



# Artificial Intelligence in Radiology: Some Ethical Considerations for Radiologists and Algorithm Developers

Maciej A. Mazurowski, PhD

As artificial intelligence (AI) is finding its place in radiology, it is important to consider how to guide the research and clinical implementation in a way that will be most beneficial to patients. Although there are multiple aspects of this issue, I consider a specific one: a potential misalignment of the self-interests of radiologists and AI developers with the best interests of the patients. Radiologists know that supporting research into AI and advocating for its adoption in clinical settings could diminish their employment opportunities and reduce respect for their profession. This provides an incentive to oppose AI in various ways. AI developers have an incentive to hype their discoveries to gain attention. This could provide short-term personal gains, however, it could also create a distrust toward the field if it became apparent that the state of the art was far from where it was promised to be. The future research and clinical implementation of AI in radiology will be partially determined by radiologist and AI researchers. Therefore, it is very important that we recognize our own personal motivations and biases and act responsibly to ensure the highest benefit of the AI transformation to the patients.

**Key Words:** Artificial intelligence; Machine learning; Ethics; Algorithm development.

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## INTRODUCTION

The development of artificial intelligence (AI) has progressed rapidly in the last several years, largely driven by the success of deep learning, a branch of AI that uses networks of simple interconnected processing units to learn from data. These algorithms have been shown to perform robustly in a variety of applications, including analyzing medical images, a task typically reserved for radiologists.

AI algorithms would have obvious advantages if they could match or exceed the performance of expert radiologists in a clinical setting and could be implemented in the healthcare ecosystem in a patient-friendly way. A superior performance would lead to diseases detected and proper treatments applied earlier, fewer unnecessary procedures, and other improved outcomes. The decreased cost could result in better access to care for many patients. The removed or reduced inter and intrareader variability would result in a better interpretability of results by other clinicians and an improved opportunity for medical research. The list of potential benefits goes on and on.

The number of ethical considerations related to AI is long. Many extend to the field of radiology AI (1–3). An important

ethical issue is responsibility for mistakes. Another important question that has a strong ethical aspect is how to utilize the potential value provided by radiology AI in order to benefit patients. This question is a very complex and it involves many actors: including patients, radiologists, radiology societies, radiology practices, hospitals, companies selling the algorithms, imaging device manufacturers, PACS providers, insurance companies, and the legislative branch of the government. The complexity of this issue derives from the fact that specific incentives of these actors are often very poorly aligned with each other and with the interest of the patients. Other ethical questions relate to consider medical data used for development of the algorithms and algorithm transparency (2) as well as more general concerns about responsible conduct of research.

In this paper, I will attend to a different ethical question that might not have received as much attention: When does it become unethical for radiologists to act in opposition to development of AI algorithms and their implementation in clinical practice? To answer this question, I will explore the potential conflict of interest between the radiologists' desire to benefit patients and the desire to advance their own careers and maintain prestige of the profession. Similarly, for AI developers, I will explore conflict between self-interest and the well-being of the patients. These phenomena are important because they pertain to research and clinical implementation decisions that will shape the future of radiology AI.

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e-mail: [maciej.mazurowski@duke.edu](mailto:maciej.mazurowski@duke.edu)

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## WHAT IS ETHICS

There is no one universally agreed upon set of moral behaviors or even a universally agreed upon set of principles or values upon which an ethical doctrine should be built. However, there is a lot that we do agree upon, and the lack of universally accepted doctrine does not absolve us from being thoughtful and considerate about our choices.

In thinking about which actions are ethical and which are not, I will assume a certain understanding of ethics that I hope most of the readers can relate to. Specifically, I will consider a combination of the utilitarian ethical doctrine and the ancient Greek doctrine of fulfilling one's role in the society.

Utilitarianism (4) is the ethical theory of "the greatest good (or happiness) for the greatest number." From this perspective, the ethical questions will be dominated by the interest of patients as they far outnumber radiologists and AI developers, and the suffering caused by disease often outweighs many other negative life outcomes (such as lost income). While the utilitarian perspective is the primary one in this article, I also consider the perspective that was common to many ethical theories of ancient Greeks. Their perspective considered the fulfillment of one's role in the society (e.g., a doctor, a scientist, an engineer, a soldier, a politician) as an important moral value (4).

## WHEN DOES IT BECOME UNETHICAL FOR A RADIOLOGIST TO OPPOSE AI?

I will begin the consideration of this question with an anecdote from the history of oncology. In the early days of research on and the clinical use of chemotherapy, the idea of treating cancer with toxic drugs was considered outrageous by some. At the very least it was looked at with a significant level of skepticism (5). The opposition continued even in light of notable evidence of efficacy of this treatment. A particularly high level of opposition came from two other "competing" branches of cancer treatment: surgical oncology and radiation oncology. It is likely that this opposition contributed to slowing progress in the understanding of chemotherapy, limiting the access of patients to new treatments, and costing lives.

I do not bring up this historical anecdote to say that AI is already here to save patients' lives and that any opposition to it is unethical. I do not believe that to be the case. However, important parallels between opposing AI and opposing chemotherapy exist.

In my experience as a scientist who works on development of AI tools for radiology, I have the pleasure of interacting with radiologists at my own institution and at many others on a regular basis in various work settings (research, grant review panels, conferences, etc.). In most of these interactions, particularly among my closest collaborators, I encounter a healthy mixture of enthusiasm and skepticism toward AI. However, I also sometimes hear biased and unhelpful opinions expressed, which make me question the motivations of

the speaker. We are dealing with a potentially significant conflict of interest that could affect decisions.

On the one hand, AI algorithms in radiology promise to have a high positive impact on patient care. Since it is a desire and an obligation of physicians to benefit patients, they have an interest in supporting work on AI. At some point it may become an obligation to relinquish some or all of their duties to a superior-performing computer algorithm. On the other hand, radiologists, having pride in their abilities, will want to use their hard-learned skills to benefit patients and maintain the prestige of their profession. They will also likely want to continue to earn a comfortable income to provide for themselves and their family. In the United States and around the world (to different extents), physicians, with radiologists among them, stand high in the social hierarchy due to their highly valued service, higher-than-average education, and, often, considerably higher-than-average wealth. This respect could be significantly diminished in the eyes of the society if it turned out that a computer could perform similar work.

While we all would like to believe that our judgments are fully rational and based on facts, it is well established that people's decisions are guided by a multitude of other, often difficult to recognize, factors (6,7). The personal motivations mentioned previously can constitute a strong reason for holding beliefs that are not friendly toward AI. For example, they might lead radiologists to focus on limitations of an AI study rather than on its conclusions. Or they could remain satisfied by some flawed argument purporting that AI will never replace radiologists.

While radiologists themselves may or may not be the group that will decide whether AI will be a significant part of radiology, their opinions will influence research on AI and its potential implementation in clinics. Radiologists might advise institutional leadership on whether to use AI in the clinical practice. They might evaluate AI research while serving on grant study sections or as reviewers for scientific journals/conferences. They might express opinions about AI on social media that are read by, for example, decision makers in governmental agencies.

Does the potential conflict in motivations between self-interest and benefit of the patients mean that radiologists should never speak out against AI or that they are obligated to promote it? By no means. A fair criticism is crucial and very much needed, particularly in this phase of radiology AI development. However, it is an ethical obligation of a radiologist to ask whether a particular direction has a chance to eventually improve patients' lives and express their opinions accordingly.

It is also important to attempt to recognize the biases caused by misaligned incentives and ask, "Would I still hold this opinion if it did not affect my future job?" If after this consideration the opinion is that a research direction or a study in question is flawed or a particular AI-based system should not be used at one's practice, then that opinion should be expressed. If research studies show that a close interaction of radiologists with AI is promising, then support should be expressed for research in this direction and clinical

implementation of these hybrid systems. Finally, if research strongly supports using AI alone to interpret some medical images instead of radiologists, then it is a moral obligation of radiologists to advocate such a practice.

## WHAT ARE THE ETHICAL RESPONSIBILITIES OF AI DEVELOPERS?

As I have set a very challenging ethical standard for radiologists, it is only fair to have a similar level of expectations from AI developers.

AI algorithms for radiology have been developed in academic settings for more than two decades. Interest in the topic has been dramatically increasing the last few years. Although there was some development of radiology AI in industry before, the last few years have seen a surge of startups in the field.

Like radiologists, AI developers have their own personal goals in addition to the goal of advancing the state of patient care. For many academics, it is advancement of one's career, including promotions, tenure and prestige among colleagues. For entrepreneurs, it is increasing the value of their company through, for example, securing the next round of funding and selling the product.

These goals, while nominally different than the goal of improving patient care, are often well aligned with it. For example, publishing a well-designed study showing an evaluation of a radiology AI algorithm will both bring our society slightly closer to highly accurate algorithms in clinical practices and bring the author closer to the next promotion. It may also increase one's respect among colleagues. Similarly, a startup founder developing and validating an AI algorithm may both contribute to the well-being of patients and bring the founder closer to owning a successful company.

However, the personal goals of AI developers are not always fully aligned with the noble goals of advancing healthcare. For example, limited (although increasing) incentives exist within academic institutions to share clinical imaging data. Sharing data is arguably one of the most important contributions one can make toward developing robust AI systems in radiology. A focus by any academic journals on innovation and technical aspects of the work directs researchers away from time-consuming validation studies of existing technologies, which are also crucial for the development of clinically useful AI.

Many related situations arise when one has to make a choice regarding where to devote time and resources of a lab. While it is more common to think of our choices of time allotment as being purely pragmatic and related to our organizational skills, they are also ethical in nature. When we choose to do something to advance our careers, we may ignore something that could be of more benefit to more people.

The fact that our actions are partially guided by career incentives is an opportunity for better aligning these incentives with the advancement of healthcare, particularly in the academic setting. For example, a more significant consideration of data and code sharing should be given in the academic

promotion and tenure process for medical data scientists. In the federal funding setting, the focus on innovation in the evaluation of technology-oriented grant applications has led to the development of highly innovative technologies, but proper validation and clinical implementation have lagged far behind. Calls for grant proposals that focus on placing AI technology in a proper clinical setting with multi-institutional (retrospective or prospective) validation could be a step in this direction.

Ethical responsibilities certainly extend beyond the allotment of our time. Another area where a conflict of motivations may arise is in the reporting of our own results and commenting on others'. Overstating the strength of conclusions in a paper might be of short-term benefit to the author because it might result in more attention and more citations for the paper. However, this may be harmful in the long term. It may create a false idea of the state of the art. That, in turn, might create difficulties for future investigators because they would be judged in light of such unrealistic expectations. Second, when it becomes apparent that the unrealistic expectations do not match reality, this could result in increased distrust toward the field from radiologists, patients, and funding agencies. This issue is even more accentuated in for-profit settings.

## CONCLUSION

In this paper, I considered two motivations that can come into conflict when shaping the future of radiology AI: (1) providing the most benefit to society, and (2) our personal benefits. This conflict is likely to affect opinions and decisions of both radiologists and AI developers. The opinions we express and the decisions we make about our time may shape research on radiology AI and future clinical implementation. We must guard against our biases if our priority is to advance patient care rather than protect our own turf. Therefore, we must guard against our biases in order to guide this transformation in radiology responsibly and with the ultimate patient's benefit in mind.

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## REFERENCES

1. Ethics of AI in radiology: European and North American multisociety statement.
2. Kohli M, Geis R. Ethics, artificial intelligence, and radiology. *J Am Coll Radiol* 2018; 15:1317–1319.
3. RANZCR ethical principles for AI in medicine - consultation.
4. MacIntyre A. *A short history of ethics: a history of moral philosophy from the Homeric age to the 20th century*. Routledge, 2003.
5. DeVita Jr VT, DeVita-Raeburn E. *The death of cancer: after fifty years on the front lines of medicine, a pioneering oncologist reveals why the war on cancer is winnable—and how we can get there*. Sarah Crichton Books, 2015.
6. Kahneman D, Egan P. (2011) *Thinking, fast and slow*. Farrar, Straus and Giroux New York.
7. Haidt J. *The righteous mind: Why good people are divided by politics and religion*. Vintage, 2012.