

Programming chatGPT in its own words

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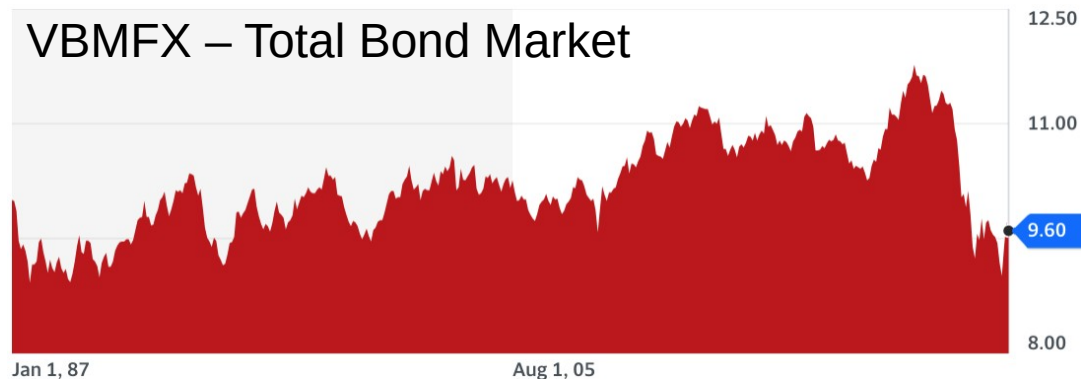
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Agenda

- Motivation: An extended conversation with a waitress
 - CIMI → Bogle
 - Simple Momentum in Excel and Colab Python
 - Simple Timing using FinGPT
- GPT Q&A
 - Can you code using LLMs?
 - How smart is chatGPT?
 - Can you keep info private?
 - What is the best way to augment and fine tune an LLM?
- Acknowledgements

CIMI → Bogle

- Gotta admit, I feel stupid asking this, but here goes.....
 - I was recently asked by a waitress about a good introductory investing book
- 7 Responses – Three mentioned “The Bogleheads Guide to Investing” – I told her to read chapter 8 “Allocation” first
- **Waitress: WTF? Page 104?**
“Bonds helped smooth out the ride for investors...”



Momentum

- **Waitress: So what do you do?**
 - Heath - “I would now reject out of hand for a beginner any book that didn't emphasize drawdown management as exemplified by Ricardo's quote in some way: “Cut short your losses, and let your profits run on.” I would rather give a beginner a book on trend following and **momentum strategies for etf and stock universes** than one about fundamentals or buy and hold”

Why do I show this to a person with low risk tolerance?

- January 2023: Noted Impact of Generative AI to Don, Ren in a Email
- June 2023: Generative AI stocks I reported on are still on a roll
- January 2024: My bet has been that in this period, investing decisions are pretty easy
- Upvoted Tickers
 - ticker votes
 - 3 NVDA 17
 - 2 AMD 14
 - 17 META 13

Simple Momentum in Excel

- **Waitress: I know excel**
- 20231227 Momentum Homework - 11 mo lookback - [excel](#)
 - Universe – META,AAPL, AMZN, NFLX, NVDA, GOOG
 - Lookback/lag – 11 mos
 - portfolio length - 1
 - Method - top 1
 - Timeframe – 10 years
 - **Waitress: What would have happened if I had started investing on 11/2021?**
 - Note that it does better than 5/6 but not better than NVDA
- 20240101 Momentum Homework - 13612 lookback - [excel](#)
 - Note: Survivorship bias
 - Note: better than 11 mo lookback

Simple Momentum in Excel

- A1-G1 – Ticker Names
- A2-G121 – Stock Prices (Cut and paste from Yahoo Finance)
- H13-M121 – Scores
 - $= (B13 - B2) / B2$ ← 11 mo returns
 - $= (B14 - B2) / B2 + (B14 - B13) / B13 + (B14 - B11) / B11 + (B14 - B8) / B8$ ← 1,3,6,12 mo returns
- O13-O121 – Index of Ticker with Highest 11 mo return
 - $= \text{MATCH}(\text{MAX}(H13:M13), H13:M13, 0)$
- P13-P121 – Ticker with Highest 11 mo return
 - $= \text{offset}(\$A\$1, 0, \text{MATCH}(\text{MAX}(H13:M13), H13:M13, 0))$
- Q13-Q121 – next month return for selected Ticker
 - $= 1 + (\text{offset}(\$A13, 1, O13) - \text{offset}(\$A13, 0, O13)) / \text{offset}(\$A13, 0, O13)$
- R14-R121 – aggregate return
 - $= \text{PRODUCT}(\$Q\$13:Q14)$

Simple Momentum in Colab Python

- **Waitress: do you use excel?**
- Python
 - Coursera: Crash Course on Python - [html](#)
 - Colab Momentum Example – [ipynb](#)
 - MonthlyPricesDf - A2-G121 – Stock Prices
 - ScoresDf - H13-M121 – Scores
 - TopNstockRankings - O13-O121 – Index of Ticker with Highest 11 mo return
 - RecommendationsDf - P13-P121 – Ticker with Highest 11 mo return

Timing using `absmM(5)(spy,tbill)`

- Skip for time

Simple Timing using FinGPT

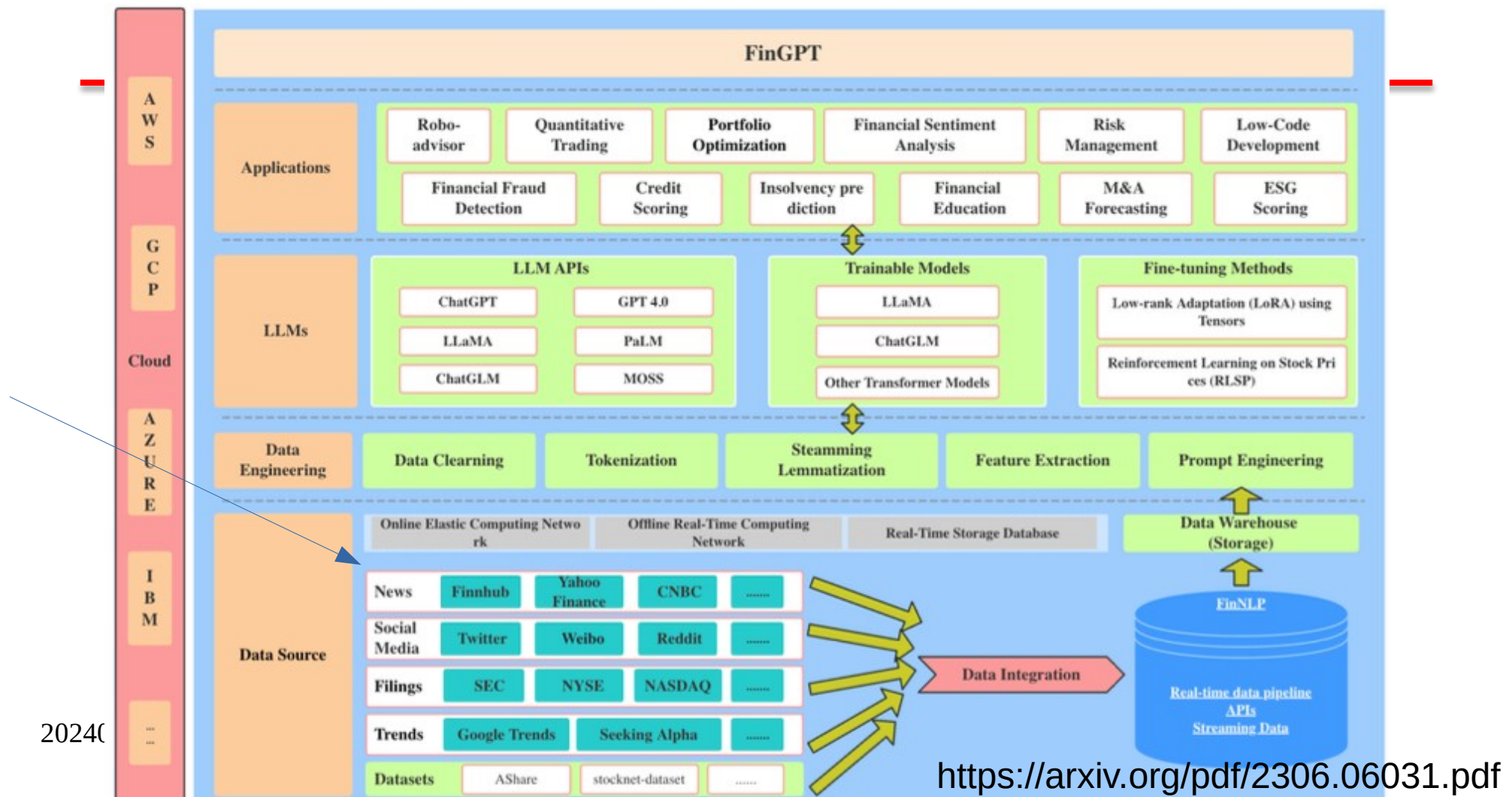
- <https://huggingface.co/spaces/FinGPT/FinGPT-Forecaster>
- [Prediction & Analysis]:
- Prediction: Up by 3-4%
- Analysis: Despite the potential concerns, the company's strong performance in the AI sector and its positive market sentiment make it a strong contender for growth. The recent news highlighting the company's advancements in AI and its recognition as a leading force in the Semiconductors sector further support the stock's upward trend.

The screenshot shows a web interface for the FinGPT-Forecaster. It has a white background with rounded corners. At the top, there's a 'Ticker' section with a text input field containing 'NVDA' and a note 'Companies from Dow-30 are recommended'. Below that is a 'Date' section with a text input field containing '2024-01-31' and a note 'Date from which the prediction is made, use format yyyy-mm-dd'. The next section is 'n_weeks', featuring a slider control set to '3' and a note 'Information of the past n weeks will be utilized, choose between 1 and 4'. There's a checkbox labeled 'Use Latest Basic Financials' with the note 'If checked, the latest quarterly reported basic financials of the company is taken into account.' At the bottom, there are two buttons: a grey 'Clear' button and an orange 'Submit' button.

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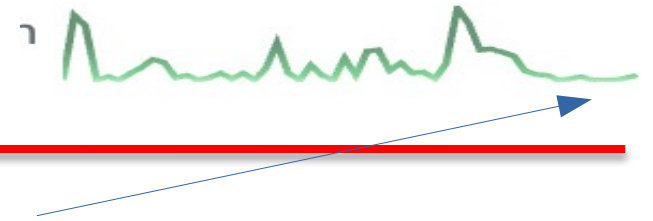
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FinGPT Architecture



2024C

FinGPT Status



- <https://github.com/AI4Finance-Foundation/FinGPT>
- What's New:
- [Model Release] **Nov, 2023**: We release FinGPT-Forecaster! Demo, Medium Blog & Model are available on Huggingface !
- [Paper Acceptance] **Oct, 2023**: "FinGPT: Instruction Tuning Benchmark for Open-Source Large Language Models in Financial Datasets" is accepted by Instruction Workshop @ NeurIPS 2023
- [Paper Acceptance] **Oct, 2023**: "FinGPT: Democratizing Internet-scale Data for Financial Large Language Models" is accepted by Instruction Workshop @ NeurIPS 2023
- [Model Release] **Oct, 2023**: We release the financial multi-task LLMs produced when evaluating base-LLMs on FinGPT-Benchmark
- [Paper Acceptance] **Sep, 2023**: "Enhancing Financial Sentiment Analysis via Retrieval Augmented Large Language Models" is accepted by ACM International Conference on AI in Finance (ICAIF-23)
- [Model Release] **Aug, 2023**: We release the financial sentiment analysis model
- [Paper Acceptance] **Jul, 2023**: "Instruct-FinGPT: Financial Sentiment Analysis by Instruction Tuning of General-Purpose Large Language Models" is accepted by FinLLM 2023@IJCAI 2023
- [Paper Acceptance] **Jul, 2023**: "FinGPT: Open-Source Financial Large Language Models" is accepted by FinLLM 2023@IJCAI 2023
- [Medium Blog] **Jun 2023**: FinGPT: Powering the Future of Finance with 20 Cutting-Edge Applications

GPT Q&A

- Can you code using LLMs?
 - ChatGPT: Creating a streamlit UI in python
- How smart is chatGPT?
 - LLM IQ test
- Can you keep info private?
 - An LLM (Llama 2) on your laptop
- What is the best way to augment and fine tune an LLM?
 - RAG Exercise: Constitution
 - Graph DB Exercise

Creating a streamlit UI in python

- You
- ChatGPT: Please generate streamlit application with that allows me to enter a list of up to 20 comma delimited stock tickers in an element called "ticker list", a pull down with items labeled "month end", "month beginning", "week end", "week beginning" in an element called "time period", and an OK button. When "OK" is pressed, I want the application to call a python interface called "doit" which is passed the ticker list and the time period.

Creating a streamlit UI in python

- import streamlit as st
- # Placeholder for the doit function
- def doit(ticker_list, time_period):
- # Implement your function logic here
- pass
- # Streamlit application layout
- st.title("Stock Ticker Analysis")
- # Ticker list input
- ticker_input = st.text_input("Enter up to 20 comma-delimited stock tickers", "")
- # Time period selection
- time_period = st.selectbox("Select Time Period", ["month end", "month beginning", "week end", "week beginning"])
- # OK button
- if st.button("OK"):
- # Splitting the ticker list and removing any extra spaces
- ticker_list = [ticker.strip() for ticker in ticker_input.split(",") if ticker]
- # Limit the list to 20 tickers
- if len(ticker_list) > 20:
- st.error("Please enter no more than 20 tickers.")
- else:
- # Call the doit function with the ticker list and time period
- doit(ticker_list, time_period)
- st.success("Function executed with the provided tickers and time period.")

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An Aside: Packages, Environments and Containers

- An Aside: Once you have more than one thing on your computer, you need organization.
- [pip](#) - install packages (e.g. numpy, pandas)
 - Issue: dependencies overwrite each other
 - e.g. one project needs numpy2.0 and another needs numpy2.1
- [Anaconda](#)
 - Disentangle dependencies: 1) load packages in one place 2) create a separate environment per project and 3) reference needed packages from that environment
- [venv](#) (virtual env)
 - Python3 builtin that creates a directory per project and puts an “env” directory inside to hold packages that the project needs
- [Docker](#) [TEAM](#) ← Good Stock
 - Store “Containers” of packages/environments on the internet and retrieve via Docker Pull
 - Virtual Machine Layer

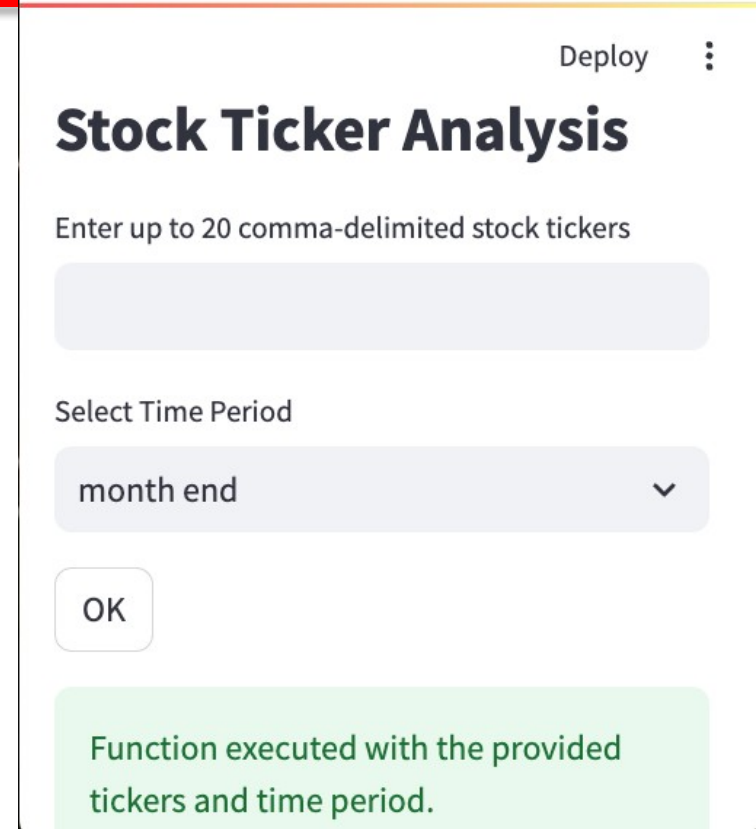
Creating a streamlit UI in python

- Do this the first time
 - `cd /Users/.../4V/streamlit`
 - `python3 -m venv env`
 - `source env/bin/activate`
 - `pip install streamlit`
- Do this every subsequent time
 - `cd /Users/.../4V/streamlit`
 - `source env/bin/activate`
 - `streamlit run app.py`

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LLM IQ test 1

There are two variables X and Y . Each has two components as possible choices (in other words their domains). The components in turn can be viewed as having two distinct fields: $p1$ and $p2$ for components in the domains of X and Y . We shall use curly braces $\{ \}$ to represent the choices for a variable and square brackets $[]$ to represent a component. The choices for X and Y are:

$X: \{ [p1:a, p2:b] [p1:a, p2:c] \}$ and $Y: \{ [p1:d, p2:e] [p1:d, p2:f] \}$

We shall further use the dot notation to refer to nested variables. Thus, $X.p1$ means the value of the $p1$ field of the component assigned to X . The constraints on X and Y are

$C1: X.p1 = a \text{ iff } Y.p2 = e$; $C2: Y.p1 = d \text{ iff } X.p2 = c$

The constraint $C1$ reads, "X.p1 has value a if and only if Y.p2 has value e".

This problem has four candidate solutions (2 choices for X x 2 choices for Y)

Which solutions are valid?

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In the given example, you have two variables X and Y , each having two components with fields $p1$ and $p2$. The constraints are as follows:

- $C1: X.p1 = a$ if and only if $Y.p2 = e$
- $C2: Y.p1 = d$ if and only if $X.p2 = c$

We can test the four candidate solutions by evaluating the choices for X and Y and checking whether they satisfy both constraints.

1. $X = [p1 : a, p2 : b], Y = [p1 : d, p2 : e]$:
 - $C1: X.p1 = a, Y.p2 = e$, so this constraint is satisfied.
 - $C2: Y.p1 = d$, but $X.p2 = b$, so this constraint is not satisfied.
 - This solution is not valid.
2. $X = [p1 : a, p2 : b], Y = [p1 : d, p2 : f]$:
 - $C1: X.p1 = a, Y.p2 = f$, so this constraint is not satisfied.
 - $C2: Y.p1 = d$, but $X.p2 = b$, so this constraint is not satisfied.
 - This solution is not valid.
3. $X = [p1 : a, p2 : c], Y = [p1 : d, p2 : e]$:
 - $C1: X.p1 = a, Y.p2 = e$, so this constraint is satisfied.
 - $C2: Y.p1 = d, X.p2 = c$, so this constraint is satisfied.
 - This solution is valid.
4. $X = [p1 : a, p2 : c], Y = [p1 : d, p2 : f]$:
 - $C1: X.p1 = a, Y.p2 = f$, so this constraint is not satisfied.
 - $C2: Y.p1 = d, X.p2 = c$, so this constraint is satisfied.
 - This solution is not valid.

So among the four candidate solutions, only the third one is valid.

LLM IQ test 2

- An inverter is a logical element that takes in a logical value (e.g. True, False) and outputs its inverse (e.g. False, True). Suppose I connect three inverters, A, B and C in a circle. I.E. A's output connects to B's input, B's output connects to C's input and C's output connects to A's input. What are the values A's B's and C's outputs?



Connecting three inverters in a circle creates a logical paradox because the output of each inverter is determined by the inverse of the next one in the loop. Let's try to analyze the situation:

1. **Assume A's output is True:**

- Then B's input is True, so B's output is False.
- Then C's input is False, so C's output is True.
- But C's output connects back to A's input, so A's input is True, which means A's output should be False, not True, leading to a contradiction.

2. **Assume A's output is False:**

- Then B's input is False, so B's output is True.
- Then C's input is True, so C's output is False.
- But C's output connects back to A's input, so A's input is False, which means A's output should be True, not False, leading to another contradiction.

The circuit, as described, has no stable logical state, and the outputs of A, B, and C will oscillate between True and False without settling on a definitive value.

In a real-world physical system, this configuration would likely lead to an unstable oscillating behavior, depending on the characteristics of the inverters (such as propagation delays).

This kind of loop is typically avoided in logical design, as it can lead to unpredictable behavior.

LLM IQ test 3a

- Your goal is to create a boolean logic circuit that inputs variables X, Y and Z and outputs their inverse. You can build the circuit using any number of N-input "and" and "or" gates but only two inverters.
- Hallucination



Given three input variables $X, Y,$ and $Z,$ and only two inverters, we can obtain the inverse of only two of these directly. To get the inverse for all three, we can use boolean algebra properties. We can express one of the variables in terms of the other two.

Using De Morgan's Law:

$$\overline{X \wedge Y} = \overline{X} \vee \overline{Y}$$
$$\overline{X \vee Y} = \overline{X} \wedge \overline{Y}$$

Let's find \overline{Z} using the above:

$$\overline{Z} = \overline{X \wedge Y} \vee \overline{X \vee Y}$$

Here's how to build the circuit:

1. Use the first inverter to obtain $\overline{X}.$
2. Use the second inverter to obtain $\overline{Y}.$
3. Get $X \wedge Y$ using an "and" gate.
4. Get $\overline{X \wedge Y} \vee \overline{X \vee Y}$ using an "or" gate, which will give $\overline{Z}.$

This way, with two inverters and two gates (an "and" gate and an "or" gate), you can get the inverse of all three variables $X, Y,$ and $Z.$

LLM IQ test 3b

OP

Your goal is to create a boolean logic circuit that inputs variables X,Y and Z and outputs their inverse. You can build the circuit using any number of N-input "and" and "or" gates but only two inverters. Show a truth table illustrating the solution



Let's first try to solve the problem, and then I'll provide a truth table.

Our goal is to find \bar{X} , \bar{Y} , and \bar{Z} with only two inverters.

One way to solve the problem:

1. Use the first inverter on X to get \bar{X} .
2. Use the second inverter on Y to get \bar{Y} .

Now, to find \bar{Z} , we can use De Morgan's Law:

$$\bar{Z} = \overline{X \wedge Y \vee X \vee Y}$$

Unfortunately, this approach won't work because we have already used both inverters.

Let's try a different approach:

1. First, let's use the first inverter on X to get \bar{X} .
2. Now, use an AND gate to get $X \wedge Y$.
3. Pass this output to the second inverter to get $\overline{X \wedge Y}$.
4. Now, using an OR gate, we can get $\overline{X \wedge Y} \vee Z$, which is equivalent to \bar{Z} when X is True and Y is True. But this won't always yield \bar{Z} for all cases.

Upon closer inspection, it seems the problem might not have a straightforward solution given the constraints.

However, let's create a truth table to see if we might find a pattern or another approach:

X	Y	Z	\bar{X}	\bar{Y}	\bar{Z}
0	0	0	1	1	1
0	0	1	1	1	0
0	1	0	1	0	1
0	1	1	1	0	0
1	0	0	0	1	1
1	0	1	0	1	0
1	1	0	0	0	1
1	1	1	0	0	0

From the truth table, it appears that our initial thinking is correct, and it might be difficult to obtain \bar{X} , \bar{Y} , and \bar{Z} for all cases using just two inverters and any number of AND or OR gates.

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• Shrug

An LLM (Llama 2) on your laptop

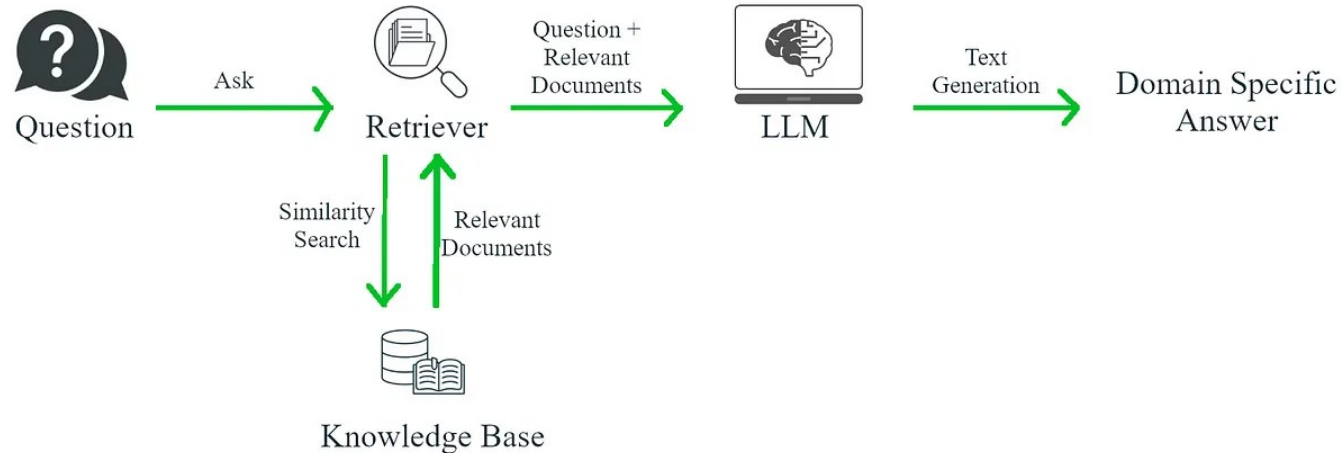
```
#!/bin/bash
# Clone llama.cpp
git clone https://github.com/ggerganov/llama.cpp.git
cd llama.cpp
# Download model
export MODEL=llama-2-13b-chat.ggmlv3.q4_0.bin
if [ ! -f models/${MODEL} ]; then
    curl -L "https://huggingface.co/TheBloke/Llama-2-13B-chat-GGML/resolve/main/${MODEL}" -o models/${MODEL}
fi
# Build it
make
# Set prompt
PROMPT="Hello! How are you?"
# Run in interactive mode
./main -m ./models/llama-2-13b-chat.ggmlv3.q4_0.bin \
    --color \
    --ctx_size 2048 \
    -n -1 \
    -ins -b 256 \
    --top_k 10000 \
    --temp 0.2 \
    --repeat_penalty 1.1 \
    -t 8
```

What is the best way to augment and fine tune an LLM?

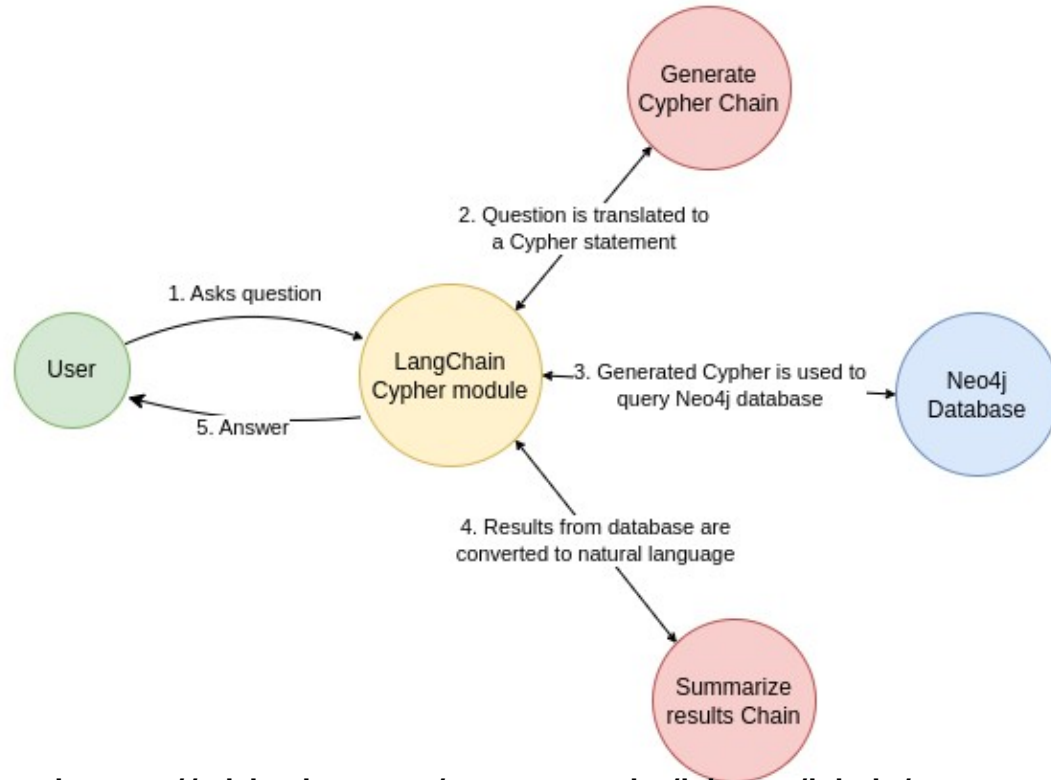
- Please provide a complete list of techniques to augment an LLMs knowledge base (not limited to RAG, LORA, fine tuning, etc)
 - **Retrieval-Augmented Generation (RAG)**
 - Knowledge Enhanced Training
 - External Knowledge Integration via APIs
 - Prompt Engineering and Example-Based Learning
 - Memory Augmented Models
 - Hybrid Models
 - Continuous Learning and Feedback Loops
 - Domain-Specific Language Models
 - Dynamic Data Embedding
 - **Graph Neural Networks for Knowledge Representation**
- Transformer-based Adapters
 - LoRA (Low-Rank Adaptation)
 - Zero-Shot and Few-Shot Learning
 - Contrastive Learning

RAG Exercise: Constitution

- “You don’t rely on internal knowledge of the LLM to produce answers. Instead, the LLM is used only for extracting relevant information from documents you passed in and summarizing it.”
- BP: RAG with constitution db was worse than using Llama 2 by itself



Graph Database Exercise

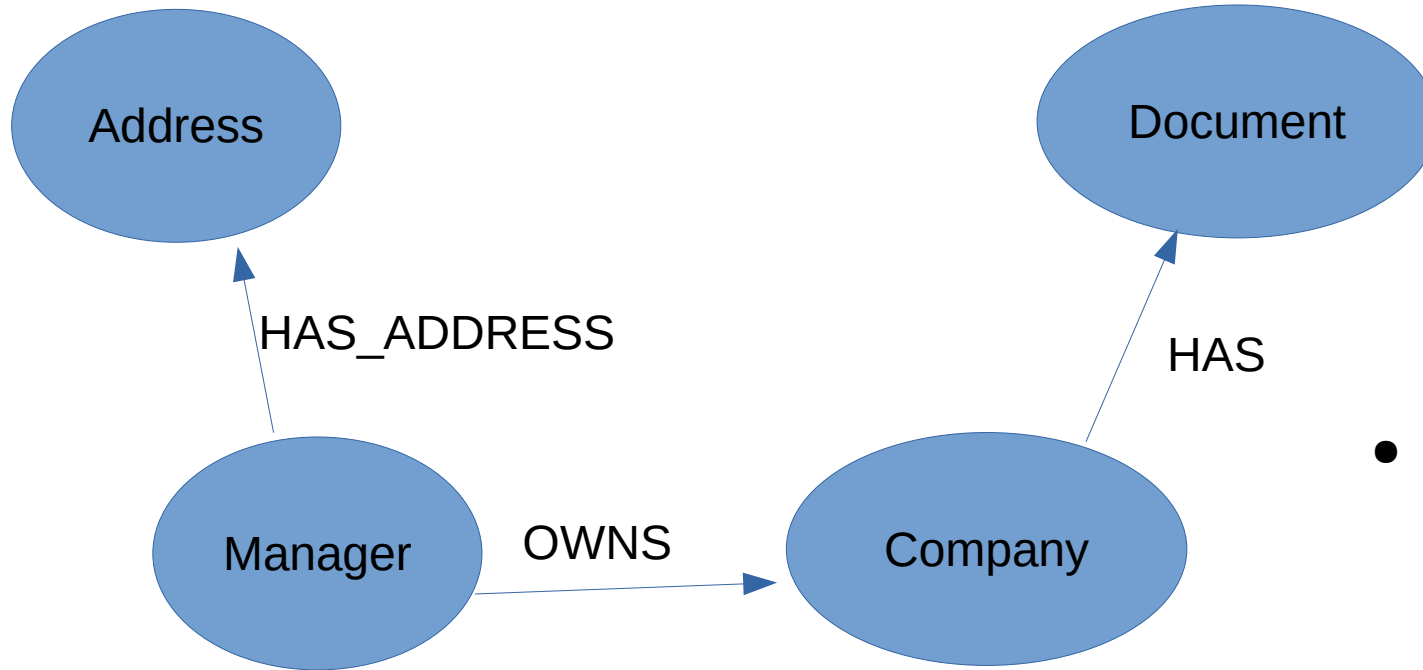


https://github.com/tomasonjo/blogs/blob/master/llm/langchain_neo4j.ipynb

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Relationships help



- Cypher

<https://medium.com/neo4j/knowledge-graphs-llms-fine-tuning-vs-retrieval-augmented-generation-30e875d63a35>

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Which asset managers are vulnerable to lithium shortage?

Vector Only

Based on the context provided, here is a summary of the asset managers that may be vulnerable to lithium shortage:

The company's products incorporate battery technology, so increased demand for batteries could place capacity constraints on the Company's supply chain. This could increase costs or impact availability of lithium and other raw materials.

The Magnesia Specialties business sources Some raw materials like coal and natural gas from countries like Chile and Australia that are experiencing severe weather due to climate change. This could cause supply chain disruptions and shortages.

The company relies on suppliers for components and systems necessary to complete projects. There may be single suppliers for certain components leading to constraints or cost pressures, especially amid supply chain disruptions.

Tight capital and credit markets or failure to maintain credit ratings could limit the company's ability to access liquidity needed for long-term growth initiatives and acquisition

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Vector + Graph

Based on the context provided, the asset managers that may be vulnerable to lithium shortage are:

- Quantamental Technologies LLC
- DEPRINCE RACE & ZOLLO INC
- Atria Wealth Solutions, Inc
- COROUP INU
- CHARLES SCHWAB INVESTMENT MANAGEMENT INC
- ROYAL LONDON ASSET MANAGEMENT LTD
- STIFEL FINANCIAL CORP
- TUCKEK ASSET MANAGEMENT LLE
- Patriot Financial Group Insurance Agency, LLC
- SeaCrest Wealth Management. LLC

The context indicates that Stanley Black & Decker uses lithium batteries in many of its products. With increasing

demand for lithium, there could be supply constraints and increased costs for lithium.

This could negatively impact the profitability of Stanley Black & Decker. The asset managers listed above have holdings in Stanley Black & Decker, and therefore may be vulnerable to the risks of lithium shortage for this company.

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Acknowledgements

- Thanks to the waitress
- And to those who responded to my question
 - John Chandler, Peter Lingane, Reed, David King, Richard O, Heath
- Answers
 - <https://www.financesforfeminists.com/>
 - Investing at level 3 - review pdf
 - bogleheads.org .
 - John Bogle, Common Sense on Mutual Funds, Wiley 1999
 - Jonathan Clements, How to Think About Money, 2016
 - Annette Thau, The Bond Book, 2010
 - https://www.bogleheads.org/wiki/Bogleheads%27_Guide_To_Investing
 - A Random walk down wall street - [audiobook](#)
 - [We're talking Millions](#)
 - Muscular Portfolios - [synopsis](#)