models and other tools and plug-ins; around $20/month
- Start chatting
  - Different chatbots can take text, voice, images, and files as inputs
- Refine your prompts to get the best output.
  - Using repetition is a powerful way to achieve the desired output.
  - Provide feedback/ask the chatbot to change something – it can refer to previous messages.

Should I pay for a Chatbot?

- There are many benefits, but it is a personal decision.
- Limits to daily discussion chats under Free plans.
- For example, ChatGPT's Advanced Data Analysis is available to ChatGPT Plus subscribers
  - Allows ChatGPT to write and execute computer code in a sandboxed environment and to display the results as well as to build and iterate on them.
  - Also allows users to upload files and perform data processing tasks on them.
- Another ChatGPT plugin that is useful for economists is Wolfram's Alpha.

Risks when using Chatbots

- Information security: be careful what you upload!
- Hallucination (esp. incorrect facts, citations)
- Bias (based on corpus of training data)
- Homogeneity (all using same models)



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Generative AI for Economic Research

- Anton Korinek published paper in JEL in 2023
- Publishing regular updates
- Website hosts introduction to using generative AI for economists
- Proposes 6 general **categories of capabilities**
  - Ideation and feedback
  - Writing
  - Background research
  - Coding
  - Data analysis
  - Math

Ideation and feedback

Source

- Ask general questions for brainstorming
- Can feed in text or a paper and ask for suggestions to improve it
- Evaluate pros and cons of hypotheses or research plans
- Provide counterarguments

Iteration is critical

- Engage in discussion with the chatbot to follow up and refine ideas.

Example ideation questions

- Can you brainstorm 10 channels through which economics growth may increase conflict? Limit your response to 10 words for each point.
- I am an economist working on climate change and economic development in rural Africa. Can you brainstorm 5 potential paper topics and describe each in one sentence?
- I am an economist working on climate change and economic development in rural Africa. In 4 bullet points, what are the main challenges in researching this topic and how can I address them?

Writing

Source

- Generating catchy titles/headlines, writing abstracts, writing a blog, writing a tweet
- Write a paragraph based on an outline/suggestions
- Editing/grammar, style advice
- Rewrite text in a way accessible to a different audience (eg non-economists)
- Generate slide content (including in Latex)

Example: Paper on locusts and conflict

- Upload current draft of paper
- Prompts:
  - Based on the introduction, can you generate a 100 word abstract that would be suitable to a top economics journal?
  - Can you summarize the main contributions of the paper in 4 bullet points?
  - Can you generate a Latex slide based on your last response?
  - Could you draft a paragraph summarizing contributions of the paper to a literature on econometrics by showing the sensitivity of estimate impacts using panel data depending on assumptions about whether treatment impacts are transitory or persistent?
  - Can you suggest ways to improve this paper and make it more suitable for a top economics journal?

Background research

- Summarizing text/papers
  - Adept at extracting most relevant content from a passage.
- Researching literature
  - Limited usefulness; beware hallucinations
  - Abstract representation of training data involves loss of information
- Formatting references
- Translating
- Explaining concepts
  - Beware mistakes!

Example: Project on flood mapping

- Using bullet points, what are the most common ways flood incidence is measured in economics papers, and what are some citations of published papers using each method?
  - Are the papers real?
- Upload Patel (2024); In 3 bullet points, what are the main takeaways from this paper for how researchers should approach measuring flood incidence?
- In 3 bullet points, can you explain the main differences between identifying flood incidence using satellite imagery and satellite radar?

AI and lit reviews (Bolanos et al 2024)

- Many existing lit review tools
  - Powerful tools for screening and extracting content from literature
- Limitations
  - "Fall short on usability and user-friendliness"
  - Many depend on outdated AI methodologies
  - Limited transparency of methods
  - Inconsistent outputs, hallucinations
- Emerging AI tools
  - Bibliographic search engine chatbots (Scopus, Dimensions, CORE)
  - Search engine tools: EvidenceHunt, Scite, Scispace, Elicit, Textero, MirrorThink, Consensus, Perplexity
    - Different bibliographic databases indexed
  - Still in their infancy

Table 1 The 21 SLR tools analysed in this survey

ID	Tool	Stage SLR	Mode	OS	References
1	Abstrackr	Screening	Web	No	Wallace et al. (2012)
2	ASReview	Screening	Desktop	Yes	Van De Schoot et al. (2021)
3	Colandr	Screening	Web	Yes	Cheng et al. (2018), Cheng and Augustin (2021)
4	Covidence	Screening	Web	No	–
5	DistillerSR	Screening	Web	No	–
6	EPPI-Reviewer	Screening	Web	No	Thomas et al. (2010), Machine Learning Functionality in EPPI-Reviewer (2019)
7	FAST2	Screening	Web	Yes	Yu and Menzies (2019)
8	LitSuggest	Screening	Web	No	Allot et al. (2021)
9	Nested Knowledge	Screening	Web	No	–
10	PICOPortal	Screening	Web	No	Agai (2020), Minion et al. (2021)
11	Pitts.ai	Screening	Web	No	–
12	Rayyan	Screening	Web	No	Ouzzani et al. (2016)
13	Research Screener	Screening	Web	No	Chai et al. (2021)
14	RobotAnalyst	Screening	Web	No	Przybyła et al. (2018)
15	SWIFT-Active Screener	Screening	Web	No	Howard et al. (2020)
16	SWIFT-Review	Screening	Desktop	No	Howard et al. (2016)
17	SysRev	Screening	Web	No	Bozada et al. (2021)
18	Dextr	Extraction	Web	No	Walker et al. (2022)
19	ExaCT	Extraction	Web	No	Kiritchenko et al. (2010)
20	Iris.ai	Both	Web	No	–
21	RobotReviewer/RobotSearch	Both	Web	Yes	Marshall et al. (2017, 2018)

OS open source

Coding

- Explain coding concepts
- Provide code to accomplish tasks
- Identify errors in code
- Convert code across language

Source

Example coding questions

- How do I generate summary statistics for a given variable ‘var1’ in a data frame ‘df’ in Python?
- Can you refine the describe() method to include the 90th and 99th percentiles?
- I wrote this code and am getting an error. Can you help me identify it? summary_stats = df['var1].describe(percentiles=[0.1, 0.5, 0.9, 0.99)
  - Can also copy in text of error messages
- How would I write that code in Stata?
- What does the following function do? [Code]

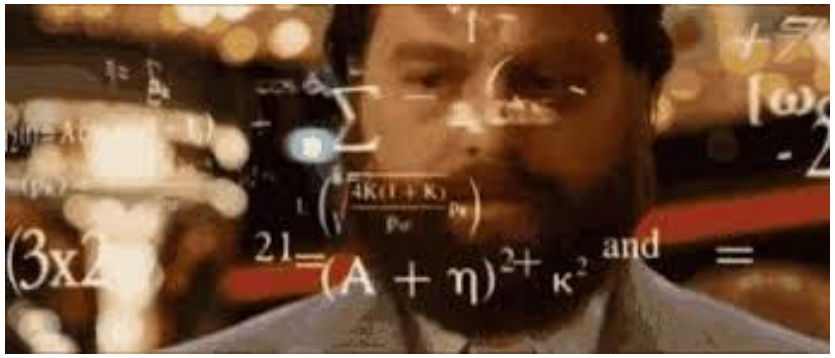
Data analysis

- Create figures
  - Particularly useful with paid subscriptions
  - E.g., ChatGPT Advanced Data Analysis
- Extract data from text
- Classifying text, extracting sentiment
- Suggest sources

Example prompts

- Paul got an 10 in econ and a 12 in math. Marie got a 13 in both econ and math. Eloise got a 15 in econ and an 11 in math. Based on this information, can you generate code to create a dataframe with information on student name, econ grade, and math grade in python?
- Can you rewrite that as a Latex table?
- Is the following FOMC statement from December 2024 hawkish or dovish? https://www.federalreserve.gov/newsevents/pressreleases/monetary20241218a.htm
- What data sources could I use to analyze electricity access in Senegal?

Math



- Derivations, integrals, etc.
  - Beware mistakes
- Turning words into equations
- Explaining models
- Converting images of equations or tables to Latex
- Examples here

Use Chatbots for this class!

- It is often quicker and easier to get a relevant response than Googling or using built in help or documentation.
- You can iterate to dig deeper or refine the response to help you solve your issue.
- It can deepen your understanding and help you troubleshoot.
- **Don't** blindly copy and paste output!!
- **Do** carefully read the output, try to understand it, and ask follow-up questions about anything you don't understand.
  - Chatbots should *complement* but not *replace* your own knowledge and skills.

Being careful with Chatbots

- **Data accuracy**:
  - Chatbots may provide outdated or incorrect information.
  - *Solution*: Cross-check data with authoritative sources and verify claims.
- **Biases**:
  - Chatbots can inherit biases from their training data.
  - *Solution*: Evaluate responses critically, using diverse perspectives and external validation.
- **Security**:
  - Privacy and consent issues may arise from chatbot interactions.
  - *Solution*: Be careful about any information you share and consider whether there are implications of making that information public.
- **Over-reliance**:
  - Excessive dependence on chatbot outputs can hinder critical thinking.
  - *Solution*: Use chatbots as supplementary tools, not replacements for human judgment.
- **Interpretation of responses**:
  - Chatbots may misinterpret complex questions or context.
    Solution: Provide clear, specific queries, and verify chatbot responses in context.

BREAK

- Then, working with big data in economics.