LLMs: Applications to Economics Research

Honors Thesis Class

Nathan Williams

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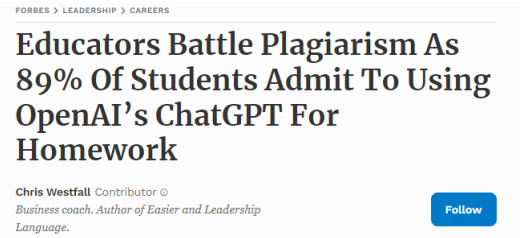
Roadmap

Questions

1. How many of you have used ChatGPT or another LLM?
2. How many of your professors have talked about it?
3. Have you had good experiences? Bad experiences?

Why are we talking about AI and Research?

The proliferation of AI applications and Large Language Models for academic research has increased drastically in the schools.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Educators Battle Plagiarism As 89% Of Students Admit To Using OpenAI's ChatGPT For Homework

Chris Westfall Contributor ⓘ

Business coach. Author of Easier and Leadership Language.

Follow

Professors are having trouble too!

Shooshan Danagoulian @shooshan.bsky.social
@Shooshan5

Next semester I will be teaching a graduate health economics course. I have decided to adopt an AI friendly format for assignments. I can imagine a number of ways this could go wrong, but I am crossing my fingers that, instead, it will empower students to write more.
#AIAcademia

11:34 AM · Aug 8, 2023 · **1,277** Views

Artificial Intelligence Platforms

The popularity of ChatGPT and OpenAI has led to the proliferation of many AI platforms

- Github Copilot
- StableLM
- Pythia
- BloombergGPT

This space is growing so quickly that there will likely be one announced over the course of this presentation.

Using AI in Research

Using generated work in research can be very dangerous for the following reasons:

- Incorrect Information
- Plagiarism

The goal of this talk is to minimize the risks of either of these issues arising.

Is this talk anti-LLM?

No! I use it in my own research! (But I use it with caution!)

Roadmap

How are we thinking about ChatGPT?

Have you ever had an annoying friend that constantly finishes your sentences **and** is also wrong?

General Rule of Thumb

LLMs tend to do worse at generating original material, as they tend to make things up if not properly prompted.

Rule of Thumb

Avoid having an LLM generate its own work, use it to enhance your already existing work

Construction of Queries

Every time a query is constructed, think of choosing a set of additional information such that the probability of a correct answer is maximized. There are a few key aspects that consistently improve the outputs of LLMs.

- Writing clear text
- Prompt Structure

Basic Prompt Structure (Source)

A well-structured prompt can have up to 4 key elements. These are not all needed but can be valuable in answering more complicated questions.

- Instruction
- Context
- Input Data
- Output Data

Some Other Key Prompt Approaches (Source)

Many of the standard rules of thumb for Google searches often apply here:

- Specificity
- Start Smaller
- Avoid Impreciseness

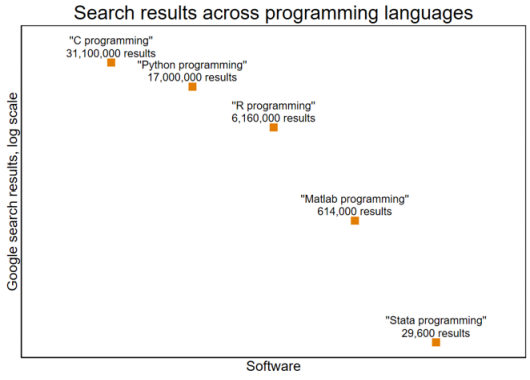
Roadmap

Coding in LLMs

The largest efficiency gain for researchers comes from LLM's coding ability.

- Writing Code
- Interpreting Errors
- Streamlining Speed

LLMs are not equally helpful



Interpreting Errors

One of the most powerful tools LLMs can be used for is interpreting errors. Simply copy and paste your error into the interface window.

This is not a substitute to StackOverflow, but rather a compliment.

Prompt Strategy - Interpreting and Fixing Errors

A better way to interpret errors can be borrowed from the prompt engineering literature:

1. Set up the prompting environment
2. Include both your code and your error
3. Ask the LLM to explain the error in the context of your code in the Output Data section

Streamlining Speed

In every subfield of economics, there exists simulations that can take a very long time (days to weeks). Small coding optimizations can take a project that takes weeks to simulate and move it to days.

- Microeconomics (Bootstrapping)
- Macroeconomics (Model Estimation)
- Econometrics (Bootstrapping)

Prompt Strategy - Speeding Up Code

1. Set up the prompting environment
2. Include your code in the Context section
3. Ask the LLM to find ways to optimize your code

Generating New Code

Per the Rule of Thumb Slide, it is a good idea to avoid an LLM generating all code for a few key reasons:

- The LLM may hallucinate packages or commands, especially as the program has less active resources on the internet (read: Stata)
- The prompt and structure must be very specific
- You still have to know what the code does!
- Certain people may construe this as academic dishonesty

It is in your best interest not to do this.

Demo Time!

1. Find some code that you have written that you **understand**
2. Ask ChatGPT how to do write it using the prompting structure discussed
3. Paste your code into ChatGPT and ask it to interpret it
4. How does it do?

Roadmap

LLMs are editors, not writers

Unlike with code, using an LLM to write for you is widely considered academic dishonesty and you should not do it ever!

However, there are some uses for ChatGPT with writing that are both largely permissible and can serve to help you in your own writing.

Writer's Voice

Why use an LLM to edit work?

One of the most popular strategies of editing is reading your work aloud to a friend (or yourself, no judgement). This helps discern the quirks of your voice that you otherwise might not see.

If you don't have friends, ChatGPT and other LLMs can serve this purpose.

Prompt Strategy - Editing Documents

- Set up the prompting environment, make sure the LLM knows it is an editor and not a writer
- Paste a section of the document that you would like to be edited and ask ChatGPT to edit it

Demo Time!

1. Find some writing that you have done for another class
2. Ask ChatGPT to edit it
3. How does it do?

Roadmap

LLMs and ChatGPT

Both are powerful, but dangerous tools in the research process. Please use caution when using.

If you have any questions, come see Hanna or Nathan and we will help you :)

Activity

In the remaining time, I want you to do the following activity:

- Find some code on your computer that you have written and ask ChatGPT or another LLM to interpret what you are doing. Is it correct? (Once done, let me know)
- Find some writing on your computer and ask ChatGPT to edit it. How does it do? (Once done, let me know)