
AI TOOLS IN SAFETY

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Learning Outcomes

- Understand the basics of AI tools, including neural networks and how they predict outputs from weighted inputs.
- Effectively use AI tools in safety analysis to brainstorm failure modes and identify potential hazards.
- Evaluate the ethics of AI use, including issues of academic integrity, confidentiality, and societal impact.

Reading

- Foundations of Spiritual and Physical Safety: with Chemical Processes; Chapter 11

Additional Resources

- Elder Gerrit Gong [talk on AI](#)

1 AI is a Regression Model

2 Data is Intellectual Property and is Valuable

The more data over varying conditions, the better the model. The quality of the data is also important. If the data is biased or incomplete, the model will be as well.

Sharing your company's data with others (other companies, other individuals outside the company, etc.) may be unethical and may violate confidentiality agreements. Ways that company data may be shared include:

- Providing data within a prompt to an AI tool that is not owned by the company (e.g., ChatGPT, Gemini, etc.)

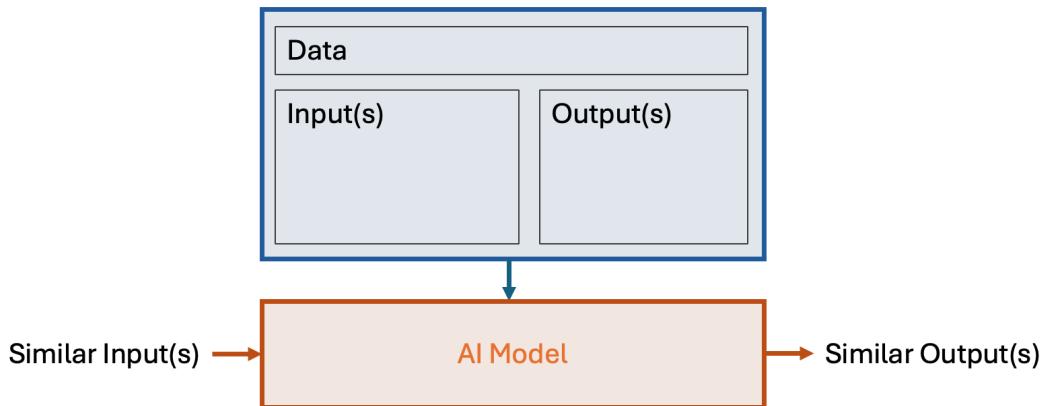


Figure 1: Data is used to generate an AI model which can then predict outputs based on inputs, similar to a regression model.

- Like uploading a file to an AI tool or copying and pasting data into a prompt.
- Using a completion service not authorized (files within the folder can be seen by the AI tool like github copilot, etc.)
- Sharing data with a third party (e.g., a consultant, another company, etc.)

3 Machinery of Artificial Intelligence (Machine Learning, etc)

See in class examples... One of the simplest models is that of a line approximating data points with one input (x value) and one output (y value)...

3.1 Karpathy Introductory Video on Neural Networks

4 Prompt Engineering

- **zero shot:** no example in the prompt just the question or request
- **one or few shot:** one or more examples of desired output (or the form or voice of the desired output are given)
- **chain of thought:** use of “explain by step-by-step” or “explain the thought process” or with a given example(s) or how the response should complete the response in steps “consider the following, 1. ... 2. ...” within the prompt

5 Safety Analysis Augmented with AI

Some options (subject to Intellectual Property Guidelines) include

- submitting process images with a prompt to identify potential failure modes
- generate a failure modes and effects analysis table for a prompt with an example table from a similar scenario
- generate a fault tree analysis from a process description, perhaps some AI service can generate a file that is compatible with a pdf editor
- generate the start of a HAZOP table given a piping and instrumentation diagram

- integrate a custom AI algorithm into plant operations that could use a camera feed to process images that could recognize safety risks

6 Agentic AI

Model can be trained to not only provide output but to complete **tasks**...

7 AI and Ethics

What ethical principles should apply to the use of AI and what responses should be optimal outputs for various scenarios?

Action Items

1. Use the basic provided machine learning code to fit the relationship for the drag coefficient of a sphere as a function of Reynolds number. See the class lecture notes, code at <https://github.com/clint-bg/safetybook>, and or Note 1 for Chapter 11(Guymon, 2025) for tips. The data to fit can be found here: [spheredragcoeffdat.csv](#). Use a Neural Net with an architecture of 1x15 and then 15x1 or the hidden or output layer. Report your weights that you optimized and the drag coefficient value your model gives for a Reynold number of 3e5. Also include a plot of your model and the data.
2. Take a picture of Figure XI.2 and submit the image to an AI chatbot with a prompt about identifying possible failure modes for personal injury when working with a reactive chemical subject to friction, impact, ESD, and thermal initiation scenarios. Compare the list of failure modes to that given in the text (page 290-292). Summarize your findings and thoughts.
3. Personal Reflection: Document three specific things you expect would happen to your critical thinking skills or engineering preparation if you overuse AI.
4. Document three (3) specific things apostles of the Lord Jesus Christ have said about AI use.

References

C. Guymon. *Foundations of Spiritual and Physical Safety: with Chemical Processes*. 2025.