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Evaluating LLM Generative A.I. Responses to Engineering Design Questions

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Evaluating Generative AI Responses to Engineering Design Questions

Dominik Steinhauer

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Purpose and Objectives of the Assignment

- Build on previous lectures about digital literacy.
 - Prerequisite Topics
 - What is Information and Digital Literacy
 - How to access Sources of Information
 - What is a Large Language Model Generative A.I.
 - What is Prompt Engineering
- To expose students to various Large Language Model Generative A.I. Products and their outputs
- To demonstrate an ability to access Large Language Model Generative A.I. outputs on the basis of usability, relevance, & accuracy
- To practice the skills of *Information Literacy* associated with the following Essential Studies Required Outcomes;
 - Students will be able to access the needed information
 - Students will be able to evaluate information and its sources critically
- To practice the skills of *Digital Information Literacy* associated with the following Essential Studies Required Special Emphasis Area Criteria;
 - Digital Citizens need foundational skills that prepare us to work with and evaluate new technologies.
 - Course develops transferable and applied skills necessary for the current and emerging workforce
 - Course teaches specialized tools and practices for finding, evaluating, and using digital information effectively, efficiently, safely, thoughtfully, and ethically.
 - Strengthening student agency, the course involves students in actual practice with rhetorical thinking through opportunities to access, communicate, create, and distribute information.
 - Course provides opportunities for metacognition: opportunities for students to reflect on their own learning.
 - Developing a digital citizen who is aware of the ways society and culture interact with technology, the course teaches critical thinking skills and interpretive strategies across modalities, helping students critically evaluate information, its contexts and availability.

Background Information: What is Generative A.I.? How Does it Work?

Generative A.I. in the form of Large Language Models (LLMs) were created to generate human-like responses to a wide range of inputs by using algorithms. Based on a large data set LLMs can generate and classify text, answer questions in a conversational manner, as well as translate text from one language to another.

Despite its strengths, Generative A.I. also comes with the risk of users believing what they are told, even if it is not true. Due to issues like data set bias or errors, Generative A.I.'s outputs are only as good as

the data it was trained on, effectively garbage in equals garbage out. Therefore, all Generative A.I. outputs need to be vetted and accessed before being used.

Assignment Prerequisites

Sign up for free accounts for the following Generative A.I. Large Language Models. If you have a paid account for any of these A.I. Tools, they are fine to use but having a paid version of any of these is required.

1. ChatGPT
 - a. [ChatGPT | OpenAI](#)
2. Microsoft Copilot
 - a. [Copilot \(microsoft.com\)](#)
3. Google Gemini
 - a. [Google Gemini](#)
4. Claude
 - a. [Claude](#)
5. Perplexity
 - a. [Perplexity](#)
6. Elicit
 - a. [Elicit: The AI Research Assistant](#)
7. Meta A.I.
 - a. [Meta AI](#)

Assignment Instructions

For this assignment, students be analyzing and evaluating what 3 different Generative A.I.s give as output to a research question related to their Sr. Design Project.

1. As a part of an in-class discussion the class will produce a Research Question about one of their Sr. Design Projects.
2. The class will then agree on which Generative A.I to start with.
3. The class will enter a prompt into the Generative A.I based on the Research Question in step 1.
4. The class will then discuss the output and list the relevant information given in the response
5. The class will next discuss how to assess the A.I. response utilizing the LLM Generative A.I. Assessment Process below for each bit of listed relevant information.
6. This information will be entered into the Blackboard Assignment.
7. The process is then repeated by the students individually for 2 additional LLM Generative A.I. outputs. Please note that in the end the same prompt is to be used on 3 different LLM Generative A.I. programs.

Generative A.I. Validation & Quality Review Process – update

The structure for the LLM Generative A.I. Assessment Process as follows:

- **What does the LLM Generative A.I. give as relevant information**
- **Could I Verify This? (Yes or No)**
- **If Yes, Where? If No, Explain**

Example

A.I.: Copilot

Prompt: What alloy of steel is the easiest to machine using CNC Technology?

Output: ADD SCREEN SHOT of copilot output
One of the easiest steel alloys to machine using CNC technology is **1215 steel**. This alloy contains a relatively high sulfur content, which helps it form small chips during machining. [This characteristic allows for higher machining rates and prevents the chips from tangling in the machine¹](#).

Is there a specific project you're working on that requires CNC machining?

Learn more

1. <https://an-prototype.com/the-ultimate-guide-to-cnc-machining-steel/>
2. <https://www.practicalmachinist.com/forum/threads/whats-a-good-steel-for-general-use.321661/>
3. <https://www.sigmatechnik.com/cnc-factory/the-ultimate-guide-to-cnc-machining-materials-selection-properties-and-applications>

What the LLM Generative A.I. Says is relevant information #1

- 1215 steel contains a relatively high sulfur content, which helps it form small chips during machining

Could I Verify This? (Yes or No)

- Yes & No

If Yes, Where? If No, Explain

- Using the 1st reference given by Copilot it can be seen that the Elongation at Break is 10% which is the lowest of all the materials listed and would lead to believe smaller chip size.
- Sulfur content was verified using www.matweb.com
- Do not have a source on the correlation between Sulfur content and Elongation at Break

What the LLM Generative A.I. Says is relevant information #2

- This characteristic allows for higher machining rates and prevents the chips from tangling in the machine.

Could I Verify This? (Yes or No)

- No

If Yes, Where? If No, Explain

- In reviewing the website that Copilot cited as its source for this statement no information backing it up could be found.

Reflection Questions

After completing the assessment, answer each of the following questions. Aim for at least 2-3 sentence responses for each question.

1. Which LLM Generative A.I. Products did you use for this assignment?
2. In your opinion, which LLM Generative A.I. used in this assignment supplied the most useable response?
3. Explain your logic on why you chose this LLM Generative A.I.
4. Have your impressions of LLM Generative A.I. changed in any way after doing this assignment? Explain why they have or have not changed and how they have changed if they did.