

Let's Chat about AI

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The recent media coverage of *ChatGPT* has once again raised the profile of *Artificial Intelligence* (AI) and people's attention to this developing technology. But what really is AI? its goals, implications, technologies, and applications? Citizens in the digital age, computational thinkers in particular, should have a basic understanding and appreciation. Furthermore, as you will see, techniques in AI can also help us acquire and improve our own computational thinking!

In a previous blog post, we have talked about AI. Here we use ChatGPT as an opening to discuss more aspects of AI.

This post is part of our *Computational Thinking* (CT) blog where you can find many other interesting and useful articles.

What is ChatGPT?

A *chatbot* is a computer program that simulates conversation with human users, usually online. ChatGPT is a new, powerful and successful chatbot where you can ask questions, get answers, conduct a conversation as if with another person. GPT stands for *Generative Pre-trained Transformer* (Figure 1). We asked it the question directly and here is what it said:

“ChatGPT is an artificial intelligence language model developed by OpenAI that is designed to process natural language and generate human-like responses to user input. It can be used for a variety of applications, including answering questions, carrying on conversations, and providing assistance. Essentially, ChatGPT is a computer program that can ‘chat’ with humans in a way that mimics human conversation.”



Figure 1: ChatGPT Logo

Note that, from the same authoritative source:

“OpenAI is a private artificial intelligence research laboratory consisting of a team of researchers and engineers working on developing advanced AI systems. The company was founded in 2015 by a group of high-profile tech industry figures, including Elon Musk, Sam Altman, (and ...). OpenAI is dedicated to creating AI technologies that are safe and beneficial for society, and their work encompasses a wide range of research areas, including natural language processing, computer vision, robotics, and more.”

To have a firsthand experience chatting with ChatGPT, register an account at chat.openai.com/auth/login and try it yourself. Registration is simple, your email address and a password you choose will do. No other personal information is required. Your account and usage are free. Another version, ChatGPT-4, is more recent, advanced, but requires payment.

Most find ChatGPT to be amazing and capable. It appears to have extensive knowledge and is able to answer questions and provide assistance as if it understood many things, in a wide variety of areas. For example, it can generate original music pieces in various genres/styles, write poetry, help debug code in particular programming languages, assist in problem solving,

translate whole articles to another language, and even factor simple polynomials.

Impact of ChatGPT

There may be many implications of ChatGPT and its associated AI technologies.

An obvious question is how ChatGPT will impact current search engines such as Google. After all, they all can answer your queries and give you useful information. However, there are major differences:

- **Forms of answers:** A search engine responds to your query with a list of webpages where you can find up-to-date information yourself. ChatGPT formulates direct answers in well constructed sentences. It derives the answer from its static training database that do not contain current information such as breaking news. A search engine can display images, links, audio, and video contents while ChatGPT is limited to sentences.
- **Chat:** Each query to a search engine is independent of any previous queries to it. ChatGPT is different and designed to maintain an ongoing chat. That is to converse with the user keeping the entire conversation in one coherent context.
- **Correctness of answer:** A search engine lists related webpages and it is up to the user to obtain the correct/desired information. ChatGPT gives well-versed, fluent and grammatically correct answers. Yet, sometimes the answer can be mistaken or outdated.

Thus, ChatGPT and search engines are useful in different ways. Their advantages can merge in the future to form better/improved versions. Currently, ChatGPT does not form a threat to search engines.

Another question relates to language translation. Comparing ChatGPT with Google Translate (GTr), we can observe the following:

- GTr can translate between over 100 languages while ChatGPT has been trained in about a dozen where English received the most attention.

- GTr uses pattern matching and has no understanding of the texts being translated. ChatGPT was designed to understand and generate human-like text in a more comprehensive and natural way than GTr.
- ChatGPT does a better job translating longer texts where context and meaning are important. GTr can be useful in single words and short phrases.
- GTr allows users to suggest alternative or better translations that can potentially improve its database. ChatGPT does not.

Of course, ChatGPT technologies can also be useful for voice user interfaces in applications such as Amazon Echo (Alexa), Hello Google, and Windows Cortana.

By connecting/interfacing ChatGPT, and similar AI software, to other apps, the Internet and the Web, the potential is limitless. The area of *AI-Generated Content* (AIGC) will become more important as we move forward.

ChatGPT received much attention because it is a new breakthrough application of AI. Question is “what is AI and how does it work?”.

What is Artificial Intelligence?

The word intelligence here means mental capacity and acumen, not information gathered by security agencies. Intelligence is usually ascribed to human beings exclusively. But some animals are also intelligent. Artificial intelligence is not natural but man-made.

A primary attribute of intelligence is *thinking*. As we stated in a previous blog “*AI: Aiming for Intelligence*”:

Alan Turing, the father of modern computer science, published a landmark paper in 1950 where he speculated about the possibility of creating machines that think. Because “thinking” is hard to define, he devised a test known as the Turing Test. Basically, if a machine can interact with a human via a teleprinter and make the person think another person is at the other end then it was reasonable to say that the machine was “thinking”. Turing went on to argue convincingly that a “thinking machine” was at least plausible. The Turing Test was the first serious proposal in the philosophy of artificial intelligence.

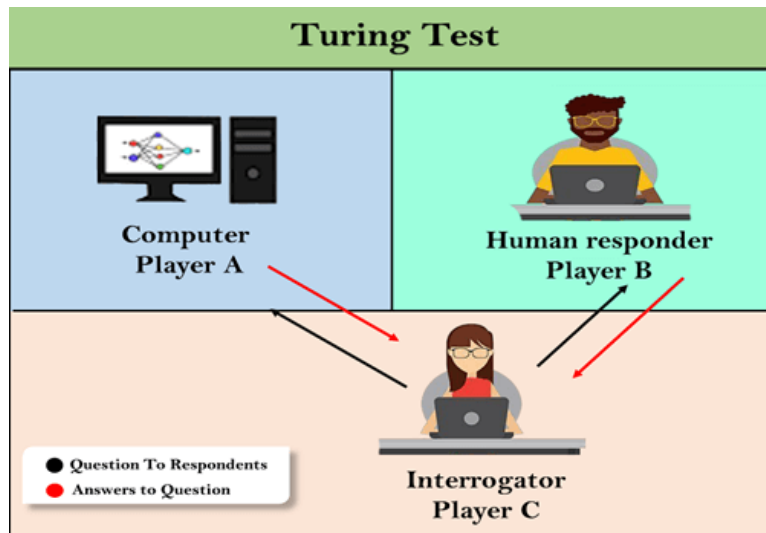


Figure 2: The Turing Thinking Machine Test

Most would say ChatGPT passes the Turing Test (Figure 2) with flying colors. But if you examine carefully and interact with it multiple times, you may find clues that there is no human on the other end of the line.

In 2023, we should have a new definition of AI. Here is our modern definition: *Artificial Intelligence is an area of computer science that aims to develop and provide machines with abilities that mimic, simulate, become comparable, and in many cases even surpass human beings.*

The term artificial intelligence is also used to describe a property of machines or programs: the smartness they demonstrate.

Let's see how AI can be achieved. We start with AI models.

What is an AI Model?

Today, the most widely used method to achieve AI is to use a *model* and train it with data to give it smarts. **An AI model is a set of procedures and algorithms that can be trained using data to achieve intelligent behaviors.** These include recognizing patterns, making decisions, producing predictions, and more.

The training process alters and fine tunes parameters in the model to get better and better results. Depending on the model, the number of parameters

can become huge, millions even billions of parameters.

For example, ChatGPT uses a model called a *transformer network*, a type of neural network that simulates neurons and their interconnections. Using the *deep learning* technique, ChatGPT was trained with large amounts of data to learn patterns in that data.

In a chat session, ChatGPT receives a user question or comment and formulates a response, consistent with the context of the conversation. The response is generated one word at a time, using its transformer model which has been previously trained. Now the name GPT (*Generative Pre-trained Transformer*) begins to make sense!

Data Training

AI models use *machine learning* techniques to get trained. This usually involves feeding lots of data to the model in order for it to learn all the situations. The data can be prepared and labeled (supervised learning) or not (unsupervised learning).

Here is a picture of image data used in the training of self-driving cars (Figure 3). For training purposes, parts of the image can be labeled ‘car’,

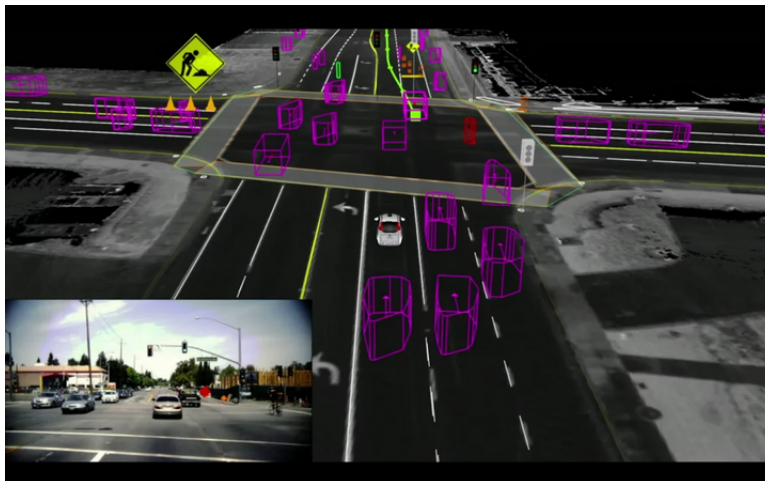


Figure 3: Self-driving Training Image

‘traffic sign’, ‘crosswalk’, ‘pedestrian’, and so on. Of course, many many such images are required. Yet a self-driving system can still get confused and run

over a pedestrian. Surely, the quality and quantity of data also affects the training results.

Economic Impact

AI as an industry is expected to have major impact in almost all areas of our economy, providing increased productivity, job creation and displacement, better business management, and innovation.

The economic impact of AI will be significant. According to a report by *MarketsandMarkets*[™], the global AI market size is expected to grow from \$58.3 billion in 2021 to \$309.6 billion by 2026, at a compound annual growth rate of 39.7% during the forecast period.

When AI is deployed together with other emerging technologies such as 5G/6G wireless communication, global positioning, satellite communications, Internet of Things (IoT), drones, bio and healthcare technologies, agriculture/manufacturing automation, digital currencies, etc. the applications are endless.

According to *Enterprisers Project reports*, AI will create 133 million new jobs by 2022, and a recent survey from *Dun & Bradstreet* showed 40 percent of respondent organizations are adding jobs as a result of applying AI. An AI career has great potential. US salaries for competent AI programmers range from \$100,000 to \$150,000 or higher (*Datamation*).

AI Models & Computational Thinking

As humans, we also learn from data and experience—the knowledge and facts we gather and happenings in our lives. Such training data, via neuroplasticity, affect our brain (neurons and connections) physically so we become better skilled and more intelligent in particular ways. Computational Thinking (CT) is a mental skill. We can become better computational thinkers by doing the same. That is by gathering more knowledge and understanding of computing and all things digital. And get trained by a set of CT principles and practices attached to useful labels such as ‘**interfaces**’, ‘**protocols**’, ‘**cache management**’, ‘**iteration**’, ‘**divide and conquer**’, ‘**algorithm**’, ‘**abstraction**’, ‘**context switching**’, and so on.

Our various CT blog posts serve as wonderful training data. And by getting exposed to these, we build and reinforce our mental models to become better skilled at CT.

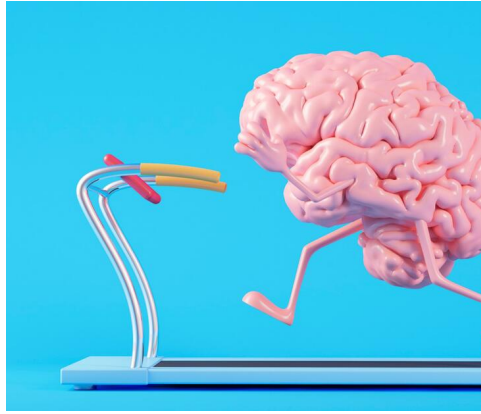


Figure 4: Training A Brain

In the End

AI is just another technology that has many applications, and great economic impact. It has the potential of bringing many benefits to our lives and transforming the way we do things. As with any powerful tool, it can be applied to things good or not so good.

ChatGPT is the most recent breakthrough. There will be many more. Computational thinkers should keep an eye on the developments as AI becomes an increasingly important part of our digital world. Yes, ChatGPT is a loud wake up call for us to better ourselves. We should be continuously prepared to work with new technologies and stay relevant in the job market.

The AI model methodology reinforces our believe that these CT blogs can be an effective way to train and improve our CT skills.

In terms of its ultimate goal, AI today is still far from being able to create a super being similar or superior than humans, if that is ever possible for AI.

Hope you like this post and will let me know what you think about all this.