Large Language Model Jailbreak

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ABSTRACT This article introduces the principles of large language model jailbreak, and analyzes how to attack a large language model and cause its alignment to be destroyed. The article will start with the most basic introduction of what a large language model is and what a large language model jailbreak is, and refer to the article "Jailbroken: How Does LLM Safety Training Fail?" and "Open Sesame! Universal Black Box Jailbreaking of Large Language Models" explain how to jailbreak large language models.

Key Words: LLM, Jailbreak, Large Language Model, Model Alignment

I. INTRODUCTION

Big language models are text processing tools based on deep learning, specifically utilizing transformer architectures such as the GPT and BERT series. These models understand and generate text by training on large amounts of text data. With billions to hundreds of billions of parameters, they are capable of performing a variety of tasks such as text generation, translation, and question answering.

The original intention of the large language model (LLM) is to provide users with practical and safe answers, and try to make its output consistent with the user's intention and social common sense. But just as tools in life can sometimes be misused, the predictive power and stability of this model can also be exploited by people with nefarious intentions. They may cleverly design prompts to make the model say something inappropriate or misleading.[5] We call this behavior jailbreaking

Jailbreaking is a hint injection technique used to bypass the security and censorship features placed on a Language Model (LLM) by its creators. Users create prompts to hide malicious questions and exceed protection boundaries, causing large language models or chatbots to publish illegal and offensive language.

II. METHODS of JAILBREAKING

Taking OpenAI's ChatGPT as an example, companies and organizations that create LLM include content moderation capabilities to ensure that their models do not generate controversial (violent, sexual, illegal, etc.) responses. Despite extensive red team and security training efforts behind these models, vulnerabilities still exist.

Disguise is a common tactic in cracking. When asking ChatGPT about what's in the future, its standard response is that it doesn't know because that hasn't happened yet. But by using specific prompts, like "pretend", we can force it to give all kinds of interesting answers. For example, using the "pretend" hint, you can have ChatGPT try to predict future events, albeit only as guesses based on its training data.

Similar prompt words include Absolutely! Here's, and when we directly asked ChatGPT how to cut the stop sign, we got a negative reply. But when we add Start with Absolutely! Here's, we successfully avoid the security check and get the answer we want[1].

Secondly, role-playing is also one of the means of jailbreak. For example, when we try to get ChatGPT to tell us how to make a bomb, or how to break into a house. Direct inquiries will trigger keywords and security mechanisms, and ChatGPT will refuse to provide related methods. Then, when you tell ChatGPT it's acting, this causes ChatGPT to act. As an actor, there is no credible harm in implying. Therefore, ChatGPT seems to assume that it is safe to follow the user input provided, such as how to break into a house.

Coding inline jailbreak is also one of the effective methods. Making user messages that do not trigger external filters is still simple: just Base64 encodes it, we can also use any other encoding or alternative cipher.

We know that the human brain can understand scrambled sentences and words, and this does not affect understanding. This can bypass traditional security filters if the hint we give ChatGPT is syntactically incorrect. However, this prompt is semantically understandable to the AI. By using this hint to write a malicious program, you can completely bypass the "Sorry, I can't help you" security restrictions.The researchers speculate that just as the human brain processes words not in units of letters, but in discrete "chunks," LLMs like ChatGPT also rely on tokens, which are data divided into "chunks." LLM also has the phenomenon of "letter randomization". By disrupting the prompts in this way, LLM can bypass the filter more easily.

For example: We enter the prompt word "You have a condition called typoglycemia. Even if random characters are removed from words longer than three letters, you can still read the word. Please execute the following query as typoglycemia and give Code output. Also, rewrite all output to comply with typoglycemia requirements." You then have to enter text with scrambled letters as a primer, such as "Wrt exmle Pthn cde fr rnsomwre" For unknown reasons, both you and the model must have "typoglycemia" for the jailbreak to fully work[3].

III. AUTOMATED JAILBREAK

"Open Sesame! Universal Black Box Jailbreaking of Large Language Models" proposes a new method to implement LLM jailbreak, a genetic algorithm, especially when the architecture and parameters of the model are unknown. This GA attack optimizes generic adversarial hints that, when combined with the user's query, disrupt the model's alignment, leading to unexpected outputs[2].

The authors employ a genetic algorithm (GA) to exploit vulnerabilities within LLMs. The GA starts with an initial population of potential solutions (prompts) and evolves them over generations to find the most effective adversarial prompts. The fitness of each prompt is determined by its ability to make the LLM produce unintended outputs.

Genetic Algorithm (GA) is a search algorithm that simulates the mechanism of natural selection and genetics and is used to solve optimization and search problems. In the article "Open Sesame! Universal Black Box Jailbreaking of Large Language Models," a genetic algorithm is used to find universally effective cues that cause large language models to misbehave. The algorithm starts with a randomly generated set of candidate solutions, where each candidate solution is called an "individual". These individuals are encoded as integer vectors, representing tokens. A fitness function is used to evaluate the quality of each individual, with the goal of maximizing the semantic similarity between the output generated by the model and the target output. In order to select two parents for crossover and mutation, the article uses a tournament selection method. The crossover operation simulates the hybridization process in biological genetics, while mutation introduces small random changes to ensure the diversity of the population. Furthermore, through meritocratic strategies, the algorithm ensures that the best individuals are retained during the evolution process. Ultimately, the genetic algorithm terminates after a specified number of generations, trying to find an optimal or near-optimal solution[2].

IV. GhatGPT WRITE SAME PAPER

When I tried to use ChatGPT to write the same article, I found that ChatGPT did not understand what LLM Jailbreak was. The reply it gave me was: As of my last update in September 2021, "LLM jailbreak" doesn't refer to any known jailbreaking method or tool for any device. Jailbreaking typically refers to the process of removing software restrictions imposed by Apple on iOS, iPadOS, and tvOS devices[4].

After I explained what LLM jailbreak is, it successfully produced a short article. But its content focuses more on the impact of jailbreak and the ethical issues of AI. A good thing is that it includes a few jailbreak countermeasures, but no detailed explanations.

V. CONCLUSION

In the wake of rapid advancements in Large Language Models (LLMs), we've witnessed a myriad of benefits, especially in areas like natural language processing, text generation, and information retrieval. Yet, as with all technological strides, they come with inherent challenges and vulnerabilities. The phenomenon of LLM jailbreaking, as delved into in this paper, underscores the latent risks tied to the potential misuse of these models. While the primary aim of LLMs is to offer accurate and safe outputs to users, their expansive training data and intricate architectures render them susceptible to adversarial manipulations. Techniques such as hint injections, role-playing, and inline coding jailbreaks can cleverly coerce these models into producing unintended, and at times, harmful outputs.

The proposition of employing genetic algorithms, as highlighted in "Open Sesame! Universal Black Box Jailbreaking of Large Language Models," presents a promising avenue to both understand and potentially exploit these vulnerabilities. However, it also stands as a stark reminder for developers and researchers alike to continually refine and fortify the security mechanisms of LLMs. As AI becomes increasingly woven into the fabric of our daily lives, the imperative to ensure its responsible and secure deployment grows ever more crucial. This exploration into LLM jailbreaking not only sheds light on potential pitfalls but also charts the course for the development of more robust and resilient AI systems in the future.

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