

IEEE Position Statement

Ethical Aspects of Autonomous and Intelligent Systems

*Approved by the
IEEE Board of Directors (24 June 2019)*

IEEE supports the inclusion of ethical considerations in the design and deployment of autonomous and intelligent systems.

Autonomous and Intelligent systems (A/IS) are systems that are capable of adaption and learning based on feedback and data from their environment. A/IS hold great promise to benefit society in applications domains as diverse as transportation, health and social care, environmental preservation, enterprise productivity, communication network optimization, power grid adaptation and management, agriculture, manufacturing, and entertainment. Recent success in machine learning, signal processing, planning algorithms, digital sensing, embedded systems, cloud computing, as well as voice, image and pattern analysis have greatly accelerated application of A/IS. They hold great promise to benefit society, but they also present potential new social, legal and ethical challenges, with corresponding new requirements to address issues of systemic risk, diminishing trust, privacy challenges and issues of data transparency, ownership and agency.

Therefore, there is a compelling need for developers and operators of A/IS systems to maintain awareness of and employ consensus-based global best technical practices and standards that recognize and align end-users' and citizen's values when building and deploying A/IS. To that end:

- IEEE supports the development of technological communities, the development and dissemination of research and development products, the promulgation of technical best practices, the development of educational programs and the development of technical standards that can extend the capacity of A/IS developers and operators to deploy the benefits of A/IS systems in a manner that respects and acknowledges the ethical obligation to consider these systems in their human and social context.

- IEEE supports efforts that encourage a global, inclusive and informed dialogue between technological communities, policy makers, regulators, legal professionals, ethicists, philosophers, economists, community representatives, end users and other interested parties regarding best practices for the ethically aligned design of A/IS.
- IEEE endorses the principle that the design, development and implementation of autonomous and intelligent systems (A/IS) should be undertaken with consideration for the societal consequences and safe operation of systems with respect to:
 - ✓ **Human Rights** A/IS should be developed and operated in a manner that respects internationally recognized human rights.
 - ✓ **Well-being** A/IS developers should consider impact on individual and societal well-being as the central criterion in development.
 - ✓ **Data Agency** A/IS developers should respect each individual's ability to maintain appropriate control over their personal data and identifying information.
 - ✓ **Effectiveness** Developers and operators should consider the effectiveness and fitness of A/IS technologies for the purpose of their systems.
 - ✓ **Transparency** To the greatest extent feasible, the technical basis of the particular decisions made by an A/IS should be discoverable.
 - ✓ **Accountability** A/IS should be designed and operated in a manner that permits production of an unambiguous rationale for the decisions made by the system.
 - ✓ **Awareness of Misuse** Designers of A/IS creators should consider and guard against potential misuses and operational risks
 - ✓ **Competence** Designers of A/IS should specify and operators should possess the knowledge and skill required for safe and effective operation.
- IEEE supports the consensus process of, and assets produced through, the IEEE Global Initiative on Ethical Aspects of Autonomous and Intelligent Systems and continues to engage the broader IEEE community in work in this area through efforts such as:
 - ✓ “Ethically Aligned Design – A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems, Edition 1.0,” produced by the IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems, is the outcome of a three-year bottom up, globally sourced (with thousands of

contributors), consensus-based project, using IEEE-SA rules, procedures, and frameworks. In addition, it has gone through a very rigorous and independent (of the original authors) review, including IEEE legal review, and editing process. IEEE SA's Board of Governors has expressed its endorsement and support to this work of the IEEE Global Initiative through a unanimous resolution.¹

- ✓ The IEEE P7000 Series of Standards² that explicitly focus on societal and ethical issues associated with a certain field of technology.
- ✓ Technology efforts across IEEE Societies and Councils, including the IEEE Computer Society, IEEE Computational Intelligence Society, IEEE Robotics and Automation Society, IEEE Society on the Social Implications of Technology and their associated Technical Conferences and Journals.
- ✓ IEEE Tech Ethics program³, which seeks to ensure that ethical and societal implications of technology become an integral part of the development process by driving conversation and debate on these issues.
- ✓ The IEEE Code of Ethics (IEEE Policies Section 7.8)⁴ is explicit in referencing IEEE's commitment to ethical design and to the societal implications of intelligent systems, and states in part:
 - We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members, and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:
 - to hold paramount the safety, health, and welfare of the public, to strive to comply with ethical design and sustainable development practices, and to disclose promptly factors that might endanger the public or the environment;
 - to improve the understanding by individuals and society of the capabilities and societal implications of conventional and emerging technologies, including intelligent systems.

IEEE is committed to developing trust in technologies through transparency, technical community building, and partnership across regions and nations, as a service to humanity. Measures that ensure that A/IS are developed and deployed with appropriate ethical consideration for human and societal values will enhance trust in these

¹ <https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/ieee-sa-bog-resolution-gieais-1218.pdf>

² <https://ethicsinaction.ieee.org/>

³ <https://techethics.ieee.org/>

⁴ <https://www.ieee.org/content/dam/ieee-org/ieee/web/org/about/whatis/ieee-policies.pdf>

technologies, which in turn will increase the ability of the technologies to achieve much broader beneficial societal impacts.

In parallel with our commitment to the ethical aspects of designing, developing and deploying AI systems, IEEE supports the development of AI technology and its application to advance the interests of society, and offers specific recommendations for public policymakers in a separate IEEE Position Statement entitled *Artificial Intelligence*.

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IEEE is the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity. Through its highly cited publications, conferences, technology standards, and professional and educational activities, IEEE is the trusted voice in a wide variety of areas ranging from aerospace systems, computers, and telecommunications to biomedical engineering, electric power, and consumer electronics.