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TOWARDS ARCHITECTING RESEARCH PERSPECTIVE FUTURE SCOPE WITH CHAT GPT

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ABSTRACT
This paper discusses OpenAI's ChatGPT, a generative pre-trained transformer, which uses natural language processing to fulfil text-based user requests (i.e., a "chatbot"). The history and principles behind ChatGPT and similar models are discussed. This technology is then discussed in relation to its potential impact on academia and scholarly research and publishing. The findings reveal a significant and increasing interest in ChatGPT-related research, predominantly cantered on direct natural language processing applications, while also demonstrating considerable potential in areas ranging from education and history to mathematics, medicine, and physics. This study endeavour's to furnish insights into ChatGPT's capabilities, potential implications, ethical concerns, and offer direction for future advancements in this field.

KEYWORDS: Software Architecture, ChatGPT, GPT-3.5,GPT-4,Language model.

1. INTRODUCTION

Architecting software-intensive systems can be a complex process. It deals with the daunting tasks of unifying stakeholders' perspectives, designers' intellect, tool-based au- formation, pattern-driven reuse, and so on, to sketch a blueprint that guides software implementation and evaluation. natural language processing (NLP) have led to the development of powerful language models such as the GPT (Generative Pre-trained Transformer) series including large language models (LLM) such as ChatGPT (GPT-3.5 and GPT-4).[71] These models are pre-trained on vast amounts of text data and have demonstrated exceptional performance in a wide range of NLP tasks, including language translation, text summarization, and question-answering. In particular, the ChatGPT model has demonstrated its potential in various fields, including education, healthcare, reasoning, text generation, human-machine interaction, and scientific research. A key milestone of LLM development is InstructGPT. AI models rely on deep learning techniques and neural networks to analyze, understand, and generate content that closely resembles human-generated outputs. Among these, ChatGPT, an AI model developed by OpenAI, has emerged as a powerful tool with a broad range of applications in various domains Understanding the origins and development of ChatGPT is crucial to appreciating its role in advancing scientific research This sec- tion provides an overview of the background, key milestones, and im- provements made in the development of ChatGPT, highlighting technology. It was designed to overcome some of the limitations of previous sequence-to-sequence models for natural language processing, such as recurrent neural networks (RNNs) and convolutional neural networks (CNNs).

1.1 Key milestones in the development of ChatGPT

The development of ChatGPT has involved a series of milestones and improvements, including.

(i) The introduction of the Transformer architecture, which enabled the creation of highly efficient and scalable language models
(ii) The development and release of the GPT series, which demon-started the potential of AI language models in various applications, including text generation, translation, and summarization.

1.2 Improvements and innovations in ChatGPT Compared to earlier models, ChatGPT boasts several key improvements and innovations, including

(i) Enhanced context understanding: ChatGPT can better compare- hand and respond to complex and

nuanced inputs, making it more effective in generating accurate and relevant text

(ii) Reduced biases: While still not completely free of biases, ChatGPT benefits from on-going efforts to minimize biases in training data, leading to more objective and balanced outputs.

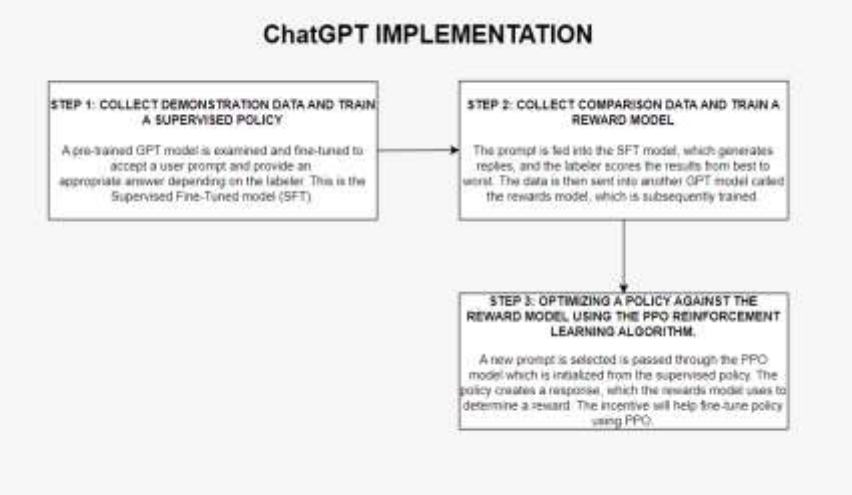

Figure 1: Diagram of the GPT Implementation Process.

The open release of the multi-modal GPT-4 model further expands the horizon of large language models and empowers exciting developments that involve diverse data beyond text. The purpose of this paper is to provide a comprehensive survey of the existing research on ChatGPT and its potential applications in various fields. To achieve this goal, we conducted a thorough analysis of papers related to ChatGPT.

Formulating the architecture story

Architecture story refers to a textual narration of the envisaged solution, i.e., software to be developed by expressing the core functionality and any constraints narrated in a natural language. As per the methodological details in Figure 2, the story is developed based on analysing software domain that represents an operational context of the system or collection of scenarios operationalized via a software solution. The architectcan analyse the domain and identify any scenarios to write an architecture story, fed to ChatGPT, that sets the foundation for architectural analysis activity in the process. Detailed architecture story is available at with its sample snippet and two scenarios highlighted below. There is no research thatinvestigates or any solution that demonstrates an architecting process by incorporating DevBots to enable human-bot collab-orative architecting of software systems. Such collaboration can enrich the architecting process that goes beyond questions & answers and recommendations, and synergizes architects' intellect (human rationale) and bot's intelligence (automated architecting process

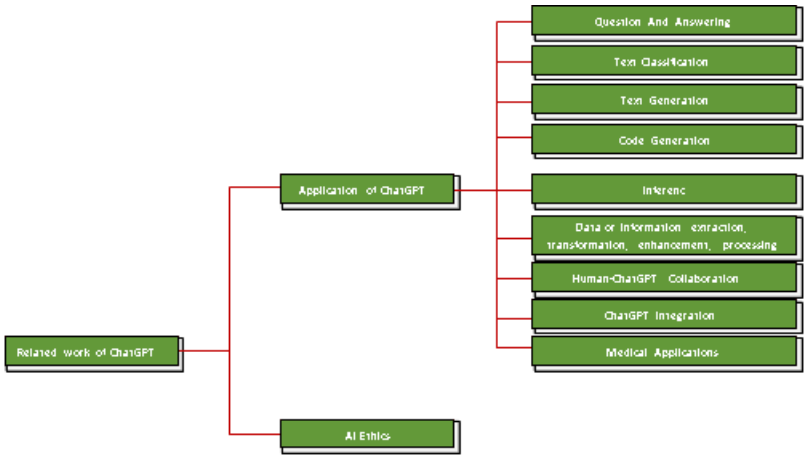

Figure 2: View of Chat GPT.

Enabling collaborative architecting:- Based on three activities adopted from detailed below.

Architectural analysis is driven by architecture story fed to ChatGPT for articulating the ASRs via automatically generated and recommended requirements (by Chat-

GPT), (ii) Manual specification of the requirements (by the architect), or (iii) A continuous dialog between ChatGPT and the architect to refine (add/remove/update) the requirements.

Architectural synthesis consolidates the ASRs to create an architecture model or representation that can act as a point of reference, visualizing the structural de-composition and runtime scenarios for the software. We preferred UML for architectural synthesis due to a number of factors, such as available documentation, ease of use, diversity of diagrams, tool support, and wide-scale adoption as a language to represent software systems in Software Engineering and Architecting The research on synergizing AI and SE can be classified into two distinct dimensions namely AI for SE (artificial intelligence in software engineering) and SE for AI (software engineering for artificial intelligence). Considering the AI for SE perspective, Xie[5] argued that SE research needs to go beyond traditional efforts of applying AI for tool- based automation and pattern selection with an exploration of methods that instil intelligence in software engineering processes and solutions. Specifically, SE solutions need to maintain the so-called 'intelligence equilibrium' – i.e., unifying and balancing machine intelligence and human intellect– in processes, patterns, and tools etc. for emergent classes of software, such as block chain and quantum applications. Barenkamp combined the findings of a systematic review and interviews with software developers to investigate the role of AI techniques in SE processes. The results of their study pinpoint three areas where SE needs intelligence to tackle (i) automation of tedious and complex SE activities such as code debugging, (ii) big data analytics to discover patterns, and (iii) evaluation of data in neural and software- defined networks. Considering the context of AI in software architecting investigated existing research and proposed a conceptual framework for the application of machine learning to mitigate architecture degradation.

AI in Software Engineering and Architecting

The research on synergizing AI and SE can be classified into two distinct dimensions namely AI for SE (artificial intelligence in software engineering) and SE for AI (software engineering for artificial intelligence) Considering the AI for SE perspective, argued that SE research needs to go beyond traditional efforts of applying AI for tool- based automation and pattern selection with an exploration of methods that instil intelligence in software engineering processes and solutions. Specifically, SE solutions need tomaintain the so-called 'intelligence equilibrium' – i.e., unifying and balancing machine intelligence and human intellect– in processes, patterns, and tools etc. for emergent classes of software, such as block chain and quantum applications interviews with software developers to investigate the role of AI tedious and complex SE activities such as code debugging, (ii) big data analytics to discover patterns, and (iii) evaluation of data in neural and software- defined networks. Considering the context of AI in software architecting, investigated existing research and proposed a conceptual framework for the application of machine learning to mitigate architecture degradation. Techniques in SE processes. The results of their study pinpoint three areas where SE needs intelligenceto tackle automation.

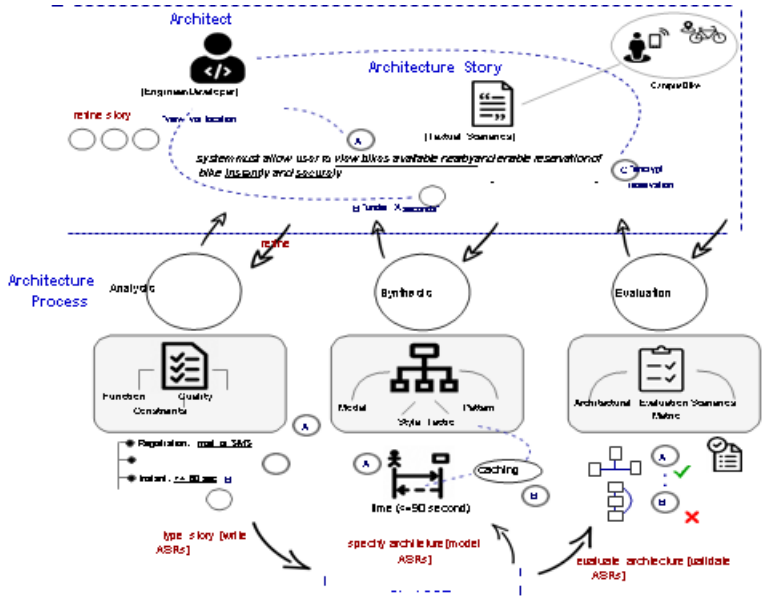

Fig. 3: Overview of the Human-Bot Collaborative Architecting Process.

Background of Chat GPT

1) The OpenAI Initiative

OpenAI is an organization focused on developing artificial general intelligence (AGI) to benefit humanity. Founded in 2015 by Elon Musk, Sam Altman, and others, OpenAI has been at the forefront of AI research, producing several groundbreaking models such as GPT-2, GPT-3, and eventually ChatGPT. Building upon the

success of GPT-3, OpenAI continued its research and development efforts, leading to the creation of ChatGPT based on the GPT-4. ChatGPT is designed to excel at conversation-based tasks and offers improvements in contextual understanding, response generation, and overall coherence compared to GPT-3. Building upon the success of GPT-3, OpenAI continued its research and development efforts, leading to the creation of ChatGPT based on the GPT-4 architecture. ChatGPT is designed to excel at conversation-based tasks and offers improvements in contextual un- distending, response generation, and overall coherence compared to GPT-3

(a) GPT-1 It is the first version of the GPT language which was released in 2018. It was based on the Transformer architecture, which is a neural network architecture designed for natural language processing tasks such as language modeling and machine translation. GPT-1 was pre-trained on a large corpus of text data, which included books, articles, and web pages, using a language modeling. The model was trained to predict the next word in a sequence of text, given the previous words in the sequence.

(b) GPT-2 It was a significant improvement over GPT-1, with 1.5 billion pa- rameters, making it one of the largest language models at the time of its release. GPT-2 was pre-trained on a massive corpus of text data, which included web pages, books, and other written materials, using a language task.

(c) GPT-3 It is one of the largest and most powerful language models ever created, with 175 billion parameters, which is several times larger than GPT-2. GPT-3 was trained on a massive corpus of text data, which included web pages, books, and other written materials, using a language modeling. The model was trained to predict the next word in a sequence of text, given the previous words in the sequence, and it was able to generate high-quality natural language text with a high degree of coherence and realism. One of the key features of GPT-3.

(d) GPT-3.5 The basic idea behind the Transformer is to use self-attention to encode the input sequence and produce a sequence of hidden representations, which can then be decoded into an output sequence. Self-attention allows the model to attend to different parts of the input sequence at different levels of abstraction, which helps it capture long-range dependencies and relationships between different parts of the sequence In the case of GPT-3.5.

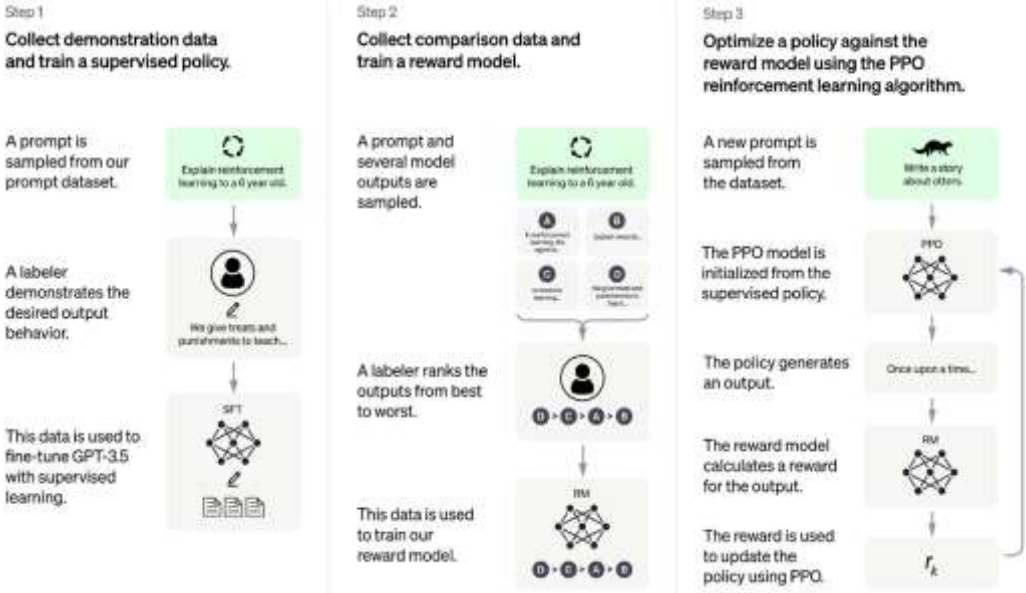

Fig. 4: GPT-3.5 model workflow.

Limitations of Chat GPAT

ChatGPT has several limitations, including inherent biases in its training data, incomplete or outdated knowledge, and difficulty discerning factual accuracy. The model also faces challenges related to contextual awareness, ethical reasoning, conversational context, and generating visual content. Furthermore, ChatGPT may struggle with handling inappropriate requests, adapting to user expertise, and providing personalized feedback. Limitations also include difficulties.

(a) Long conversational contexts: ChatGPT may have difficulty maintaining coherence and consistency in long conversational contexts or when responding to a series of interconnected ques- tions. This can result in disjointed or conflicting responses that may confuse users.

(b) Inability to generate visual content: As a text-based AI language model, ChatGPT cannot generate visual content, such as images, videos, or graphs, limiting its applicability in multimedia content

creation and visual communication tasks.

(c) Response to inappropriate or harmful requests: ChatGPT may struggle to consistently recognize and handle inappropriate, harmful, or offensive input, potentially generating content that violates ethical guidelines or user expectations.

(d) Lack of personalized feedback: ChatGPT, as a general-purpose language model, may not provide personalized feedback tailored to individual users' needs or learning goals. This can limit its effectiveness in educational or coaching contexts where individual- ruralized guidance is essential.

CONCLUSION

This paper provides a comprehensive survey of ChatGPT, highlighting their potential applications and significant contributions to the field of natural language processing. The findings of this study reveal that the interestin these models is growing rapidly, and they have shown considerable potential for application across a wide range ofdomains. One key factor contributing to the success of ChatGPT is their ability to perform large-scale pre-training, which captures knowledge from the vast expanse of the internet, allowing the models to learn from a massive amount of data. While ChatGPT and GPT-3 represent major advancements in artificial intelligence, machine learning, and natural language processing, it is necessary to ensure that they are used ethically and responsibly for scholarly research and publishing. Many questions about the ethics of using GPT in academia and its impact on research productivity remain unanswered. the power of AI respon- sibly to push the boundaries of human knowledge and understanding. Addressing these challenges will enhance performance, utility, and user experience of ChatGPT and other conversational AI models, making them more effective in various applications and industries. In various applications and scientific research field, ChatGPT has shown great promise in improving efficiency, facilitating collaboration, and drivinginnovation.

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