

Snowmass2021 - Letter of Interest

Ethical implications for computational research and the roles of scientists

Topical Group(s): (check all that apply by copying/pasting /)

- (CompF03) Machine Learning
- (CompF06) Quantum computing
- (CommF01) Applications & Industry
- (CommF03) Diversity and Inclusion
- (CommF04) Physics Education
- (CommF06) Public Policy and Government Engagement
- (Other) This item is relevant to all frontiers.

Contact Information:

Name (Institution) [email]: Brian Nord (Fermilab/UChicago) [nord@fnal.gov]

Authors:

Brian Nord (Fermilab/UChicago), Chanda Prescod-Weinstein (University of New Hampshire), Lindsey Gray (Fermilab), Nhan Tran (Fermilab), Jessica Esquivel (Fermilab), Joshua Isaacson (Fermilab), Bo Jayatilaka (Fermilab), Jason St. John (Fermilab), Djuna Croon (TRIUMF), Lucianne M. Walkowicz (The Adler Planetarium), Seyda Ipek (University of California, Irvine), Camille Avestruz (University of Michigan), John Wu (Space Telescope Science Institute), Federica B. Bianco (University of Delaware), Andrew Connolly (University of Washington), Ami Choi (The Ohio State University), Yuanyuan Zhang (Fermilab), Bryan Ramson (Fermilab), Tammy Walton (Fermilab), Daniel Bowring (Fermilab), Tien-Tien Yu (University of Oregon), Alex Drlica-Wagner (Fermilab), William Fisher (University of Chicago), Jacob Searcy (University of Oregon), Aleksandra Ciprijanovic (Fermilab), Tim M.P. Tait (UC Irvine)

The endeavor of scientific research has far-reaching implications. When we pursue a new understanding of the universe, we often create knowledge that can be used in a variety of ways --- from stepping stones for the next fundamental discovery to applications in everyday life across the globe. In many cases, it can be difficult to portend the long-term consequences, and even more difficult to control or orchestrate them. This highlights the necessity for scientists to deeply consider research choices before we make them.

The societal consequences of physics research throughout history are multi-faceted. These not only include new technologies for energy production¹, medical technologies (as noted by US Particle

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<https://www.smithsonianmag.com/history/how-first-man-made-nuclear-reactor-reshaped-science-and-society-180967557/>

Physics²), and space exploration, but also technologies for colonial empiricism³, weapons development^{4 5}, and financial market modeling⁶ with consequences that have contributed to the decimation of cultures and impoverishment of millions. Modern high-energy physics (HEP) research carries all of these legacies.

In this letter, we focus on the ethical implications of computational research and the role of scientists in its development. A growing wave of sciences and technologies ---comprising Artificial Intelligence (AI) and Quantum Information Systems (QIS) --- is already having widespread, quantifiable, and deeply ingrained effects across global society. These effects are, again, multifaceted. AI brings automation --- which can accelerate many activities, but in so doing often alters the employment landscapes. AI-enabled computer vision technology can be applied across numerous scientific contexts, but facial recognition applications of computer vision are biased against racial minorities⁷ and is increasingly used as part of larger-scale surveillance apparatuses⁸⁹. Quantum computing, while enabling a new class of calculations, is irrevocably altering the landscape of cryptography and digital security. More broadly, algorithms and data themselves permeate society in ways that both benefit and oppress^{10 11 12}.

Many physicists and physics institutions have striven to take on leadership roles in the development of AI, QIS, and algorithms --- largely in the pursuit of scientific applications. Regardless of these intentions, the technologies and tools we create can, have, and will be used for a variety of purposes. Some of these purposes will cause harm. It is critical for us to reflect on, understand, and consider how our research choices affect society. In this letter of interest, we recommend that the physics community directly address ethical implications of our work with the following elements:

1. We should discuss openly and publicly all potential consequences of our research.
2. We should partner ethics education with all scientific education and training.
3. We should establish policies and systems of assessment and accountability for the ethical implications of our research.
4. We should engage with professionals and scholars in other fields (Science and Technology studies, social science, ethics, and more) for the establishment and execution of pedagogy and accountability systems.

² <https://www.usparticlephysics.org/brochure/benefits/>

³ <https://medium.com/@chanda/decolonising-science-reading-list-339fb773d51f>

⁴ <https://www.nature.com/news/history-from-blackboards-to-bombs-1.18056>

⁵ <https://www.aps.org/units/fps/newsletters/201407/war.cfm>

⁶ <https://www.ft.com/content/8461f5e6-35f5-11e3-952b-00144feab7de>

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<https://www.washingtonpost.com/technology/2019/12/19/federal-study-confirms-racial-bias-many-facial-recognition-systems-casts-doubt-their-expanding-use/>

⁸ <https://www.nytimes.com/2020/01/24/business/london-police-facial-recognition.html>

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<https://www.nytimes.com/2019/04/14/technology/china-surveillance-artificial-intelligence-racial-profiling.html>

¹⁰ <https://nyupress.org/9781479837243/algorithms-of-oppression/>

¹¹

<https://www.publicaffairsbooks.com/titles/shoshana-zuboff/the-age-of-surveillance-capitalism/9781610395694/>

¹²

<https://www.wiley.com/en-us/Race+After+Technology:+Abolitionist+Tools+for+the+New+Jim+Code-p-9781509526437>