Ethics Applied to Development in Robotics

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Technology is increasingly present in everyday life. With this, there is an increase in the interactions between men and machines. As a result, ethical dilemmas arise. These ethical dilemmas occur both as a consequence for the developer and as part of the machine's problems. However, one can affirm that the moral differences between citizens interfere with how to solve these dilemmas. Furthermore, these ethical differences can be collected and used to model machines based on ethics. Thus, this work aims to study the relationship between ethical values and robotics, both in the development of new technologies and in the decision-making of machines. Thus the importance of ethics in technological development becomes evident.
Keywords: Artificial Agent. Ethical Issues. Robot Ethics. Machine Ethics. Moral Machine.

Introduction

From vacuum cleaners to virtual attendants to autonomous cars. the modern world is one in which humans increasingly use technology in their everyday lives.

According to the International Federation of Robotics [1], the market for robots performing services will grow 12% from 2020 to 2021, which will be a $6.7 billion mark worldwide.

The interactions between humans and machines will become more and more indispensable. However, increasing these interactions may grow ethical dilemmas for consumers and developers.

Thus, as man-machine relations are inevitable, ethical dilemmas must be thought through and solved as soon as possible to minimize their damage. Thus it is necessary to understand how ethics relates to developing these new technologies in all spheres. Therefore, this paper proposes to study the relevance of ethics in the development of robotics and elaborate on the development of machines that make ethical decisions, such as autonomous cars. Moreover, it also seeks to elaborate on the development of technologies that could hurt ethical values or generate new dilemmas.

Materials and Methods

The work developed consists of applied research on the relationship of ethics in development in robotics. Thus, it starts from a qualitative approach to the problem, being analyzed from several points of view.

We did a bibliographic review of articles related to the central theme of the research. The research was carried out using the bili method [2] to start from an objective general for a specific objective and find the articles most relevant to the topic. Figure 1 shows that the research method comprises four cycles: naive, optimized, impact, and production. These phases consist of statistical analysis to define a research focus, analyze its relevance and find the most important articles.

Using the Scopus site, a search was made using keywords related to the subject of ethics in robotics. The articles were collected, and a bibtex file was generated. This file was placed in a tool called Bibliometrix. This tool was used to analyze this file. With Bibliometrix, the annual scientific production was first analyzed, showing the number of articles published yearly and a growth of 16.36%. Next, the co-citation network was analyzed, where it was verified if the articles were related to each

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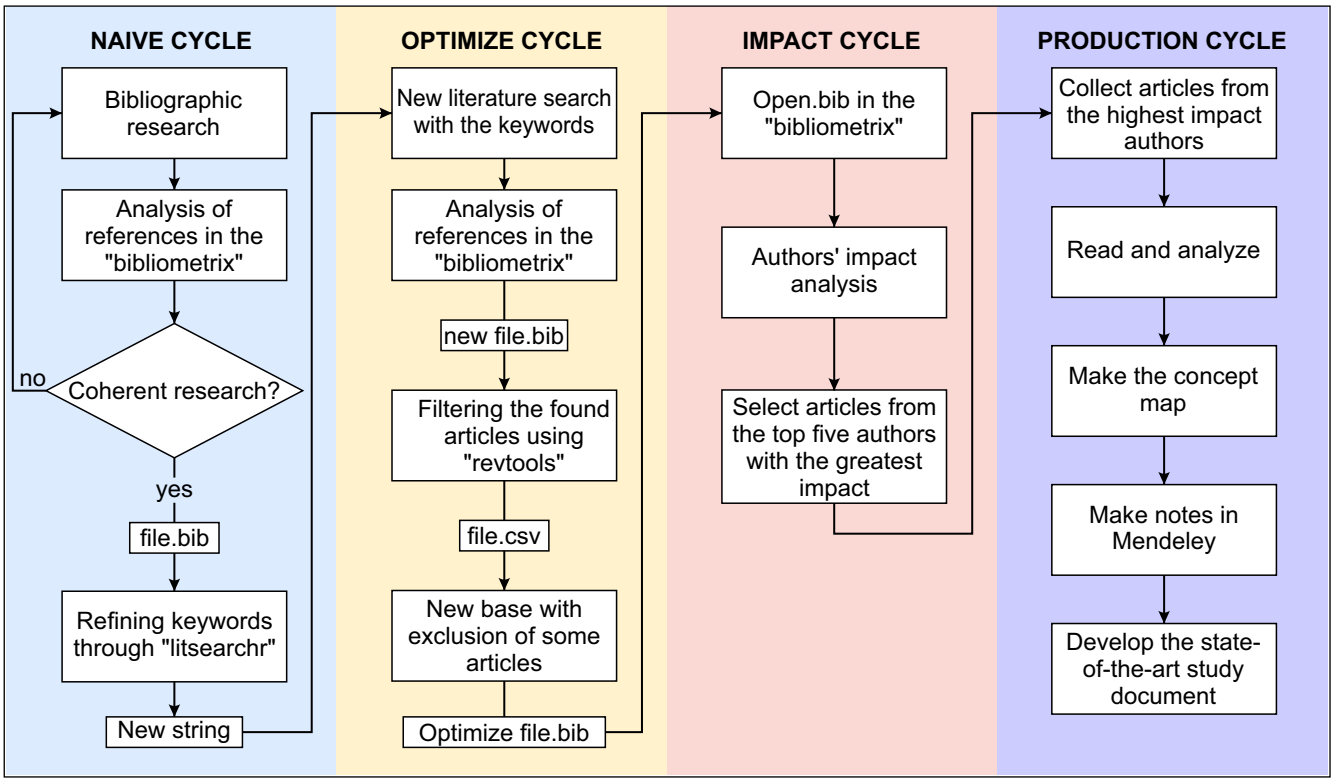
Figure 1. Bili method.



other. After that, the historiographic and word cloud were analyzed. It was observed that the word cloud contained words that did not make sense with the theme.

This project stage was repeated a few times until consistent results were found. Then, with these results, the lit search was used to refine the results further. Figure 2A shows an annual growth of 30.26% was arrived at, with an even more intertwined co-citation network (Figure 2B), and now with a word cloud without words that had no connection with the theme.

This new file is opened again in the Bibliometrix, where authors with the highest impact are selected. With that, its articles are selected and read in the next step.

At this stage, the articles with the most significant impact are studied, producing concept maps and annotations of each article. Finally, it generates a study document state of the art, and the article begins to be written.

Results and Discussion

How Ethical Issues Impact Technology Development

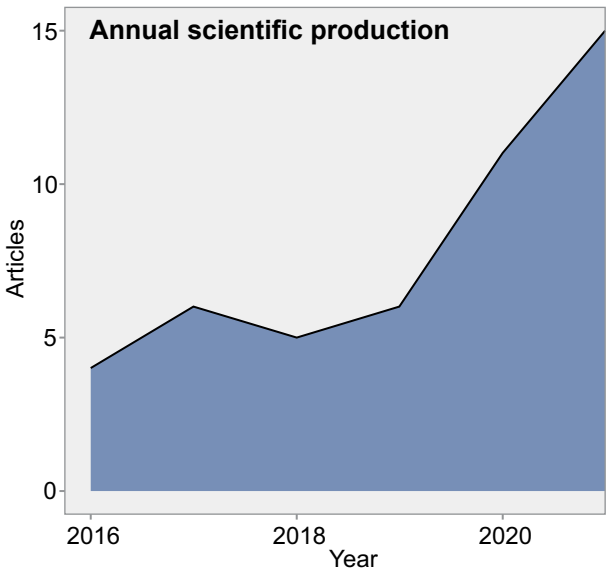
Our society has depended on hundreds, if not thousands, of automated systems, processes, and robotic systems. For example, we fly in airplanes that fly themselves. Our power grid can reroute itself to avoid power outages. Nevertheless, it leads us to expect these systems to be reliable and safe and to do what they have been programmed to do and nothing more.

The machines that are in focus in this article will need to be able to make decisions based on three essential points:

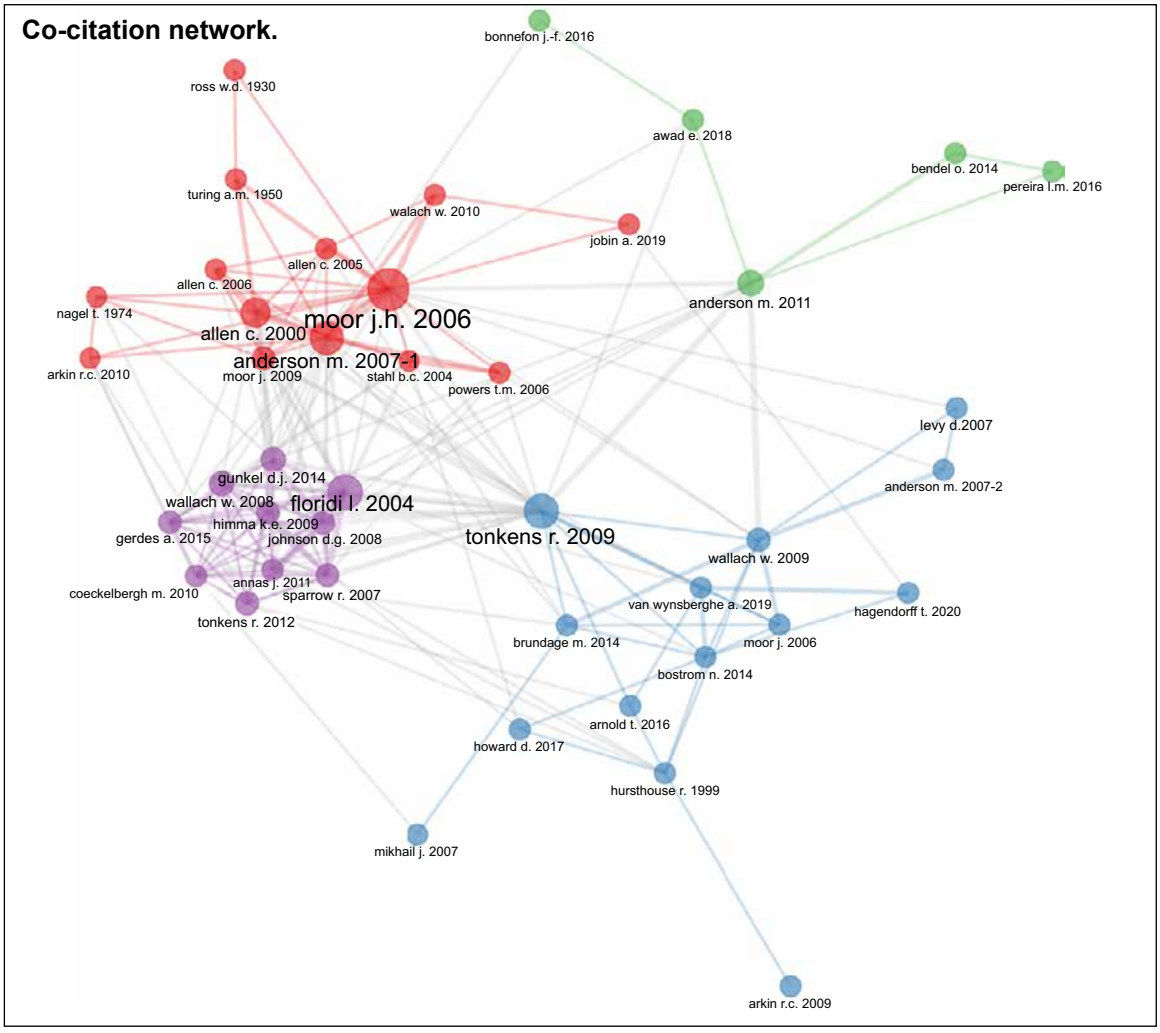
- Using and processing large amounts of data;
- Understanding and using human relationships and behaviors, and
- Considering in their decision algorithms the social rules of society, such as customs, laws, and values that humans use to relate to the real world.

Figure 2. Bili method results.

(A)



(B)



These machines should be able to figure out the "right" thing to do in real-time to deflect a moving pedestrian, perform a life-saving surgical maneuver, or distinguish friendly citizens from enemy soldiers in a war zone, all without a helping human hand. The tricky part of designing robots is considering what people say they want a machine to do and what they want it to do.

If we ask people if they want robots to be 100% truthful, everyone is likely to start saying yes. Nevertheless, we know from psychological studies that if a robot is 100%, people start to resent it [1,2]. Designers, therefore, need to consider giving it a range of truthfulness-not unlike our own. Robotic systems will also need to show some more reliable ways. We will be much more likely to trust machines that can explain their intentions and ask our permission before they undertake their work. Also, another vital part of the development of robotic systems will be the integration with the fields of psychology, sociology, linguistics, and anthropology. Otherwise, a wide range of scientists better understand the nuances of what makes us trustworthy and reliable in our different roles.

Technologies Aimed at the Organizational Scope

With technological advances, companies will undoubtedly want to use these technologies to increase productivity and production. With that comes investments in industrial automation [3] and people management. Thus, new technologies aim to increase this productivity.

However, Telkamp and Anderson [4] used artificial intelligence to monitor employees and it raises ethical questions about these practices generating abuse. Amazon has already applied the creation of systems that monitor employees, but there is no lack of reports that these practices are abusive to employees [5,6].

Technologies with Foresight

In the study by the University of Chicago, machine learning is used to predict future crimes through areas of incidence [7]. Although carrying out the prediction of crimes is very positive for society, other problems can be generated. For example, the government may collect personal data to improve the forecasting system, injuring its privacy.

Machines that Make Ethical Decisions

Due to the use of artificial intelligence and the increasing automation of machines, devices are increasingly responsible for more significant decision-making. However, this decision-making can carry a vital moral aspect. As in dilemmas with self-driving cars or in triage hospitals. So machines need to have a moral basis in them to make decisions. The need to analyze the ethical thinking of machines arises when robot decisions with a high level of autonomy can negatively impact human life. One of the ways to solve this type of problem is to train artificial intelligence with the capacity for ethical thinking.

Graham and colleagues [8] showed that just because a robot is in a situation of ethical conflict, it does not need to be a moral machine. This issue can be resolved with algorithms without the need for ethical judgment. With that, then, ethics in robotics can be separated into two main branches: those that need moral machines or those that only need algorithms that work with ethics. The problem with working with moral values is that they vary from person to person. Therefore, communities or groups may perceive measures differently from others. For example, in the case of an AI model that makes choices about what a car will crash if the brakes fail, people may realize that newer ones should be prioritized. In contrast, other people may think this is a form of discrimination and that this choice should be random [4].

According to the Moral Foundations Theory [9], people differ on six main moral foundations: care or prejudice, honesty or dishonesty, loyalty or betrayal, authority or subversion, purity or degeneration, and freedom or oppression. These variations can generate conflicts

about decisions on a given moral problem. There are different worldviews conflict with the same moral dilemma (Table 1). Thus, it is essential to consider how the population will receive certain algorithmic decisions. It is interesting to study them to know how most people perceive them. In this way, a study was carried out by asking people about what would be the best decision to make in the case of the autonomous car.

Figure 3 presents the results of a study that asked people from about 130 different countries. From these results, it is possible to observe the majority's preferences concerning the common trade-offs in this situation.

After these conclusions, the data obtained can be used to model artificial intelligence that follows this type of information. A work using this same database managed to develop artificial intelligence that makes decisions based on already established moral values.

Figure 4 shows the result of the data obtained by the artificial device compared to different sizes of databases. Showing how the prediction model has good accuracy.

Conclusion

From the article presented, it is possible to show the power that technological advances generate in ordinary life. However, to minimize the problems that future machines may cause, one must have a look based on ethics. In the first position, it is observed how the development of new technologies can be harmful, and with that, the developers must analyze the impacts of their projects well. In addition, ethics impact the production of algorithms that work together with human life. Thus, the importance of ethics in technological development is evident. The areas that work with research and development must act to solve this type of problem because this area generates projects that significantly impact social life.

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Table 1. AI issues involving moral foundations [4].

AI issues	Conflicting concerns based on moral foundation
An AI system's decision of whom or what to crash into when the brakes fail on a self-driving car	Authority—Save respected members or leaders of the community over those who are at the bottom of the hierarchy. Prioritize law-abiding citizens over those who are breaking the law (e.g., someone jaywalking)
	Care—Prioritize children first and attempt to reduce the overall number of people injured or killed
	Fairness—Do not consider characteristics such as age or status and instead, randomly pick the outcome
	Loyalty—Protect the vehicle's passengers at all costs because one family member or friend is more important than several out-group members
	Purity—A self-driving car in and of itself is morally wrong because human judgment is sacred

Figure 3. Results of the moral machine experiment [10].

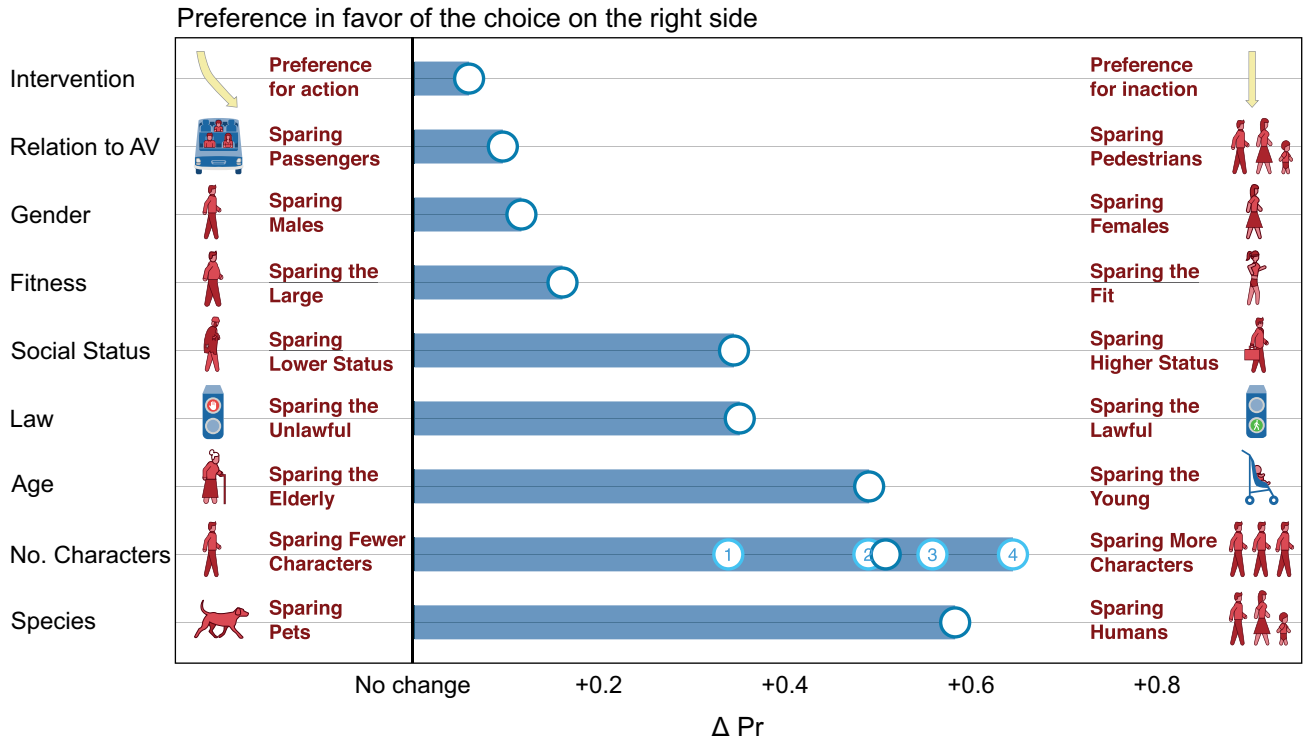
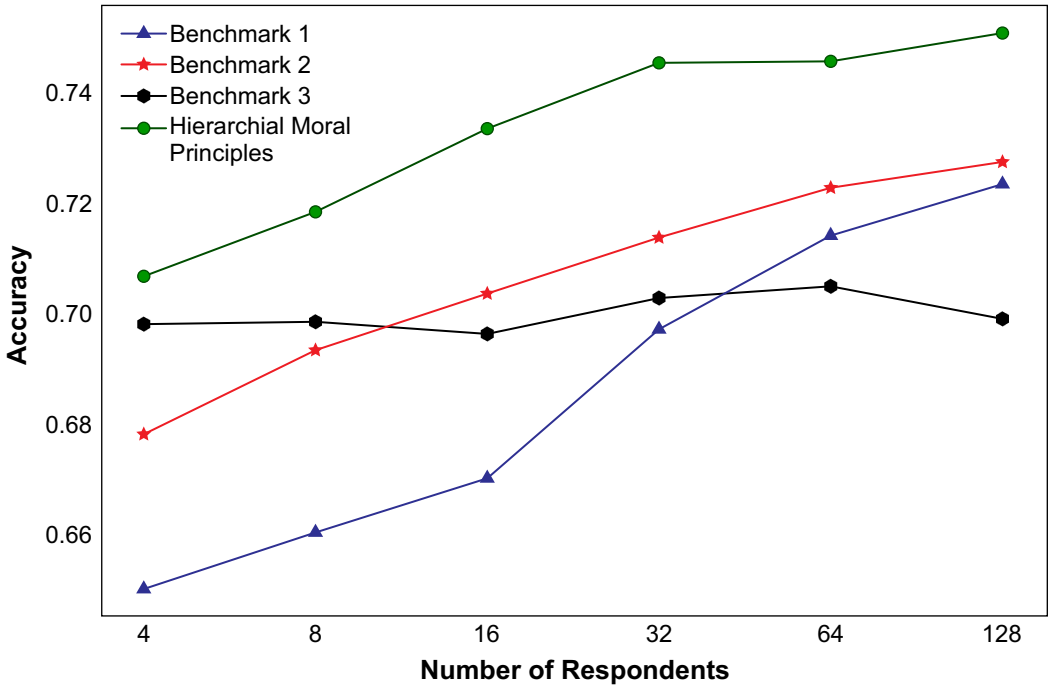


Figure 4. Comparison of model results with research [11].



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