

ADAPTING TO CHALLENGES POSED BY THE FOURTH INDUSTRIAL REVOLUTION:

A REGULATORY CALL TO ACTION CONCERNING CYBERNETIC TECHNOLOGY

THOMAS GIACOBBE

I. INTRODUCTION

For over a half century, science fiction (“Sci-fi”) films and other media have incessantly filled consumers’ heads with fascinating possibilities for the future. I was seven when I first tasted the magic of Sci-fi. Flash back in time to the Edwardsville Showplace theater, *Star Wars: Episode III* projected up on the big screen. Little Thomas squirmed in his seat while sipping on a large White Cherry Icee. He was totally immersed in the movie as lightsabers clashed and spaceships battled. He was clueless that this was the start of a borderline obsession with Sci-fi.

As a child, I did not fully recognize the correlation between sci-fi movies and real-life technology—at least, not until the devices magically started appearing in everyday life. Touch-screen supercomputers were created and purchased by everyone as Apple and Android raced to the future; interactive robots moved from the big screen onto the shelves of every tech store nationwide; and Red Bull developed jet packs, enabling people to fly like Iron Man. Ultimately, *Star Wars: Episode III – Revenge of the Sith* was just one of a few movies that changed the way I viewed the possibilities of the future. I dreamed about the possibilities that could be sourced from my favorite science fiction movies and magazines and imagined all the things I wanted: a jetpack, so I could fly like Iron Man; a touch-screen supercomputer that talked like Jarvis; a super-cool smartwatch like James Bond’s; and a warp-speed spaceship to traverse the universe like Han Solo. While I was dreaming about the future, any of my concerns surrounding the regulation and management of the new inventions and innovations were practically nonexistent. Flash forward nearly twenty years later, and it seems that the key consideration is no longer whether such technology can be created—although warp speed may need more research and development—but how the technology should be regulated, what infrastructure and security

protocols are required, and what the operational safety protocols and usage of technological breakthroughs will be in such advanced-technology eras.

Artificial intelligence (“AI”) and machine learning are poised to become major catalysts to transform the field of law. These technologies represent a turning point across a diverse array of fields and necessitate a proactive and robust regulatory infrastructure capable of handling imminent issues, pitfalls, and other problems. There is no question that the current regulation on AI is insufficient. However, even the current calls for enhanced regulation are inadequate; Substantial preparation must be done for potential impending developments. Congress needs a structured plan in place that is well adapted to deal with the multiple forms and styles of artificial intelligence. This note will discuss the theories behind current law and explain why improved legislation and regulation strategies are needed to incentivize innovation during a time of rapid development and technological advancement.

II. THE PHILOSOPHY AND ETHICAL DILEMMAS SURROUNDING THE REGULATION OF AI AND MACHINE LEARNING AS IMPLEMENTED IN BRAIN-MACHINE INTERFACES, SELF-DRIVING VEHICLES, AND OTHER CYBERNETIC TECHNOLOGY.

New advancements, implementations of artificial intelligence, and machine-learning logic software have begun to seriously impact the technology sector. These new technological software developments, in conjunction with hardware advancements¹ have all just scratched the surface

1. Various types of advancements include: (1) Brain-computer interfaces (“BCI”) that allow brain signals to control externalities like a cursor or prosthetic limb. Max Krucoff et al., *Enhancing Nervous System Recovery Through Neurobiologics, Neural Interface Training, and Neurorehabilitation*, FRONTIERS IN NEUROSCIENCE 1 (Dec. 27, 2016), <https://www.frontiersin.org/articles/10.3389/fnins.2016.00584/full> [<https://perma.cc/FG2L-3JBN>]; (2) deep learning neural networks that mimic the human brain by using knowledge and examples to generate an output which in turn allows a machine to “adapt and learn without having to be reprogrammed,” *Neural Networks and Deep Learning Explained*, W. GOVERNORS UNIV. BLOG (Mar. 10, 2020), <https://www.wgu.edu/blog/neural-networks-deep-learning-explained2003.html#close> [<https://perma.cc/X24Q-KAFY>]; (3) various advancements in 3D vision with hardware such as “a system-on-a-chip (SoC) [that] can integrate ARM processors, neural processors, and FPGA fabrics all in one, allowing a whole series of 3D processing pipelines to run on the chip. This multiplicity of new onboard processing devices allows more intensive 3D image processing operations to run inside 3D scanning devices[.]” John Lewis, *Advances in 3D Vision Tackle Tough Automation Challenges*, ASS’N FOR ADVANCING AUTOMATION (Mar. 18, 2022), <https://www.automate.org/industry-insights/advances-in-3d-vision-tackle-tough-automation-challenges> [<https://perma.cc/FP7T-TF7T>]; (4) Quantum computers with processing power capable of performing tasks using “all possible permutations simultaneously . . . to achieve results that are not possible to achieve with classical computers,” Ahmed Banafa, *Quantum Computing and AI: A Transformational Match*, OPENMIND BBVA (Mar. 15, 2021), <https://www.bbvaopenmind.com/en/technology/digital-world/quantum-computing-and-ai/> [<https://perma.cc/X2SN-L4AU>]; and (5) Lidar for autonomous vehicle vision detection as well as radar

and have already stirred up plenty of controversy.² The legal field also will feel the impact of AI, as there are already discussions of using it to render case judgements to alleviate pressure on an overburdened court system. Such discussions are based on the notion that, unlike humans, algorithms are not susceptible to outside noise, and therefore will come to the same conclusion when faced with the same problem twice and consequently improve outcome reliability.³ There is no question that these new innovations necessitate regulation across the legal spectrum, spanning from intellectual property (“IP”) and contract to criminal and constitutional law.

Artificial Intelligence: Background and Current Regulation

Today, few specific laws or regulations exist surrounding the usage and development of artificial intelligence. Ethical concerns surrounding AI are ever-present. Many proponents of AI technology, such as Elon Musk and other developers, are requesting that Congress avoid waiting for a crisis or disaster to modify existing regulation or implement new laws, and instead, act proactively rather than reactively when dealing with artificial intelligence and machine-learning technologies.⁴ In August of 2018, the John S. National Defense Authorization Act created the National Security Commission on Artificial Intelligence “to consider the methods and means necessary to advance the development of artificial intelligence, machine learning, and associated technologies to comprehensively address the national security and

improvements and camera detection. Joseph Keller, *Consumer Devices Ready to Revolutionize the Optics Industry*, INVESTING NEWS NETWORK (May 4, 2020, 2:00 PM), <https://investingnews.com/innspired/camera-technology-revolutionizing-optics-industry-consumer-devices/> [https://perma.cc/5DD8-J2JF].

2. Liam Drew, *The Ethics of Brain-Computer Interfaces*, NATURE (July 24, 2019), <https://www.nature.com/articles/d41586-019-02214-2> [https://perma.cc/9JPQ-QLNW]; *Deep Learning*, IBM (May 1, 2021), <https://www.ibm.com/cloud/learn/deep-learning> [https://perma.cc/GT8E-MJKM]; James Morris, *Self-Driving Cars Won't Go Mainstream Until We Solve This Problem*, FORBES (Feb. 13, 2021, 5:15 AM), <https://www.forbes.com/sites/jamesmorris/2021/02/13/self-driving-cars-wont-go-mainstream-until-we-solve-this-problem/?sh=56be11b42f3b> [https://perma.cc/CYM9-QS7S].

3. See, e.g., *How AI-based Systems Can Improve Medical Outcomes*, KNOWLEDGE AT WHARTON (Dec. 12, 2018), <https://knowledge.wharton.upenn.edu/article/ai-based-systems-can-improve-medical-outcomes/> [https://perma.cc/27MD-UT94]. There, an FDA approved AI was used to detect diabetic retinopathy as well, if not better than, humans. *Id.* “As with other machine-learning innovations involving imaging and diagnosis, the machines are beginning to perform as reliably, or more reliably, than the humans.” *Id.*

4. Cf. Sam Shead, *Elon Musk Says DeepMind Is His ‘Top Concern’ When It Comes to A.I.*, CNBC (July 29, 2020, 5:57 AM), <https://www.cnbc.com/2020/07/29/elon-musk-deepmind-ai.html> [https://perma.cc/LS6N-HDEY] (detailing Musk’s concerns); Brandon Gomez, *Elon Musk warned of a ‘Terminator’-like AI apocalypse — now he’s building a Tesla robot*, CNBC MAKE IT (Aug. 24, 2021, 10:31 AM), <https://www.cnbc.com/2021/08/24/elon-musk-warned-of-ai-apocalypsenow-hes-building-a-tesla-robot.html> [https://perma.cc/7U8G-DMDW] (same).

defense needs of the United States.”⁵ On January 7, 2019, following an Executive Order on Maintaining American Leadership in Artificial Intelligence on February 11, 2019,⁶ the White House’s Office of Science and Technology Policy released draft Guidance for Regulation of Artificial Intelligence Applications. This draft contains ten principles including, but not limited to, public trust, participation, risk assessment, disclosure, transparency, and security.⁷ These principles are intended to be used as guidelines for United States agencies when deciding whether and how to regulate AI.⁸ In response, the National Security Commission on Artificial Intelligence published a report emphasizing the areas where action is necessary while upholding the White House’s Ten Principles,⁹ and the Defense Innovation Board has issued recommendations on the ethical use of AI.¹⁰ A year later the White House Administration called for comments on regulation in another draft of its Guidance for Regulation of Artificial Intelligence Applications.¹¹ In response, Congress employed other means, such as the National Artificial Intelligence Initiative Act of 2020. This Act, which became law in January 2021, is meant to accelerate AI research and develop security measures in preparation for future integration across all sectors of society.¹²

With this new focus on AI, Congress began positioning itself to pass regulations confronting the potential challenges arising from such technology. Although this is a step in the right direction, more legwork is needed to tackle the complex and multifaceted problems that AI creates. The next step is to determine whose or what ethics will be determinative. Because AI is primarily being used as a commercial tool for businesses and technology advancement,¹³ the first ethical source of interest is creating the

5. NSCAI, <https://www.nscai.gov> [<https://perma.cc/K44L-JVU3>] (last visited Dec. 17, 2021).

6. Exec. Order No. 13,859, 84 Fed. Reg. 3967 (Feb. 11, 2019).

7. *AI Update: White House Issues 10 Principles for Artificial Intelligence Regulation*, INSIDE TECH MEDIA (Jan. 14, 2020), <https://www.insidetechnia.com/2020/01/14/ai-update-white-house-issues-10-principles-for-artificial-intelligence-regulation/> [<https://perma.cc/U9KG-U5PG>].

8. *Id.*

9. NAT’L SEC. COMM’N ON A.I. (NSCAI), FINAL REPORT (2021), <https://www.nscai.gov/wp-content/uploads/2021/03/Full-Report-Digital-1.pdf> [<https://perma.cc/UD5S-NBGY>].

10. David Vergun, *Defense Innovation Board Recommends AI Ethical Guidelines*, U.S. DEP’T OF DEFENSE (Nov. 1, 2019), <https://www.defense.gov/News-Stories/Article/Article/2006646/defense-innovation-board-recommends-ai-ethical-guidelines/> [<https://perma.cc/T88V-LEHL>].

11. Memorandum from Russel T. Vought, Dir. of the Off. of Budget & Mgmt., for the Heads of Executive Dep’ts & Agencies (Nov. 17, 2021), <https://www.whitehouse.gov/wp-content/uploads/2020/11/M-21-06.pdf> [<https://perma.cc/6U78-88CE>].

12. National Defense Authorization Act for Fiscal Year 2020, 116 Pub. L. No. 92, 133 Stat. 1198.

13. “Around the world, businesses today are leveraging AI-enabled processes for better sales prediction, enhanced product recommendation engines, warehouse automation and building the e-

greatest utility, or usefulness. Similarly, given the potential consequences or concerns discussed later in this paper, deontological values such as privacy, liberty, and other basic human rights will reflect what type of regulations should be adopted.¹⁴ The relative importance of these factors will depend on how intertwined the AI is with each particular right and the inherent risks associated with the technology.

The Legal and Ethical Issues with AI Generally

Current AI technology is meant to augment human decision-making, resulting in fewer mistakes and increased efficiency. In an ideal world, AI would be free of errors. However, pragmatically, computers get bugs, input data can be biased, and as a result, mistakes happen. Using AI as a replacement for human decision-making presents new risks and unforeseeable consequences. The types of mistakes computers make can differ from those made by people because an AI can propagate human errors in data selection or coding through iteration, amplifying the overall bias or effect. AI that is poorly regulated risks stifling the development and implementation of useful AI solutions. Designing a regulatory scheme based on speculative or unknown risks is not the most effective means to regulate AI. Devising a regulatory plan or set of general principles that can be used to assess the utilization of AI is a better long-term strategy.

Advancements in AI are ethical minefields laden with dangerous possibilities with each new step forward.¹⁵ In response, larger companies and industries have released general protocols and guidelines for AI. Companies such as Google, Microsoft, and Facebook have all developed public standards for their use of AI systems.¹⁶ The idea is predicated on the notion that AI is so different and versatile that the only way to regulate it is to see

commerce platforms of tomorrow. Amazon, Alibaba and eBay, among countless others, have significantly transformed their market strategy owing to advancements in AI.” Jacob William, *Major Advances in AI That Businesses Should Keep an Eye On*, FORBES (Nov. 19, 2020, 7:00 AM), <https://www.forbes.com/sites/forbesbusinesscouncil/2020/11/19/major-advances-in-ai-that-businesses-should-keep-an-eye-on/?sh=d8582df53c6d> [https://perma.cc/5HN4-2A23].

14. See *infra* Section II.B.

15. For further discussion on some of the concerns surrounding AI, see, for example, Kathleen Walch, *Ethical Concerns of AI*, FORBES (Dec. 29, 2019, 1:00 AM), <https://www.forbes.com/sites/cognitiveworld/2020/12/29/ethical-concerns-of-ai/?sh=43d6196c23a8> [https://perma.cc/6XZP-5HZN].

16. See AI.GOOGLE, <https://ai.google> [https://perma.cc/XU6X-YN4S] (last visited Jan. 8, 2022); Deepa Seetharaman et al., *Facebook Says AI Will Clean Up the Platform. Its Own Engineers Have Doubts.*, WALL ST. J. (Oct. 17, 2021, 9:17 AM), <https://www.wsj.com/articles/facebook-ai-enforce-rules-engineers-doubtful-artificial-intelligence-11634338184> [https://perma.cc/9BBM-JGNK]; Responsible AI Principles, MICROSOFT, <https://www.microsoft.com/en-us/ai/responsible-ai?activetab=pivot1:primaryr6> [https://perma.cc/C3UJ-X9PU] (last visited Jan. 7, 2022).

where new issues unfold or dilemmas emerge and then adapt rules best suited to the new domain.¹⁷ Along this basis, establishing foundational guidelines that provide a categorical framework to easily develop regulation is a proactive approach that will allow for a smoother transition for dealing with issues when they arise.¹⁸

The Software and Information Industry Association (“SIIA”) is a longtime leading advocate for the education-technology industry’s push for responsible policies at the federal, state, and international level to protect student privacy, close the digital divide, increase funding for education, promote accessible technology, and address other issues that allow the industry to grow.¹⁹ SIIA’s AI principles, for instance, call for companies to evaluate whether: (1) their data and data analytics practices are consistent with universal human rights; (2) they tend to promote human welfare; and (3) they help people develop and maintain virtuous character traits.²⁰ In general, companies that develop AI affecting a person’s life also should have policies and procedures in place to provide transparency, clarification, and fairness.²¹

In situations where AI systems are used for “decisions that affect important aspects of a person’s life, companies should conduct disparate impact analyses to ensure that these uses do not have an unjustified, disproportionate adverse impact on vulnerable populations.”²² Theoretically, these guidelines would function like assessment tools used to categorize and organize, but unfortunately, such guidelines fall short in providing a universal key for all the answers. These general principles do not guide how companies should behave in specific situations. Algorithmic transparency, for instance, is a significant issue at the forefront of legal discussions on AI.²³ For example, people who are denied jobs, refused loans, put on no-fly lists, or denied benefits without knowing why are left without answers or

17. *AI Update*, *supra* note 7.

18. *Id.*

19. SIIA, <https://www.siiia.net> (last visited Jan. 5, 2022).

20. Mark MacCarthy, *The EU Should Not Regulate Artificial Intelligence as a Separate Technology*, FORBES (Feb. 8, 2019, 5:53 PM), <https://www.forbes.com/sites/washingtonbytes/2019/02/08/the-eu-should-not-regulate-artificial-intelligence-as-a-separate-technology/?sh=3ed1570452c9> [<https://perma.cc/U8QV-9LFU>].

21. *See e.g.*, Olga Akselrod, *How Artificial Intelligence Can Deepen Racial and Economic Inequities*, ACLU (July 13, 2021), <https://www.aclu.org/news/privacy-technology/how-artificial-intelligence-can-deepen-racial-and-economic-inequities> [<https://perma.cc/FL9E-AHQP>] (“AI tools have perpetuated housing discrimination, such as in tenant selection and mortgage qualifications, as well as hiring and financial lending discrimination.”).

22. MacCarthy, *supra* note 20.

23. Rowena Rodrigues, *Legal and Human Rights Issues of AI: Gaps, Challenges and Vulnerabilities*, 4 J. RESPONSIBLE. TECH. 4 (2020).

recourse.²⁴ But the decision to disclose is not always straightforward—which is why these situations need to be evaluated on a case-by-case basis. Revealing the source code of a program that evaluates public school teachers for a job or assesses crime-scene evidence for indications of a DNA match could help prevent violations of one’s constitutional right to due process. However, revealing the IRS algorithm for detecting fraud in tax returns or disclosing machine-learning programs that turn intelligence material into actionable insights for national security officials could allow bad actors to game the system. Thus, a general rule that requires source code disclosure would be proper in some cases and disastrous in others.²⁵ Therefore, a risk assessment process which looks both into the nature of the AI and the potential outcome of disclosing such source code is preferable to ensure the framework is flexible and can address the multifaceted nature of AI.

Regulators have already begun to target some of these issues. Currently, the Consumer Financial Protection Bureau is assessing challenges created by alternative data acquisition methods and alternative analytical techniques.²⁶ Conversely, the United States Food and Drug Administration is evaluating what rules should apply to machine-learning, clinical-decision software, and the like.²⁷ Even the United States Department of Defense has initialized ethics-based discussions surrounding the usage of AI in conjunction with fully-autonomous drone operations—looking to see if the decisions made by the operationalized AI in battlefield simulations would adequately represent those made by a commander or general.²⁸

As addressed previously, the ethical issues related to AI cover a broad landscape. For example, based on a synthesis of qualitative research, one study enumerated thirty-nine separate ethical issues elicited as concerns by experts in the fields of AI and ethics.²⁹ For brevity, five key issues are examined here: (1) Misuse of Personal Data (Privacy and Data Protection);

24. *Id.*

25. MacCarthy, *supra* note 20 (“In a similar way, a general rule that machine learning programs must be explainable or they should not be used would be just the right thing in some cases and a serious misstep in others. It is probably a good idea for nurses to take preventive actions based on the discovery that vital signs in premature babies become unusually stable twenty-four hours before the onset of a life-threatening fever, even though no one has a good understanding of the causal mechanism involved. But, a correlation that emerges inexplicably from a machine learning program suggesting that asthma patients with pneumonia are at lower risk of death than other patients should not be used to make hospitalization decisions.”).

26. *Id.*

27. *Id.*

28. *See id.*

29. Bernd Carsten Stahl, *Ethical Issues of AI*, in SPRINGER BRIEFS IN RESEARCH AND INNOVATION GOVERNANCE 35, 35–53 (2021), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7968615/pdf/978-3-030-69978-9_Chapter_4.pdf [<https://perma.cc/P92W-BLK9>].

(2) Potential for Criminal and Malicious Use; (3) Potential Reliance on Inaccurate Data; (4) Unintended and Unforeseeable Outcomes; and (5) Safety and Lack of Accountability/Liability.³⁰ Because AI depends on the acquisition and continuous flow of copious diverse, broad-based, and detailed data, experts believe personal and corporate privacy issues are primary concerns.³¹ From a personal privacy standpoint, AI can potentially link disaggregated data from a large pool of individuals, which could jeopardize the privacy of subgroups of people based on their demographic, socioeconomic, geographic, and behavioral information. In fact, such processes can even compromise the privacy of specific individuals. Keep in mind that currently, the critical concerns regarding privacy rest with the demands and requirements for data acquisition used to fuel AI, storage of such data, and protection of such data from other potential acquirers or users.³² However, concerns have been raised about how AI itself can spawn emotional-based and psychographic-based personal profiles from raw data.³³

Potential malicious usage of data sets developed for AI systems elevates the need for diligent safeguards and state-of-the-art security systems. This issue is important not only out of concern for individuals' protection but is critical for organizations that build and use AI models for more effective and efficient operations, product development, and strategic and tactical decision making. Such models are susceptible to external, malevolent actions, such as hacking and data poisoning. Data poisoning (i.e., implanting false data into competitors' AI data sets) is especially problematic due to its stealthy nature.³⁴ As such, the entire legal environment faces extreme challenges in establishing processes including legislation, disclosure procedures, and standards needed to address such rapidly changing and emerging activities that threaten to violate individuals' rights, undermine confidence in institutions, and disrupt the competitive framework of businesses.

While the sophistication of model algorithms is often cited as the basis for designing accurate AI systems, data accuracy is the foundation upon which all such models function.³⁵ This premise applies to any model that

30. *See id.*

31. Guy Pearce, *Beware the Privacy Violations in Artificial Intelligence Applications*, ISACA NOW BLOG (May 28, 2021), <https://www.isaca.org/resources/news-and-trends/isaca-now-blog/2021/beware-the-privacy-violations-in-artificial-intelligence-applications> [https://perma.cc/6F2S-KZ7G].

32. *Id.*

33. Jianhua Tao & Tieniu Tan, *Affecting Computing: A Review*, in *AFFECTIVE COMPUTING AND INTELLIGENT INTERACTION* 981, 981–95 (2005) (Jianhua Tao et al. eds., 2005).

34. *See* Sue Poremba, *Data Poisoning: When Attackers Turn AI and ML Against You*, SEC. INTEL. (Apr. 21, 2021), <https://securityintelligence.com/articles/data-poisoning-ai-and-machine-learning/> [https://perma.cc/3EBC-26QA].

35. *Looking to Maximize the Quality of AI Throughput? Think Data Accuracy*, CLAIM GENIUS BLOG (March 20, 2020), <https://claimgenius.com/data-accuracy/> [https://perma.cc/Z7CC-LAGS]; *see*

uses acquired data (even objective, quantitative data) to correlate other data and predict outcomes (often intended or actual behaviors). Even tracking data is subject to inaccuracies, such as incomplete tracking, tracking overrides, inflated/false positives, incomplete/partial/missing components, and lethargic updating.³⁶ Data inaccuracy is particularly problematic in AI systems because: (1) the input data is often presumed to be completely reliable; (2) AI algorithms built on inaccurate data have the capability to compound the inaccuracy; and (3) error detection in AI systems may be revealed only after a serious and possibly dangerous mishap occurs.³⁷

While some elements of the future are accurately predictable, most are not. Furthermore, such accuracy is inversely related to the predictive horizon. That is, a prediction of something to occur tomorrow is likely to be more accurate than one made for ten years from now, and so on. This is especially true in emerging, complex, and rapidly evolving contexts such as AI. “Unintended Consequences” of new technologies have been a focal point of concern by societies for centuries but have become increasingly more salient due to major advances made in science and technology in the past hundred years.³⁸ AI is clearly a field where several serious unintended consequences have already surfaced such as cyber-terrorism, warfare, and competitive sabotage.³⁹ However, while the potential future negative impacts that could result from AI are speculative, some are quite serious. The following are examples of potential impacts that some experts identify as problematic: (1) accelerated hacking;⁴⁰ (2) individual autonomy and freedom of choice gradually erode;⁴¹ (3) AI will be programmed to do harm to specific

also Henry Schuck, *Why Data Accuracy Is Critical to the Evolution of Artificial Intelligence in B2B Sales*, FORBES (May 2, 2022, 7:15 AM), <https://www.forbes.com/sites/forbestechcouncil/2018/05/02/why-data-accuracy-is-critical-to-the-evolution-of-artificial-intelligence-in-b2b-sales/?sh=7542c5f4466d> [<https://perma.cc/B5W6-GPYV>].

36. See Amin Shawki, *Top 4 Reasons for Data Inaccuracy*, INFOTRUST (Aug. 25, 2016), <https://infotrust.com/articles/top-4-reasons-for-data-inaccuracy/> [<https://perma.cc/2AE8-VU8W>].

37. See *id.*

38. Authman Apatira, *Ethics and the Unintended Consequences of Technology*, CODING DOJO BLOG (June 1, 2018), <https://www.codingdojo.com/blog/ethics-unintended-consequences-technology> [<https://perma.cc/86R3-Z6GC>].

39. NSCAI, *supra* note 9, at 2 (“States, criminals, and terrorists will conduct AI-powered cyber attacks and pair AI software with commercially available drones to create ‘smart weapons.’”).

40. Bernard Marr, *What Are the Negative Impacts of Artificial Intelligence (AI)?*, BERNARD MARR & CO. (July 2, 2021), <https://bernardmarr.com/what-are-the-negative-impacts-of-artificial-intelligence-ai/> [<https://perma.cc/9VAW-AQZ9>].

41. See *id.*

individuals or subgroups;⁴² and (4) a costly AI “arms race” will emerge among powerful countries to gain/prevent global power.⁴³

In addition, job displacement is becoming a growing concern considering the technological leaps made by AI. Bloomberg reports that “more than 120 million workers globally will need retraining in the next three years due to artificial intelligence’s impact on jobs, according to an IBM survey.”⁴⁴ Issues arise surrounding whether the government should step in to help the transition. As discussed in Section II, making such a decision will depend on risk assessment and iterative feedback regulation strategies. One of the biggest challenges with AI is that it is always evolving and changing. The very nature of machine learning is amplified evolution. Because it can develop quickly, ex post facto regulation stands no chance of keeping pace unless changes are made and tools are created to generate regulation efficiently to keep pace.

EMERGING TECHNOLOGIES AND THE SUBSEQUENT REGULATION
DILEMMAS—EXAMPLES OF THE AI LEGAL AND ETHICAL ISSUES ACROSS
THE LEGAL LANDSCAPE

1. Product Liability and Autonomous Vehicles

The combination of safety when using machines that operate using AI and the corresponding accountability and liability of failures is a primary

42. Cheng-Tek Tai, *The Impact of Artificial Intelligence on Human Society and Bioethics*, 32 TZU CHI MED. J. 339, 340–41 (2020).

43. See Gonenc Gurkaynak et al., *Stifling Artificial Intelligence: Human Perils*, 32 COMPUT. L. & SEC. REV. 749–58 (2016).

44. Shelly Hagan, *More Robots Mean 120 Million Workers Need to Be Retrained*, BLOOMBERG (Sept. 5, 2019, 11:00 PM), <https://www.bloomberg.com/news/articles/2019-09-06/robots-displacing-jobs-means-120-million-workers-need-retraining> [<https://perma.cc/DL6F-8E4J>].

concern for developers of automobiles and other transport vehicles, medical delivery systems, and other autonomous products and delivery systems that directly interact with humans.⁴⁵ The critical legal question is who should be held responsible for errors caused by the AI facet of the product or service provided.⁴⁶ For example, determining who is to blame when a self-driving car hits and kills a pedestrian while attempting to avoid a minor collision with a truck is inherently challenging. Should it be the owner who implicitly accepts the risks of operating an AI vehicle? The auto producer who manufactured and or sold the car? The AI system developer? All of the above? Determining what factors could shift the blame from one party to another is equally challenging. Should we follow the credit-card model of assigning responsibility to some actors and protecting others or should we allow market players to sort it out through contracts? What if the condition is more closely akin to the moral quandary posed by the classic “Trolley Dilemma?” In a nutshell, is it morally proper for someone to save several lives by sacrificing an innocent “other,” who at the time is at no risk of harm? In other words, if an AI system is programmed to follow the basic utilitarian model that “it is better to avoid a collision that could result in multiple injuries by hitting a single person on the sidewalk,” what would be the responsibility consequences when the AI hits that single person? What makes the Trolley Dilemma even more complex is that the more detached the decision maker is from the decision to sacrifice the innocent bystander, the more acceptable the decision seems to be to others. So, what decision-making model should be programmed in autonomous, human-interactive AI products and systems, and who is accountable even when such models perform properly, yet cause physical harm or monetary damages? In autonomous vehicles, the manufacturer of a driverless car may be held liable for injuries caused by its software, but this is a technical question that faces many different challenges.⁴⁷

45. See Stahl, *supra* note 29.

46. See generally William Tanenbaum et al., *Theories of AI liability: It's Still About the Human Element*, REUTERS (Sept. 20, 2022, 11:53 AM), <https://www.reuters.com/legal/litigation/theories-ai-liability-its-still-about-human-element-2022-09-20/> [<https://perma.cc/R7MD-2RKM>] (“Many AI companies use AI-developer favored allocations of risk in relevant contracts, but these contractual provisions have not been tested in a court of law. There are other contractual liabilities that could arise for the AI system and the AI-developer: liabilities arising from the breach of a condition or certain warranties in the contract such as the implied warranty of fitness or quality of AI system. . . . [T]he nascent nature of AI applications across various sectors limit the application of the traditional liabilities on AI systems, which may be addressed when authorities implement a regulatory framework for AI liabilities (e.g., the European Commission’s proposed rules to regulate AI, and the U.S. Consumer Product Safety Commission’s AI regulatory initiatives).”).

47. *Id.* (“First, the legal issue for [product liability] or [strict liability] of AI systems is whether the AI’s defect existed when it left the control of the manufacturer or developer. The technical issue lies in

The question becomes a balance of whether the regulation of such technology would make people safer or whether it will slow the adoption of technology that makes people safer. Autonomous driving technology brings with it numerous safety and economic benefits because it has the potential to remove human error while driving.⁴⁸ Recently the National Highway Traffic Safety Administration passed a new regulation for autonomous vehicles that is set to take effect in September 2022.⁴⁹ However, the regulation's grounds are narrow, merely taking the already existing standards for non-autonomous vehicles and supplanting them with self-driving cars.⁵⁰ The new rule leaves the software and decision-making logic of autonomous vehicles untouched and unrestricted.⁵¹ In addition, states vary on how they regulate self-driving cars; some states like Florida take a hands-off approach, and other states such as California implement strict requirements.⁵² Given that driving and accidents affect interstate commerce, there is a strong possibility that the federal government could regulate self-driving cars because driving affects interstate commerce. Since AI self-driving vehicles have the potential to

the inherent adaptive nature of AI: AI is constantly evolving in its analytical capacity by continuously amassing more data for it to analyze and build its predictive model from its use.”).

48. Steve Schwartz, *Are Self-Driving Cars Really Safer than Human Drivers?*, THE GRADIENT (Jun. 13, 2021), <https://thegradient.pub/are-self-driving-cars-really-safer-than-human-drivers/> [https://perma.cc/5KV2-P4DV] (citing Automated Vehicles for Safety, NHTSA, <https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety>) (“Automated vehicles’ potential to save lives and reduce injuries is rooted in one critical and tragic fact: 94% of serious crashes are due to human error. Automated vehicles have the potential to remove human error from the crash equation, which will help protect drivers and passengers, as well as bicyclists and pedestrians. When you consider more than 35,000 people die in motor vehicle-related crashes in the United States each year, you begin to grasp the lifesaving benefits of driver assistance technologies. Automated vehicles could deliver additional economic and additional societal benefits. A NHTSA study showed motor vehicle crashes in 2010 cost \$242 billion in economic activity, including \$57.6 billion in lost workplace productivity, and \$594 billion due to loss of life and decreased quality of life due to injuries. Eliminating the vast majority of motor vehicle crashes could erase these costs.”).

49. Occupant Protection for Vehicles with Automated Driving Systems, 49 C.F.R. § 571 (2022).

50. 49 C.F.R. § 571.5(a) (“NHTSA identified the narrow scope of the NPRM clearly and has retained that scope for this final rule. Although the agency is sympathetic to many of the suggestions from CAS, CR, NSC and IIHS that NHTSA should focus on other vehicle safety issues and technologies, the agency believes it remains appropriate to finalize today’s action on the narrow grounds identified in the NPRM, while continuing its other research and ongoing rulemaking actions on the issues identified by those commenters, including those related to ADS performance and ADAS technologies.”).

51. *Id.*

52. See 2019 Legis. Bill Hist. Fla. H.B. 311, <https://flsenate.gov/Session/Bill/2019/311/BillText/er/PDF> [https://perma.cc/BZ2H-3B7U] (Florida allows Level 4 and 5 autonomous cars “to operate in this state regardless of whether a human operator is physically present in the vehicle.”); cf. Roy Furchgott, *Public Streets Are the Lab for Self-Driving Experiments*, N.Y. TIMES (Dec. 23, 2021), <https://www.nytimes.com/2021/12/23/business/tesla-self-driving-regulations.html> [https://perma.cc/VU43-TFD5] (stating that California is one of the stricter states as it relates to autonomous vehicles because it has a 132-page standards document for autonomous operation covering permits, insurance, data sharing and a requirement for a driver competent to operate the vehicle).

improve the overall safety of driving,⁵³ the costs of overregulation would likely stifle the development of even safer autonomous driving vehicles. All things considered, it is in the federal government's best interest to use the states as laboratories of democracy and make its determination based on the individual successes or failures of the states before developing a nationwide regulative scheme for autonomous vehicles.

It is important to keep in mind that other security concerns such as terrorism and hacking may emerge that alter the safety levels of autonomous vehicle technology that play a role in the safety and moral calculus which have not been considered. This includes cyber-terrorism, a different kind of terrorism that targets technology, networks, and communication which has emerged in the past decade.⁵⁴ Cyber-terrorism is more than a matter of inconvenience. Anything that runs on networking technology is susceptible to cyber hackers who can completely disable networking organizations.⁵⁵ This could potentially pose an issue for the autonomous vehicle industry because self-driving cars are expected to communicate with one another and drive themselves. Anyone able to hack into the system could cause catastrophes with virtual anonymity. Ultimately, the networking computer systems on the self-driving cars would likely need to have a fail-safe level of security to prevent possible attacks from cyber terrorists.

2. Artificial Intelligence and Intellectual Property

AI is a tool that functions like a catalyst, increasing the rate of discovery and innovation. “[IP] systems have been designed to incentivize *human* innovation and creation. Until very recently, such innovation and creation consisted of one of the defining characteristics of the human species.”⁵⁶ AI is challenging but simultaneously full of potential because it is novel, complicated, multifaceted, dynamic, and covers a wide range of practice areas including, but not limited to, personalized medicine, neuroscience

53. In 2015, the U.S. Department of Transportation reported that nearly 94% of fatal crashes are due to human error. Many major automobile companies “regard autonomous cars with the hope that they will save lives by being involved in far fewer accidents—resulting in fewer injuries and deaths than those for which human-driven cars are infamous.” Hussain Kanchwala, *Are Autonomous Cars Really Safer than Human-Driven Cars?*, SCIENCE ABC (July 8, 2022), <https://www.scienceabc.com/innovation/are-automated-cars-safer-than-human-driven-cars.html> [<https://perma.cc/J6AK-7QB2>].

54. Eric Weiner, *Interview: Robert Bain and Dan Verton Discuss How Real the Threat of Cyberterrorism Is and What Can Be Done to Prevent Such an Occurrence*, NPR (Aug. 31, 2002, 12:00 AM), <https://www.npr.org/templates/story/story.php?storyId=1149299> [<https://perma.cc/7XTM-RU3F>].

55. *Id.*

56. *Artificial Intelligence and IP*, WORLD INTELL. PROP. ORG., https://www.wipo.int/about-ip/en/artificial_intelligence/policy.html [<https://perma.cc/6FUW-RJ5K>] (last visited Sept. 27, 2022) (emphasis added).

BCIs, autonomous vehicles, cyber security, imaging, art, music, and diagnostics.⁵⁷ As AI continues to emerge as a general-purpose technology with widespread applications throughout the economy and society, it poses fundamental questions that sit at the heart of the existing IP systems. Does AI need I.P. incentives to innovate and create? How should the value of human invention and creation be balanced against AI innovation and creation? Does the advent of AI require changes to the existing IP frameworks? And, lastly, do the existing IP systems need to be modified to provide balanced protection for machine created works and inventions, AI itself, and the data AI relies on to operate?

One important question surrounding machine learning and artificial intelligence is whether AI will ever receive its own rights. AI is already capable of creating works that appear to be copyrightable, but courts and the copyright office consistently refuse to grant authorship status.⁵⁸ Similarly, there is an ongoing debate surrounding whether a computer utilizing artificial intelligence will ever be able to acquire U.S. patent rights.⁵⁹ In the recent case *Thaler v. Hirshfeld*, a judge for the District Court for the Eastern District of Virginia determined that an AI could not acquire patent rights.⁶⁰ *Thaler* has been around the world, securing only one win so far in South Africa.⁶¹ *Thaler's* goal was not to secure a win in the courtroom but to

57. Roger Brown, *Where is Artificial Intelligence Used Today?*, BECOMING HUMAN: A.I. MAG. (Dec. 4, 2019), <https://becominghuman.ai/where-is-artificial-intelligence-used-today-3fd076d15b68> [<https://perma.cc/EG6P-3GQ5>].

58. Current AI technology already exists that can create various copyrightable works such as music, artwork, and news articles. See GPT-3, *A Robot Wrote this Entire Article. Are You Scared Yet, Human?*, THE GUARDIAN (Sept. 8, 2020, 4:45 AM), <https://www.theguardian.com/commentisfree/2020/sep/08/robot-wrote-this-article-gpt-3> [<https://perma.cc/7D5J-QH2D>] (where an AI wrote an entire news article); Jane Recker, *U.S. Copyright Office Rules A.I. Art Can't Be Copyrighted*, SMITHSONIAN MAG., (Mar. 24, 2022), <https://www.smithsonianmag.com/smart-news/us-copyright-office-rules-ai-art-cant-be-copyrighted-180979808/> [<https://perma.cc/XX2K-XB8D>] (where an AI created a work of art that simulated a near death experience, and where an algorithm repurposed pictures to create images seen by a synthetic dying brain; “[T]he USCO found the ‘human authorship’ element was lacking and was wholly necessary to obtain a copyright.”); *Thousands of Staff-Picked Royalty-Free Music Tracks for Streaming, Videos, Podcasts, Commercial Use and Online Content*, MUBERT, <https://mubert.com/> (last visited Sept. 27, 2022) (where Mubert is a music AI that can create music based on millions of samples from hundreds of artists).

59. See *Thaler v. Hirshfeld*, 558 F. Supp. 3d 238, 247 245 (E.D. Va. 2021), *aff'd sub nom.* *Thaler v. Vidal*, 43 F.4th 1207 (Fed. Cir. 2022).

60. *Id.* *Thaler* created a “creativity machine” called DABUS that “invented” a beverage container and a “device for attracting enhanced attention.” *Id.* at 241. The U.S. Patent and Trademark Office rejected the applications for failure to list a person as inventor, and *Thaler* appealed to the district court. The district court held that only humans and not AI machines can get a U.S. patent—construing the term “individual” in the Patent Act narrowly to not encompass artificial intelligence. *Id.* at 245.

61. Samantha Handler, *Federal Circuit Panel Balks at Accepting AI as Inventor*, BLOOMBERG (June 6, 2022, 12:11 PM), <https://news.bloomberglaw.com/ip-law/federal-circuit-panel-balks-at-accepting-ai-as-inventor> [<https://perma.cc/7WK4-C8HW>].

modernize laws and raise awareness.⁶² Presently, decentralized autonomous organizations (“DAOs”) are likely next in line to challenge what constitutes an inventor.⁶³ DAOs are human run collective “entit[ies] that use[] blockchains, digital assets and related technologies to direct resources, coordinate activities and make decisions,” and naturally, issues arise with such entities that challenge the status quo.⁶⁴

Even though the District Court and the Federal Circuit favored a narrower interpretation of the Patent Act in *Thaler*, this paper suggests an objective categorical framework be created to come to grips with anticipated developments in technological innovation. Limiting inventorship to the original inventor of the AI is one potential solution, but it could become a tricky endeavor. If artificial intelligences were to invent more artificial intelligences, and so on, inventorship would become so far removed from the original inventor that it would be akin to saying that Thomas Edison’s great-grandparents invented the lightbulb instead of Edison himself. The creative insights and toil that go into an invention are the essence of what makes an invention valuable. AI like DABUS, the AI at issue in *Thaler*, trained with general information in the field of endeavor that independently creates an invention, deserves some form of recognition or form of ownership and therefore should be able to receive some sort of patent rights. What is needed is an AI bill of rights to provide, thereafter, the foundation for other secondary rights such as patent ownership. Such a framework would allow policymakers and judges to render decisions that both align with these rights and coincide with policy-related values.

AI, like *Thaler’s* DABUS, is potentially at odds with the fundamental principles surrounding patent law—inc incentivizing initial inventors to disclose their ideas earlier rather than later to achieve a faster pace of innovation in return for a brief period of exclusivity.⁶⁵ “[IP] systems have been designed to incentivize *human* innovation and creation. Until very recently, such

62. *Id.*

63. Chris Katopis, *Blockchain IP: DAOs Are Innovative—But Will They Be Inventors?*, IPWATCHDOG (Aug. 10, 2022, 5:15 PM), <https://www.ipwatchdog.com/2022/08/10/blockchain-ip-daos-innovative-will-inventors/id=150806/> [<https://perma.cc/AK59-AGS3>] (“A corporation may have employees who are the true inventors, but they may have an obligation to assign the resulting patent instrument to the organization. The legal inquiry at the heart of this issue is whether a DAO may be the digital tree that provides ‘the fruits of intellectual labor.’”).

64. *Id.*

65. “A patent grants the patent holder the exclusive right to exclude others from making, using, importing, and selling the patented innovation for a limited period of time.” *Patent Overview*, LEGAL INFO. INST. CORNELL L. SCH., <https://www.law.cornell.edu/wex/patent> [<https://perma.cc/WZ5W-RJQ8>] (last visited Sept. 27, 2022); *see also* U.S. CONST. art. I, § 8, cl. 8.

innovation and creation consisted of one of the defining characteristics of the human species.”⁶⁶

With further development, AI like DABUS is potentially at odds with the fundamental principles surrounding patent law because there is no need to incentivize AI to invent and disclose. Presumably, this statement has two underlying assumptions: (1) that AI will eventually reach a status where it is fully or virtually completely autonomous or independent from humans (i.e., that AI will reach the level of artificial general intelligence or artificial super intelligence capabilities) and (2) that AI is not and will not be concerned with capitalism. Being at the early stages of AI development, these assumptions are not absolute. However, in a hypothetical world where an AI is developed that satisfies both assumptions, the fundamental principles of patent law may become inapplicable to some forms of AI.

Given the current state of the world—technologically, politically, competitively, and communicatively—the definition of IP needs to change, and it cannot be limited to the human intellect. AI can use data to generate content, videos, images, a piece of art, or even a novel—components of both copyrights and trademarks.⁶⁷ For patents, protecting AI inventions poses several challenges to the current IP system. One of the most prominent and disconcerting issues surrounding AI innovation is its potential to reshape the nature of innovation itself. Innovators use machine-learning tools, setting a faster pace for innovation, and AIs also use machine learning to develop innovations.⁶⁸ The balance that a patent system strives to achieve— incentivizing the disclosure of innovation in return for a twenty-year period of exclusivity—needs to be recalibrated given the new tools involved in the innovation, creation, and generation process.⁶⁹ In the future, a special

66. *Artificial Intelligence and IP*, *supra* note 56.

67. *See* sources cited *supra* note 58.

68. *See Thaler*, 558 F. Supp. 3d at 247, 238, 241. Thaler created a “creativity machine” called DABUS that “invented” a beverage container and a “device for attracting enhanced attention.” *Id.*

69. *But see* Daria Kim, ‘AI-Generated Inventions’: Time to Get the Record Straight?, 69 GRUR INT’L 5, 443 (2020) <https://doi.org/10.1093/grurint/ikaa061> [<https://perma.cc/EVD7-T3GY>] (“The real danger of artificial intelligence is not that computers are smarter than us, but that we think [they] are.” . . . Drawing on the extensive literature review, this article depicts AI techniques as methods of computational problem-solving. It emphasi[z]es that such methods should not be equated with a computer’s ‘cognitive autonomy’. Further, it clarifies that the types of AI that have been most debated in the patent law literature – artificial neural networks and evolutionary algorithms – essentially require detailed instructions that determine how the relation between inputs and outputs is derived through computation. Accordingly, it is argued that, as long as computers rely on instructions defined by a human as to how solve a problem, the separation between human and non-human (algorithmic) ingenuity is, in itself, artificial. Ultimately, the article calls for a broader technical inquiry that would elucidate the relevance of the currently debated normative concerns over ‘non-human inventorship’ against the background of the technological state of the art.”) (quoting GARY SMITH, THE AI DELUSION 237 (Oxford Univ. Press 2018)).

allowance for AI needs to be carved out of the patent system to keep up with innovation instead of lagging behind by applying antiquated principles to circumstances that were never anticipated. With new AI tools at inventors' disposal, innovation is likely to accelerate to levels never reached historically. Therefore, as the number of AI inventions increases, perhaps the twenty-year period of exclusivity should be reduced to ten or fifteen years to keep up with the rate of innovation. Another potential solution is to separate inventions that are created by applying AI from those that are not—where inventions that are largely created by AI or contributed largely in part by AI are subject to reduced periods of exclusivity. Overall, the balancing act gets complicated as machines or software are developed that can think and solve problems like human beings. Conversely, the *Thaler* issue surrounding whether AI can achieve patent rights in the first place is more of a constitutional rights interpretation issue involving what constitutes an inventor and whether AIs are individuals instead of a patent law issue. Regardless, if an invention is largely the product of an AI's creative toil, then the period of exclusivity or exclusivity rights should be altered in a corresponding fashion to be on par with the momentum of AI innovation.

3. Automation v. Augmentation and the Legal Landscape

AI is a useful tool for the legal field so long as it is used as a tool and the answers provided by legal AI are not treated as a legal certainty that requires no further investigation. Although the usage and rights of AI is the subject of debate in various legal fields, AI is also a potential tool that can augment legal professionals capacity and efficiency worldwide by reducing litigation times, streamlining research efforts, and even making judicial decisions.⁷⁰ As a powerful and highly adaptive instrument, it can make quick decisions based on various factual inputs and may be able to circumvent some of the clogging the courts experience on a day-to-day basis.⁷¹ As such, judges would be available to focus on less straightforward cases that require a deeper and more complex human analysis. In other words, AI can act as a catalyst to reduce the burden of the judiciary, especially for cases that

70. AI Machine learning researchers have used language models like BERT to train the network with case data and incorporate deep neural network to predict decisions in the judicial system. M. Mahfujur Rahman, *Artificial Intelligence in the Judiciary System*, MEDIUM (Dec. 1, 2021), <https://medium.com/the-future-machine-learning-and-ai/artificial-intelligence-in-the-judiciary-system-61b5d2d0e0e8> [<https://perma.cc/D5JP-9LSP>]. Other functions of AI include similar case matching, judiciary question-answering advice, text summarization, and digitization of documents. *Id.*

71. *See id.*

involve simplistic, menial or easily decided issues/offenses, leaving the more complicated cases for judges.⁷² Although still primarily speculative within the American court systems, slowly, several law firms and judiciaries have already adopted AI in its early forms.⁷³ It provides practical and cost-effective solutions to lawyers by: (1) pointing to legal infirmities in judgements; (2) predicting the outcome and duration of potential litigation based on various data inputs (i.e., the judge, the court, previous similar cases, etc.); (3) aiding in contractual documents; (4) executing due diligence protocols such as checking citations, prior art and other sources; and (5) providing other legal analytic services.⁷⁴ Ross, an AI developed by IBM, has been adopted by many law firms worldwide, particularly in the United States, and is primarily used to vet legal contracts, conduct legal research, and briefly summarize case law, among other things.⁷⁵ Likewise, Linklaters LLP, a multinational law firm, is also developing an AI program, Nakhoda, with the objective of providing effective contract management and structured legal data.⁷⁶ Given the countless advantages that AI brings to the table, there is no doubt that the technology is here to stay and will continue to grow at a rapid pace. While AI is a useful tool, it should never replace the judiciary or attorneys altogether. The law itself is constantly changing and can be applied

72. See Samuel Gibbs, *Chatbot Lawyer Overtakes 160,000 Parking Tickets in London and New York*, THE GUARDIAN (June 28, 2016, 6:07 AM), <https://www.theguardian.com/technology/2016/jun/28/chatbot-ai-lawyer-donotpay-parking-tickets-london-new-york> [https://perma.cc/34AS-3FNV]. “An artificial-intelligence lawyer chatbot has successfully contested 160,000 parking tickets across London and New York for free, showing that chatbots can actually be useful.” *Id.* The chatbot appealed over 4 million dollars’ worth of parking tickets. *Id.*

73. Cecille De Jesus, *AI Lawyer “Ross” Has Been Hired by Its First Official Law Firm*, FUTURISM (May 11, 2016), <https://futurism.com/artificially-intelligent-lawyer-ross-hired-first-official-law-firm> [https://perma.cc/F2JH-TB7F].

74. *Id.*

75. *Id.* (“Law firm Baker & Hostetler has announced that they are employing IBM’s AI Ross to handle their bankruptcy practice, which now consists of nearly 50 lawyers. According to CEO and co-founder Andrew Arruda, other firms have also signed licenses with Ross, and they will also be making announcements shortly. Ross, ‘the world’s first artificially intelligent attorney’ built on IBM’s cognitive computer Watson, was designed to read and understand language, postulate hypotheses when asked questions, research, and then generate responses to back up its conclusions. Ross also learns from experience, gaining speed and knowledge the more you interact with it.”)

76. *About Us // Linklaters > Nakhoda*, LINKLATERS (2021), <https://www.linklaters.com/en-us/about-us/nakhoda> [https://perma.cc/E5WN-932W] (“[Linklaters] believe[s] that the right combination of technology and legal expertise can fundamentally change how legal problems are solved – and, in turn, make legal data a driver for value creation. . . . CreateiQ is a digital contract automation and negotiation platform that captures valuable structured data from legal documents at the source. While many firms can help you draft your contracts, we are the only law firm with proprietary and proven technology to manage, negotiate and settle contracts in one encrypted and secure system. CreateiQ significantly speeds up the contracting process, frees up valuable in-house time to focus on high-value work, and most importantly surfaces commercial data contained in legal documents in a structured format to help institutions to better manage risk and make critical business decisions.”).

in many ways. AI supports a functional approach to law as it is the latest advancement in empirically understanding the contributing factors of the decision-making process. The very nature of the law demands it to be fluid because of the “constant development of unprecedented problems” which requires a dynamic and flexible legal system.⁷⁷ Collectively, for these reasons, AI is already showing promise as a useful tool in the legal field, and it should remain just that—a tool to help make decisions as opposed to being the ultimate decision maker itself.

While proper application of AI is beneficial for attorneys and other legal professionals, there are drawbacks when it comes to the educational gap that exists between legal professionals and the technology. This educational gap refers to the extant knowledge schism between technicians (i.e., AI designers, model developers, programmers, software engineers) and members of the legal profession (i.e., attorneys, judges, legislators, legal support staff). Without an appropriate understanding of the limitations, risks and dangers of AI as a tool, augmentation efforts may turn into automation, resulting in an ignorance-based process for rendering legal conclusions. As the educational gap widens between legal professionals and software engineers who are responsible for AI machine learning and neural networks, the importance of transparency of input data, logic, and status increases.⁷⁸ On the other hand, new developments have led to legal chatbots which provide legal advice to individuals online, looking to help people with basic traffic violations, crime advice, and drafting of basic agreements and contracts.⁷⁹

77. JEROME FRANK & BRIAN BIX, *LAW AND THE MODERN MIND* 6–7 (1st ed. 1930).

78. See Neil Sahota, *Will A.I. Put Lawyers Out of Business?*, FORBES (Feb. 9, 2019, 10:43 PM), <https://www.forbes.com/sites/cognitiveworld/2019/02/09/will-a-i-put-lawyers-out-of-business/?sh=279a2ab331f0> [https://perma.cc/8C3D-SLRA]. Song Richardson, Dean of the University of California-Irvine School of Law, stated the following in an interview with Forbes:

What worries me is that we won't have lawyers who understand algorithms and AI well enough to even know what questions to ask, nor judges who feel comfortable enough with these new technologies to rule on cases involving them," says Richardson. In light of such valid concerns, it is becoming increasingly clear our law schools must prepare tomorrow's lawyers to use the new technology. But even this isn't enough. We also need today's practicing counsel and judges to grasp AI and all it promises to better serve and protect our fellow humans.

Id. Furthermore:

Some law schools, such as Georgia State University School of Law, are experimenting with ways to teach students how to work with AI software. The school's Legal Analytics and Innovation Initiative allows law students to collaborate with computer science and business students. Together, they develop technologies to fix legal problems that, until now, have been unsolvable. For example, they're building a predictive model for civil employment cases.

Brittainy Boessel, *Can AI Be Problematic in the Legal Sector?*, KIRA (Apr. 16, 2020), <https://kirasystems.com/learn/can-ai-be-problematic-in-legal-sector/> [https://perma.cc/CAD8-KEEH].

79. David Lat & Brian Dalton, *The Ethical Implications of Artificial Intelligence*, ABOVE THE LAW (June 15, 2018, 11:42 AM), <https://abovethelaw.com/law2020/the-ethical-implications-of-artificial->

4. Human Integration and Brain Machine/Chip Interfaces

Once again science fiction has turned into reality with Brain-Machine Interfaces (“BMI”) straight out of shows and movies like *Total Recall*, *Altered Carbon*, and *Black Mirror*. Enter Elon Musk’s up-and-coming Neuralink brain interface that can read brainwaves and use them to control externalities such as a video game or synthetic limb.⁸⁰ Human cyborgs are just around the corner. This new era of artificial intelligence and brain chip interfaces will require extensive regulation to ensure that foundational principles rooted in the First Amendment—freedom of speech, property rights, privacy, due process and beyond^{81,82}—are not violated.

A BMI decodes direct brain signals from firing neurons into commands a machine can understand.⁸³ Using either an invasive method—a chip implanted directly in the brain—or non-invasive neuroimaging tools, it lets the machine extract raw data from the brain and translate it to action in the outside world.⁸⁴ The user can simply think about turning left or right, moving an immobile limb, or command a smartphone to perform various tasks.⁸⁵

Although BMIs are relatively new pieces of technology, machine-learning, operating software like the one Neuralink uses has been around for nearly half a century.⁸⁶ According to the Neuralink website, the company is “building devices now that will help people with paralysis and inventing new technologies that will expand our abilities, our community, and our world.”⁸⁷ Attached to the chip are wires thinner than a human hair, which reach out into the brain. These threads are placed close to important parts of the brain and can detect messages as they are relayed between neurons, recording each impulse, and stimulating their own.⁸⁸ This device was implanted in a macaque named Pager who played pong using only his mind for a delicious

intelligence/ [https://perma.cc/SVD9-878H] (“These chatbots can be very helpful to consumers, especially consumers who cannot afford the high cost of hiring a lawyer, and they could help bridge the yawning ‘justice gap’ that exists in both the United States and around the world. But they do raise the issue of unauthorized practice of law, especially if the chatbot or other tool is created or maintained by an attorney.”).

80. *About*, NEURALINK, <https://neuralink.com/about/> (last visited Sept. 28, 2022).

81. U.S. CONST. amend. I, V, XIV.

82. U.S. CONST. amend. I.

83. Mikhail A. Lebedev & Miguel A. L. Nicolelis, *Brain-Machine Interfaces: From Basic Science to Neuroprostheses and Neurorehabilitation*, 97 *PHYSIOLOGICAL REVIEWS* 767, 770 (2017), <https://journals.physiology.org/doi/full/10.1152/physrev.00027.2016>.

84. *Id.*

85. *Id.*

86. *Id.*

87. *About*, NEURALINK, *supra* note 80.

88. *Id.*

banana smoothie.⁸⁹ The device monitored the macaque’s brain activity while playing the game with a joystick and learned the patterns and signals that corresponded with movements of the cursor.⁹⁰ Thereafter, the joystick was removed from the test, and Pager was able to play pong with only his mind.⁹¹ Trials were also done on pigs using the Neuralink in a similar fashion to predict and measure the movement of their limbs.⁹² The idea is that the Neuralink will be able to transmit signals to other parts of the body to effectively “rewire” the human body for those who are paralyzed and cannot control their extremities.⁹³

Regulations and laws echo developments in technology but often lag. While regulations are not yet in place regarding Neuralink, the concerns surrounding the technology, AI, and software suggest that regulations will be coming soon. Although some of the concerns are speculative, several crucial considerations and risks come to light when evaluating the potential implications of Neuralink in society. These concerns include: terrorism, vulnerability, cybersecurity, privacy, general fear, invasiveness, availability, scholastics/learning, and widening of the professional socioeconomic gap.⁹⁴

The invasiveness of such a device implicates the ultimate invasion of a person’s privacy and can be detrimental if such privacy is breached. Other issues, directly extrapolated from science fiction films, may eventually become legal focal points. Should a government or organization be permitted to use BMI to increase army lethality? What safeguards are in place to protect BMIs from being infiltrated by hackers? Researchers have already demonstrated that the bi-directional communication channel generated in a BMI may be used to “hack the brain” and retrieve pin codes, dates, home locations, and facial recognition of known people.⁹⁵ BMI may be utilized in

89. *Monkey Mindpong*, NEURALINK (Apr. 8, 2021), <https://neuralink.com/blog/monkey-mindpong/> [<https://perma.cc/VL7T-5D8P>].

90. *Id.*

91. *Id.*

92. *Id.*

93. Although the test trials on pigs, monkeys and other animals proved to be successful and the animals were alive and fully functional, these trials still faced heavy criticism from groups such as PETA. Press Release, PETA, PETA’s Response to Neuralink Video of Monkey Appearing to Play Video Game (Apr. 9, 2021), <https://www.peta.org/media/news-releases/petas-response-to-neuralink-video-of-monkey-appearing-to-play-video-game/> [<https://perma.cc/J957-UBJ9>] (“PETA—whose motto reads, in part, that ‘animals are not ours to experiment on’—opposes speciesism, a human-supremacist worldview.”).

94. Liam Drew, *The Ethics of Brain-Computer Interfaces*, NATURE (July 24, 2019), <https://www.nature.com/articles/d41586-019-02214-2> [<https://perma.cc/H2Y8-PL5W>].

95. Marcello Ienca & Pim Haselager, *Hacking the Brain: Brain-Computer Interfacing Technology and the Ethics of Neurosecurity*, 18 ETHICS & INFO. TECH. 117, 117 (2016), <https://link.springer.com/article/10.1007/s10676-016-9398-9>.

the future to detect cognitive intent and even to initiate actions that the individual did not want to perform.⁹⁶

However, BMI has the potential to be a game-changer in rehabilitative medicine. Patients with severe musculoskeletal diseases, including paralysis, can use BMI systems to control an iPad, play computer games, turn on and off lights, play the piano, or eat from a fork held by a robotic arm.⁹⁷ Similarly, direct-brain stimulation where the brain is activated or inhibited using electricity can greatly improve a person's ability to see or hear; it also can be used to impact people's behaviors, self-perception, and comprehension of their environment.⁹⁸ Deep-brain stimulation, which is strongly related to BMI, is being successfully used to reduce symptoms of major neurological dysfunction in illnesses like Parkinson's disease, Amyotrophic Lateral Sclerosis ("ALS"), stroke, schizophrenia, bipolar disorder, and major depression.⁹⁹

It is important to investigate and respond to key questions about BMI's ethical, legal, and societal implications regarding liberty, autonomy, data security, and privacy. It is imperative that collaboration among scientists, various industry professionals, civil society, and government be integrated in any approach designed to properly address these issues. This is the best method to develop a realistic governance structure that will encourage the development of BMI applications while minimizing the dangers of harmful exploitation of these technologies by private or public entities. Such a solution is a subset of the AI BMI technology discussed previously. While consistent with the more general framework discussed earlier, BMIs invoke even stronger concerns with respect to violating one's privacy, human dignity, freedom of thought and freedom of expression.¹⁰⁰

Given the inherent intrusiveness of BMI technology as a surgical implant into an individual's brain, liberty, autonomy, and privacy rights are amplified when compared to traditional AI, and therefore, this signifies that BMIs are a high-risk AI technology that will necessitate regulation. These rights are fundamental. Human dignity, for example, is built into the first article of the United Nations' Universal Declaration of Human Rights: "All human beings are born free and equal in dignity and rights. They are endowed with reason

96. *Id.*

97. Limor Shmerling Magazanik, *The Ethical and Legal Implications of Brain-Computer Interfaces*, CTECH (May 24, 2021, 8:48 AM), <https://www.calcalistech.com/ctech/articles/0,7340,L-3762798,00.html> [<https://perma.cc/H3XE-CYHC>].

98. *Id.*

99. *Id.*

100. Alžběta Solarczyk Krausová, *Legal Aspects of Brain-Computer Interfaces*, 8 MASARYK UNIV. J. L. & TECH. 2 199, 206 (2014), https://www.researchgate.net/publication/292846508_Legal_aspects_of_brain-computer_interfaces.

and conscience and should act toward one another in the spirit of brotherhood.”¹⁰¹ Furthermore, the Fourteenth Amendment to the Constitution states that “[n]o state shall . . . deprive any person of life, liberty, or property, without due process of law nor deny to any person within its jurisdiction the equal protection of the laws.”¹⁰² In this sense, BMIs have the capability to suppress and/or broaden the autonomy of an individual. The ability to suppress necessitates strong regulation to ensure that a person’s dignity and equal protection rights are not violated.

The possibilities of BMI technology come with costs. Privacy seems to dissolve as what was once an impenetrable mind becomes accessible. This is inherent in the way that BMIs function and is a natural consequence of the technology. Even further, what has always been considered a completely private and autonomous function—one’s thoughts¹⁰³—now becomes accessible. Fear of mind monitoring may cause individuals to try to conform and change their own ways of thinking, resulting in mindless automatons in the collective instead of creative, emotional, and sociable individuals.¹⁰⁴ While this doom and gloom argument may have some merit, it relies on the key assumption that adoption of such a technology would happen. Consent for something like this would have to be required in this hypothetical system. Notably, forcing anyone to do anything (even for the greater good of society) has proven to be incredibly difficult in modern America.¹⁰⁵ Furthermore, considering the large number of individuals paranoid about getting a covid vaccination, the probability that a majority of people would adopt such an invasive technology for non-health related reasons is even more unlikely.¹⁰⁶ However, if people were to adopt the technology, protocols providing ample

101. G.A. Res. 217 (III) A, Universal Declaration of Human Rights, art. I (Dec. 10, 1948), <https://documents-dds-ny.un.org/doc/RESOLUTION/GEN/NR0/043/88/PDF/NR004388.pdf?OpenElement>.

102. U.S. CONST. amend. XIV, § 2.

103. Samuel D. Warren & Louis D. Brandeis, *The Right to Privacy*, 4 HARV. L. REV. 195, 198 (1890) (“The common law secures to each individual the right of determining, ordinarily, to what extent his thoughts, sentiments, and emotions shall be communicated to others. Under our system of government, he can never be compelled to express them (except when upon the witness-stand); and even if he has chosen to give them expression, he generally retains the power to fix the limits of the publicity which shall be given them.”) (internal citations omitted).

104. See, e.g., Avery Blank, *3 Ways to Avoid Groupthink (and Gain Respect)*, FORBES (Jan. 21, 2020, 8:20 PM), <https://www.forbes.com/sites/averyblank/2020/01/21/3-ways-to-avoid-groupthink-and-gain-respect/?sh=2986313f7240> [<https://perma.cc/W2M6-WUP4>] (“Groupthink is when people make decisions in a way that conforms with others, either because individuals want a certain outcome . . . or because they value harmony. Groupthink is practiced everywhere: at work, at home and in politics. Conforming can lead to unintended, even disastrous, consequences.”).

105. After all, a large percentage (20.5%) of the U.S. population remains unvaccinated amidst a global pandemic. Hannah Ritchie et al., *Coronavirus (COVID-19) Vaccinations*, OUR WORLD IN DATA (2021), <https://ourworldindata.org/covid-vaccinations?country=USA> [<https://perma.cc/239U-GBS7>].

106. See *id.*

information regarding the risks, the information collected (if any) and the nature of the operational methods would have to be disclosed, and general regulations set in place by the government to ensure that human dignity, freedom of thought, and privacy are all retained despite the BMIs inherent functionality.

III. KEEPING PACE: AN ITERATIVE, COLLABORATIVE, AND ADAPTIVE PROBLEM-SOLVING SCHEME FOR REGULATING AI.

Figuring out when and how to regulate new technologies like AI is becoming more and more important, especially as they continue to become increasingly impactful on society and daily life. This section recommends a set of guidelines to help regulators determine both when and how to appropriately regulate AI using a risk-assessment taxonomical framework. The underlying goal of regulation in the technology industry is to protect the public and ensure fair markets while not restricting the flow of innovation. AI is no different; both maintaining public safety and encouraging innovation are paramount considerations. The essence of the problem to be solved by a new regulatory scheme is keeping pace with innovation to prevent the basic violation of human rights while optimizing the development and implementation of AI technology.

Identification: Risk Assessment and Categorization

The first and most difficult step in the proposed AI regulation framework is to look at the relevant technology or field of endeavor and determine the level of risk. The National Institute of Standards and Technology (“NIST”) defines risk as the “composite measure of an event’s probability of occurring and the consequences of the corresponding events.”¹⁰⁷ Depending on the risk associated with the various forms of AI, regulations may or may not be pursued. “AI risk management is as much about offering a path to minimize anticipated negative impacts of AI systems, such as threats to civil liberties and rights, as it is about identifying opportunities to maximize positive

107. *AI Risk Management Framework Concept Paper*, NAT’L INST. OF STANDARDS & TECH. (Dec. 13, 2021), https://www.nist.gov/system/files/documents/2021/12/14/AI%20RMF%20Concept%20Paper_13Dec2021_posted.pdf [https://perma.cc/LD7R-ZAV4]. Management Framework (“AI RMF”) concept paper incorporates input from the Notice of Request for Information (“RFI”) released by the NIST on July 29, 2021, and discussions during the workshop, “Kicking off NIST AI Risk Management Framework,” held October 19–21, 2021. *Id.*

impacts.”¹⁰⁸ Some criteria for evaluating the level of risk should be: (1) the duration or life expectancy of the AI the probability of success or failure; (2) how theoretical or speculative the technology is; (3) the likelihood of systemic effects; and (4) the level of impact to primary and secondary users (those without a choice as compared to those who voluntarily use the technology). Discovering and quantifying subjective risk in such a way is not an easy task because it involves “attitude measurement and psychological scaling.”¹⁰⁹ Furthermore:

A major problem in the epistemology of risk is how to deal with the severe limitations that characterize our knowledge of the [behavior] of unique complex systems that are essential for estimates of risk, such as the climate system, ecosystems, the world economy, etc.

Each of these systems contains so many components and potential interactions that important aspects of it are unpredictable. However, in spite of this fundamental uncertainty, reasonably reliable statements about some aspects of these systems can be made.¹¹⁰

Moral analysis methods are necessary to guide decisions on risk-taking actions and risk impositions. First, one must investigate how standard moral theories can apply to risks that are presented in the same way as in decision theory, “namely as the (moral) evaluation of probabilistic mixtures of (deterministic) scenarios.”¹¹¹ In addition, the utility of the technology is clearly a factor of consideration. As utility increases, the perception of the technological risk to society naturally is slightly counterbalanced. Using a loose rights-based deontological moral theory perspective, the violation of someone’s rights due to the technology should be evaluated based on the probability of the particular outcome with an understanding that eliminating any increase in risk would make human society impossible.¹¹² The *prima facie* moral right to not be exposed to risk of negative impact, such as damage to health or property, must be overridden or exempted in many cases in order to make social life possible. This exemption problem may be obtained by allowing for “reciprocal exchanges of risks and benefits,” where exposure to risk is acceptable if it is part of an equitable social system of risk taking that works to an individual’s overall advantage.¹¹³

108. *Id.*

109. Sven Ove Hansson, *Risk*, STAN. ENCYC. OF PHIL. (July 19, 2018), <https://plato.stanford.edu/archives/fall2018/entries/risk/>.

110. *Id.*

111. *Id.*

112. *Id.*

113. *Id.*

The objective of the risk categorization step is a method for determining whether the federal government should remain inactive or act with respect to certain AI technologies. The subjective analysis is not going to be perfect, but it does not need to be. For technologies that are determined to be weak risks, the federal government should keep the technology on its radar but focus on the more pertinent risks that AI could impose on society. In addition, the categorization needs to be dynamic and updated, including the potential for reevaluation at later times. Once the AI technology is determined to present moderate-to-high risk, the next step is to determine how it should be regulated. A quick, iterative feedback-sourced approach is one of the best methods for attempting to solve such a problem.

Early product entry into a market is a critical concern for businesses, especially regarding startups that are dependent on the success of emerging and rapidly changing technologies.¹¹⁴ Timely market entry also can make digital services and products more effective because rapid and widespread exposure allows valuable data to be collected from early adopters while the product is being used.¹¹⁵ Such data can be analyzed to detect new patterns and trends, information that can make the product more accurate, safe, effective, and personalized.¹¹⁶ Because of the iterative nature of the technology and how it relies on collecting data, the sooner safe and effective products get to the market, the better. After determining whether the technology is risky, having an iterative, adaptive approach to regulation is necessary to ensure that regulation keeps pace with innovation.¹¹⁷

Strategies to Evaluate and Monitor AI—Feedback Loops and Other Tools

The notion that regulations are intentionally crafted with every permutation and combination of outcomes in mind is not realistic in the modern age of technologies that are subject to rapid changes and advancements. Regulations are not meant to be immutable once they are established, and this premise becomes applicable with each new technological advancement that challenges previous scientific understandings and their related practical applications. Furthermore,

114. William T. Robinson et al., *First-Mover Advantages from Pioneering New Markets, A Survey of Empirical Evidence*, 9 REV. INDUS. ORG. 1, 1 (1994).

115. See, e.g., Fred Lambert, *Tesla Drops a Bunch of New Autopilot Data, 3 Billion Miles and More*, ELECTREK (Apr. 22, 2020), <https://electrek.co/2020/04/22/tesla-autopilot-data-3-billion-miles/> [https://perma.cc/RRY3-YLJP].

116. *Id.*

117. *Id.*

revisiting regulations via review and reevaluation is imperative to avoid thicket problems where old irrelevant laws dam the flow of innovation.¹¹⁸ Looking at regulation in retrospect forces regulators to update existing laws to coincide with the available tools, processes, and practices available in the current technological era.¹¹⁹

Adaptive rather than static regulation methods with fast feedback loops have the capacity to keep pace with advancements in technology because they allow regulators to easily compare policies against set standards.¹²⁰ A problem-solving, feedback-loop approach enables regulators to tackle multiple problems involving regulation of all technology—not just AI—with unparalleled efficiency. After all, feedback loops are the essence of learning in general, are the most fundamental aspect of machine learning, and are present in all forms of problem solving in general. Perhaps ironically, AI regulation could be solved in a fashion akin to AI machine-learning.

Incorporating a feedback loop into the regulation framework is only part of the solution. There are numerous tools that can be used to establish effective feedback loops and retrieve feedback data such as “setting up policy labs, creating regulatory sandboxes, crowdsourcing policymaking, AI automation, and providing representation to the industry in the governance process via self-regulatory and private standard-setting bodies.”¹²¹ Regulatory sandboxes operate like laboratories of democracy where prototypes and new technologies are controllably introduced into environments and observed on a small scale.¹²² This method provides greater insight into the inherent risks of the technology as well as how it will interact with society on a larger scale. Although sandboxes can be misused or abused, a well-designed sandbox can facilitate innovation and protect consumers.¹²³ In addition, crowdsourcing is also a good method to harness the collective intelligence of a group of people to make smart regulative decisions. Having a thinktank fueled by the brainpower of many minds is effective at solving

118. William D. Eggers et al., *The Future of Regulation: Principles for Regulating Emerging Technologies*, DELOITTE (June 19, 2018), <https://www2.deloitte.com/us/en/insights/industry/public-sector/future-of-regulation/regulating-emerging-technology.html> [https://perma.cc/3GFA-BQBV]. On this point, a Deloitte analysis of the 2017 U.S. Code of Federal Regulations found that 68% of federal regulations have never been updated. *Id.*

119. *Id.*

120. *Id.*

121. *Id.*

122. *Id.*

123. Dan Quan, *A Few Thoughts on Regulatory Sandboxes*, STAN. PACS, <https://pacscenter.stanford.edu/a-few-thoughts-on-regulatory-sandboxes/> [https://perma.cc/997Z-3FVP] (last visited Sept. 29, 2022).

problems and developing regulation.¹²⁴ This framework parallels the open-source free information ethos of organizations like Mozilla Foundation.¹²⁵ Like all open-source public driven organizations and technology, errors and biases are more prevalent. As a result, such contributions will likely need to be peer reviewed to prevent misinformation.

Another potentially useful tool is soft-law-regulation tactics. These are essentially provisions that create substantive expectations as opposed to instituting directly enforceable laws like treaties and statutes. “Soft law can include informal guidance, a push for industry self-regulation, best-practice guidance, codes of conduct, and third-party certification and accreditation.”¹²⁶ With soft-law-regulation provisions, potential violators can turn into collaborators, working toward a common good. For example, a company in the process of creating AI facial recognition software could do so by first starting with the soft-law standards and working from the ground up—identifying the potential pitfalls of and improvements that can be made to both the technology and the guiding standards to avoid biases and discrimination.¹²⁷

Solving the problem of regulating complicated technology like AI may involve utilizing the very type of technology that requires regulation. AI and robotic automation can also help a regulator to process large amounts of paperwork and perform other repetitive, labor-intensive tasks quickly and efficiently.¹²⁸ Accelerating this bottleneck in regulation offers another tool for shifting to more adaptive regulation methods.

Shifting the focus of regulation from being means-driven to results-oriented and outcome based can improve efficiencies for regulators and allow inventors greater freedom to achieve the same desired ends for the AI

124. Eggers et al., *supra* note 118; see also *Agile Governance Reimagining Policy-making in the Fourth Industrial Revolution*, WEF (2018), 10 https://www3.weforum.org/docs/WEF_Agile_Governance_Reimagining_Policy-making_4IR_report.pdf [<https://perma.cc/ENQ7-PVU9>].

125. See *Mozilla Insights*, MOZILLA FOUND., <https://foundation.mozilla.org/en/insights/> [<https://perma.cc/PA74-SCAP>] (last visited Oct. 8, 2022).

126. Eggers et al., *supra* note 118.

127. See Alex Najibi, *Racial Discrimination in Face Recognition Technology*. HARV. UNIV. GRADUATE SCH. OF ARTS & SCI.: BLOG SCI. POL’Y (Oct. 24, 2020), <https://sitn.hms.harvard.edu/flash/2020/racial-discrimination-in-face-recognition-technology/> [<https://perma.cc/5XD7-U439>].

128. IBM Cloud Education, *Robotic Process Automation*, IBM (Oct. 22, 2020), <https://www.ibm.com/cloud/learn/rpa> [<https://perma.cc/WS56-MC5T>]. Government entities have begun to use technologies such as Robotic Process Automation (RPA) to shorten wait times and free up staff time for more complex cases. RPA can sift through large data backlogs and take appropriate action, leaving more difficult cases to human experts. Some of the toughest operational challenges facing regulators, e.g., resource constraints backlog massive volumes of public comments also, offer some of the biggest opportunities for new technologies and techniques. *Id.*

technology.¹²⁹ A more hands-off approach shifts the burden onto the inventors to achieve desired outcomes. This results in fewer big brother directives and more freedom for businesses to choose their own path to comply with the law.

IV. CONCLUSION

Whether it is solving the privacy problems posed by Neuralink BMIs, regulating self-driving vehicles to improve driver safety, or figuring out ways to safely use AI without contributing or enhancing racial bias, it is time to face the pressures posed by expanding AI technology and other challenges posed by the Fourth Industrial Revolution—the marriage of physical and digital technologies. Regulators worldwide have a critical task in rethinking their approaches and can begin the process by adopting agile, iterative, and collaborative models. Not only is AI regulation needed to ensure safety and preserve fundamental rights, but regulation is necessary to promote trust between consumers and AI. As trust builds and consumers become aware that regulations are set in place to prevent violations of privacy, safety, and autonomy, the level of adoption of AI will increase. Furthermore, the increased demand for AI in the workplace will stimulate more advancement and propel the Fourth Industrial Revolution forward to a brighter future.

129. *Id.*