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ARTIFICIAL INTELLIGENCE AND PRINCIPLED PROBLEMS

K. Kathiresan*[1] and E. Umamaheswari[2]
*[1]*Department of Pharmacy, Annamalai University, Annamalai Nagar, Chidambaram.*
2 Researcher, Department of Electrical Engineering, Annamalai University, Annamalai Nagar, Chidambaram.

ABSTRACT
Intelligence displayed by an entity that at least in some aspects exceeds or matches that of human beings. The characteristic of an entity that is able to make moral or rational decisions on its own and therefore is answerable for its behavior. When members of a society regard an entity as responsible, they react to it with a characteristic set of feelings and attitudes such as gratitude, indignation, resentment, respect, forgiveness, or love. Generally speaking, for an entity to be morally responsible for something not only must it have done or caused some act but also it must be able to give an account of its actions including explaining its intentions.

ARTIFICIAL INTELLIGENCE DEFINED

Artificial Intelligence

Artificial intelligence (AI) is defined generically as the demonstration of intelligence by computers or machines; that is, making machines do things that are usually done by minds. According to the Longman Dictionary of Psychology and Psychiatry, for an entity to display intelligence, it requires a "general mental ability, especially the ability to make flexible use of memory, reasoning, judgment, and information in learning and dealing with new situations and problems." Intelligence in this sense includes the ability to think, see, remember, learn, understand, and, in the long run, use common sense. This is a useful working definition of intelligence although some AI researchers differ on how it is to be applied to their work.

Information Processing or Symbolic Model and Artificial Neural Networks: Two Main Concepts of AI

John McCarthy first used the term artificial intelligence at the field's founding conference held at Dartmouth College in 1956. The underlying assumption of the conference was that "very aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it." This assumption led initially to the use of symbolic logic, patterned after the theories of George Boole, as a model of mind. Research based on this assumption resulted in an information processing or "cognitivist" theory of intelligence, one that emphasizes the functions of discriminating, acquiring, recording, analyzing, and remembering information and the role these functions play in decision making [1]. Approaches based on this assumption are called symbolic or symbol-processing AI. These systems tend to be designed and programmed from the top down and proceed deductively rather than by means of training the computer and evolving concepts inductively. Symbolic AI is structured in levels. The top is the knowledge level at which basic rules and another knowledge are specified. This flows down to the symbol level at which the knowledge is represented by symbolic structures. Finally, at the base, is the implementation level at which the symbol-processing operations are actually carried out. Most AI systems of this type employ logical reasoning methods to deduce actions to be taken and conclusions to be drawn.

Expert systems (ESs) [2] are one popular manifestation of symbolic AI. Arguably the first

Address for correspondence:
E. Umamaheswari
Researcher, Department of Electrical Engineering, Annamalai University, Annamalai Nagar, Chidambaram

AI program was of this type. Dubbed the "Logic Theorist" it was written in the fall of 1955 by Allen Newell, Herbert Simon, and J. C. Shaw to prove theorems in geometry. This paradigm reigned until the early 1970s when, among others, Terry Winograd, a student of AI pioneer Seymour Paper, began to question the strong representational assumptions being made by Newell and Simon. Winograd predicted that future research would not uncover a unified set of principles of intelligence adequate to form the knowledge level. Rather, he envisioned a variety of mechanisms and phenomena. Some would be consistent with the symbolic AI paradigm; some, however, would be quite different.

The second major type of AI is called artificial neural networks (ANNs). ANNs are modeled on the structure of the brain and nervous system, based in part on theories originally developed by John von Neumann, Warren McCulloch, Walter Pitts, and Donald Hebb. Sometimes also called sub symbolic AI systems, ANNs proceed from the bottom up, beginning with primitive signals. As they move up the hierarchy signals are converted into symbols. Proponents of this approach, such as MIT professor Rodney Brooks, believe that AI programs should be coupled closely with the physical world and made to evolve much as human intelligence has evolved over hundreds of thousands of years. The strategy they propose is called subsumption architecture. It begins inductively by simulating lower level animal functions and proceeds by adding competencies at higher levels. Whereas symbolic AI assumes that symbolic representation is necessary and fundamental to general intelligence, ANN downplays the importance of representation or, as in the case of Brooks, denies that it is needed at all.

THE MORAL CONTEST OF AI

Is an AI Machine a "Person"?

Midway through the 20th century Norbert Wiener, a founder of cybernetics the science of control and communication in animals and machines, [3] anticipated the application of cybernetic and related theories to develop automata, robots, and other machines with intelligence. In his 1948 book Wiener observed: "It has long been clear to me that the modern ultrarapid computing machine was in principle an ideal central nervous system to an apparatus for automatic control; and that its input and output need not be in the form of numbers or diagrams but might very well

be, respectively, the readings of artificial sense organs, such as photoelectric cells or thermometers, and the performance of motors or solenoids. With the aid of strain gauges or similar agencies to read the performance of these motor organs and to report, to "feedback" to the central control system as an artificial kinesthetic sense, we are already in a position to construct artificial machines of almost any degree [3,4] of elaborateness of performance. He concludes, "this new development has unbounded possibilities for good and evil."

Traditionally, granting moral status to an entity depends on it showing some form of rationality such as that displayed by humans. Indeed, Aristotle defined "man" as a rational animal. It can be argued that if an AI program truly exhibits "intelligence" or rationality, then it deserves the moral status of "personhood." This is true in part because such a machine's actions would be able to either affect (1) itself as subject or (2) others in its role as an agent, agents being the means by which something is done or caused.

Steps of Personhood

Thus, the question of granting personhood to an AI machine or robot depends on where the line is drawn between persons and inanimate objects. It is useful to think in terms of a continuum running from "persons" on one end and "objects" on the other [3,4]. An inanimate object may be accorded a "0," whereas an ideal full-fledged human citizen may be accorded a "1." A rating of 1 signifies perfect personhood, something deserving of receiving total respect. Granting an entity total respect means giving it complete autonomous determination over its actions and not imposing limitations on its liberty; that is, treating it as a full-fledged

Kantian end and not as a means. As alluded to above, many entities in our society are accorded partial personhood. In effect they have a rating greater that 0 but less than 1. Nevertheless, the higher the rating the more respect an entity deserves from other members of its society. For example, according to Roe v. Wade, during the first trimester of gestation a fetus may receive less respect than it does during the next two trimesters. A newly born child receives less respect than a young adult, etc. In each of these successive stages, the fetus/human gets a higher rating on the object/person or degrees of personhood scale. A fundamental ethical question posed by AI is what rating should be given to a particular AI computer program, machine, or robot.

THE COMMON ROLE OF AI RESEARCH AND DEVELOPMENT

Five General Categories

Using this approach, the results and use of AI research can be classified into five general categories of use, each with implications for responsibility and moral status: research object, tool or instrument, slave, partner or assistant, [5] and superintelligence or autonomous being. Generally speaking, as an AI program moves from research object to superintelligence it qualifies for a higher degree of personhood and should be accorded more respect.

Responsible Parties for an AI System

In assessing responsibility in these five roles, several human contributors to a particular AI program or those who use it should be considered:

- Computer manufacturers who produced the machines on which the AI program runs
- Systems designers who conceived of and designed the systems
- Programmers who write the instructions that the machines execute
- Knowledge engineers who elicit knowledge from human experts and introduce it into the machines
- Data collectors who introduce raw data into the machines' databases
- Inference engine designers who developed the logic technologies that apply the knowledge, draw inferences from data in the databases, and decide what steps to take next
- Human users who employ the AI system to serve some purposes such as decision making.

Moral Inferences of Using AI as a Tool or Instrument

The history of technology is the story of humanity's efforts to control its environment for its own benefit by creating tools. Tools are artifacts that are constructed to aid a human being to solve a problem. Thus, tools amplify human behavior, but they are morally malleable. Inherently, they are neither good nor evil. Their social value depends on how they are used by those who employ them. Put to use as a tool, technology both shapes its users as subject and affects other parties in its role as an agent. That is, tools serve as a means to an end.

Moral Implications of AI as Superintelligence

Superintelligence Prophesized

"Within thirty years," Vernor Vinge prophesied in1993, "we will have the technological means to create superhuman intelligence [6]. Shortly after, the human era will be ended." Inventor and entrepreneur Ray Kurzweil writing in 1999 agrees (depending on how the concept "human" is defined). "Before the next century is over, human beings will no longer be the most intelligent or capable type of entity on the planet." Both authors forecast that society will reach a point—some call it the "Singularity" point, others the "Omega"—beyond which machines will have more social power than humans. This will result from the accelerating rate of computing and communications power brought about by technological improvements. If or when this point is reached, the human experience as we know it will be radically changed. Intelligent machines will rule the world.

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