Policy

Autonomous and intelligent systems (A/IS) are a part of our society. The use of these new, powerful technologies promotes a range of social goods, and may spur development across the economies and society through its numerous applications, including in commerce, employment, healthcare, transportation, politics, privacy, public safety, national security, civil liberties, and human rights. To protect the public from adverse consequences, intended or otherwise, resulting from these applications, effective A/IS public policies and government regulations are needed.

The goals of an effective A/IS policy center on the protection and promotion of safety, privacy, intellectual property rights, human rights, and cybersecurity, as well as the public understanding of the potential impact of A/IS on society. Without policies designed with these considerations in mind, there may be critical technology failures, loss of life, and high-profile social controversies. Such events could engender policies that unnecessarily stifle entire industries, or regulations that do not effectively advance public interest and protect human rights.

To ensure that A/IS best serves the public interest, we believe that effective A/IS policies should embody a rights-based approach[1] that achieves five principal objectives:

1. Support, promote, and enable internationally recognized legal norms

2. Develop workforce expertise in A/IS technology

3. Include ethics as a core competency in research and development leadership

4. Regulate A/IS to ensure public safety and responsibility

5. Educate the public on societal impacts of A/IS

1 This approach is rooted in internationally recognized economic, social, cultural, and political rights.

Policy

As autonomous and intelligent systems (A/IS) become a greater part of our everyday lives, managing the associated risks and rewards will become increasingly important. Technology leaders and policy makers have much to contribute to the debate on how to build trust, prevent drastic failures, and integrate ethical and legal considerations into the design of A/IS technologies.

Disclaimer: *While we have provided recommendations in this document, it should be understood these are not formal policy recommendations endorsed by IEEE and do not represent a position or the views of IEEE but the informed opinions of Policy Committee members providing insights designed to provide expert directional guidance regarding A/IS. In no event shall IEEE or IEEE-SA Industry Connections Activity Members be liable for any errors or omissions, direct or otherwise, however caused, arising in any way out of the use of this work, regardless of whether such damage was foreseeable.*

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Objective:
Ensure that A/IS support, promote, and enable internationally recognized legal norms.

Background

A/IS technologies have the potential to negatively impact internationally recognized economic, social, cultural, and political rights, through unintended outcomes or outright design decisions (as is the case with certain unmanned aircraft systems (Bowcott, 2013). In addition to the military application of A/IS, the domestic use of A/IS in predictive policing (Shapiro, 2017), banking (Garcia, 2017), judicial sentencing (Osoba and Welser, 2017), job hunting and hiring practices (Datta, Tschantz, and Datta, 2014), and even service delivery of goods (Ingold and Soper, 2016) can negatively impact human rights by automating certain forms of discrimination, inhibiting the right to assembly, freedom of expression, and access to information. To ensure A/IS are used as a force for good, it is crucial to formulate policies that prevent such violations of political, social, economic, and cultural rights.

A/IS regulation, development, and deployment should, therefore, be based on international human rights standards and standards of international humanitarian laws (in the case of armed conflicts). This can be achieved if both states and private actors consider their responsibility to respectively protect and respect internationally recognized political, social, economic, and cultural rights. For business actors, this means considering their obligation to respect international human rights, as laid out in the UN Guiding Principles for Business and Human Rights (OHCHR, 2011), also known as the Ruggie principles.

When discussing the responsibility of private actors, the UN Guiding Principles on Business and Human Rights should be reflected. These principles have been widely referenced and endorsed by corporations and led to the adoption of several corporate social responsibility (CSR) policies in various companies. As such, they have led to a better understanding of the role of businesses in protection and promotion of human rights and ensured that the most crucial human values and legal standards of human rights are respected by A/IS technologists.

Candidate Recommendations

A rights-based approach means using the internationally recognized legal framework for human rights standards that is directed at accounting for the impact of technology on individuals. This framework also addresses inequalities, discriminatory practices, and the unjust distribution of resources. A/IS right-based policies will reflect the following principles:

- Responsibility: The rights-based approach shall identify the right holders and the duty bearers, and ensure that duty bearers have an obligation to realize all human rights; this should guide the policy development and implementation of A/IS.

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- Accountability: As duty bearers, states should be obliged to behave responsibly, seek to represent the greater public interest, and be open to public scrutiny of their A/IS policy.

- Participation: the rights-based approach demands a high degree of participation of all interested parties.

- Non-discrimination: Principles of non-discrimination, equality, and inclusiveness should underlie the practice of A/IS. The rights-based approach should also ensure that particular focus is given to vulnerable groups, to be determined locally, such as minorities, indigenous peoples, or persons with disabilities.

- Empowerment: The rights-based approach to A/IS should empower right holders to claim and exercise their rights.

- Corporate responsibility: Companies must ensure that when they are developing their technologies based on the values of a certain community, they do so only to the extent that such norms or values fully comply with the rights-based approach. Companies must also not willingly provide A/IS technologies to actors that will use them in ways that lead to human rights violations.

Further Resources

- Human rights-based approaches have been applied to development, education and reproductive health. See: the UN Practitioners' Portal on Human Rights Based Programming.

- Bowcott, O. "Drone Strikes By Us May Violate International Law, Says UN." *The Guardian*, October 18, 2013.

- Shapiro, A."Reform Predictive Policing." *Nature News* 541, no. 7638 (2017): 458.

- Garcia, M. "How to Keep Your AI from Turning Into a Racist Monster." *Wired*, April 21, 2017.

- Osoba, O. A., and W. Welser. "An Intelligence in Our Image: The Risks of Bias and Errors in Artificial Intelligence." Santa Monica, CA: RAND Corporation, 2017.

- Datta, A., M. C. Tschantz, and A. Datta. "Automated Experiments on Ad Privacy Settings: A Tale of Opacity, Choice, and Discrimination." arXiv:1408.6491 [Cs], 2014.

- Ingold, D., and S. Soper. "Amazon Doesn't Consider the Race of Its Customers. Should It?" *Bloomberg,* April 21, 2016.

- United Nations. *Guiding Principles on Business and Human Rights: Implementing the United Nations "Protect, Respect and Remedy" Framework*. United Nations Office of the High Commissioner of Human Rights. New York and Geneva: UN, 2011.

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Objective:

Develop and make available to government, industry, and academia a workforce of well-qualified A/IS personnel.

Background

There is a clear consensus among private sector and academic stakeholders that effectively governing A/IS and related technologies requires a level of technical expertise that governments currently do not possess. Effective governance requires more experts who understand and can analyze the interactions between A/IS technologies, programmatic objectives, and overall societal values. With current levels of technical understanding and expertise, policies and regulations may fail to support innovation, adhere to national principles, and protect public safety.

At the same time, the A/IS personnel should not only possess a necessary technology knowledge, but also receive adequate ethical training, and have access to other resources on human rights standards and obligations, along with guidance on how to make them a fundamental component of their work.

Candidate Recommendations

A high level of technical expertise is required to create a public policy, legal, and regulatory environment that allows innovation to flourish while protecting the public and gaining public trust.[1] Policy makers and market leaders should pursue several strategies for developing this expertise:

- Expertise can be furthered by setting up technical fellowships, or rotation schemes, where technologists spend an extended time in political offices, or policy makers work with organizations that operate at the intersection of tech-policy, technical engineering, and advocacy (like the American Civil Liberties Union, Article 19, the Center for Democracy and Technology, or Privacy International). This will enhance the technical knowledge of policy makers and strengthen ties between political and technical communities, needed to make good A/IS policy.

- A culture of sharing best practices around A/IS legislation, consumer protection, workforce transformation, and economic displacement stemming from A/IS-based automation should be fostered across borders. This can be done by doing exchange governmental delegation trips, transcontinental knowledge exchanges, and by building A/IS components into existing venues and efforts surrounding good regulation (General Data Protection Regulation (GDPR)).

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1 This recommendation concurs with the multiple recommendations of the United States National Science and Technology Council, One Hundred Year Study of Artificial Intelligence, Japan's Cabinet Office Council, European Parliament's Committee on Legal Affairs and others.

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- In order to ensure that the next generation of policy makers is tech savvy, it is necessary to rely upon more than their "digital nativeness." Because A/IS are evolving technologies, long-term educational strategies are needed, e.g., providing children access to coding and computer science courses starting from primary school, and extending into university or vocational courses.

Further Resources

- Holdren, J., and M. Smith. "Preparing for the Future of Artificial Intelligence." Washington, DC: Executive Office of the President, National Science and Technology Council, 2016.

- Stanford University. "Artificial Intelligence and Life in 2030: One Hundred Year Study on Artificial Intelligence." Stanford, CA: Stanford University, 2016.

- "Japan Industrial Policy Spotlights AI, Foreign Labor." *Nikkei Asian Review,* May 20, 2016.

- Weng, Y.-H. "A European Perspective on Robot Law: Interview with Mady Delvaux-Stehres." *Robohub,* July 15, 2016.

Objective:
Support research and development needed to ensure continued leadership in A/IS.

Background

Greater national investment in ethical A/IS research and development would stimulate the economy, create high-value jobs, and improve governmental services to society. A/IS can significantly improve our societies: the use of A/IS in computer vision and human-computer interactions will have far-reaching implications. Intelligent robots will perform difficult and dangerous tasks that require human-like intelligence. Self-driving cars will revolutionize automobile transportation and logistics systems and reduce traffic fatalities. A/IS will improve quality of life through smart cities and decision support in healthcare, social services, criminal justice, and the environment. However, to ensure such a positive impact, more support for R&D, with a particular eye for the ethical impact of A/IS, is needed.

Candidate Recommendations

Investment in A/IS research and development (including ethical considerations) is essential to maximizing societal benefits, mitigating any associated risks, and enabling efficient and effective public sector investment. To enable efficient and effective public and private sector investment, there should be benchmarks

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for A/IS technologies and applications with continuing focus on identifying promising future applications of A/IS. An important government role is to strategically educate the public and private sectors on key A/IS technologies and applications. We recommend the following:

- Enable a cross-disciplinary research environment that encourages research on the fairness, security, transparency, understandability, privacy, and societal impacts of A/IS and that incorporates independent means to properly vet, audit, and assign accountability to the A/IS applications.

- Governments should create research pools that incentivize research on A/IS that benefits the public, but which may not be commercially viable.

Further Resources

- Kim, E. T. "How an Old Hacking Law Hampers the Fight Against Online Discrimination." *The New Yorker*, October 1, 2016.

- National Research Council. *"Developments in Artificial Intelligence, Funding a Revolution: Government Support for Computing Research."* Washington, DC: National Academy Press, 1999.

- Chen, N., L. Christensen, K. Gallagher, R. Mate, and G. Rafert (Analysis Group). "Global Economic Impacts of Artificial Intelligence," February 25, 2016.

- The Networking and Information Technology Research and Development Program, "Supplement to the President's Budget, FY2017." NITRD National Coordination Office, April 2016.

- Furber, S. B., F. Galluppi, S. Temple, and L. A. Plana. "The SpiNNaker Project." *Proceedings of the IEEE* 102, no. 5 (2014): 652–665.

- Markram, H. "The Human Brain Project." *Scientific American* 306, no. 2 (June 2012): 50–55.

- L. Yuan. "China Gears Up in Artificial-Intelligence Race." *Wall Street Journal*, August 24, 2016.

Objective:
Provide effective regulation of A/IS to ensure public safety and responsibility while fostering a robust AI industry.

Background

Governments must ensure consistent and appropriate policies and regulations for A/IS. Effective regulation should address transparency, understandability, predictability, and accountability of AI algorithms, risk management, data protection, and safety. Certification of systems involving A/IS is

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a key technical, societal, and industrial issue. Good regulation encourages innovation, and harmonizing policy internationally will reduce barriers to trade.

Good regulation can take many different forms, and appropriate regulatory responses are context-dependent. There is no one-size-fits-all for A/IS regulation, but it is important that such regulation is developed through an approach that is based on human rights[2] and has human well-being as a key goal.

Candidate Recommendations

- To ensure consistent and appropriate policies and regulations across governments, policymakers should seek informed input from a range of expert stakeholders, including academic, industry, and government officials, to consider questions related to the governance and safe employment of A/IS.

- To foster a safe international community of A/IS users, policymakers should take similar work being carried out around the world into consideration. Due to the transnational nature of A/IS, globally synchronized policies can have a greater impact on public safety and technological innovation.

- Law schools should offer interdisciplinary courses such as "Introduction to AI and Law" to reduce the gap between regulators, lawyers, and A/IS researchers and developers.

- Establish policies that foster the development of economies able to absorb A/IS, while providing broad job opportunities to those who might otherwise be alienated or unemployed. In addition, the continued development of A/IS talent should be fostered through international collaboration.

- Continue research into the viability of universal basic income. Such a non-conditional and government-provided addition to people's income might lighten the economic burden that comes from automation and economic displacement caused by A/IS.

- Ambiguity regarding whether and how proprietary A/IS may be reverse engineered and evaluated by academics, journalists, and other researchers can stifle innovation and public safety. Elimination of these impediments is essential.

Further Resources

- Stanford University. "Artificial Intelligence and Life in 2030: One Hundred Year Study on Artificial Intelligence." Stanford, CA: Stanford University, 2016.

- Calo, R. "The Case for a Federal Robotics Commission." The Brookings Institution, 2014.

- Mannes, A. "Institutional Options for Robot Governance," 1–40, in *We Robot 2016*, Miami, FL, April 1–2, 2016.

2 Human rights–based approaches have been applied to development, education, and reproductive health. See: the UN Practitioner's Portal on Human Rights Based Programming.

Policy

- Marchant, G. E., K. W. Abbott, and B. Allenby, *Innovative Governance Models for Emerging Technologies*. Cheltenham, U.K.: Edward Elgar Publishing, 2014.

- Weng, Y. H., Y. Sugahara, K. Hashimoto, and A. Takanishi. "Intersection of 'Tokku' Special Zone, Robots, and the Law: A Case Study on Legal Impacts to Humanoid Robots." *International Journal of Social Robotics* 7, no. 5 (2015): 841–857.

Objective:
Facilitate public understanding of the rewards and risks of A/IS.

Background

Perception drives public response. A/IS technologies and applications can both capture the imagination such as self-driving cars, and instill fear. Therefore, it is imperative for industry, academia, and government to communicate accurately both the positive potential of A/IS and the areas that require caution. Developing strategies for informing and engaging the public on A/IS benefits and challenges are critical to creating an environment conducive to effective decision-making.

The success of A/IS technology depends on the ease with which people use and adapt to A/IS applications. While improving public understanding of A/IS technologies through education is becoming increasingly important, so is the need to educate the public about the social and cultural issues of A/IS. The way A/IS interact with final users, build cognitive models of their power and limits, and so help their adoption and sense of control, are key technological objectives.

If society approaches these technologies primarily with fear and suspicion, societal resistance may result, impeding important work on ensuring the safety and reliability of A/IS technologies. On the other hand, if society is informed of the positive contributions and the opportunities A/IS create, then the technologies emerging from the field could profoundly transform society for the better in the coming decades.[3]

Another major societal issue — and the subject of much ongoing debate — is whether A/IS should have, or could develop, any sense of ethical behavior. A/IS will require a commonly accepted sense of ethical behavior, or, at the very least, possess behaviors with ethical implications. Therefore, technology awareness *and* understanding of social and ethical issues of A/IS are new literacy skills society must embrace if A/IS applications are to be accepted and trusted as an integral part of modern living.

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3 One hundred year study of AI (AI100), Stanford University, August, 2016.

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Candidate Recommendations

- Encourage A/IS development to serve the pressing needs of humanity by promoting dialogue and continued debate over the social and ethical implications of A/IS. To better understand the societal implications of A/IS, we recommend that funding be increased for interdisciplinary research on topics ranging from basic research into intelligence to principles on ethics, safety, privacy, fairness, liability, and trustworthiness of A/IS technology. Societal aspects should be addressed not only at an academic level but also through the engagement of business, public authorities, and policy makers. While technical innovation is a goal, it should not be prioritized over the protection of individuals.

- Begin an international multi-stakeholder dialogue to determine the best practices for using and developing A/IS, and codify this dialogue into international norms and standards. Many industries, in particular system industries (automotive, air and space, defense, energy, medical systems, manufacturing) are going to be significantly changed by the surge of A/IS. A/IS algorithms and applications must be considered as products owned by companies, and therefore the companies must be responsible for the A/IS products not being a threat to humanity.

- Empower and enable independent journalists and media outlets to report on A/IS, both by providing access to technical expertise and funding for independent journalism.

- Conduct media outreach to illustrate A/IS beneficial uses, and the important steps being taken to ensure safety and transparency. Public opinion related to trust, safety, privacy, employment, and the economy will drive public policy. It is critical to creating an environment conducive to effective decision-making, particularly as more government services come to rely on A/IS, that strategies are developed to inform and engage the public on AI benefits and challenges. Care must be taken to augment human interaction with A/IS and to avoid discrimination against segments of society.

Further Resources

- Networking and Information Technology Research and Development (NITRD) Program. "The National Artificial Intelligence Research and Development Strategic Plan." Washington, DC: Office of Science and Technology Policy, 2016.

- Saunders, J., P. Hunt, and J. S. Hollywood. "Predictions Put into Practice: A Quasi-Experimental Evaluation of Chicago's Predictive Policing Pilot," *Journal of Experimental Criminology* 12, no. 347, (2016): 347–371. doi:10.1007/s11292-019272-0

- Edelman, B., and M. Luca. "Digital Discrimination: The Case of Airbnb.com." Harvard Business School Working Paper 14-054, 2014.

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- Garvie, C., A. Bedoya, and J. Frankle. "The Perpetual Line-Up: Unregulated Police Face Recognition in America." Washington, DC: Georgetown Law, Center on Privacy & Technology, 2016.

- Chui M., and J. Manyika, "Automation, Jobs, and the Future of Work." Seattle, WA: McKinsey Global Institute, 2014.

- The IEEE Global Initiative for Ethical Considerations in Artificial Intelligence and Autonomous Systems. *Ethically Aligned Design: A Vision for Prioritizing Human Well-being with Artificial Intelligence and Autonomous Systems,* Version 1. IEEE, 2016.

- Arkin, R. C. "Ethics and Autonomous Systems: Perils and Promises [Point of View]." *Proceedings of the IEEE* 104, no. 10, (1779–1781): 2016.

- Eurobarometer Survey on Autonomous Systems (published June 2015 by DG Connect) looks at Europeans' attitudes to robots, driverless vehicles, and autonomous drones. The survey shows that those who have more experience with robots (at home, at work or elsewhere) are more positive toward their use.