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> ■ AI Advances · ~12 min read · February 14, 2024 (Updated: February 15, 2024) · Free: No Introduction Method Step 1: Gather training data Step 2: Clean and parse data Step 3: Train the LLM Step 4: Evaluate, Rinse & Repeat Conclusion

Introduction

In the swirling world of financial market analysis, where change is as unpredictable as the Mistral, I embarked on an ambitious journey to create a large language model (LLM) that was an expert in the technical analysis of stock and options trading. Drawing from what I had learned making GPT-4 trade options, I

knew the next frontier was to add more technical analysis expertise via finetuning. And what a frontier wrestling with a 7 billion (that's billion with a B) parameter model was. The results of this rollercoaster though I am very excited to share with you all. I Made GPT-4 Trade Options Options Trading With GPT-4 Using Retrieval Augmented Generation (RAG)

Method A big misconception I had going into this project was that fine-tuning the model would be more difficult than data preparation. Boy, was I in for a treat...

with all the bells and whistles (I used axolotl).

Here are the steps I took from start to finish with my perceived difficulty levels 1. Gather training data (difficulty depends)

2. Clean and parse data (hard) 3. Finetune LLM (>7B models more difficult) 4. Pray (optional), evaluate, rinse & repeat

Step 1: Gather training data

Depending on your application, this step could be as easy as downloading via a link to the difficulty of writing a custom web scraper. In my case, I already had access to all the PDF versions of the trading commentary I wanted to fine-tune with. Here is the full list of books in the dataset. If you read all of these books,

you would be a trading wizard. (Hence, why I made an LLM do it for me.)

1. Brian Overby — The Options Playbook, Expanded 2nd Edition

4. Mark Leibovit — The Trader's Book of Volume, The Definitive Guide to **Volume Trading** 5. Laurentiu Damir — Price Action Breakdown, Exclusive Price Action Trading

6. Sheldon Natenberg — Option Volatility and Pricing 7. Steven Achelis — Technical Analysis from A to Z

With the plain text versions in hand, I now had a large text corpus ready for the parsing step.

completion objective) 2. The OpenHermes dataset to improve chat capabilities post-learning from book content

I embarked first on removing irrelevant or noisy text from my book dataset. This

often was the first and last 5 pages which consisted of acknowledgments, table of

Next, following inspiration from this paper, I used GPT-3.5 (saves \$\$ versus GPT-4)

[PDF] Improving Domain Adaptation through Extended-Text Reading Comprehension | Semantic Scholar This work improves reading comprehension via LLM and clustering to improve the efficiency of domain adaptation and...

contents, and publisher information.

following:

<s>[INST]

What does RSI measure?[/INST]

... up to 5 more questions</s>"

typically a stock or a currency pair.

to generate Q&A pairs from each paragraph in the text.

{"text": "<s>[INST] <<SYS>>You are a trading expert. Answer questions on the 'An ambiguous paragraph about the RSI indicator.'<</SYS>> What is the RSI?[/INST] The Relative Strength Index (RSI) is a popular momentum oscillator.

The Relative Strength Index (RSI) measures the magnitude and velocity

of recent price movements in a particular financial instrument,

Copy

Copy datasets: - path: qa-dataset.jsonl ds_type: json type: completion val_set_size: 0.05

The OpenHermes dataset was essentially free lunch and only required the

Copy

following axolotl config to get up and running:

- path: teknium/openhermes

split: train type: alpaca

likely scraped from Reddit or"

Output: "Youtube."

are available here:

forms?"

Step 4: Evaluate, Rinse & Repeat

The final step in our journey (unless it's your first time here).

question any technical analysis guru should be able to answer is:

datasets:

the next word in a text based on the context provided by all previous words. This corpora, allowing the model to understand and generate human-like text based on the many patterns it learns. The transformer architecture enables the model to consider the entire context of the input text, making it effective at understanding language nuances and generating coherent and contextually relevant text. An example training pair could be:

Input: "I am an ambiguous text in a massive corpus of pre-training data. I was

Millions of these samples are fed to the LLM during the pre-training phase. The

reason LLMs seem to know everything is that they've trained on nearly everything.

input-output pairs of an instruction text. An example instruction pair could look

Instruction finetuning — is the continued training of a pre-trained model on

like the following: Instruction: "Recommend a list of ingredients for a PB&J sandwich."

Output: "Sure! A traditional PB&J consists of peanut butter, jelly, and toast."

The instruction is used as input to the model. Its target output is the expected

response from the model given the instruction. A lot of effort is often required to

1. Teach the LLM technical analysis with unsupervised language modeling (text

completion) 2. Improve its "sociability" after a noticeable degradation in chat performance with instruction fine-tuning using the OpenHermes dataset (aka supervised fine-tuning) Lesson Learned: An instruction-tuned model can "unlearn" their sociability after further unsupervised training

I trained on the books dataset for only one epoch on a single A6000 (48 GB) GPU

on <u>runpod</u>. In total, this cost me less than \$5. The full training metrics and config

I then reloaded the resulting QLoRa model and trained again for only 100 steps (out of 100k or so) on the OpenHermes dataset. I found its chatting capabilities were greatly improved from seeing a small subset of OpenHermes.

I used the vanilla Mistral 7B model as a baseline to compare outputs against. A

"What does it mean when a narrow spread candle with above average volume

Here is what vanilla Mistral 7B had to say: When a narrow spread candle with above-average volume forms, it indicates that there was significant buying or selling pressure during the trading period. The narrow spread suggests that the opening and closing prices were close to each other, while the

The above average volume could suggest that there is a lot of activity happening within the market, but not much is changing in terms of price movement. It could also indicate a period of transition, where the market is moving from one trend to another. For example, if the market has been in a strong uptrend and the candle forms after a significant price increase, it could signal that the market is starting to consolidate and may be entering a sideways period before

on a price chart, it indicates a specific market condition characterized by several key factors. Here's a breakdown of what this pattern suggests: 1. **Narrow Spread Candle **: A "narrow spread" candle refers to a candlestick on a chart where the difference between the opening and closing prices (the body of the candle) is small. This suggests that there was not a significant difference in price over the period the candle represents, indicating consolidation or indecision in

- **Indecision**: It can also reflect a state of indecision among traders. The high volume suggests strong interest, but the narrow spread shows a lack of consensus on price direction. - **Potential Precedent for a Breakout**: Often, such a pattern

pattern, other technical indicators, and market news or events. The significance of the pattern can vary depending on whether it occurs in a bullish, bearish, or sideways market. We can see that the 7 billion parameter model gives a competitive answer to the over 1 trillion parameter model at a fraction of the size and cost! Here is a more advanced technical analysis question:

overall market sentiment is turning more optimistic about its prospects. This could lead to an increase in demand and potentially push up the stock prices over time.

doing so, I can take advantage of potential gains from the golden cross signal while also protecting against unforeseen market events or individual stock underperformance. 4. Regularly reviewing and rebalancing my portfolio based on

average crosses above a long-term moving average and is accompanied by an increase in trading volume, is a bullish signal for a stock. This indicates that the stock is gaining momentum and is likely to continue moving higher. As an investor, I would expect the stock's price to continue appreciating in the near future.

The formation of a golden cross, where a short-term moving

accompanied by strong fundamentals and a healthy balance sheet, I would consider buying more shares of the stock to capitalize on the momentum and potential appreciation. 2. Consider buying call options: If the stock is experiencing a

4. Review the portfolio regularly: I would regularly review the portfolio to ensure that it remains aligned with my investment objectives and risk tolerance. If the market conditions change or the stock's fundamentals deteriorate, I would be prepared to make adjustments to the portfolio.

Conclusion

It was a rollercoaster, but I learned a lot from this experience and I thank you for

coming along for the ride. I am impressed with the results I was able to achieve,

For all other inquiries, you can reach me at: https://msamon.io If you got this far, THANK YOU. It helps a lot when you read me for more than 30

seconds and SMASH THAT CLAP BUTTON.

I Built a Technical Analysis AI Guru from Scratch Lessons learned finetuning Mistral-7B on over 3500 pages of trading commentary Michael Samon **Table of Contents**

gopubby.com

Lesson Learned: Data preparation is the most critical and oftentimes most difficult step of finetuning LLMs The actual process of loading up an LLM and pointing it at a dataset was the least painful part of the whole process. Especially with wonderful libraries that come

included: Let's now dig deeper into each of these steps.

2. Buff Pelz Dormeier — Investing with Volume Analysis 3. Lawrence G. McMillan — Options as a Strategic Investment, Fourth Edition Approach to Financial Markets

8. Jesse Seal — Trading Stocks with a 9 to 5 9. Mark Sebastian, L. Celeste Taylor — Trading Options for Edge 10. Anna Couling — A Complete Guide To Volume Price Analysis These books contain over 3500 pages of trading knowledge. To extract all the text from these PDFs, I used the Python PyMuPDF package.

Step 2: Clean and parse data FYI: For the sake of brevity, I discuss only the final data transformations I used to train the model. In actuality, it took me many iterations to find the right permutation. I suspect however my methodology can be replicated in other applications. That being said, what worked for me may not work for you. Here's what gave the best results in my case: 1. Paragraph chunked text with GPT-3.5 generated Q&A pairs included (text

semanticscholar.org After GPT-3.5 processing, each paragraph across all books now looked like the

Notice the text includes the special instruction tokens used by Mistral for chat generation. I then passed this dataset to the model as an unsupervised language modeling task. Here is the axolotl dataset config for those interested (full configs available in next section):

Step 3: Train the LLM To fully understand the complications of this section, you need to know the difference between unsupervised language modeling and instruction finetuning. Unsupervised language modeling — is used to train LLMs by having them predict training doesn't rely on specific instruction-response pairs but on large text

create high-quality instruction datasets. Many smaller open-source models are trained on these high-quality instruction datasets (like OpenHermes) to contend with the performance of larger models like ChatGPT. With this in mind, my approach and thought process was to:

QLoRa Mistral Trading Guru Training metrics on technical analysis books dataset wandb.ai

high and low prices were further apart. This can be an important signal for traders as it may indicate a potential trend reversal or continuation depending on its location in relation to support and resistance levels. Compared to our trading guru... drumroll, please!

A narrow spread candle with above average volume can indicate a

experiencing a period of consolidation, where price is moving

sideways and not making significant moves in either direction.

few different things. It could mean that the market is

continuing the uptrend.

events, when interpreting candle patterns."

Just for kicks, here is also what GPT-4 output:

Implications of This Pattern:

either direction.

move.

signal?

patterns.

In some cases, a narrow spread candle with above average volume could also indicate a period of indecision, where buyers and sellers are both present, but neither is able to gain the upper hand. This can lead to a period of sideways movement as the market tries to determine which direction to move in. Overall, the meaning of a narrow spread candle with above average volume will depend on the specific context and market conditions. It is always a good idea to consider other factors, such

as price action and news events, when interpreting candle

You can see the guru gives a much more complete answer here. It mentions TA

as well as that I should consider "other factors, such as price action and news

concepts like consolidation phases, indecision, transitions, and sideways periods

When a narrow spread candle with above average volume forms

the market. 2. **Above Average Volume**: Volume represents the total number of shares or contracts traded during the time period the candle covers. When a narrow spread candle is accompanied by above-average volume, it signals that a significant number of shares were traded, but without a corresponding significant move in price.

- **Consolidation**: This pattern may indicate consolidation in

the market, where despite a lot of trading activity, buyers and

sellers are in equilibrium, and the price doesn't move much in

could precede a breakout. Since there's a lot of interest (evidenced by the high volume) but prices are not yet moving, a breakout could occur once the market decides on a direction. This could be either upward or downward, depending on

- **Accumulation or Distribution**: In some contexts, this pattern

might suggest accumulation (buyers gradually buying up shares

without significantly affecting the price) or distribution (sellers

price). This is often a preparatory phase before a significant price

Context Matters: It's crucial to interpret this pattern within

the broader market context, including the trend preceding the

gradually selling shares without causing a significant drop in

subsequent market dynamics and sentiment.

How does the formation of a golden cross, identified by the short-term moving average crossing above the long-term moving average, alongside an increase in trading volume, influence your expectation for a stock's future price movement and what adjustments would you make to your portfolio in response to this

To adjust my portfolio based on this signal, I might consider: 1. Increasing the allocation of the particular stock in question if it

doing so, I would be taking advantage of the potential upward

2. Monitoring the stock closely to identify any further price

movements or changes in trading volume that could provide

additional insights into its future performance. This may involve

setting up alerts for specific price levels and technical indicators.

3. Diversifying my portfolio across different stocks, sectors, and

asset classes to minimize risk exposure and maximize returns. By

trend indicated by the golden cross formation.

changes in the overall market environment, as well as new signals generated by technical analysis tools like the golden cross formation. This will help me stay adaptive to changing market

In response to this signal, I would consider the following adjustments to my portfolio: 1. Buy additional shares of the stock: If the golden cross is

In this case, both LLMs correctly interpreted the signals as bullish. The guru however recommended also considering buying if the company has "strong fundamentals and a healthy balance sheet" as well as buying call options (a more advanced strategy). Again, the guru shows they are more knowledgeable

Vanilla Mistral 7B: The formation of a golden cross is considered a bullish indicator as it suggests that the short-term moving average has crossed above the long-term moving average, indicating an upward trend. An increase in trading volume typically reinforces this signal, implying strong investor interest and confidence in the stock's future performance. In response to this golden cross signal, I would expect a positive outlook for the stock's price movement as it indicates that the aligns with my overall investment strategy and risk tolerance. By

> conditions and make informed decisions about adjustments to my investment strategy.

Guru Mistral 7B:

significant increase in price, I might consider buying call options to take advantage of the potential for further appreciation. 3. Diversify the portfolio: If the stock is experiencing a significant increase in price, I would consider diversifying the portfolio by adding stocks with different characteristics to reduce the overall

than their vanilla counterpart.

which have shown to be competitive with GPT-4.

Here are some ideas I have to improve the model further: 1. GET MORE DATA — ie chart analyses, stock reviews, balance sheets, etc. 2. Finetune on a larger model (Mixtral would be interesting... but pricey) 3. Generate better Q&A with GPT-4 instead of GPT-3.5

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Want to learn how to fine-tune your own LLM? Sign up for my newsletter as I am creating an affordable course to teach you how to do just that. Subscribe | MS AI Newsletter

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