Review Paper for Computing Machinery and Intelligence

A. M. Turing(1950)

The imitation game includes 3 participants (Suppose A, B, C). “C “ is referred to be the interrogator who has the object of recognizing A and B, either they are a man or a woman. “A” has an objective of confusing “C” with tricky answers so that he/she makes a wrong identification. In other hand B has an objective of giving honest answers to C. The interrogator(C) has initial marking on “A” and “B” as “X” and “Y” which he is needed to solve throughout the interrogation. All the participant are kept in different rooms so that they cannot interact with each other physically and verbally. An intermediate person or a typewriter can be used for communication among them.

The author reveals a question about replacing “A” with a machine. If he replaces “A” with a machine then the question is “Can machines think?”, i.e. the possibility of creating a machine that can mimic human behavior and represent its own decisions in real time. Although it might not be consisting sensory organs(like eyes, ear, skin etc.) still it can have enough developed skills to play the game as there is no direct contact between the player and the interrogator. Rest of the paper concerns with for, against and a suitable conclusion in support of the learning ability of machines.

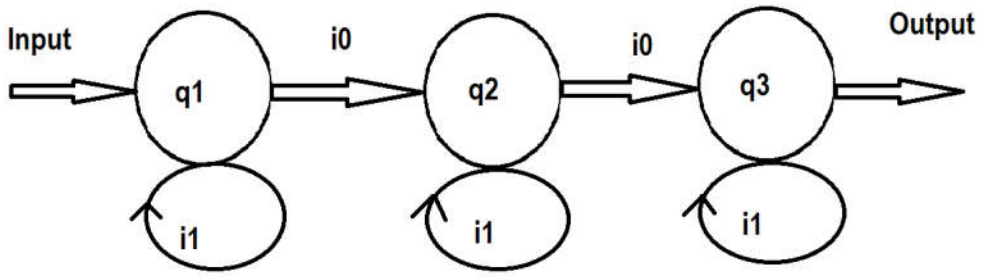
Constructing a Thinking Machine:

A digital computer is a machine which can solve problems that cannot be done by humans. Such as arithmetic operations on larger digits in an instant. The process comparison for solving such problems in Digital and Human computers are as below-

Part	Digital Computer	Human Computer
Store	Information Center divided in to small packets	A bunch of blank paper and memory unit
Executive Unit	Triggers the rule required to solve the problem	The “book of rules”
Control	Rectification unit that checks if the right rule has been followed for the given problem	Its thinking ability

From this observations, it is possible to create such a set of instruction for the Digital computer so that it can repeat its execution of operation until and unless a predefined goal is reached. A table with such instruction is called **Programme.** In fine, a Digital Computer with infinite (sufficient) memory and an accurate programming can replace “A” in the imitation game.

Digital computers are discrete-state machines, i.e. they have finite number of states and each stage change is distinct and sudden. For example, assume a system has three discrete states q_1, q_2, q_3. It has input values i_0 and i_1. The system has output when it reaches q_3. The state space representation is:



State Space Representation for a discrete system

Digital computers has enormous number of discrete states and this values are represented as the logarithmic function with base 2 which is described as the **Storage Capacity** of a machine. According to the above representation if we have the initial states stored with adequate accuracy, we can achieve a proper prediction of state at any step of the discrete system. Therefore establishing the fact that digital computers, with enough storage capacity can mimic any discrete system with greater accuracy and speed.

Disbelief in Constructing a Thinking Machine:

Theologically only human beings are gifted with immortal souls because of which they can think read write discuss etc. No machines can be granted that gift. But what if a machine achieves certain mastery levels? Will it be eligible for granting the gift? It is the lack of knowledge that keeps us from believing this.

Besides orthodox people may say it is extremely disagreeable that machine can think. This is mostly because they fear loosing their superiority in earth.

Godel's theorem(1931) states that there is no logical system which can justify its own statements within the system and the consistency of the theorem cannot be established within the system. This theorem strictly denies the capability and construction of a thinking machine. There are certain questions which the machine cannot answer or imply wrong answer, it is also common for human beings. This theory of certain limitation to machine's capability is only stated, there is no rigid proof. So it is debatable that the limitation of one machine can be overcome with another.

It is a common belief that machine's can not feel emotions. But how can we know what a person feels without being that person. In same manner one can understand machine's feeling only by transforming to one. They cannot mimic human behaviors(Kindness, making mistakes, love or enjoy a delicious meal etc). But trying to implement this things will be stupid. Though we can introduce conditional human like error which the machine is instructed to perform in purpose to confuse the interrogator in the imitation game. Beside if the storage capacity of a machine can be significantly

increased to store enough instructions, it must be able to perform various kind of operations. Therefore we can put aside this contrary view and look forward to the thinking machine.

According to Lady Lovelace's objection a machine cannot produce original ideas by itself, rather it will run only over its predefined instruction set. The disagreement statement is, every original thing is a fruitfulness of the knowledge that is nourished and grown to proper direction by one.

The nervous system requires tremendous accuracy to perform a task related to nervous impulse (reflex action, muscle movement etc). This kind of accuracy can never be obtained in a discrete-state machine. But we can introduce a differential analyzer. It provides multiple results for a given problem with the probability of their accuracy. Therefore it is possible to choose a result with best probabilistic accuracy.

The learning machine:

Instead of trying make instruction for a machine (programming) so that it can mimic human behavior it is more acceptable to build a machine which can simulate a child's learning procedure. Therefore the focus should be on making a good child machine with proper experiments and evaluating the results. Once the child machine is built it can be provided with proper course of training and education as we do with human child. This mutation will be accepted and stored as new rule in the machine and it will give more convincing results in real time as its learning process goes by. The experimenter should provide proper judgment to the actions performed by the machine during learning period, which introduces punishment and reward process of learning.

The storage capacity for the child machine will be consisting of various definitions and propositions (Mathematical theory, well established facts etc.) The only way to communicate with the machine is giving him reward signal for better implementations and punishment signal for the reverse. The more reward signal it achieves the more it will get knowledge about correct implementation. Although the learnt objectives will not result 100% accurate, as sometimes it may be needed to unlearn the previous establishment.

Going back to the imitation game we can here introduce some coaching on mimicking common human mistakes in a natural way so that the machine can confuse the interrogator precisely.

Further replacement for sensory organs can be built with clever engineering and accumulate them together to build a digital thinking machine with capabilities of mimicking human behavior.