

Developing Design Features to Facilitate AI-Assisted User Interactions

(Technical Paper)

The Role of Artificial Intelligence in Decision-Making

(STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Prospectus

Introduction

Imagine a world where the judge officiating your case, or the doctor performing your surgery, or even the politician making decisions on how to govern your country are all decisions and actions taken by Artificial Intelligence (AI). In a world where every job is automated and humans are simply tasked with the role of existing in it. It seems insane to even think about, but with roughly “50% of organizations already adopting AI into at least one business function (McKinsey, 2022)” and AI successfully passing many esteemed exams in law, medicine, and business (Terwiesch, 2023), how far can AI push the limits of what it can do?

Taking a step back to the current capabilities of AI, it is often used in industry to automate tasks in order to reduce costs and improve efficiency. More recently AI has taken the form of ChatGPT, a generative AI language model that uses machine learning to learn from vast amounts of data provided to it in order to generate new content or make predictions on new data. It is important to note that currently AI models are only as strong as the data provided to it, which could be limited or biased and in turn impact the model (Ben, 2023, March 28). We can still however see the growing impact that AI has been having on our everyday lives and will continue to have.

In the scope of our technical project, we are developing design features that enhance AI-assisted user interactions for query formulation. Our focus is on redesigning the user interface of existing solutions to incorporate AI technology seamlessly into the log management domain to simplify and enhance user engagement, ensuring a more intuitive and effective experience. Through AI integration, we are addressing the challenge of traditional code-centric designs that require users to overcome a significant learning curve, and at times require users to undergo

specific training to use the tool effectively. Our goal is to transition towards a more user-friendly interface where customers can interact with AI in a manner similar to ChatGPT, allowing for easier and more efficient log querying. Our design features serve as a strategic move not only to enhance usability but also to help organizations implementing the feature to stay competitive in the log querying space. We recognize that failing to adopt AI-driven interface enhancements could lead to customers seeking alternatives that offer more innovative technologies, potentially resulting in customer attrition.

In the context of Science Technology and Society, the concept of decision making being left solely in the hands of AI seems very outlandish, especially when trust in AI seems to be divided. A survey conducted by MITRE captures the divide of generations where “most Gen Z (54%) and millennials (58%) are willing to use AI to perform everyday tasks, but a much lower percentage of Gen X (39%) and boomers (30%) are willing to do so (MITRE, 2023).” The lack of trust makes sense when we think of how our parents and grandparents are hesitant to adopt new technologies, whereas our generation tends to more readily accept and adopt those new technologies (Vogels, 2019, September 9). AI overall has a positive view in our minds as “64% believe the primary purpose of AI is to assist, enhance, and empower consumers (MITRE, 2023).” Given current capabilities of AI and a generally positive outlook for future innovations, I don’t believe it is unreasonable to imagine a world where many important decisions are left to be made by AI, allowing humans to enjoy life more. The question is, do we want to give AI the power to make decisions, unsupervised by humans? Or is there an optimal balance we should explore as to what should and shouldn’t be left for AI to decide?

Technical Discussion

We are assisting in developing new design features aimed at enhancing AI-assisted user interactions within the domain of log management and query functionalities. The features will allow for more effective use of existing tools within the relevant domain such as monitoring, searching, and analyzing machine-generated data, such as logs, metrics, and event data. The tool is primarily used by organizations to gain insights into their applications and infrastructure, troubleshoot issues, ensure security and compliance, and make data-driven decisions. In the context of information technology and data analysis log querying refers to the process of searching and retrieving specific information or events from log files. Log files are records of various activities and events that occur in computer systems, applications, or network devices. These logs are essential for monitoring and troubleshooting system behavior, tracking security incidents, and analyzing performance (Jansen, 2006).

A good user interface (UI) is paramount for enhancing the user experience, improving efficiency, reducing errors, and minimizing the learning curve. It fosters customer satisfaction and retention, provides a competitive advantage, reflects a positive brand image, and can lead to increased revenue through higher conversion rates. A well-designed UI is also critical for accessibility, accommodating diverse user needs, and collecting valuable feedback and data for ongoing product improvements (Eberts, 1994).

We are working on the topic of implementing a new user interface that incorporates AI in order to increase usability of the log query software provided by any company within the domain to its users. The implementation is being done in part to embrace the endless possibilities present through AI, as well as reducing the challenging barriers of use currently present in the search query which currently require users to learn a software specific coding language. As a group, we are seeking to incorporate AI as a user interface in a manner that allows users to more

easily use the software, implementing consideration for users of all levels. To be more specific, AI will provide user's with suggestions based on their queries that will allow them to either get a better understanding of the data they are querying on, or more effectively query on that data in order to achieve better results and insights.

Failing to address the destabilizing condition could very well lead to a company within the domain no longer being competitive in the log management and query sphere, losing customers to competitors. As a company, the goal is profitability, but this is generally achieved by enhancing the customer experience continuously.

Our work will be supported by constant feedback from log-management experts who are familiar with the existing log query functionality and the drawbacks as well as benefits associated with it. These users will allow us to see first-hand how our modifications and implementation of AI impact the software and ideally improve the overall experience. Our main challenges lie in our limited knowledge in the sphere of AI, something common with many users as this technology has begun to become widely used only recently. Our anticipated deliverable will be a fully functional addition to the existing software in place of the existing functionality of log querying.

STS Discussion

The recent development of Chat GPT in late November, 2022 has arguably been one of the largest catalysts in exposing many of us to actual, functional uses of AI that we can incorporate in our everyday lives. Throughout our lives we have heard of countless pop culture references, to name a few: *The Terminator* (1984), *The Matrix* (1999), and *Westworld* (2016), all of which touch on the topic of machines taking over or having a significant impact/influence on how we live, or don't live in some cases, our lives. The common theme is a general fear of what

would happen, or the worst possible outcome of what happens when robots or AI take over. Fear comes from a lack of understanding, from the unknown (Jalonen, 2012), and is understandable as our minds are very effective in coming up with dystopian scenarios that inevitably lead to the end of the world. As AI emerges, we gain a deeper understanding of its diverse capabilities and the extent of its proficiency in various tasks.

Recent testing on the capabilities of ChatGPT version 4 (GPT-4) have pitted generative AI models against many of the most prestigious exams that many students, lawyers, doctors, and business leaders have to take in order to progress in their respective fields. Examples of the prestigious exams are AP exams that high school students take for college credit, the Bar Exam required to become a lawyer, the Wharton MBA exam, the US Medical Licensing Exam, and even as abstract as a sommelier examination (wine tasting). The results are pretty incredible.

On the AP exams, “GPT-4 received a 5 on AP Art History, AP Biology, AP Environmental Science, AP Macroeconomics, AP Microeconomics, AP Psychology, AP Statistics, AP US Government and AP US History (OpenAI, 2023),” the highest possible score. GPT-4 also received a 4 (second highest score) on AP Physics 2, AP Calculus BC, AP Chemistry, and AP World History. On the Bar Exam “GPT-4 scored in the 90th percentile with a score of 298 out of 400 (OpenAI, 2023).” On the Wharton MBA exam, Wharton's Professor Christian Terwiesch conducted an evaluation of GPT-4 using questions from his operations management final exam. Terwiesch was satisfied with GPT-4s performance in responding to fundamental operations questions, particularly those rooted in case studies. GPT-4 did, however, exhibit occasional errors, notably in basic mathematical calculations that one might expect from a 6th-grader. Ultimately, Terwiesch determined that GPT-4’s overall performance would equate to a grade in the range of B or B- (Terwiesch, 2023). Finally, the US Medical Licensing Exam,

where several researchers put GPT-4 up against a three part exam that aspiring doctors take between med school and residency. They found that “GPT-4 performed at or near the passing threshold for all three exams without any specialized training or reinforcement. Additionally, ChatGPT demonstrated a high level of concordance and insight in its explanations’ (Kung et al., 2023).”

The results show that, while not perfect, AI - namely GPT-4 - is extremely powerful. One could say that, at the very minimum, a student using AI could likely pass many of the required exams to become a lawyer, doctor, or work in business. That being said, the graduating student would likely be a very poor lawyer, doctor, or business man as passing the exam is not the sole qualification to becoming each respective role. The question now is how far do we allow AI automation and suggestion to go? At the rate that human tasks are being replaced by machines, is it unreasonable to envision a future where even more complex roles are taken up by AI? A robot to do medical surgeries, or defend someone in court, or run a fortune 500 company.

Actor-Network Theory (ANT), a framework developed by French sociologist Bruno Latour along with scholars Michel Callon, Madeleine Akrich and sociologist John Law, is an approach that focuses on understanding how relationships between various actors, both human and non-human, shape the construction of social reality (Latour, 2007). When applied to the realm of Artificial Intelligence (AI), ANT proves invaluable in analyzing the complex dynamics between humans and AI. Within ANT, however, agency is not equally distributed but rather emerges as a dynamic quality among various actors. For instance, in the context of AI, the human user, the AI system itself, and the data sources feeding the AI, are all actors that exhibit varying degrees of agency, contributing to the complexity of the relationship. The human user exercises agency in their choices, preferences, and decision-making processes when utilizing AI.

They determine the goals, inputs, and expectations, thereby shaping the direction of the AI's actions. Conversely, the AI system itself exhibits a form of agency in its capacity to process, analyze, and respond to the data and inputs provided by the user. The AI's algorithms and programming dictate its responses, and it may exhibit a certain degree of autonomy in executing tasks or making decisions, depending on its design and programming. The data sources that feed the AI also play a pivotal role in the network. Data sources, whether they are structured datasets, user-generated content, or other forms of information, have their own influence on the AI's functioning. The quality, quantity, and biases within the data can significantly impact the AI's outputs and behaviors, thus exerting a particular form of agency. ANT provides a lens through which we can examine how the actors come together, influence one another, and collectively shape the evolving landscape of AI and human interaction. ANT is essential to navigating the research I will be conducting for my thesis paper as we tend to get carried away with new technologies (AI) by focusing on what is possible without understanding how our relationships with new technologies evolves. The relationships are essential as they dictate what role is given, namely how much power will be given up to AI in regards to making decisions for us without human supervision (or more specifically what level of human supervision do we expect to provide AI with).

Conclusion

Our development of AI-assisted design features in the log management domain has led to impactful changes in the related user experience, with a more intuitive interface and cutting-edge integration. These design features are now integrated into beta versions of log management interfaces following extensive testing and iterative improvements based on user feedback.

Through my STS research, I hope to be able to better understand the breadth of possibilities present with AI as it develops into a powerful tool that one day might be able to take even more significant roles in the future. Through it I wonder if tasks such as the log querying tool and the analysis and insight provided will become obsolete. The human completed task of using another tool to analyze data and come up with insights is well within the scope of a task that can be automated. The challenge for AI is coming up with insights that are shaped by the changing world and not simply by the data fed to it.

If the technical deliverable is successfully completed and appropriately implemented, we can expect to see an increase in the user experience when completing log queries through the interface. The interface will ultimately add more value to any company implementing the design features should place them as a stronger candidate when acquiring new customers in the future over other competitors. This can also arise in the form of customer turnover, whereas before the company may have not retained customers as long as they had hoped, after the implementation of our deliverable, we would expect to see customers no longer leaving, or staying longer with the company.

As for the STS portion, I hope to start a conversation regarding how far we can truly take AI. We have opened the door, but should we instead be breaking down the wall? Will we reach a point where AI can make decisions without the need to be managed by humans? Do we as humans want decision-making left in the hands of AI? With my thesis question I don't necessarily expect a yes or no answer, I instead expect us to challenge and push the limits of AI in the ways that best benefit us as humans.

References

- Ben, A. (2023, March 28). *Council Post: How AI Is Integrating Into The Workforce*. Forbes. Retrieved October 27, 2023, from <https://www.forbes.com/sites/forbestechcouncil/2023/03/28/how-ai-is-integrating-into-the-workforce/?sh=6613c7934da9>
- Choi, J. H., Hickman, K. E., Monahan, A., & Schwarcz, D. (2023, January 23). *ChatGPT Goes to Law School*. Papers.ssrn.com. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4335905
- Eberts, R. E. (1994). *User interface design*. Prentice-Hall, Inc.
- Jalonen, H. (2012). The uncertainty of innovation: a systematic review of the literature. *Journal of management research*, 4(1), 1-47.
- Jansen, B. J. (2006). Search log analysis: What it is, what's been done, how to do it. *Library & information science research*, 28(3), 407-432.
- Kung, T. H., Cheatham, M., Medenilla, A., Sillos, C., De Leon, L., Elepaño, C., Madriaga, M., Aggabao, R., Diaz-Candido, G., Maningo, J., & Tseng, V. (2023). Performance of ChatGPT on USMLE: Potential for AI-assisted medical education using large language models. *PLOS Digital Health*, 2(2), e0000198. <https://doi.org/10.1371/journal.pdig.0000198>
- Latour, B. (2007). *Reassembling the social: An introduction to actor-network-theory*. Oup Oxford.
- McKinsey & Company. (2022, December 6). *The state of AI in 2022--and a half decade in review* | *McKinsey*. [www.mckinsey.com. https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2022-and-a-half-decade-in-review](https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai-in-2022-and-a-half-decade-in-review)
- OpenAI. (2023). *GPT-4 Technical Report*. <https://cdn.openai.com/papers/gpt-4.pdf>

MITRE. (2023, September 19). *Public Trust in AI Technology Declines Amid Release of Consumer AI Tools*.

<https://www.mitre.org/news-insights/news-release/public-trust-ai-technology-declines-amid-release-consumer-ai-tools>

Terwiesch, C. (2023). *Would Chat GPT3 Get a Wharton MBA? A Prediction Based on Its Performance in the Operations Management Course*.

<https://mackinstitute.wharton.upenn.edu/wp-content/uploads/2023/01/Christian-Terwiesch-Chat-GTP.pdf>

Trifiletti, C. (2023, July 25). NATO Leverages MITRE's AI Expertise. MITRE; MITRE.

<https://www.mitre.org/news-insights/impact-story/nato-leverages-mitres-ai-expertise>

Vogels, E. A. (2019, September 9). *Millennials stand out for their technology use, but older generations also embrace digital life*. Pew Research Center.

<https://www.pewresearch.org/short-reads/2019/09/09/us-generations-technology-use/>