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Is human intelligence quantifiable and can it be recreated in lines of code?

With brains the size of clenched fists, humans have been endowed a natural gift that has been the single most important factor to its dominance in the animal hierarchy. Containing 100 billion grey cells, our brains are bigger in comparison to most of the animal kingdom (Robson). This size difference, one of various factors, has allowed human brains the required intelligence for the ability to memorize Pi to a thousand decimal places, articulate our deepest feelings, conscious thought, laws of physics and express ourselves with words in indefinite combinations (Robson). While these are some examples of human intelligence, the significance of just abilities cannot be undermined, the fact of the matter is that these are just some of the reasons that have allowed the human race to evolve exponentially since the inception of the human race. The achievements of human civilization, the aesthetic nature of culture, the advancements in technology, all can be deemed the results of human intelligence.

It is the 21st century yet the world has failed to craft a definition of human intelligence that is widely accepted. Robert Sternberg, professor of psychology at Tufts University, wrote an article about human intelligence on Encyclopædia Britannica. Sternberg defined human intelligence as, “The mental quality that consists of the abilities to learn from experience, adapt to new situations, understand and handle abstract concepts, and use knowledge to manipulate one’s environment,” (Sternberg). While this definition is still not the only one, it forms the basis of what we interpret

intelligence to be. While this definition was strictly defined for humans, other animals' intelligence can also be defined by the same definition. Taking the example of dolphins, which are considered highly intelligent animals right after humans, who are being used by the military of various countries to find humans and explosive devices under water after being trained by dolphin experts (David Grimm). Or we could take the example of dogs, from being trained to help police find humans from the scent of evidence left behind at the crime scene to becoming obedient by understanding various words from their owners, dogs truly provide proof of the intelligent capabilities of other organisms (Stromberg). These examples not only prove their fascinating abilities; they hint on the answer to the crucial question that arises at this point, is intelligence defined or is it something with which an organism is endowed with at birth? An even more critical question rises at this point. Can intelligence be measured?

As defined in the Cambridge dictionary, Intelligence is “the ability to learn, understand, and make judgments or have opinions that are based on reason” (Cambridge University Press). The society standard “intelligence” tests provide minute information about the intellectual capacity of an organism (Johnson). As these tests use various questions on critical thinking to estimate a person's intelligence quotient¹ (IQ), they don't take into account short-term memory, reasoning and verbal agility (Connor). This has led to an inaccurate estimation of intelligence. An example of using these tests to measure intelligence is like trying to approximate the value of a house by examining what is in the fridge. So, the question still remains, can intelligence be measured?

According to an article called, “IQ tests 'do not reflect intelligence',” published by a renowned newspaper company called The Telegraph, “our intelligence can only be predicted by

¹ An intelligence quotient is a total score derived from a set of standardized tests or subtests designed to assess human intelligence.

combining results from at least three different tests of our mental agility,” (Collins). Upon research, one truly does find ways to measure intelligence but also realizes that while success does have a positive correlation with intelligence, it is not the only factor that makes one successful. Now onto an even more crucial question, is intelligence inherited?

Upon research, scientists have given their verdict on differences on intelligence tests. Their findings show that the differences between people on intelligence tests are substantially the result of genetic differences (Plomin). Emily Willingham, in an article that was published by Forbes, provides a more specific outlook to this claim. She says, “while half of our intelligence as we currently define and measure it is inherited, that proportion is in turn fractured into many genetic variants scattered across our genomes,” (Willingham). Studies have been conducted on adopted children and have provided further proof that the intelligence quotient of adopted children is similar to their biological parents (Geddes). But does this mean that one’s intelligence quotient is fixed at birth? According to Russell Warne, a psychologist at Utah Valley University, “Genetics sets the limits. But it is the environment that determines where within those limits a person develops,” (Geddes). Just like height, which is also a heritable trait, environmental factors have a substantial effect on one’s intelligence (Geddes).

As we move deeper into the 21st century, giant tech companies have been pushing out what they like to call Artificial Intelligence or AI for short. According to Darrel West, founding director of the Centre of Technology Innovation at the Brookings Institution, describes AI as “machines that respond to stimulation consistent with traditional responses from humans, given the human capacity for contemplation, judgment, and intention,” (West). AI currently is still in its infancy, as what many people are calling AI are under the hood are algorithms that responds based on pre-defined multi-faceted input or user behavior (Adams). These algorithms aren’t necessarily AI. A

real AI system learns on its own from user contact and uses neural networks² to make deep connections with the user. Examples of such systems could be Google's Deep Mind or IBM's Watson. By using interactions with users, these systems are able to improve on past iterations becoming more smart, aware and allowing them to enhance their capabilities.

While machines are becoming better at imitating human tasks, Yann LeCun, a French scientist that works as the head of Facebook's A.I. research facility, clarified that "Humans are very far from having machines that can learn the most basic things about the world in the way humans and animals can do," (Eadicicco). This embodies the current reality of artificial intelligence.

Thinking, the very essence of intelligence, is divided into two types, Convergent and Divergent. Convergent thinking is the ability to store and process knowledge and produce one answer to one question. Divergent thinking, on the other hand, is the ability to use the knowledge that is provided to generate many potential answers to one question. Divergent thinking drives creative endeavors and allows for humans' artistic potential. The main ability these neural networks use is predictive analysis. This requires the software to go through databases that were created by data scientists³ or were developed alongside the AI system to reach to an answer. This process is very similar to convergent thinking and hence systems that currently use neural networks, are still in their beginning stages and hence lack divergent thinking. At the end of the chain, these so called "intelligent" systems are using data on human intelligence as their basis to create something that can think and act rationally and humanly.

² Neural networks are a set of algorithms, modeled loosely after the human brain, that are designed to recognize patterns.

³ Data scientists are analytical experts who utilize their skills in both technology and social science to find trends and manage data

One of the ways in which these systems will be able to think more like humans is through deep learning. A huge part of machine learning is deep learning, which is with the creation of algorithms that are similar to the structure and function of the human brain (Brownlee). Andrew Ng, Chief Scientist at Baidu Research and founder of Google Brain, in a talk about deep learning has said, “Using brain simulations on these neural networks would allow learning and making algorithms to become easier and consequently make revolutionary advances in machine learning and AI,” (Brownlee). As we progress even more into the 21st century, we have more powerful computers and access to more data and storage to create larger neural networks. The more sophisticated these neural networks become the more these artificial systems would be able to think and act like humans.

Reflection and Conclusion

There will always be a debate on the definition of intelligence and if it is quantifiable or not. That being said, before researching on the topic I truly believed that the way we have been measuring intelligence for the past century was correct and provided an accurate estimation of one’s intelligence. But, upon research I have come to the conclusion that intelligence while subjective can be quantifiable but the test/measurements we have been using are obsolete. Dogs, dolphins, chimpanzees and other living organisms provide various examples of intelligence yet we don’t have one concrete way to evaluate intelligence. The measure of intelligence, as Einstein put it is the ability to change, and there hasn’t yet been a test invented to evaluate the extent of change.

While computer scientists are researching to create the perfect artificial systems, there will be a time in the near future in which AI neural networks would be able to think more critically than humans. This would be a time where these neural networks would grow at an exponential rate. Answers to complex problems and cures for diseases would be some of the major

accomplishments of Artificial Intelligence systems. However, terming them as real intelligence as of now is still a far stretch as neural networks are still in their infancy. On the question if intelligence can be recreated as mere lines of code much more research has to be conducted on intelligence and its evaluation before coming to a final conclusion.

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