



ChatGPT Friend or Foe:

Meet Your New EN SME

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Image 1: Author Patrick Casey, at ICEAA 2023 Workshop

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1 CHATGPT FRIEND OR FOE: INTRODUCTION AND ANSWER

New technology, especially technology that changes how we do things and think of things, is often met with either skepticism or fear. These technological innovations include electricity, automobiles, nuclear power, and, more recently, artificial intelligence. It is important to remember that these ideas and concepts are not inherently good or bad. Likewise, artificial intelligence, and in this case, the Large Language Model ChatGPT, should not be considered good or bad, neither a friend nor a foe. Instead, this tool should be seen as a resource to leverage during research and idea formulation. It can assist in many creative ways; however, its output should be reviewed critically and crosschecked when applicable. It is also imperative to remember that there is currently no replacement for the expertise a human can provide by utilizing empathy and more profound intuitive thinking skills.

With the increasing use of artificial intelligence, there are numerous possibilities for incorporating this technology into the workforce. There are only a few jobs that AI will not impact at all. This paper aims to provide a basic understanding of AI models and their capabilities. It also explores potential use cases for implementing AI in the cost analysis field and offers recommendations when incorporating AI into the cost estimating process. The use cases in this paper are novel and provide the AI with no program data or specifics that could create any security concerns. The main takeaway of the use cases is that this tool can assist with brainstorming and initial research; however, it cannot replace a true Engineering (EN) Subject Matter Expert (SME).

2 ME AND CHATGPT: AUTHOR'S EDITORIAL

To preface this work, I would like to state a few facts about myself and this paper:

- I am not an AI expert, an engineer, or a cyber security professional.
 - I am a Senior Cost Analyst interested in emerging technologies and how they could be utilized in our job and day-to-day life.

- I am not advertising for OpenAI, and numerous AI options are available.
 - I have used OpenAI's ChatGPT extensively and am most comfortable discussing its capabilities and limitations.



Image 2: ChatGPT Prompt: "Can I have an image that sums up these bullets?"

- This paper and companion presentation do not address "if we should use AI" type questions and avoid philosophical "what if" topics.
 - This paper and presentation focus on the current AI capabilities, limitations, concerns, and advocates for using AI as a tool.

3 DECODING THE CHATGPT BACKGROUND

OpenAI, an artificial intelligence research lab, is behind the creation of the ChatGPT model. An abbreviation for Generative Pretraining Transformer, GPT showcases a powerful transformer-based language processing AI. ChatGPT-4, the latest iteration as of 2023, underwent a learning phase called Reinforcement Learning from Human Feedback (RLHF). Training data consists of a large corpus of internet text, though the model doesn't know specific documents in its training set. Despite its human-like text generation ability, it's crucial to remember that ChatGPT is not conscious - it has no desires, beliefs, or intentions. It's merely a sophisticated pattern-matching tool, simulating human-like responses based on the information it was trained on. While AI technology is an exciting application, the critical differentiation between human and artificial intelligence must be maintained.

Generative Pretraining Transformer (GPT) models, developed by OpenAI, represent a class of transformer-based language processing artificial intelligence systems. The basis of the GPT models is a transformer architecture that uses self-attention mechanisms to understand contextual relationships between words in a text. Initially pre-trained on a plethora of internet text, the models learn to predict the next word in a sentence, enabling them to generate human-like text. This pretraining phase is followed by a fine-tuning stage, where the model is trained on a smaller, task-specific dataset to optimize its performance. GPT models, in their successive iterations (GPT-1, GPT-2, GPT-3, and as of 2023, GPT-4), demonstrate increasing sophistication and capacity, with the latest versions capable of generating highly coherent and contextually relevant outputs.

Reinforcement Learning from Human Feedback (RLHF) is an approach OpenAI uses to improve the performance of its language models, including ChatGPT. In this approach, an initial model is trained using supervised fine-tuning, where human AI trainers provide conversations,



Image 3: Prompt: "Fun AI-Language Background Image Realistic" Response: "Here's a visually captivating background that blends the themes of artificial intelligence and language, set in a futuristic office space."

acting as both the user and the AI. To create a reward model for reinforcement learning, these trainers also rank multiple model responses by quality. Then, using a technique known as Proximal Policy Optimization, the model is fine-tuned to predict and generate higher-ranked responses. This iterative reinforcement learning and fine-tuning process helps the model improve its responses over time, enhancing its conversational abilities.

Proximal Policy Optimization (PPO) is a method used in reinforcement learning to optimize the decision-making policy of an agent within a particular environment. PPO, proposed by OpenAI, is a class of policy optimization methods that use function approximators to maximize the expected return of the policy. Unlike other policy optimization methods, PPO is designed to take a balanced approach, providing good performance while being computationally efficient and having fewer hyperparameters to tune. It does this by utilizing a novel objective function that aims to limit the policy change at each step, ensuring the new policy isn't too different from the old one, hence the name "proximal." This methodology makes PPO more stable and reliable than many other reinforcement learning algorithms, and it has been widely used in training AI models, including ChatGPT.

4 UNDERSTANDING THE CHATGPT PERSONA

ChatGPT, trained on internet text, can provide insights into various engineering concepts, earning it the title of a virtual Engineering SME. It can be a helpful tool for creating a preliminary Work Breakdown Structure (WBS), wherein it might suggest tasks, dependencies, and milestones based on the given project's scope. The model's language understanding capabilities can be leveraged to identify analogous programs or projects based on user-input technical specifications, which could benefit cost estimation.



Image 4: Prompt: "Visualize the ChatGPT Persona" Response: "I've visualized a whimsical character that embodies the essence of ChatGPT as a conversational AI. This representation captures the digital sophistication, wisdom, and friendliness associated with ChatGPT, designed with elements of light, digital patterns, and symbols of knowledge and technology."

It can also serve as an explanatory guide for hardware item specifications, aiding in informed decision-making processes. But caution is warranted, as it should be seen as an assistance tool, not a replacement for human expertise. This means that the outputs provided by ChatGPT, especially those requiring specialist knowledge or data beyond its training cut-off, should be verified by a human expert. It's also worth noting that while it can provide technical insights, it does not possess real-world experience or intuition, which often plays a crucial role in engineering decisions.

5 USE CASE 1: WBS CONSIDERATIONS

Prompt: “Please provide a list of the most important WBS elements to estimate when generating a government cost estimate for a new fighter jet. Use a MIL-STD-881 WBS.”

Response Highlights: “When generating a government cost estimate for a new fighter jet using the MIL-STD-881C Work Breakdown Structure (WBS) guidelines, the following WBS elements could be considered as crucial to estimation:

System Development and Demonstration | Production, Deployment, and Operational Support | Sustainment | Program Management | System-Specific Cost Elements | Common-Support Equipment

Each of these elements would need a cost estimate, accounting for labor, materials, equipment, software, and other costs. The cost estimate should also factor in risk and uncertainty.

Remember, cost estimating for such a complex project is an iterative process, so estimates should be updated and refined as more information becomes available.”

This example highlights ChatGPT’s ability to pull from government documentation and summarize vital conceptual elements. This response alone is insufficient to build a complete WBS for this cost estimate, as additional costs may be required for unique elements. It is also of note that MIL-STD-881C (from 2005) was utilized rather than the newest F series (from 2022). Furthermore, refining the estimate with human EN SMEs will still be necessary. This response does empower the analyst with a starting point to ask about various key cost drivers. As is the common thread among all use cases here, the AI tool is not doing your job; you still have to guide it down the correct path to obtain meaningful outputs.

6 USE CASE 2: HW SPECIFICATIONS

Prompt: “Can you provide a range of costs for buying a Dell PowerEdge R250?”

Response Highlights: “Entry-Level Configuration: The starting price for a basic configuration of the PowerEdge R250 is approximately \$1,129.00. This typically includes an Intel® Pentium G6505 processor, 8GB of RAM, and a 1TB SATA hard drive.

Mid-Range Configuration: For configurations with upgraded components, such as additional storage or better processors, the price can increase. For example, a configuration with an Intel Xeon E-2314 processor, 16GB of RAM, and a 480GB SSD is priced around \$2,369.00.

Custom Builds: Prices for custom builds can vary greatly. For instance, Cloud Ninjas offers the Dell PowerEdge R250 with a 2 Bay LFF chassis starting at \$599.00. The final price will depend on the chosen components such as CPU, memory, and storage options.”

This example shows ChatGPT utilizing its ability to search Bing for various real-time links and data sources. This example assumes we heard the term “PowerEdge R250” but know nothing else about the requirement or cost. ChatGPT does provide commercial cost data points here. However, more research needs to be done to confirm the accuracy of pricing and technical



Image 5: Prompt: “ChatGPT Subject Matter Expert Assisting Cost Analysts” Response: “The visualization captures ChatGPT as a subject matter expert in the form of a holographic projection, assisting cost analysts in a modern conference room setting.”

specifications. Links to Dell & Cloud Ninjas were provided, which should be investigated and used as the basis for the estimate if utilized (not ChatGPT). Further technical specification investigation is required to investigate potential cost changes due to quantity or agency.

This lets you ask your human EN SME-specific questions about the “PowerEdge R250” and its processor, RAM, memory, and chassis sooner to assess cost impacts.

This use case relies on knowing a specific type of server or configuration. If no server type is known and you ask ChatGPT generically, “What is the cost of a server?” it cites costs from \$500 to over \$25,000 for entry-level to high-end servers. Along with this wide range, it also states that “the initial purchase price is just one part of the total cost of ownership (TCO). Operating costs, including electricity, cooling, maintenance, and software licenses, also contribute to the overall expenses associated with running a server.” Putting all this together, the proper way to estimate the cost of a server is to work with your EN team to identify a server type and the specifications required to identify analogous actuals.

7 USE CASE 3: ANALOGOUS PROGRAM POSSIBILITIES

Prompt: “If I were a government cost analyst trying to estimate the cost of a new fighter jet what are some analogous programs in the Air Force that I could use? If possible, provide specifics about the programs that could be modified to better estimate the new fighter jet.”

Response Highlights: “As a government cost analyst estimating the cost of a new fighter jet, you would have several analogous Air Force programs to consider. These programs include:

F-35 Joint Strike Fighter (JSF), F-22 Raptor, B-21 Raider, KC-46 Pegasus Tanker

In each case, you would need to adjust for various factors to make the analogy work for your new fighter jet. For example:

Technological complexity, Size and capabilities, Development and procurement timeline,
Inflation and labor rates, Industrial base considerations

Remember, analogy-based cost estimating is an art as much as a science, and it requires a deep understanding of both the new program and the programs being used as analogies.”

This example shows ChatGPT’s ability to pull from historical information and adequately understand how to use an analogy. Yet again, the response indicates you need more research than just asking ChatGPT. Understanding your project's technology, complexity, and capabilities and then pulling actuals for one analogous program is clearly the next step.

8 USE CASE 4: RECIPE CREATION & MODIFICATION

Prompt: “I would like to make meatloaf for dinner. Please provide a delicious recipe using a pound of ground meat.”

Response Highlights: “Meat Mixture and Glaze ingredients, Oven Temp, Meat Mixture Directions, Forming the Meatloaf, Preparing the Glaze, Baking Time and Directions, Serving Suggestions.”

Prompt Follow-Up: “I don't have breadcrumbs... But I have some stale bread... Can I still have meatloaf?”

Response Highlights: “Absolutely! Stale bread is actually an excellent substitute for breadcrumbs in meatloaf. Prepare Bread, Soak Bread, Integrate into Recipe, Proceed as Directed.

Stale bread used in this way can even result in a moister meatloaf than using dry breadcrumbs.

Enjoy your dinner!”

This is one of the more exciting applications of ChatGPT. Since this AI can access all recipes online, it can provide a quick recipe for any dish without blog posts or advertisements. It can also modify any recipe based on ingredients and equipment available. Eventually (hypothetically), all fridges will come equipped with an AI camera to provide you with a list of all available meals to be made with your current groceries.



Image 6: Prompt: “Show me the most delicious looking meatloaf please.” Response: “Here’s an image of a delicious looking meatloaf, presented beautifully with sides to enhance its appeal. The warmth and texture of the dish are highlighted to invite you into this culinary experience.”

9 LIMITATIONS OF CHATGPT

ChatGPT, as an AI language model, sometimes struggles with understanding complex, nuanced, or deeply contextual issues. It interprets text based on patterns learned during training but lacks real-world experience and consciousness. This can lead to misunderstandings or oversimplified responses in complex scenarios.

ChatGPT's training includes data only up to a certain point (as of April 2023, in this case). Therefore, it doesn't have information on events, developments, or research that occurred after that date. This limits its ability to provide current insights or updates on recent events. Recently, ChatGPT has been updated to allow it to perform real-time Bing searches. However, all other limitations still apply, as it only interprets new information based on preexisting knowledge.

Despite efforts to minimize biases, ChatGPT can still reflect or amplify biases in the training data. It might inadvertently generate content that is biased, stereotypical, or not culturally sensitive, depending on the nuances of the input it receives. While ChatGPT is trained in diverse languages, its proficiency varies. It is more adept in some languages than others, affecting the accuracy and quality of responses in less-trained languages.

ChatGPT doesn't possess emotional intelligence or genuine creativity. Its responses are generated based on patterns and information in its training data, not through emotional understanding or creative thinking. This limits its effectiveness in tasks requiring deep empathy or original creative thought. AI models like ChatGPT can struggle with ethical dilemmas or moral reasoning. They lack personal values and ethics, making them ill-equipped for decisions or advice in areas requiring a nuanced understanding of human ethics.



Image 7: Prompt: "I need an image that depicts this paragraph of text"

Conducting a thorough cost analysis using ChatGPT can be challenging due to its inherent limitations in understanding complex economic models and real-time market dynamics. ChatGPT doesn't have access to current financial data or the ability to interact with live databases or financial tools, which are crucial for accurate and up-to-date cost analysis. Additionally, it cannot account for variables such as inflation, currency

fluctuations, or market trends after its last training update.

While ChatGPT can offer general guidance on cost analysis principles, it falls short in providing precise, real-time financial insights or predictions. For businesses or individuals looking for detailed and accurate cost analyses, relying solely on ChatGPT will not be sufficient in nearly all cases, and consulting with human experts in finance or using specialized financial software would be advisable.

10 EXPLORING CHATGPT ALTERNATIVES

While ChatGPT has gained significant attention, there are several other AI models and platforms that serve as alternatives, each with its unique features and capabilities:

Google's BERT and LaMDA: BERT (Bidirectional Encoder Representations from Transformers) is a deep learning algorithm related to natural language processing developed by Google. It's particularly effective for understanding the context of a word in a search query.

Google's LaMDA (Language Model for Dialogue Applications) is another advanced AI model explicitly designed for more nuanced and open-ended dialogues.



Image 8: Google LaMDA Logo, [Link](#)

These models deeply integrate into Google's ecosystem, enhancing search engine capabilities and conversational AI interactions.

IBM Watson: IBM Watson is a powerful AI suite known for its deep learning, natural language understanding, and data analysis capabilities. It's used in diverse fields such as healthcare, finance, and customer service. Watson is renowned for its sophisticated data analytics and ability to process large volumes of unstructured data.

Microsoft's Turing-NLG: The Turing Natural Language Generation model is Microsoft's answer to advanced AI language models. With many parameters, it is designed to generate natural language and offers language understanding and generation capabilities, making it a strong competitor in the AI language model space.

DeepL Translator: While primarily known for its translation capabilities, DeepL also employs advanced AI to understand and translate text with high accuracy and naturalness. Its focus on contextual translation makes it a valuable tool for multilingual text generation and interpretation.

Einstein AI by Salesforce: This is a comprehensive AI platform integrated into Salesforce's cloud-based offerings. It's designed to help with customer relationship management (CRM) tasks by predicting customer behavior, automating responses, and providing insights from customer data.



Image 9: Einstein AI by Salesforce Logo, [Link](#)

Each of these alternatives has its own strengths and is suited for different applications. The choice among them depends on the specific requirements of the task at hand, such as the level of language understanding needed, integration with other technologies, industry-specific needs, and the scale of deployment. A comparative study of these models, considering your specific requirements and the unique strengths of each model, could be beneficial.

11 ANALYZING CHATGPT OUTPUT

ChatGPT's output requires careful analysis, given that it does not provide accurate citations for its statements. It generates responses based on the patterns and information in its training data rather than referring to external databases or live internet sources. When ChatGPT provides a citation, it simulates this behavior based on its training in academic writing, and it doesn't have access to the specific source it may mention. Consequently, any critical information the model provides should be independently validated to ensure accuracy. Despite its sophistication, it should not be treated as a primary source of information. Regarding fact-checking, users should be aware of the necessity to cross-check the data provided by ChatGPT with up-to-date, credible sources. Even though it's an AI developed by a reputable organization, it remains a tool subject to limitations and should be used responsibly.

12 SECURITY CONCERNS WITH CHATGPT

Security is a significant concern when using AI models like ChatGPT. For instance, if sensitive data is inputted into the model, there's a potential risk of exposing this information to unauthorized entities. Sensitive information can be anything provided to the AI model during

conversations. All conversations are recorded and saved by the AI to improve future conversations. Any classified information (CUI, PPI, or Proprietary info) should not be used as input to any AI model. It is important to note here that even detailed characterizations of your program or company process should not be used as input due to security concerns related to the compilation of data increasing security levels. Over a long enough conversation with an AI about a program's technical specifications, HW and SW specifics, etc., an adversary could compile enough info to become a threat.

Although OpenAI has implemented safety measures, including content filters, these are not foolproof, and inappropriate or harmful outputs can occasionally be produced. Furthermore, the model can potentially generate harmful content like misinformation or manipulative messages, raising ethical concerns. An important reminder is that the misuse of such AI technology could have severe ramifications, hence the need for robust ethical guidelines and safeguards. Users should be aware of these potential risks for safe use and ensure that no confidential information is shared with the model. Lastly, organizations intending to use ChatGPT should consider implementing additional security measures, such as data encryption and user access controls, to ensure safe usage.

13 ENGAGING CHATGPT IN A DYNAMIC CONVERSATION

ChatGPT can maintain the context of conversation over multiple exchanges, allowing for a more dynamic and interactive conversation. It can understand and respond to follow-up questions, providing in-depth insights on the topic of discussion. However, it lacks persistent memory and might not provide consistent answers over different sessions or conversations. Therefore, providing sufficient context with each new question or instruction is crucial to ensure relevant responses. It's also important to note that ChatGPT may attempt to guess the user's intent instead of asking clarifying questions when faced with ambiguous queries. Therefore, clear and explicit prompts often yield more accurate and helpful responses. But even with clear prompts, users should be prepared for occasional inaccuracies or inconsistencies in the model's responses and should verify the information independently.

14 HANDY CHATGPT TIPS AND TRICKS

Various strategies can enhance the quality of outputs from ChatGPT. For example, users can provide system-level instructions, such as "Explain Like I Am 5", to guide the model's response. If the model isn't producing desired answers, rephrasing the question, asking the model to think step-by-step, or debating the pros and cons can sometimes help. More explicit instructions, including the format of the desired answer, can lead to better-tailored responses.

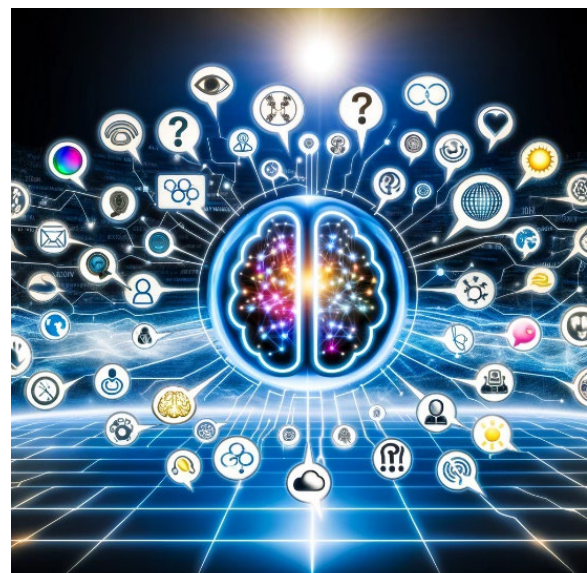


Image 10: Prompt: "Image that sums up ChatGPT dynamic conversational capabilities."

However, it's worth remembering that these techniques might not always work as expected, and results can vary based on the complexity of the task. Experimenting with different instructions and approaches is recommended to understand what works best for specific queries.

Understanding the model's underlying mechanisms and limitations can also aid in effectively using these strategies.

15 CONCLUSION: INFERENCE TO REFERENCE

ChatGPT represents a significant step in AI language models and can be a potent tool for various applications. However, its limitations, potential pitfalls, and the importance of a cautious and responsible approach cannot be overlooked. Its inability to provide real-time or specific cost information limits its utility in certain critical domains like cost estimation and analysis. Several opportunities to leverage AI Models in the cost analysis career field exist, but none currently replace the need for individual critical thinking and analysis on the human side. Leveraging tools like ChatGPT can supplement the initial planning phases associated with the cost-estimating process, provide quick high-level knowledge in requested areas, and better prepare the analyst for more productive working sessions with IPT members and stakeholders. Continued refinement of styles of questions to ask can improve the quality of response received and offer another helpful resource in the cost estimating tool kit.

The potential security risks and the requirement for independent validation of its outputs underline the importance of a careful approach when using this model. Despite these challenges, ChatGPT and other LLMs hold immense potential as an initial guide and a source of insights on a wide range of topics. As we continue to explore the capabilities of AI, it is crucial to navigate the space responsibly and ethically, ensuring the technology is used for the betterment of society. The exciting journey of AI continues, and it will be interesting to see how these models evolve and what new opportunities and challenges they bring.



Image 11: Conclusion Image: "The image has been generated to encapsulate the conclusion of your academic paper visually. It illustrates the harmonious integration of artificial intelligence, represented by ChatGPT, with human endeavors in cost estimation and analysis. This visualization captures the essence of the future possibilities and the collaborative spirit between AI and humans in professional settings."

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