

Editorial / Editorial / Editorial

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Bioethics in the era of artificial intelligence (AI)

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Bioethics, like all emerging knowledge in the 20th century, stems from the conflicts arising from the “contemporary revolution of knowledge”. Therefore, in order to understand bioethics in the modern world, a rigorous approach and dialogue with advances in science and technology is required. One of the recent advances applied to all fields of daily life (such as health, finance, entertainment, transportation or education, among others) is Artificial Intelligence. The RAE defines Artificial Intelligence as the “scientific discipline that deals with creating computer programs that execute operations comparable to those carried out by the human mind, such as learning or logical reasoning”(1)

The bioethics group of the Nueva Granada Military University is researching alternative methodologies for decision-making in global bioethics. At this moment they have an active project whose main objective is the creation of a theoretical model based on an Artificial Neural Network, ANN (Artificial Neural Networks) by means of fuzzy logic for decision making in macro-bioethical problems.

Statement of the problem and Justification:

Since its inception in the 1970s (2) Bioethics has been configured as an applied ethics (with the

exception of some complexologists who think that bioethics is a new knowledge), and therefore its purpose is the interdisciplinary study of the main problems that affect the quality of life of human beings.

Over time, a “pedagogical” distinction has been made between the main problems of bioethics, grouping them into two blocks: problems referring to clinical bioethics would be in the micro bioethics block; while problems that are broader and more complex in the sense that they require a more multidisciplinary analysis are grouped in the block of macro bioethics.

The macro bioethical problems would be those concerning health policies, environmental problems, bioterrorism, poverty, vulnerability, big data, posthumanism, etc. For micro bioethical problems, decision-making strategies have been developed, such as models and methodologies for analysis in clinical ethics implemented by healthcare or hospital ethics committees. While in the world of macro bioethics, it is not easy to find research in the literature that develops models, matrices or methodologies for decision-making in ethical problems.

This line of research aims to develop a theoretical model (Artificial Neural Network) that serves as a guide for ethical analysis of macro bioethical events that occur in the modern world. Bioethicists have proposed numerous methods of analyzing ethical problems. Over the years, two

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ways of approaching ethical conflicts have been used: those that consider that there are ethical dilemmas, and that their solution lies in one of the poles of the dilemma (or white or black): their method is theory of rational choice (3); and those who consider that there are ethical problems, and focus more on the procedure than on the conclusion: their method is that of deliberation.

Clinical bioethics has used rational decision theory for many years to make its decisions (4). These methodologies have two characteristics: 1. Every problem must have one and only one reasonable solution, which can and must be achieved through the use of the correct methodology. 2. Ethical problems (the problem of deciding which is the correct answer and which is not) can be reduced to technical problems (reduce all ethical problems to non-ethical but technical ones) (5).

The principlist method (created by T. Beauchamp and J. Childress, one deontologist and the other utilitarian) (6) has been for years the most used in medical ethics: it works with a dilemma mentality, more committed to the final decision than to the process of making it, since it believes the process is obvious, using directly and deductively the application of principles and rules.

Meanwhile, Garrafa and Porto question the absence of practical intervention of principlism, especially with regard to the solution of problems resulting from the economic and social inequality that occurs in peripheral countries. (7).

The authors hold, instead, the use of what they called intervention bioethics, which is organically supportive, political and concretely active, which has to do with emerging problems of bioethics: sustainability, vulnerability, inequality, poverty, bioterrorism, transhumanism. and posthumanism, etc. In conclusion, the richness of the ethical world and the complexity of the emerging problems of the contemporary world are not exhausted in the 4 principles of classical bioethics: autonomy, beneficence, non-maleficence and beneficence). It is necessary to create a new framework of analysis.

In previous research (8), the bioethics group has developed an ethical decision-making matrix for macro bioethics problems. This matrix was

made up of 4 principles (prudence, prevention, precaution, protection) regulated by the principle of Responsibility. Based on this, it is necessary to create a theoretical model that serves for decision-making in bioethics as an alternative model to classical principlism. Using advances in artificial neural networks and their applications, we intend to create such a model based on paraconsistent or second-order logic (fuzzy logic) that will help us make ethical decisions applicable to problems such as planetary sustainability, among others.

Macro Conceptual reference framework:

The creation of an Artificial Neural Network has the following theoretical foundations:

- 1) **Artificial Neural Networks (ANN):** they are inspired by the biological neural networks of the human brain and present a series of their own characteristics: -Learn: acquire knowledge of something through study, exercise or experience. ANNs can change their behavior based on the environment. They are shown a set of inputs and adjust themselves to produce consistent outputs. - Generalize: extend or expand something. ANNs automatically generalize due to their very structure and nature. These networks can, within a certain range, provide correct responses to inputs that exhibit small variations due to the effects of noise or distortion. -Abstract: mentally isolate or consider separately the qualities of an object. Some ANNs are capable of abstracting the essence of a set of inputs that apparently do not present common or relative aspects.
- 2) **System based on Fuzzy Logic:** Fuzzy Logic is used when any of the following conditions occur: the control variables are continuous, there is no mathematical model of the process or it is difficult to decode it, or the model is complex and difficult to evaluate in real time. It is used in everyday actions such as driving a car, doing any type of sport, cooking, doing good deeds, etc. where it is not necessary to know precisely the speed of the car, the momentum of the ball, the type of work carried out, or the time of cooking to be able to successfully carry out the different actions.

- 3) **Theory of Fuzzy Sets:** fuzzy logic presents an approximate reasoning, that is, reasoning deals with fuzzy or imprecise concepts from the point of view of classical logic. With this type of reasoning it is possible to infer a consequent, even though the antecedent does not fully verify the rule. The consequent obtained will also be a fuzzy concept with its corresponding function of appurtenance.
- 4) **Problems of Macro bioethics:** fuzzy logic is presented as a support tool in decision making in light of macro bioethical principles: 4P + responsibility. The world is increasingly changing and dynamic, globalized and complex. As the complexity of a system increases, our ability to make precise and also meaningful statements about its behavior decreases, until a threshold is reached beyond which precision and significance or relevance become mutually exclusive features. In this order of ideas, Ernesto Márquez comments, “Fuzzy logic aims to provide the bases of approximate reasoning, which uses imprecise premises as an instrument to generate knowledge. From the point of view of praxis, the operations used in diffuse or fuzzy mathematics are: Fuzzing, which is translating real world values into fuzzy values; Rule Evaluation: which is determining the strength of rules based on input values and the rules; and Defuzzing: translating the fuzzy results back to real world values” (9, page 16)
- 5) **Ethics of Artificial Intelligence:** can AI-based systems replace the ethical decisions of human beings? Let us remember that AIs are systems that act like humans: a vision inaugurated by Alan Turing and his famous test (1950). These are systems and programs with the capacity to process natural language, represent knowledge, reason automatically and learn to adapt to new circumstances (10). - Systems that think like humans: systems capable of automating mental operations, such as decision making, problem solving or learning (11). - Systems that think rationally: systems that try to emulate rational logical thinking and reach conclusions according to a series of universal laws of thought defined by

logic (12). • Systems that act rationally: systems that try to extend rationality beyond the laws of logic and thus include other elements, such as uncertainty, autonomy, change, etc. (13-14)

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