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Global Bioethics and Artificial Neural Networks

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For centuries, the brain was a mystery. Only in the last few decades have scientists begun to uncover its secrets. And in recent years, with the help of cutting-edge technology and supercomputers, key discoveries have been made to understand how the most complex organ works. The human brain contains some 11 trillion specialized nerve cells capable of receiving, processing, and transmitting the electrochemical signals on which all human sensations, actions, thoughts, and emotions depend (1).

The BRAIN Project, also known as the BRAIN initiative ("Brain Research through Advancing Innovative Neurotechnologies" or "Brain Activity Map Project"), is a human brain research initiative that was devised by Spanish neurobiologist Rafael Yuste, inaugurated on April 2, 2013, by former U.S. President Barack Obama and is expected to conclude in 2026. The BRAIN Project aims to achieve a three-dimensional mapping of the activity of each neuron in the human brain, making it possible to record the communications of thousands of neurons at a time; in other words, what this project seeks is to map all neuronal activity in the human brain and, in this way, understand how the most mysterious organ of all works (2).

Attempts to mimic the brain's functioning have followed the evolution of the state of technology. Between 1940 and 1950, scientists began to think seriously about neural networks using the notion that neurons in the brain function as digital (on-off) switch like the newly developed digital computer. Thus was born the idea of the "cybernetic revolution" that handles the analogy between the brain and the digital computer. (3) In 1943, Walter Pitts, Bertran Russell, and Warren McCulloch tried to explain the functioning of the human brain through a network of cells connected to experiments by executing logical operations. Starting from a minor psychic event, i.e., the all/nothing impulse a nerve cell generates. During the summer of 1951, Minsky and Edmonds assembled the first neural network machine, consisting of 300 vacuum tubes and a B-24 bomber autopilot. They called their creation "Sharc"; it was nothing less than a network of 40 artificial neurons that mimicked a rat's brain. And the story continues to this day (3).

The question that prompts us to write this editorial is: Can we create an artificial neural network to assist in bioethical decision-making? For neurologists, "decision making (DM) can be defined as selecting an alternative within a range of existing options, considering the possible outcomes of the choices and their consequences on present and future behavior. Traditionally, it has been stated that from an anatomical point of view, the fundamental neural basis of this process is the prefrontal cortex (PFC); however, new studies validate the hypothesis of the existence of a complex neural network that includes both cortical and subcortical structures" (4). Could an artificial neural network mimic the decision-making that neurologists describe as a

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human brain would do? How to make decisions in global bioethics problems?

The problems addressed by Global Bioethics are characterized by being:

- ***Non-linear.*** That is to say that the changes that occur in any problem can have disproportionate and unexpected effects. Disproportionate and unexpected effects.
- ***Multidisciplinary.*** As Potter states, bioethics requires a need to go beyond the boundaries of the discipline and beyond the boundaries of the discipline and beyond, recognizing multidisciplinarity and its dimensions by dimensions facing all the dilemmas of our times. The multiplicity of truths.
- ***Evolutionary and dynamic.*** That is to say; they are not seasonal. They have yet to arrive in time due to the rapid evolution occurring in the world, including the rapid evolution of society, knowledge, and technology.
- The model should respond to regional bioethical problems.

The model under construction that meets the conditions indicated in the previous section would correspond to neural networks in fuzzy systems (5).

Fuzzy systems are characterized by:

- Systems that emulate the way the brain reasons or thinks;
- Combine input variables (defined in terms of fuzzy sets), using sets of rules that produce one or more output values;
- They can be applied to similar problems as neural networks, so they are especially interesting for nonlinear or ill-defined problems (5).

A neuro-fuzzy system incorporates the human-like reasoning style of fuzzy systems through fuzzy sets and a linguistic model consisting of a set of fuzzy SI-ENTONCES (IF-THEN) rules. The main strength of neuro-fuzzy systems is that they are universal approximators that can request interpretable IF-THEN rules (6).

What is central to fuzzy logic is that, unlike classical systems logic, it is oriented towards modeling imprecise modes of reasoning, which play an essential role in the remarkable human ability to make rational decisions in an environment of uncertainty and imprecision (characteristic of global bioethics) (7).

Finally, we must ask ourselves the following questions:

- When is fuzzy control advisable?
  - For very complex processes, when there is no simple mathematical model.
  - For highly nonlinear processes.
  - If the processing of (linguistically formulated) expert knowledge can be performed.
- When is fuzzy control not recommended?
  - Conventional control theoretically yields a satisfactory result.
  - There is an easily solvable and adequate mathematical model.
  - The problem needs to be solvable (6).

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