CSCE 681 600: SEMINAR REPORT 6

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1. SUMMARY:

a. Problem Statement:

Alan Turing, started this famous and impactful paper of his with the proposal of taking the following question into consideration: "Can machines think?". Since this question is ambiguous in nature he proposes a game named the "imitation game" to replace the original question. The game is played between 3 people: (1) a man A (2) a woman B (3) an interrogator C whose gender can be either of the two and is separated from A and B. The objective of C is to correctly identify the gender of the two people whom he knows by the labels X and Y. He can ask any questions to X and Y and finally at the end he has to provide his answer in either of the 2 ways: (1) 'X is B and Y is A' (2)'X is A and Y is B'; based solely on their answers alone. The objective of A is to get C to make the incorrect identification and the objective of B is to assist the interrogator in making the correct identification. Even if B tries to provide helpful hints to C through her answers, it won't be of much help to him since A can also provide wrong hints disguised as helpful ones. The author then proposes the replacement question that if a machine takes the role of A in the game, then will the interrogator C give the wrong decision as often as when he does when it is played between a male A and female B.

b. Proposed solution:

The author then presents the advantages of the replaced question for the original purpose. He argues that there is little advantage in making a "thinking machine" look like a human. So, in the replaced form of the question, since the interrogator cannot see, hear, or touch other players, the real appearances and the abilities of the thinking machine and the human don't matter for the purpose of playing the game. This gives the players the ability to lie about their abilities and appearances without the need to give any proof about it to the interrogator.

Further, only digital computers were allowed to take part in playing the game which can generally be considered to have 3 parts: (1) Store (2) Executive unit (3) Control; and that can carry out pre-programmed instructions in a consistent manner. The author assumed that digital computers had an infinite capacity for storage and were universal machines capable of replicating any system which has non-continuous and discrete states. These assumptions implied that theoretically only 1 digital computer can be programmed for all the contexts. Thus only "digital computers" are enough to play the "imitation game" and no other machines are required since Turing claims that only "digital computers" can truly have the ability to mimic the thought process of a human being.

The author then forecasts that within 50 years human interrogators will not be able to distinguish computers from people in the "Imitation Game" with more than a 70% chance, and he weighs opposing viewpoints regarding his forecast. He targeted the notion that machines cannot perform the action of thinking as they have not been provided a soul by God but Turing argues that God who is almighty can easily provide a soul to a machine. He also targeted the mathematical argument that discrete-state machines cannot possibly answer all questions and have limitations in this regard with a counter-argument that there is no evidence that humans are also not bound by the same limits.

Then the author discusses the possible issue and ways of constructing a machine that can think. He claims that instead of programming every aspect of human behavior into the computer, a program can be designed that instructs a computer to learn. As a result, just like a toddler, a computer will be able to acquire its own understanding. A human child learns from his experiences and education as he grows, similarly, a computer can also be made to learn via a program designed specifically to instruct the computer to do so.

c. Results:

This paper deals with the exploration into the possibility of the existence of a system that can perform the action of thinking as humans do. According to Turing, "digital computers" will be capable of mimicking the human computer. He hopes that computers will someday be able to contend with humans in a variety of intellectual challenges. The concept of learning machines and teaching a machine to do certain tasks just like how a human child learns was discussed in this paper and these ideas form the backbone of all Artificial Intelligence and Machine Learning research in modern times. Turing suggested that many think the abstract activity of playing chess to be the best intellectual activity that machines should be targeted to start to compete against humans with. Turing also proposed giving computers sensory organs and training them to communicate and understand the English language, with the learning process following a similar approach to how a human child is taught. In the end, Turing mentions that although only a little way ahead can be seen in this path, we can envision a lot of work that can and needs to be done.

2. CRITIQUE:

a. Pros:

- **i.** The paper presents a valid way to investigate the question "Can machines think?" through the "Imitation game".
- **ii.** The author's imagination of a possible digital computer in the future which can think like a human being was far ahead of the thinking of his time and seeing the current trends in technology we can safely say he was right in his beliefs and imaginations.
- **iii.** Turing in this paper had written about the concept of learning machines and that we don't have to program every aspect of human behavior into the machine but we can design a program that will instruct the computer/machine to learn. This idea forms the backbone of all modern Machine Learning and Artificial Intelligence research.
- **iv.** Turing had delved deep into the philosophical aspects of the arguments against the question "Can machines think?" and have given strong arguments to refute all those claims in this paper. He had finally established that he can see no reason why computers cannot be as intelligent as humans someday in the near future.

b. Cons:

- **i.** The author had assumed that the digital computer has unlimited capacity for storage in this paper which is practically not possible.
- **ii.** Though the paper delves both into the technical and philosophical aspects of the question “Can machines think?”, there was considerably more discussion on the philosophical part of the question.
- **iii.** The "Imitation game" cannot be used to design or analyze systems that are more intelligent than humans since it cannot assess intelligence beyond human capabilities.
- **iv.** Also in order for a computer to be successful in convincing an interrogator in the game that the computer is a human, the paper has suggested that the computer deliberately does some mistakes in the arithmetic questions given to it by the interrogator. So the game itself encourages the computers to commit a mistake which should ideally not be the case to pass a test.
- **v.** The “Imitation Game” only tells us whether the computer is intelligent or not but does not give us a measure of its intelligence.

3. FOLLOW UP:

a. Based on the concept of Learning Machines, research in the fields of Machine Learning and Artificial Intelligence has taken such a massive leap in modern society.

b. Turing's prediction that computers will be able to contend with humans in a variety of intellectual challenges has indeed come true. Recently we have seen computers playing games against humans as opponents and even an AI which defeated a world champion in the game of chess.

c. Turing also suggested providing the computers with sense organs and teaching them to speak and understand the language English. Modern advances in Natural Language Processing and Speech Processing enable computers to not only learn, understand, and speak the language English but also enables the computers to do so for any other language in the world. Chatbots, Dialog Systems, Personal Assistants have become a common thing in our lives and we use them on our hand-held devices on a daily basis. Admittedly, more work is required to make them more intelligent and humane, but seeing the progress in this field of research we can safely say that we are on the correct path.

d. Similar research in Computer Vision has also achieved astounding results in modern times. Object Identification, Image segmentation, self-driving cars, optical character recognition, etc. are all the are the different applications of Computer Vision that have improved a lot in modern times.