Term Project Pitch

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***Abstract*—This paper pitches a computational model/ tool track under the broad topic of artificial intelligence, specifically in how humans interact with it, also known as interactive intelligence. The aim of this project is to improve the reasoning that is used by machines, especially in respect to dealing with humans. Essentially, the goal of this study is to show how artificial intelligence can work better with humans.**

***Index Terms*—artificial intelligence, HCI, psychology, cognitive science, biological intelligence, neuroscience**

I. Project Description

A. Broad Topic

The broad topic of this study is artificial intelligence and how it can potentially be trained to think like various types of minds, especially in regard to human thought. I will discuss the current limitations of artificial intelligence compared to biological intelligence, i.e. the brain. As a larger effort, I would like to explore how feasible it is to train artificial intelligence to develop better concepts of abductive logic and even bounded rationality.

I am mainly interested in exploring the psychology and neuroscience of the mind. Also of interest is how biological intelligence informs decision-making. The goal of this experiment is to allow the AI based model to effectively work with and solve problems using various types of mind (i.e., biological, organizational, animal, artificial intelligence, etc.). As an evaluation, the model will function almost as a study partner or tutor.

B. Research Questions

- How does the mind work, in general?
- Can machines be trained to think in patterns that apply to all types of minds?
- How well can artificial intelligence navigate various problems?
- How can machines benefit from biological intelligence and vice versa?

C. Interest

The psychology of the biological versus the artificial is of great interest to me personally. A recent study of mine in Human Computer Interaction (HCI) set out to improve upon AI based mental healthcare applications. Much of my study informed me that humans do not truly trust AI because of the different thought patterns compared to biological intelligence. This raises a good point. Artificial intelligence must first understand all types of mind to become better informed.

I have a deep interest in understanding how the mind works in addition to computer science, since I almost became a psychologist before entering computer science and becoming an engineer. Since I was a child, the concept of machine-based intelligence has been a focal point of mine. I recall seeing the 1986 film Short Circuit, which details a robot that is designed to help humans and enjoys learning. The robot named Johnny 5 eventually becomes sentient and goes on a series of adventures. Although it is a fictional account, films such as this one inspired me to better understand artificial intelligence and their cognition and how it interacts with humanity. However, more than this, it provides a window into how the mind processes information and, in this case, it was an artificial one.

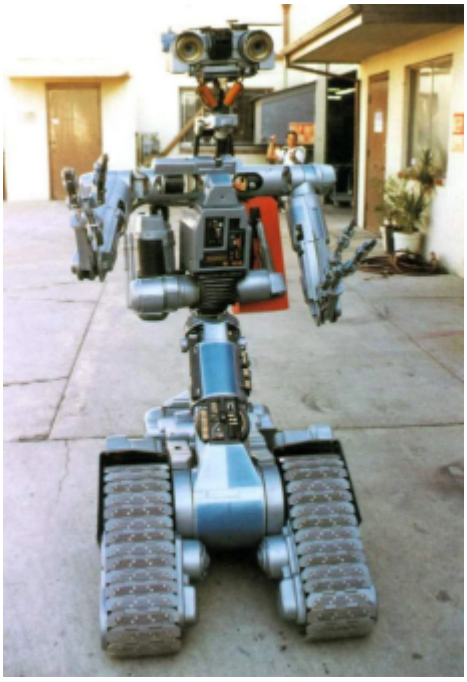

Fig. 1. The character Johnny 5, Short Circuit 1986.

D. Importance

A common issue with artificial intelligence is that, although it is just that. It is artificial, and, as a result, there are certain

pitfalls that it can fall into. For example, many Large Language Models (LLMs) use methods such as back-propagation, which can result in stereotyping or taking mental shortcuts by associating groups of objects together and giving them common traits. Stereotyping has an attributed stigma about it, but it does serve a cognitive purpose. Reduces the cognitive load of having to cross reference between the short-term/working memory and the long-term. Stereotypes can be many times analogous, but AI has a tendency to depend on this too much due to its design and is often unable to distinguish when confronted with problems or tasks.

Many artificial models feed forward, but the biological neural system does not function in this way. Thagard discusses this in detail [1]. This goes for both animals and humans because the brain cannot perform back-propagation because its neurotransmitters and neurons cannot fire backward, they only fire forward. This makes it impossible for this very reason.

Another limitation is that artificial neural networks can currently only be trained on certain concepts, where a biological neural network can be trained on many and in unison. LLMs incorporate many different neural networks in their design, but are still limited due to their physical computing capacity.

II. Computational Model/Tool Design

A. Relevant Topics

- **Logic and Reasoning:** Many AI models utilize deduction and induction, but do not use abduction. Abduction is important because it allows the being to think outside of the proverbial box, especially in relation to previous information they have retained.
- **Linguistics:** Sometimes it is not simply what one says, but how they say it. The mind views words as symbols to assist with processing information.
- **Bounded Rationality:** One thing that most AI models are not is pragmatic, and it is because they often lack the ability to comprehend limitations. Often times, this can lead to issues of overconfidence in their own judgment. Satisficing is not something that AI can typically do.
- **CRUM:** In general CRUM helps us understand both biological and artificial thought. Concepts such as David Marr's Trilevel Hypothesis are essential for improving AI's cognitive capabilities.

B. Expected Outcome

By the end of this project I hope to accomplish the following:

- **Type of of Information:** The model will be trained on the material from this course CS 6795 Intro to Cognitive Science
- **Develop a cognitive framework:** I plan to develop a cognitive framework using CRUM concepts to better improve this models' problem solving.
- **AI to better understand various types of cognition:** The AI can then be tweaked and trained using this cognitive framework.
- **Type of Model:** LLM model based chat-based integration application developed through the Python chainlit framework.

C. Relevant Research

My research will consist of reading the scholarly literature on topics such as cognitive science, artificial intelligence, and linguistics.

Through an iterative process, I will be developing software that integrates LLMs through API consumption and user interface design.

I will also employ various concepts from HCI, including, for example, distributed cognition, design heuristics, and others.

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Week #	Task #	Task Description	Estimated Time (Hours)	Complete? (Y/N)	Total Hrs	80.75
3	1	Create the template task list.	1	Y		
3	2	Choose research question	0.25	Y		
3	3	Read Examples from previous semesters	2	Y		
3	4	Brainstrom ideas	2	Y		
3	5	Research literature	4	Y		
4	6	Research design alternatives	2.5	Y		
4	7	Complete project pitch	4	Y		
4	8	Review and submit	1	Y		
PROJECT PITCH DUE						
6	16	Read selected literature	7	N		
6	17	Analyze cognitive techniques	2	N		
6	18	Design cognitive framework	3	N		
6	19	Experiment with the model bare bones	4	N		
7	20	Evalaute experiemnt	2	N		
7	21	Document findings	3	N		
7	22	Apply findings to next design	2	N		
7	23	Research chainlit Pyhon framework	2	N		
8	24	Evalaute several LLMs to use	2	N		
8	25	Research using chromadb or mongo db	3.5	N		
8	26	Complete midpoint project	5	N		
8	27	Review and submit	1	N		
OPTIONAL MIDPOINT CHECK-IN DUE						
10	32	Apply cognitive framework to design	2	N		
10	33	Develop front end UI	4	N		
10	34	Attach data source	2	N		
10	35	Evalaute experiemnt with new design	3	N		
11	36	Document findings	3	N		
11	37	Sign off on live protype	0.5	N		
11	38	Complete final project	6	N		
FINAL REPORT DUE						
15	52	Prepare presentation	3	N		
15	53	Record presentation	2	N		
15	54	Complete presentation	0.5	N		
15	55	Review and submit	1.5	N		
FINAL PRESENTATION DUE						