ARTIFICIAL INTELLIGENCE AND ACCESS TO THE PATENT SYSTEM

W. Keith Robinson*

How likely is it that the average American will become an inventor? With a novel idea and hard work, it should be a possibility for all Americans. However, the data suggests otherwise. Most patents are obtained by inventors that work for large corporations. Small businesses, solo inventors, women, and minorities lag behind their counterparts in patenting. A common explanation for this phenomenon is that it is a "pipeline" issue. However, the patent system is not accessible to underrepresented innovators for more problematic reasons.

At the same time as information about the disparity in patenting activity has garnered attention, the U.S. Patent and Trademark Office ("USPTO") has become more vocal about its interest in Artificial Intelligence ("AI"). AI will transform how the USPTO examines patent applications. It may also transform how humans invent. What has been absent from the conversation about AI and patenting is the negative effect AI has had when introduced into other social systems. For example, AI models can exhibit bias that concentrates power around incumbent actors. In addition, decisionmakers overestimate the ability of AI models to solve human issues. This Article refers to these problems collectively as "AI enthusiasm."

This Article argues that AI enthusiasm threatens to make the patent system less accessible for underrepresented innovators. In response, this Article presents a framework for improving access to the patent system given the emergence of AI. First, limits must be placed on AI-assisted examination informed by best practices that combat AI bias. Second, the USPTO should grant patents to inventions that are created with the assistance of AI only if the AI involved adheres to a set of best practices that reduce the chance of biased outcomes. Finally, true access involves removing obstacles to the innovation culture that has historically been closed to underrepresented inventors. Thus, AI tools should be deployed to assist

*Altshuler Distinguished Teaching Professor, Co-Director, Tsai Center for Law, Science and Innovation, Associate Professor of Law, SMU Dedman School of Law, Faculty in Residence, SMU; J.D. Cum Laude, 2004, Duke University School of Law; B.S. Electrical Engineering, 1999, Duke University; the author formerly practiced at Foley & Lardner LLP in Washington, D.C. I presented versions of these ideas at American University Washington College of Law, Texas A&M University Law School, New Hampshire Franklin Pierce School of Law, the 2020 Intellectual Property Scholars Conference, and as a part of the Iowa College of Law's 2020 Innovation, Business & Law Center Speaker Series entitled Examining Institutional Structures: Race, Business, and the Law. I thank the participants at those fora, particularly Elizabeth Rowe, Xuan-Thao Nguyen, Ann Bartow, Peter Yu, Nicholson Price, Zahr K Said, Andrew Chin, Dmitry Karshtedt, Carliss Chatman, Saurabh Vishnubhakat, Jason Rantanen, Shubba Ghosh, Peter Menell and Llewellyn J. Gibbons for their helpful comments.

underrepresented innovators in the patenting process. Collectively, these measures may provide U.S. innovators from all walks of life the opportunity to call themselves an inventor.

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INTRODUCTION

This Article is about the future of innovation in the United States. That future will be shaped by two major forces—artificial intelligence ("AI") and the patent system.[1] Historically, the U.S. patent system is one of the most impressive drivers of innovation in the world.[2] It continues to be an effective tool to incentivize innovators to disclose their inventions.[3] However, recent studies examining U.S. innovators have uncovered a troubling reality. That is, the number of small businesses, women, and minorities in the U.S. that apply for patents is woefully low.[4]

Serious discussions about how the U.S. might improve accessibility for underrepresented inventors also comes at a time where patent policymakers are focusing on the emergence of AI.[5] Like other technologies before it, AI promises to improve the way we work.[6] This could mean huge productivity gains for

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[1] *See, e.g.*, A. Michael Froomkin, *The Death of Privacy?*, 52 STAN. L. REV. 1461, 1483 (2000) (explaining that advancements in artificial intelligence will allow governments to improve already sophisticated surveillance programs); Mariano-Florentino Cuéllar, *A Simpler World? On Pruning Risks and Harvesting Fruits in an Orchard of Whispering Algorithms*, 51 U.C. DAVIS L. REV. 27, 32 (2017) (noting the significant venture capitalist investment in artificial intelligence related technologies). *But see* Arthur R. Miller, *Copyright Protection for Computer Programs, Databases, and Computer-Generated Works: Is Anything New Since CONTU?*, 106 HARV. L. REV. 977, 1070 (1993) (noting that AI capabilities have not yet surpassed the intelligence of a cockroach). *See* Richard S. Gruner, *Why We Need a Strong Patent System and When: Filling the Void Left by the* Bilski *Case*, 28 SANTA CLARA COMPUT. & HIGH TECH. L.J. 499, 501 (2012) (arguing that uncertainty in the patent system reduces the incentive to invent); Colleen V. Chien, Inequality, Innovation, and Patents 5–6 (2018) (unpublished manuscript) (on file with Santa Clara University School of Law) (finding that patents are the best measure of industrial innovation).

[2] *See, e.g.*, Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 265 (1977) (arguing that the patent system "increase[s] the output from resources used for technological innovation").

[3] *See* Stephen Yelderman, *The Value of Accuracy in the Patent System*, 84 U. CHI. L. REV. 1217, 1224 (2017) (explaining that the purpose of the patent system is to incentivize invention).

[4] *See* ADAMS NAGER ET AL., INFO. TECH. & INNOVATION FOUND., THE DEMOGRAPHICS OF INNOVATION IN THE UNITED STATES 1 (2016), http://www2.itif.org/2016-demographics-of-innovation.pdf [perma.cc/42J3-UQMX] (finding that only 8 percent of U.S. innovators born in the United States are minorities and that women represent 12 percent of U.S. innovators).

[5] *See, e.g.*, Andrei Iancu, Dir., USPTO, Remarks Delivered at the Artificial Intelligence: Intellectual Property Considerations event (Jan. 31, 2019), https://www.uspto.gov/about-us/news-updates/remarks-director-iancu-artificial-intelligence-intellectual-property [perma.cc/3HYA-85FV] [hereinafter Remarks by Director Iancu] (discussing the capabilities and economic impact of AI); *see also* Request for Comments on Patenting Artificial Intelligence Inventions, 84 Fed. Reg. 44,889 (Aug. 27, 2019) (listing a number of questions from the USPTO regarding artificial intelligence).

[6] *See, e.g.*, Robin C. Feldman et al., *Artificial Intelligence in the Health Care Space: How We Can Trust What We Cannot Know*, 30 STAN. L. & POL'Y. REV. 399, 400 (2019) (explaining how AI will revolutionize the medical field); *see also* Victoria Prussen Spears, Note, *AI, Law, and More!*, 1 J. ROBOTICS A.I. & L. 63, 63 (2018) (explaining that in the future "very little legal work will be done without substantial assistance from intelligent machines").

the patent office. In addition, the USPTO also has a unique opportunity to implement procedures regarding AI inventions that could have ripple effects in numerous industries. But what does AI have to do with the fact that only 12 percent of U.S. patent applicants are women?[7] As you will see, quite a bit.

For the purposes of this Article, the patent system refers to a number of public and private actors engaged in activities related to the patenting process. The founders of the United States recognized the importance of providing sufficient incentives to stimulate innovation.[8] The system does this by granting inventors a limited monopoly in exchange for the disclosure of their inventions.[9] The country benefits from the disclosure of inventions that may eventually be used by the public.[10] Inventors benefit by obtaining an exclusivity period within which they can commercialize their inventions without interference from competitors.[11] Thus, inventors are the main actors and stakeholders in the U.S. patent system.

The stories of successful American inventors are so revered that they have arguably become myths.[12] These stories tell us that to become a successful inventor in the United States, one must be creative, hard-working, and persistent.[13] Thomas Edison is often mentioned as an inventor that best exemplified these qualities.[14] The myth of the American inventor also tells us that inventors are thought of as a little crazy or eccentric.[15] Henry Ford and Steve Jobs fit this mold.[16] Overall, the myth of the American inventor gives almost anyone hope

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[7] NAGER ET AL., *supra* note 4.

[8] *See* U.S. CONST. art. I, § 8, cl. 8 (giving Congress the power "[t]o promote the [p]rogress of [s]cience and useful [a]rts, by securing for limited [t]imes to [a]uthors and [i]nventors the exclusive [r]ight to their respective [w]ritings and [d]iscoveries").

[9] *See* Gregory R. Day & W. Michael Schuster, *Patent Inequality*, 71 ALA. L. REV. 115, 121 (2019) (explaining that a patent is considered a legally granted monopoly).

[10] Jessica Litman, *The Public Domain*, 39 EMORY L.J. 965, 975 (1990) (defining IP in the public domain as "ineligible for private ownership" and accessible to "any member of the public").

[11] *See* Stephen Yelderman, *Coordination-Focused Patent Policy*, 96 B.U. L. Rev. 1565, 1572 (2016) (summarizing the commercialization incentives theory of patent law); *see also* Michael Abramowicz, *The Danger of Undeveloped Patent Prospects*, 92 CORNELL L. REV. 1065, 1067 (2007); Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1037 (1989).

[12] RAYVON FOUCHÉ, BLACK INVENTORS IN THE AGE OF SEGREGATION: GRANVILLE T. WOODS, LEWIS H. LATIMER & SHELBY J. DAVIDSON 9–10 (2003) (arguing that the celebrity of Henry Ford and Thomas Edison perpetuated the myth of the great American inventor capable of changing the world).

[13] *Id*. at 10.

[14] *Id*. at 10–11.

[15] *But see* Alan Johnson et al., *Employee-Inventors Compensation*, 47 LES NOUVELLES 24, 27 (2012) (arguing that this image is not a commercial reality).

[16] *E.g*., JAMES M. RUBENSTEIN, MAKING AND SELLING CARS: INNOVATION AND CHANGE IN THE U.S. AUTOMOTIVE INDUSTRY 28 (2001) (describing some of Ford's more unpopular opinions that were explained away by his eccentricity); *see also* WALTER ISAACSON, STEVE JOBS 327–28 (2011) (explaining the process for creating Apple Computer's famous "Crazy Ones" commercial).

that they too can become a successful inventor. Unfortunately, many U.S. innovators do not have access to the patent system.[17]

In recent years, more data has emerged about the patenting activity of U.S. women and minorities. A growing body of literature indicates that women and minority inventors have a different experience with the patenting process than white male inventors.[18] While women make up about half of the population, they are named as inventors for roughly 12 percent of patents granted in the U.S.[19] The data for minorities is even more alarming. For example, a recent study found that only 0.4 percent of all U.S. innovators are African American.[20] The lack of participation can be explained in a number of ways—there is a STEM pipeline problem,[21] women and minorities lack inventive characteristics due to social conditioning,[22] women and minorities do not have access to capital, and the patent examination process itself is biased.[23] It is perhaps this last explanation that is most concerning. Ideally, the patent examination process should be gender and race neutral.[24]

In addition, recent data suggests that patenting among small businesses in the U.S. is not as robust as one would imagine. In fact, patenting is concentrated around large corporations.[25] And the number of patents filed by foreign corporations continues to increase.[26] This trend is alarming because small businesses play a vital role in the U.S. innovation ecosystem. Small businesses are

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[17] *See generally* NAGER ET AL., *supra* note 4.

[18] *See* Kyle Jensen et al., *Gender Differences in Obtaining and Maintaining Patent Rights*, 36 NATURE BIOTECHNOLOGY 307 (2018) (concluding that women patent applicants have less favorable outcomes than male applicants); NAGER ET AL., *supra* note 4, at 8, 10; *see also* Chien, *supra* note 1, at 25–26 (citing statistics that challenge the view that patenting is a meritocracy).

[19] NAGER ET AL., *supra* note 4, at 5.

[20] *Id*. at 25.

[21] *See id*. at 1 (recommending that the U.S. STEM pipeline be strengthened). *See generally* ELYSE SHAW & CYNTHIA HESS, INST. WOMEN'S POL'Y RSCH. CLOSING THE GENDER GAP IN PATENTING, INNOVATION, AND COMMERCIALIZATION: PROGRAMS PROMOTING EQUALITY AND INCLUSION (2018), https://iwpr.org/wp-content/uploads/2020/10/C471_Programs-promoting-equity_7.24.18_Final.pdf [perma.cc/2M4H-F7GF] (listing several programs that are meant to address the minority and women STEM pipeline problem).

[22] FOUCHÉ, *supra* note 12, at 12 (explaining how racial discrimination affected black inventors after the era of Reconstruction); *see also* Dan L. Burk, *Diversity Levers*, 23 DUKE J. GENDER L. & POL'Y 25, 31 (2015) (asserting that women have been socialized to solve problems differently than men).

[23] *See generally* Jensen et al., *supra* note 18 (concluding that women patent applicants have less favorable outcomes than male applicants).

[24] *See* Arti K. Rai, *Machine Learning at the Patent Office: Lessons for Patents and Administrative Law*, 104 IOWA L. REV. 2617 (2019) (arguing that the use of machine learning in patent examination does not raise concerns about individual rights).

[25] Tabrez Y. Ebrahim, *Automation & Predictive Analytics in Patent Prosecution: USPTO Implications & Policy*, 35 GA. ST. U. L. REV. 1185, 1236 (2019) (noting that the majority of patents that are granted are assigned to large corporations).

[26] Chien, *supra* note 1, at 5 (noting that the increase in foreign patenting may be responsible for the decrease in the patenting activity of U.S. inventors).

responsible for many of the largest leaps in innovation in the past half-century.[27] Moreover, many American innovators started small businesses that grew into successful corporations.[28]

At the same time that commentators are raising concerns about the lack of inclusiveness in U.S. innovation, the USPTO is considering new challenges presented by artificial intelligence.[29] In the last fifty years, AI has transitioned from a computer scientist's dream to another tool corporate managers deploy to impact their company's bottom line.[30] How the USPTO will engage AI will likely shape U.S. innovation for decades. The USPTO seems to understand the significance of this moment. In a 2019 speech, Director Iancu said that understanding and exploiting AI will be important if the U.S. is to keep pace with other countries such as China.[31] In 2019, the USPTO issued a request for comments on AI.[32] The request asked the public for responses to several questions ranging from how artificial intelligence should be used in the patent examination process to whether inventions created by artificial intelligence should be eligible for patenting.[33]

What impact will artificial intelligence have on the U.S. innovation ecosystem?[34] Generally, AI models allow humans to work faster.[35] AI also takes advantage of available data to make connections and draw conclusions that might otherwise have been missed by humans.[36] However, the drawbacks of AI are also well documented. First, humans have placed too much faith in AI models'

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[27] OFF. OF ADVOC., U.S. SMALL BUS. ADMIN., THE SMALL BUSINESS ECONOMY: A REPORT TO THE PRESIDENT 185, 186 tbl.8.1 (2005) [hereinafter THE SMALL BUSINESS ECONOMY: A REPORT TO THE PRESIDENT], http://www.sba.gov/sites/default/files/files/sb_econ2005.pdf [perma.cc/ZA8B-4KP8].

[28] *See, e.g.*, Jamie Johnson, *7 Entrepreneurs Who Started Small and Built Their Way to Success*, U.S. CHAMBER COM., https://www.uschamber.com/co/start/startup/successful-entrepreneurs-who-started-small [https://perma.cc/VHJ2-WEWD].

[29] *See, e.g.*, Remarks by Director Iancu, *supra* note 5 (discussing the capabilities and economic impact of AI); *see also* Request for Comments on Patenting Artificial Intelligence Inventions, 84 Fed. Reg. 44,889 (Aug. 27, 2019) (listing a number of questions from the USPTO regarding artificial intelligence).

[30] *See* E. C. Lashbrooke, Jr., *Legal Reasoning and Artificial Intelligence*, 34 LOY. L. REV. 287, 302 (1988) (describing a rule-based AI system for bankruptcy reorganization).

[31] *See* Remarks by Director Iancu, *supra* note 5 (discussing the capabilities and economic impact of AI).

[32] Request for Comments on Patenting Artificial Intelligence Inventions, 84 Fed. Reg. at 44,889 (listing a number of questions from the USPTO regarding artificial intelligence).

[33] *Id.*

[34] *See generally* Ryan Abbott, *Everything Is Obvious*, 66 UCLA L. REV. 2 (2019) (exploring how AI will change the obvious standard in patent law); Bryan Casey & Mark A. Lemley, *You Might Be a Robo*t, 105 CORNELL L. REV. 287 (2020) (discussing how the law should define robots).

[35] MEREDITH BROUSSARD, ARTIFICIAL UNINTELLIGENCE: HOW COMPUTERS MISUNDERSTAND THE WORLD 187 (2018) (explaining that AI is good at helping humans speed up tasks).

[36] *See* CATHY O'NEIL, WEAPONS OF MATH DESTRUCTION: HOW BIG DATA INCREASES INEQUALITY AND THREATENS DEMOCRACY 75 (2016) (describing how machine learning systems use data to draw conclusions).

ability to solve problems.[37] In addition, despite beliefs to the contrary, AI models have produced results that exhibit the same amount of bias as humans.[38] In some domains this has led to life-altering results and in others the centralization of control among already powerful incumbent actors.[39] Several commentators have warned that the combination of blind technological optimism with poorly implemented AI models will wreak havoc on existing human social systems.[40] This Article refers to these problems collectively as "AI enthusiasm."

Despite its proximity to technology, the U.S. Patent system is very much a social system with its own unique dynamics.[41] Underrepresented innovators are a specific group within this system that is worthy of study.[42] The primary question that this Article seeks to answer is how will AI affect the patenting activity of underrepresented U.S. innovators? This Article is specifically concerned with how the possible use of AI in the examination of patent applications will impact women, minorities, and small businesses. Further, how will these groups be affected, if at all, by granting patents to inventions where AI is a named inventor?

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[37] *See* BROUSSARD, *supra* note 35, at 7–8 (coining the term "technochauvinism" for the belief that technology is always the solution for any problem).

[38] SAFIYA UMOJA NOBLE, ALGORITHMS OF OPPRESSION: HOW SEARCH ENGINES REINFORCE RACISM 1 (2018) (defining the phrase "technological redlining" as the way in in which technology "reinforces oppressive social relationships"); O'NEIL, *supra* note 36, at 3 (noting that many existing algorithmic models are encoded with bias).

[39] *See* Julia Angwin et al., *Machine Bias*, PROPUBLICA (May 23, 2016), https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing [perma.cc/Y64Q-PKVS] (studying use of COMPAS risk assessment tool in one county and finding bias against African-Americans).

[40] O'NEIL, *supra* note 36, at 3 (noting that many of the models studied by the author "punish[ed] the poor and oppressed"); NOBLE, *supra* note 38, at 1 (arguing that due to bias, artificial intelligence could "become a major human rights issue"); BROUSSARD, *supra* note 35, at 44 (arguing that humans must question the decisions made by algorithms).

[41] *See* John R. Allison et al., *Our Divided Patent System*, 82 U. CHI. L. REV. 1073, 1075 (2015) (finding that views on the patent system are divided by patentee's technology); Michael Risch, *The Layered Patent System*, 101 IOWA L. REV. 1535, 1577 (2016) (listing enforcers, patentees, and technology as key elements in a layered system); Mark A. Lemley, *The Surprising Resilience of the Patent System*, 95 TEX. L. REV. 1, 2 (2016) (finding that the patent system is resilient to changes in the law).

[42] *See* Ashish Arora et al., *The Acquisition and Commercialization of Invention in American Manufacturing: Incidence and Impact*, 3–14 (Nat'l Bureau of Econ. Rsch., Working Paper No. 20264, 2014), http://www.nber.org/papers/W20264.pdf [perma.cc/5TWS-G5E2] (finding that independent inventor inventions are commercially valuable); Annette I. Kahler, *Examining Exclusion in Woman-Inventor Patenting: A Comparison of Educational Trends and Patent Data in the Era of Computer Engineer Barbie*, 19 AM. U. J. GENDER SOC. POL'Y & L. 773, 784 (2011) (noting that due to a lack of information the true state of women inventors remains unknown); Shontavia Jackson Johnson, *The Colorblind Patent System and Black Inventors*, LANDSLIDE, Mar./Apr. 2019, at 1, 16 (2019) (discussing recent technological achievements of African American inventors).

Currently, corporations generate the majority of patentable inventions.[43] Why then should we care about the participation of small businesses, women, and underrepresented minorities in the patenting process? Historically, small businesses are incredibly important to innovation in the U.S.[44] For example, a 2011 study found that small businesses were responsible for the majority of leaps of innovation in the U.S. during the twentieth century.[45] Second, there is an argument that if women and minorities are participants in innovation, it will provide for their own upward mobility.[46] Third, women and minorities are best positioned to create innovation for their respective populations.[47] Moreover, inventions created by underserved populations can be of incredible utility.[48] Thus, at a time of change for the U.S. patent system, there are social and utilitarian motives for exploring the impact of AI on patent accessibility.

This Article argues that AI enthusiasm threatens to make the patent system less accessible for underrepresented innovators. In response, this Article presents a framework for improving access to the patent system given the emergence of AI. First, limits must be placed on AI-assisted examination informed by best practices that combat AI bias. Second, the USPTO should grant patents to inventions that are created with the assistance of AI, only if the AI involved adheres to a set of best practices that reduce the chance of biased outcomes. Finally, AI tools should be deployed to assist underrepresented innovators in the patenting process. Collectively, these measures may provide U.S. innovators from all walks of life the opportunity to call themselves an inventor.

Several researchers have contributed to the growing body of literature regarding the lack of access to the patent system.[49] In addition, for several decades researchers have studied the impact of artificial intelligence on socially immobile communities.[50] AI models can exhibit bias that concentrate power

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[43] Ebrahim, *supra* note 25 (noting that the majority of patents that are granted are assigned to large corporations).

[44] *See* Joseph A. Castelluccio, III, Note, *Sarbanes-Oxley and Small Business: Section 404 and the Case for a Small Business Exemption*, 71 BROOK. L. REV. 429, 437 (2005) (arguing that small businesses are the source of the U.S. economy's innovation and opportunity); THE SMALL BUSINESS ECONOMY: A REPORT TO THE PRESIDENT, *supra* note 27, at 185–86; H.R. REP. NO. 112-98, pt. 1, at 50 (2011) (asserting that helping small businesses will nurture U.S. innovation).

[45] THE SMALL BUSINESS ECONOMY: A REPORT TO THE PRESIDENT, *supra* note 27, at 185–86.

[46] *See* Chien, *supra* note 1, at 19, 33 (explaining that "innovation can reduce inequality by [improving] social mobility).

[47] *See id*. at 33 (arguing that "innovation that meets the needs of underrepresented stakeholders" has a greater social impact).

[48] *See id*.

[49] NAGER ET AL., *supra* note 4 (finding that only 8 percent of U.S. innovators born in the United States are minorities and that women represent 12 percent of U.S. innovators); Jensen et al., *supra* note 18, at 307 (concluding that women patent applicants have less favorable outcomes than male applicants); Chien, *supra* note 1, at 25–26 (citing statistics that challenge the view that patenting is a meritocracy).

[50] *See* O'NEIL, *supra* note 36, at 3 (noting that many of the models studied by the author "punish[ed] the poor and oppressed"); NOBLE, *supra* note 38, at 1 (arguing that due to bias,

around incumbents.[51] In addition, leaders overestimate the ability of AI to solve social issues.[52] This Article's unique contribution to the literature is to connect the revelations regarding patent accessibility with a growing concern about the problem of AI enthusiasm.

The result paints a grim picture. Despite hope that AI technology would eliminate human error from decision-making, there are numerous examples where AI models have resulted in bias against underrepresented groups.[53] The trends in both areas threaten to eradicate the ability for the most vulnerable of U.S. innovators (women, minorities, and small businesses) to patent their inventions. An increase in foreign patent activity combined with social mobility trends have perpetuated this trend.[54] Without some intervention, the USPTO's AI enthusiasm threatens to exacerbate the situation. So, what if anything can be done to slow or even reverse this trend?

Reversing the exclusion of certain innovators from the patenting process will require implementation of several policies. This Article provides a starting point for implementation by linking the separate conversations in the patent literature about inclusion and artificial intelligence. It acknowledges the objective reality that AI is neither good nor bad.[55] Given this starting point, we can identify ways in which AI may exacerbate the exclusion of small businesses, women, and minorities from the patent system. In turn, we can also understand ways in which implementing policies about AI can increase inclusion and encourage the creation of better AI models.

The USPTO's approach to AI must be inventor-centric and informed by best practices. For example, any AI tools that are used to assist in the patent examination process must be transparent, continuously updated and produce clear outcomes.[56] Further, patent policy can promote the creation and use of socially responsible AI models by requiring that the AI used to produce AI-assisted in-

artificial intelligence could become a major human rights issue); BROUSSARD, *supra* note 35, at 44 (arguing that humans must question the decisions made by algorithms).

[51] *See* BROUSSARD, *supra* note 35, at 115.

[52] *See id*. at 52 (explaining that data cannot solve social problems).

[53] *See id*. at 46 (providing an example of Internet price discrimination based on customer zip codes where wealthier zip code customers were charged less for the same products); *see also* NOBLE, *supra* note 38, at 4 fig.I.1 (describing that in 2011, the first search results produced for the search term 'black girls' was pornographic in nature).

[54] *See* Chien, *supra* note 1, at 6 (explaining that more patents are filed by foreign corporations and in the U.S., patent activity is concentrated by geography along the coasts and in metropolitan areas).

[55] *See* BROUSSARD, *supra* note 35, at 87 (suggesting that social problems occur when people misjudge how suitable a computer is to perform a task).

[56] *See* O'NEIL, *supra* note 36, at 27 (noting that healthy models, such as those used for baseball are transparent, continuously updated and clear).

ventions are transparent and "human-in-the-loop" systems.[57] Finally, AI tools can help underrepresented innovators better navigate the patent system.[58]

This Article will proceed as follows. Part I will explain the patent system's accessibility problem. It will then discuss AI and specifically, the USPTO's current AI enthusiasm. Finally, it will link these two separate phenomena together. Given this environment, Part II will propose a framework for addressing the patent system's accessibility problem in the age of artificial intelligence. Section II.A will describe how to use best practices to limit the scope of AI-assisted examination. Section II.B will argue for the implementation of additional examination requirements on AI-assisted inventions informed by best practices. Finally, Section II.C will explain why the USPTO should make AI technology available to innovators to assist them during the patenting process.

In summary, this Article asks, what if anything can be done to improve inclusivity in the United States patenting process given the inevitable adoption of AI technologies? History teaches us that the most likely path forward for humans facing technological change is to learn as much as they can about that technology and discover how they can add value.[59] This Article attempts to apply this abstraction to the patenting process. It suggests a path forward for creating a more diverse and informed U.S. inventor. The Article also demonstrates that the patent system can play a critical role in how AI-assisted inventions are created. Given an opportunity, underrepresented innovators can become an engine that will propel the American economy into the next century.

I. THE U.S. PATENT SYSTEM AND ARTIFICIAL INTELLIGENCE

This part provides an overview of the current innovation landscape. This Article is particularly concerned with the intersection of the U.S. patent system with AI. The patent office is faced, on one hand, with the question of to what extent inventions "created" with or by AI should be afforded patent protection, and on the other hand, with the question of how to best use AI in its own mission.

What makes this moment in time any different from other points at which the patent office adopted new technology? Was there an uproar over the typewriter? What about the copy machine? Certainly computers were welcome. The difference is that these technologies were seen as tools, not cure-alls.[60] The

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[57] *See* BROUSSARD, *supra* note 35, at 175 (arguing that systems where humans work with machines are better than AI-only systems).

[58] *See* Ebrahim, *supra* note 25, at 1188 (predicting that those that have access to artificial intelligence "will gain an advantage over the USPTO").

[59] *See generally* MARIE HICKS, PROGRAMMED INEQUALITY: HOW BRITAIN DISCARDED WOMEN TECHNOLOGISTS AND LOST ITS EDGE IN COMPUTING 19–57 (2017) (chronicling the contribution of women to British computing during World War II).

[60] *See* BROUSSARD, *supra* note 35, at 7–8 (explaining technochauvinism as the belief that technology is always the solution).

problem with cure-alls is that they rarely work for edge cases.[61] AI is no exception.

In addition, at this moment, commentators are concerned with who is obtaining a patent.[62] The trend for many years has been that foreign patenting activity in the U.S. is outgrowing U.S. based innovation.[63] Further, the patents granted to U.S. innovators are granted primarily to white males.[64] Historically, women and minorities have had difficulty accessing the patent system and it is only getting worse.

The goal of this part is twofold. First, it describes the current state of the patent system. It further explains recent patenting trends and concludes that the patent system is inaccessible for underrepresented innovators. Next, this part describes the current challenges AI has in dealing with social issues. It further explores how attitudes towards AI threaten to make the patent system less accessible. Thus, Part I provides a framework for understanding the need for the paper's prescriptive proposals detailed in Part II.

A. The "Social" Innovation System

The U.S. patent system is made up of several parts. Inventors create inventions and apply for patents.[65] The USPTO is the governmental agency dedicated to processing patent applications.[66] The USPTO employs thousands of patent examiners to examine patent applications.[67] These subject matter experts are assigned patent applications and are charged with determining whether they meet the legal qualifications to be worthy of a patent.[68] Patent owners rely on the federal court system to enforce their patent rights which includes the Court of Appeals for the Federal Circuit.[69] Finally, companies commercialize inventions that are sold to the public.[70] When a patent's term ends, the invention be-

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[61] *See id*. at 176–77 (arguing that "[a]utomation will handle . . . mundane work" but will fail at successfully handling "edge" cases).

[62] *See* NAGER ET AL., *supra* note 4 (reporting the demographic makeup of U.S. born innovators).

[63] *See* Chien, *supra* note 1, at 42 (noting the increase in patent filings by foreign firms).

[64] NAGER ET AL., *supra* note 4, at 5, 26 (reporting that 88 percent of U.S. innovators are male and 92.4 percent are white).

[65] *See* Alexander J. Kasner, *The Original Meaning of Constitutional Inventors: Resolving the Unanswered Question of the* MadStad *Litigation*, 68 STAN. L. REV. ONLINE 24, 24 (2015) (explaining that Congress has the power to award patents to inventors).

[66] *See* Nippon Shinyaku Co. v. Iancu, 369 F. Supp. 3d 226, 231 (D.D.C. 2019) (referring to the delay on behalf of the USPTO in examining and issuing patents).

[67] Remarks by Director Iancu, *supra* note 5 (explaining that about 9,000 of the 13,000 USPTO employees are patent and trademark examiners).

[68] *See* ROBERT P. MERGES ET AL., INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE 29 (6th ed. 2012) (listing requirements that must be met to obtain a patent).

[69] *See generally* Rochelle Cooper Dreyfuss, *The Federal Circuit: A Case Study in Specialized Courts*, 64 N.Y.U. L. REV. 1 3,4 (1989).

[70] *See* Arora et al., *supra* note 42, at 14–15, 21 (finding that commercially viable inventions are most often assigned to small firms).

comes a public good, free for anyone to make, use, or sell.[71] Thus, first through commercialization and then through the public domain, the patent system's primary goal is to benefit the public.

Because patenting is related to technology and innovation, it is easy to look at this system as we would a mathematics problem. If we find the right algorithm, we can model the system and use math to solve its problems.[72] However, this would be an oversimplification. In fact, our innovation system is a complex social system that just happens to involve technology. As with any other social structure, the patent system has its own unique challenges that are beyond the power of math to solve.[73] Every part of the patent system described above depends on human ability and interaction. To illustrate, let's look at a story about an inventor trying to solve a very human problem—underwear.

1. A Fairytale Innovation Story

Sara Blakely is a self-made billionaire.[74] Forbes estimates that her net worth is one billion dollars.[75] Early in her life, she had ambitions to be a lawyer.[76] However, those dreams ended when she did very poorly on the LSAT.[77] Instead, she began her professional career as a fax machine salesman.[78] Attempting to sell faxes every day, Blakely learned what it was like to fail and keep going.[79]

One day while complaining to a friend about the appearance of her underwear underneath her clothes, Blakely came up with the idea that would become Spanx.[80] Blakely designed several prototypes from her own ripped stockings.[81]

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[71] *See* MERGES ET AL., *supra* note 68, at 130 (explaining that the current patent term is 20 years).

[72] *See* O'NEIL, *supra* note 36, at 17 (explaining how the game of baseball can be modeled to suggest more competitive strategies).

[73] *See* John R. Allison & Mark A. Lemley, *The Growing Complexity of the United States Patent System*, 82 B.U. L. REV. 77, 79–80 (2002) (presenting patent activity findings based on nationality and size of the patentee). *See generally* Deepak Hegde & Manav Raj, Does Gender Affect Work? Evidence from U.S. Patent Examination 4 (Mar. 31, 2020) (unpublished manuscript) (on file with New York University Stern School of Business) (exploring the difference in how patent examiners work based on gender).

[74] Clare O'Connor, *Undercover Billionaire: Sara Blakely Joins the Rich List Thanks to Spanx*, FORBES (Mar. 7, 2012, 11:54 AM), https://www.forbes.com/sites/clareoconnor/2012/03/07/undercover-billionaire-sara-blakely-joins-the-rich-list-thanks-to-spanx/ [perma.cc/L6J7-6SHH] (adding Blakely to Forbes' billionaire list at the age of forty-one).

[75] Kerry A. Dolan et al. *America's Richest Self-Made Women: #32 Sara Blakely*, FORBES (Oct. 13, 2020), https://www.forbes.com/self-made-women/ [perma.cc/THD2-WT6N].

[76] O'Connor, *supra* note 74.

[77] *Id*.

[78] *Id*. (noting Blakely worked for Danka, an office supply company).

[79] *See id*. (explaining that despite "being escorted out of buildings" for solicitation, Blakely became Danka's national sales trainer).

[80] How I Built This with Guy Raz, *Spanx: Sara Blakely*, NPR (Sept. 12, 2016, 12:01 AM), https://www.npr.org/2017/06/07/493169696/spanx-sara-blakely [perma.cc/7MHT-BVTQ]

She worked and refined her prototypes until she came up with what she thought was a working solution.[82] Blakely saved up her fax machine money and took a portion of that money ($5,000) to start her company.[83]

The first thing Blakely did was find help with manufacturing. After rejection via phone and in person, Blakely found a textile manufacturer in North Carolina that was willing to make her prototype.[84] Reportedly, the manufacturer thought Blakely's idea was crazy and did not fully understand it because he was a man.[85] After describing Blakely's product to his family at dinner, the manufacturer learned from his daughters that Blakely's product was a good idea.[86] With that endorsement, he decided to help Blakely manufacturer her prototypes.[87]

Blakely was also savvy enough to understand she needed basic intellectual property protection. To that end, she filed for the Spanx trademark herself.[88] Blakely also used the Georgia Tech University library to do some preliminary patent research.[89] Her research led her to believe that it was worth pursuing a patent.[90]

Blakely used an off-the-shelf commercial book to educate herself about what was required to obtain a patent.[91] She drafted the specification.[92] Her mother drew the figures.[93] Finally, Blakely sought legal assistance to draft the claims of her application.[94]

Blakely searched for a female patent attorney she could afford.[95] Since she was solving a problem unique to women, she thought a woman was best situated to help her.[96] Blakely claims that she could not find a woman patent attorney,[97] so she resorted to cold calling attorneys. After being politely turned away several times, Blakely had success with a male attorney that was impressed by her doggedness and the fact that she had written much of the patent herself.[98]

[hereinafter How I Built This].

[81] *Id*.

[82] *Id*.

[83] O'Connor, *supra* note 74.

[84] How I Built This, *supra* note 80.

[85] *Id*.

[86] *Id*.

[87] *Id*.

[88] *Id*.

[89] O'Connor, *supra* note 74 (explaining the research Blakely did on hosiery patents).

[90] *See id*.

[91] *Id*.

[92] How I Built This, *supra* note 80.

[93] *Id*.

[94] *Id*.

[95] *Id*.

[96] *See id*.

[97] *Id*.

[98] *See id*.

He agreed to write the patent claims on the weekend for a little less than $1,000.[99]

Blakely successfully obtained a patent and went on to commercialize her invention and related products with great success.[100] Sara Blakely's story is the stuff movies are made of. On closer examination, it also reveals an incredible amount about U.S. innovation and the patent system. Using Blakely's story, the following sections unpack what we understand about the patent system. Let's start where all inventions must—with an inventor.

2. Who Is the American Inventor?

When we tell ourselves stories about the U.S. innovation we like to picture people like Sara Blakely—the solo inventor with limited resources and a scrappy work ethic that succeeded against the odds. In reality this is a myth that does a disservice to the very people it seeks to motivate.[101]

The majority of patents filed in the United Sates are filed by inventors that work for large companies.[102] Large companies have resources to invest in research and development.[103] They also have systems in place to capture and exploit innovation.[104] Large companies also have access to capital that will allow them to commercialize innovation.[105] In addition, companies have access to legal services that allow them to use their patents to exclude competitors from a specific market.[106]

Until recently, the United States only allowed individual inventors to file for patents. The law changed in 2011 to also recognize that corporations (non-inventors) could file for and obtain patents in their own name.[107] This small change speaks volumes about the current state of the U.S. inventor.

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[99] *Id*.

[100] *See* O'Connor, *supra* note 74 (detailing Blakely's efforts to sell her Spanx products).

[101] *See* FOUCHÉ, *supra* note 12 (arguing that the celebrity of Henry Ford and Thomas Edison perpetuated the myth of the great American inventor capable of changing the world).

[102] Ebrahim, *supra* note 25, at 1236 (noting that the majority of patents that are granted are assigned to large corporations).

[103] *See* Janet Freilich, *Prophetic Patents*, 53 U.C. DAVIS L. REV. 663, 715 (2019) (relating the story of an entrepreneur attempting to partner with a corporation to commercialize an invention).

[104] *See* Lemley, *supra* note 41, at 41–42 (explaining that companies manage how their engineers interact with lawyers).

[105] *See* Kara W. Swanson, *Food and Drug Law As Intellectual Property Law: Historical Reflections*, 2011 WIS. L. REV. 331, 395 (2011) (explaining how companies were "well positioned" to commercialize genetically engineered seeds).

[106] *See* Ted Sichelman, *Patents, Prizes, and Property*, 30 HARV. J.L. & TECH. 281, 282 (2017) (explaining how patents are used to prevent competitors from entering a particular market).

[107] *See* 35 U.S.C. § 118 (2012) (authorizing an assignee to file a patent application).

First, most patenting is now concentrated at the corporate level.[108] The number of patents filed and granted to independent inventors or inventors from small businesses has been under observation since the 1980s.[109] Researchers have observed that the number of patents granted to independent inventors continues to decline.[110]

Second, the majority of inventors in the U.S. are white men. A study conducted by the Information Technology and Innovation Foundation ("ITIF") in 2016 found that only 12 percent of U.S. innovators are women as compared to half the population.[111] The number of U.S. innovators that were minorities was also alarmingly small. For example, according to the study, Black innovators are almost non-existent at 0.4 percent.[112] Hispanic innovators made up 3.3 percent of innovators.[113] Asian or Pacific Islanders made up 18.7 percent of innovators in the study.[114]

In addition to U.S. inventors being predominately white, they were also highly educated and old.[115] In fact, the average age of an innovator in the U.S. is forty-seven.[116] This contradicts the narrative played out in the news and on popular T.V. shows such as HBO's Silicon Valley—that only young people in hoodies are driving U.S. innovation.[117]

3. The Problem to Be Solved

Blakely's story is instructive in what it says about the problems U.S. inventors set out to solve. The myth of the American inventor tells the story of an individual that creates something that changes the world.[118] A close cousin to this myth is the myth of disruptive innovation.[119] That is where an inventor creates a new invention so groundbreaking that it eliminates a product category or

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[108] Ebrahim, *supra* note 25, at 1236 (noting that the majority of patents that are granted are assigned to large corporations).

[109] Chien, *supra* note 1, at 5 (explaining increase in patenting activity among corporations and decline among smaller entities).

[110] *Id*.

[111] NAGER ET AL., *supra* note 4, at 5.

[112] *Id*. at 25.

[113] *Id*.

[114] *Id*.

[115] *Id*. at 33, 39, 42 (finding that 55.7 percent of innovators have Ph.Ds).

[116] *Id*. at 42.

[117] *See generally Silicon Valley* (HBO 2014).

[118] FOUCHÉ, *supra* note 12, at 9–10 (arguing that the celebrity of Henry Ford and Thomas Edison perpetuated the myth of the great American inventor capable of changing the world).

[119] *See* BROUSSARD, *supra* note 35, at 163 (explaining that the promise of disruptive innovation is huge profits and reduction in competition).

changes how that product is consumed.[120] In fact, most inventions are incremental.[121] In the case of Spanx, Sara Blakely invented better underwear.[122]

Blakely's story also counters the inventor narrative that one must invent to change the lives of everyone. Instead, Blakely's story supports the idea that innovators can be successful addressing the problems of specific subsets of the public.[123] Women and minorities are often an afterthought in product development. Melinda Gates famously criticized Apple for not including menstruation tracking in its health app.[124] Thus, another way underrepresented innovators contribute to the innovation landscape is by solving the problems of underserved populations.[125] This is often due to the fact that large firms lack access to information that these individuals have.[126]

4. Inventor Networks

What kind of personal network does an inventor need to participate in U.S. Innovation? Sara Blakely had less of a network than many Silicon Valley entrepreneurs. Despite that, her story illustrates the need for an inventor to build a sufficient network of people to assist them in their innovation journey. For example, Blakely realized that she needed access to a manufacturer to make her product.[127] She also needed legal assistance to acquire protection for her invention.[128]

The U.S. legal system is inaccessible to most Americans. It is widely accepted that there is an access to justice gap.[129] This means that the poor do not have access to legal services.[130] A less often told narrative is that legal services are also out of reach for most middle-class Americans.[131] In the instance of Sara

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[120] *Id*.

[121] *See e.g*., Adam Mossoff, *The Rise and Fall of the First American Patent Thicket: The Sewing Machine War of the 1850s*, 53 ARIZ. L. REV. 165, 168 (2011) (describing the incremental inventions in the sewing machine industry).

[122] O'Connor, *supra* note 74.

[123] In almost all instances, firms are better suited to engage in innovation. However, one area where individuals may have an advantage over existing firms is solving problems customers did not know they had or that they did not think could be solved.

[124] BROUSSARD, *supra* note 35, at 158.

[125] Chien, *supra* note 1, at 33 (arguing that innovation that addresses the needs of underrepresented stakeholders has a greater social impact).

[126] *See id*.

[127] How I Built This, *supra* note 80.

[128] *Id*.

[129] *See generally* BENJAMIN H. BARTON & STEPHANOS BIBAS, REBOOTING JUSTICE: MORE TECHNOLOGY, FEWER LAWYERS, AND THE FUTURE OF LAW 47–57 (2017) (explaining evidence that supports the conclusion that there is an access to justice problem in the U.S. for the poor and middle-class).

[130] *Id*.

[131] *Id*.

Blakely, she overcame the financial barrier by doing most of her early legal work herself.[132]

However, the fact that she was unsuccessful in finding a female patent attorney speaks volumes about the diversity problem in the legal profession.[133] Specifically, in the IP field, men account for 70 percent of all attorneys.[134] The most common reason given for this low number is that there is a pipeline problem.[135] To represent a client before the USPTO, a person must have a science or engineering degree or its equivalent according to the USPTO's Office of Enrollment and Discipline ("OED").[136] Less women go into these fields and so there are less that can meet the qualifications to become patent attorneys.[137]

In recent years, the USPTO has launched a patent pro bono program with the goal of making more patent attorneys available to the public.[138] More inventors are being served.[139] However, when one compares the numbers to overall population, etc. they are less than admirable.[140]

In sum, Blakely was able to build her personal network so that she had access to legal assistance, manufacturing and commercialization opportunities.[141] Her story is remarkable for how rare it is.

5. Access to Capital

Sara Blakely used money she saved from her full-time job to start her business.[142] Access to capital is an essential ingredient for any innovator. Capital is used to conduct research, invest in product development, acquire legal services, manufacture the product, and market it. Despite the country's strong economy, access to capital is a problem for U.S. innovators. Capital sources are concen-

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[132] How I Built This, *supra* note 80; O'Connor, *supra* note 74.

[133] *See* How I Built This, *supra* note 80.

[134] J. Shontavia Johnson et al., *Diversifying Intellectual Property Law: Why Women of Color Remain "Invisible" and How to Provide More Seats at the Table*, LANDSLIDE, Mar./Apr. 2018, at 30, 31 (2018).

[135] *See id*. at 32–33 (arguing for pipeline programs to increase diversity in the IP field).

[136] USPTO OFF. ENROLLMENT & DISCIPLINE, GENERAL REQUIREMENTS BULLETIN FOR ADMISSION TO THE EXAMINATION FOR REGISTRATION TO PRACTICE IN PATENT CASES BEFORE THE UNITED STATES PATENT AND TRADEMARK OFFICE 3 (2020), https:// www.uspto.gov/sites/default/iles/OED_GRB.pdf [perma.cc/6HEV-8PUJ].

[137] *See* NAGER ET AL., *supra* note 4, at 23 (explaining that women are underrepresented in STEM fields).

[138] *See generally* Jennifer M. McDowell & Saurabh Vishnubhakat, *The USPTO Patent Pro Bono Program*, 7 CYBARIS® INTELL. PROP. L. REV. 1 (2015) (detailing the growth of the USPTO Patent Pro Bono Program).

[139] *See id*. at 44–46 (providing statistics for the number of inventors served by the Minnesota patent pro bono program).

[140] *See id*. at 48.

[141] How I Built This, *supra* note 80.

[142] O'Connor, *supra* note 74.

trated geographically.[143] Further, the projects that affect capital are not necessarily the best ideas nor the most needed ones.[144] This problem is particularly acute for women and people of color.[145]

For solo inventors and startups there are very few sources of capital. Friends and family are generally the first source that solo inventors will tap.[146] Angel investors are a source of capital and typically will invest several hundred thousands of dollars.[147] Venture capitalists are an option for mature startups and provide investment opportunities in the millions of dollars.[148] Finally, depending on the innovator's financial situation, they may be able to acquire funding in the form of bank loans and grants.[149]

Surprisingly, an inventor's success at raising capital in the U.S. may depend on where they live. Access to capital in the U.S. is geographically concentrated. Capital is abundant on the east or west coast.[150] It is available in large cities and in areas that have research universities.[151] If an innovator does not live in an area that meets one of these criteria, their opportunity to raise money is severely hampered. On the other hand, if an innovator lives in a major east or west coast city that is the home to at least one major research university, then they have a better chance of finding capital.

Another issue regarding capital is the type of projects that attract investment. In a recent article, Professor Colleen Chien explained that because well-off investors provide most of the capital, their money tends to go toward projects that improve the lives of people that are already doing well financially.[152] In contrast, underrepresented innovators tend to solve problems for underserved populations.[153]

Gender and race dynamics compound the access to capital problem. Who gets capital is largely determined by who has the money to invest.[154] Less capital is available to women founders. For example, in a recent article, Cheryl

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[143] *See* Chien, *supra* note 1, at 11 (explaining that innovation activity is increasingly coastal).

[144] *See id*. at 27–28 (explaining the problem of overinvestment in problems of the rich).

[145] *See generally* Cheryl Contee, *Advice on Launching a Tech Startup When You're Not a White Man*, HARV. BUS. REV. (Oct. 11, 2019), https://hbr.org/2019/10/advice-on-launching-a-tech-startup-when-youre-not-a-white-man [perma.cc/NJ3F-32GC] (providing advice to women entrepreneurs on how to find funding for their business).

[146] RICHARD S. GRUNER ET AL., TRANSACTIONAL INTELLECTUAL PROPERTY: FROM STARTUPS TO PUBLIC COMPANIES 86 (3d ed. 2015).

[147] *Id*. at 87.

[148] *See id*. at 78.

[149] *Id*. at 82.

[150] Chien, *supra* note 1, at 11 (explaining that innovation activity is increasingly coastal).

[151] *Id*.

[152] *Id*. at 27 (explaining the problem of overinvestment in problems of the rich).

[153] *See id*. at 33 (arguing that innovation that addresses the needs of underrepresented stakeholders has a greater social impact).

[154] *See* Contee, *supra* note 145 ("77% of venture-backed founders are white and 90% of them are men.").

Contee explained that of $424 billion in available venture funding only 0.0006 percent went to black female founders.[155] Thus, for underrepresented innovators, access to capital remains a significant hurdle.

6. Commercialization

What does Blakely's story say about commercialization? In her particular instance, Blakely was able to find someone to agree to manufacture her prototype.[156] Even though, the manufacturing facility was not in her state, Blakely was lucky in that she could afford to travel there.[157] She was also able to communicate with the manufacturer because they spoke the same language.[158] And because her product was a textile, it was relatively inexpensive to make.[159]

In reality, most inventions are not commercialized.[160] Inventors may lack the ability to commercialize their invention due to lack of technical expertise.[161] In addition, inventors may also lack the capital necessary to pay for manufacturing.[162] Generally, inventions created by independent inventors are licensed to a company with the network and capital to carry out the necessary manufacturing, distribution, and marketing activities.[163]

What happens to uncommercialized patents? A number of inventors lose the right to enforce their patents for failure to pay maintenance fees.[164] Those that are maintained eventually expire. In sum, uncommercialized patents fail to reach their full potential. This is not to say that they are a complete waste of resources. Patents provide a mechanism for inventors to exclude others from participating in some forms of competitive activity covered under infringement.[165] In theory, this gives the owner valuable time to commercialize their invention.

In sum, commercialization is another way in which we see an inventor's network play a critical role. The inventor's skills or resources may not be well-suited to carryout manufacturing, distribution or marketing of their invention. An inventor with a network can take these next steps by asking the people in her network for help. Sara Blakely was able to build her network. In most cas-

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155 *Id*.

156 How I Built This, *supra* note 80.

157 *See id*.

158 *See id*.

159 *See id*.

160 Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 362 (2010) (suggesting that over half of U.S. inventions are not commercialized).

161 *Id*. at 369.

162 *See id*. at 381.

163 *See id*. at 366–68.

164 *See id*. at 362 (finding that applicants fail to pay maintenance fees on about 60 percent of applications over twelve years).

165 Sichelman, *supra* note 106, at 282.

es, however, underrepresented innovators in the U.S. lack access to networks capable of bringing their inventions to fruition.[166]

7. The Patent Office

The USPTO plays a critical role in Blakely's story. She obtained IP protection for her product's name and her invention using the USPTO.[167] These protections allowed Blakely to commercialize her products. Thus, the patent office is arguably the most critical component in the U.S. innovation ecosystem.

The USPTO, with professional patent examiners, has been in existence since 1836.[168] The purpose of the Office is to examine patent and trademark applications.[169] Within the last decade, the USPTO's role has expanded to also review the quality of certain patents after they have been granted.[170] The USPTO's post grant procedures allow the office to ensure that the patents at issue were properly granted.[171]

The largest group of USPTO employees are patent examiners.[172] Examiners are grouped by subject matter expertise into Art Units.[173] Examiners are tasked with reviewing patent applications and evaluating whether those applications have met the statutory requirements to become a granted patent.[174] Examiners tend to be highly educated and are trained extensively by the USPTO.[175]

In the last decade, the USPTO has responded to several challenges. It has been criticized for granting low quality patents that led to an explosion of patent infringement lawsuits.[176] It has also come under criticism for a significant patent backlog.[177] Partly in response to these challenges, the patent office has increased its reach by opening satellite offices in cities across the United States.[178] In addition to satellite offices, the USPTO has facilitated the opening

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[166] Katrin Lindberg & Anette Romare, *Examining the Gender Patenting Gap*, MANAGINGIP.COM, Mid-Year 2018, at 50, 54 (explaining that women tend to have more limited networks than men).

[167] *See* How I Built This, *supra* note 80.

[168] MERGES ET AL., *supra* note 68, at 126.

[169] *See* Hegde & Raj, *supra* note 73, at 10 (describing the patent examination process).

[170] *See* MERGES ET AL., *supra* note 68, at 290 (describing the USPTO's post grant review process).

[171] *See id*.

[172] Remarks by Director Iancu, *supra* note 5 (explaining that about 9,000 of the 13,000 USPTO employees are patent and trademark examiners).

[173] *See* Hegde & Raj, *supra* note 73 at 10 (describing the patent examination process).

[174] *Id*. at 11.

[175] *Id*. at 3.

[176] *See* MERGES ET AL., *supra* note 68, at 290 (describing the government's response to calls to "weed out 'mistake patents' ").

[177] *E.g*., Nippon Shinyaku Co. v. Iancu, 369 F. Supp. 3d 226, 231 (D.D.C. 2019) (referring to the delay on behalf of the USPTO in examining and issuing patents).

[178] *See* Annette I. Kahler, *Women Joining the Patent Workforce*, 5 LANDSLIDE, Mar./Apr. 2013, at 48, 50 (2013) (listing locations of the USPTO satellite offices).

of several patent clinics at law schools across the U.S.[179] The USPTO also created a Patent Pro Bono program to make patent assistance available to underserved inventors.[180] Despite these efforts, the USPTO continues to look for ways to keep up with legal changes, international pressure, and emerging technologies.

One technology that has become of interest to the USPTO is AI.[181] This Article is primarily concerned with the impact AI will have on innovators like Sara Blakely. Before exploring that topic, the next section briefly discusses current AI technology.

B. Artificial Intelligence

Unlike humans, the history of computers begins in isolation. Try explaining to any person born in the last twenty years that the very first computers did not have access to the Internet.[182] They are likely to ask what people used them for. Before the Internet, a computer's main function was to help humans work faster.[183] Computers' functions rapidly grew to include entertainment including playing simple games.[184] As processing power grew, computers became capable of playing and competing with experts in games such as chess.[185] Computer advancement in conjunction with connectivity has recently made it possible for computers to compete and beat humans in highly complex games such as Go and poker.[186] This section provides an overview of Artificial Intelligence through the lens of games. When viewed in this way, it is understandable how enthusiasm for AI can carry over into other domains of human endeavor. How-

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[179] *Law School Clinic Certification Program*, USPTO, https://www.uspto.gov/learning-and-resources/ip-policy/public-information-about-practitioners/law-school-clinic-1 [perma.cc/P8HJ-JPH2] (explaining the law school patent clinic program).

[180] *See generally* McDowell & Vishnubhakat, *supra* note 138 (detailing the growth of the USPTO Patent Pro Bono Program).

[181] *E.g.*, Remarks by Director Iancu, *supra* note 5 (discussing the capabilities and economic impact of AI); *see also* Request for Comments on Patenting Artificial Intelligence Inventions, 84 Fed. Reg. 44,889 (Aug. 27, 2019) (listing a number of questions from the USPTO regarding artificial intelligence).

[182] The World Wide Web and the Internet were first proposed by Tim Berners-Lee in 1989. Tim Berners-Lee, *Information Management: A Proposal*, WORLD WIDE WEB CONSORTIUM (Mar. 1989), http://www.w3.org/History/1989/proposal.html [perma.cc/9UEN-LARM] (introducing the concept of "linked information systems").

[183] Mara Calvello, *A Complete History of Computers: From the 1800s to Now*, LEARN HUB (July 8, 2019), https://learn.g2.com/history-of-computers [perma.cc/UX6W-GU8V].

[184] Bonnie B. Phillips, *Virtual Violence or Virtual Apprenticeship: Justification for the Recognition of a Violent Video Game Exception to the Scope of First Amendment Rights of Minors*, 36 IND. L. REV. 1385, 1390 (2003) (explaining that Pong was invented in 1972).

[185] BROUSSARD, *supra* note 35, at 33 (explaining that Chess has been used by computer scientist as a benchmark for computer capability).

[186] *Id.*; *see also* Noam Brown & Tuomas Sandholm, *Superhuman AI for Multiplayer Poker*, 365 SCIENCE 885, 885 (2019) (discussing an AI capable of playing and beating humans in a multi-player poker game).

ever, as this Article describes *infra*, it also becomes clear how AI falls short in more complex social domains.

Artificial intelligence is often pitted against human intellect. Over the last half century, the most popular artificial intelligence stories are related to AI playing a game against a human opponent. For example, IBM made history when it's computer, Deep Blue, defeated grandmaster Gary Kasparov in a game of chess.[187] More recently, a team of researchers have developed an AI system capable of defeating an expert Go player.[188] In addition, researchers have developed technology that can defeat multiple human opponents in poker.[189] How engineers have succeeded in building technology that can defeat the best humans at complex games tells us a lot about the potential of AI. But, it also speaks volumes about its limitations.

AlphaGo is the name of the artificial intelligence project that created an artificial Go player.[190] In 2017, AlphaGo played and defeated a champion Go player.[191] Go is a game of Asian origin.[192] The defeat was significant because Go is considered to be a much more complex game than chess.[193] Accordingly, it was much more difficult for the AlphaGo team to create an artificial player that could challenge, let alone defeat, an expert Go player.

How was the AlphaGo team capable of building an artificial player that could defeat a grandmaster in Go? First, the team had superior computing power available to it.[194] In addition, the AlphaGo team benefited from historical data. The AlphaGo team was able to analyze hundreds of thousands of hours of Go games played by real humans all over the world.[195] This allowed them to incorporate strategies and more importantly experience into the AlphaGo project.[196] Armed with computing power and an incredible amount of historical da-

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[187] James O'Malley, *The 10 Most Important Breakthroughs in Artificial Intelligence*, TECHRADAR (Jan. 10, 2018), https://www.techradar.com/news/the-10-most-important-breakthroughs-in-artificialintelligence [perma.cc/U5FM-2GHS].

[188] Bryan Casey, *Amoral Machines, or: How Roboticists Can Learn to Stop Worrying and Love the Law*, 111 NW. U. L. REV. 1347, 1356 (2017).

[189] Brown & Sandholm, *supra* note 186. This is especially significant since part of the game of poker includes bluffing or deception.

[190] *See generally* David Silver et al., *Mastering the Game of Go with Deep Neural Networks and Tree Search*, 529 NATURE 484 (2016).

[191] BROUSSARD, *supra* note 35 at 33.

[192] ARTHUR SMITH, GAME OF GO: THE NATIONAL GAME OF JAPAN 1 (1908) (tracing the origin of Go back to China in 2000 B.C.).

[193] Hope Reese, *How Google's DeepMind Beat the Game of Go, Which Is Even More Complex than Chess*, TECHREPUBLIC (Feb. 16, 2016, 1:19 PM), https://www.techrepublic.com/article/how-googles-deepmind-beat-the-game-of-go-which-is-even-more-complex-than-chess [perma.cc/2ZE5-YB4L] (explaining that Go has a large number of potential moves and that players rely on intuition).

[194] BROUSSARD, *supra* note 35, at 36 (explaining that AlphaGo was made possible by advancements in computer hardware and software).

[195] *Id*. at 35 (noting that the AlphaGo team analyzed thirty million games of Go).

[196] Silver et al., *supra* note 190, at 485–89.

ta, the AlphaGo team was able to successfully create a formidable artificial Go player.

When discussing AI, fact must be separated from fiction. General AI, an all-knowing, all-seeing computer brain that can do every human job, does not exist.[197] Different predictions exist for if and when general AI will become a reality.[198] According to one commentator, general AI could come into being as early as 2050.[199] Other commentators are much more skeptical and predict it will be at least another century if more before general AI technology is realized.[200] Some researchers argue that it will never exist.[201]

In the alternative, specific AI is a technology that is well-suited to operate in a discrete problem domain. Specific AI is defined as "mathematical model for prediction."[202] For example, an AI technology that is tasked with determining how a baseball team can maximize its chance of winning is a specific AI model.[203] The outcome is concrete and the problem domain is narrowly defined.[204] Specific AI is our current reality.

In her book, *Weapons of Math Destruction*, Cathy O'Neil explains that an important building block of artificial technology systems is modeling.[205] A model is a simplistic representation of a system.[206] That system could be the world at large, but more likely, the system represents a discrete problem domain.[207] Games such as Go are a primary example of a discrete domain where specific AI technology can gain a competitive advantage. Each player has a clear objective and their moves are confined to a finite number by the rules of the game. In these situations, computers shine because their raw computing power allows a game specific AI to process thousands of move possibilities in seconds.[208]

Thus, the story of AlphaGo is a microcosm of the story of AI. For AI to function well and accomplish a desirable goal, the creators of the AI have to have a clear definition of success. The requisite technology from a processing standpoint has to exist to solve the problem in a satisfactory time frame. The AI has to be deployed in a closed loop system with well-defined rules for a finite number of scenarios. Finally, we know that a data set with lots of historical data will assist predictive systems in making best decisions based on probabilities.

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197 *See id*. at 32.
198 Ryan Abbott, *supra* note 34, at 26.
199 *Id*.
200 *Id*.
201 *See id*.
202 BROUSSARD, *supra* note 35, at 32.
203 *See* O'NEIL, supra note 36, at 16 (explaining the Ted Williams shift in baseball).
204 *See* BROUSSARD, *supra* note 35, at 32.
205 *See* O'NEIL, supra note 36, at 18 (explaining baseball modeling).
206 *Id*. at 18, 20.
207 *See id*.
208 *See* BROUSSARD, *supra* note 35, at 36.

In order for AI to model systems, it needs data.[209] Typically, the more data available, the more complex the system.[210] In addition, the more data there is available from a historical standpoint, the better a model can be at making predictions about the future.[211] The rise of big data has allowed for mathematical modeling to reach new heights.[212]

Big data is the explosion in the quantity of potentially useful data.[213] The advancements made in computing power and storage have made it possible for this field of endeavor to exist.[214] In addition, interconnectivity has been instrumental in allowing the sharing of data across the globe. One development that has been instrumental in the field of big data is the proliferation of the smart phone.[215] This device has allowed the collection of huge amounts of data from individuals in various walks of life and in various locations across the globe.

Data is used to train AI technologies.[216] This is often referred to as machine learning.[217] These technologies learn from the data and use what they have learned to make determinations or predict what is likely to happen in the future.[218] Data is a collection of past human interactions and behaviors. It follows then that if humans can be biased then this bias can also find its way into the data.[219] Some of the earliest recidivism models exhibited bias in this way.[220] If the data is biased, then there is a strong likelihood that the AI technology using the biased data will recommend outcomes that are also biased.[221]

Data is more accessible than ever before. For example, the AlphaGo team benefited from the ability to use hundreds of thousands of hours of data from previous AlphaGo games.[222] Broussard points out that the AlphaGo team great-

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[209] *See id*. at 32 (explaining that narrow AI relies on datasets).

[210] *See* O'NEIL, *supra* note 36, at 22 (explaining how more inputs and preferences create a more complex model).

[211] *See* BROUSSARD, *supra* note 35, at 35 (describing the historical data used by AlphaGo).

[212] *See* O'NEIL, *supra* note 36, at 6 (explaining how complex algorithms use big data to improve).

[213] Francis X. Diebold, *"Big Data" Dynamic Factor Models for Macroeconomic Measurement and Forecasting*, *in* 3 ADVANCES IN ECONOMICS AND ECONOMETRICS: THEORY AND APPLICATIONS, EIGHTH WORLD CONGRESS 115 (Mathias Dewatripont et al. eds., 2003).

[214] Ebrahim, *supra* note 25, at 1233.

[215] *See* Casey & Lemley, *supra* note 34, at 292 (2020).

[216] O'NEIL, *supra* note 36, at 20 (discussing using data to train a hypothetical model).

[217] Harry Surden, *Artificial Intelligence and Law: An Overview*, 35 GA. ST. U. L. REV. 1305, 1311 (2019) (defining machine learning as "detecting useful patterns in large amounts of data").

[218] *See id*. at 1331–32 (discussing technology for predicting legal outcomes).

[219] *See generally* Tolga Bolukbasi et al., *Man Is to Computer Programmer as Woman Is to Homemaker? Debiasing Word Embeddings*, 29 ADVANCES NEURAL INFO. PROCESSING SYS. 4356 (2016).

[220] *E.g*., BROUSSARD, *supra* note 35, at 155 (describing the COMPAS system that identified black defendants as more likely to commit future crimes than their white counterparts).

[221] *See* Bolukbasi et al., *supra* note 219, at 4363.

[222] *Id*. at 35 (noting that the AlphaGo team analyzed thirty million games of Go).

ly benefited from the countless hours of human labor that went into playing Go games.[223]

It is no surprise then that billions of dollars are spent each year to collect and store data in every human endeavor from shopping to medical information.[224] This data is used to create models. As time passes, these models become more accurate at predicting possible future outcomes.[225] Armed with some idea of what is likely to happen in the future, AI developers have the ability to shape the course of human events.

Often the human effort required to achieve a technological accomplishment is dwarfed by the technology itself. For example, the atomic bomb is marveled at as a significant technical accomplishment.[226] However, Richard Rhodes' book, *The Making of the Atomic Bomb*, captures the human effort and toll that went into the creation of such a powerful weapon.[227] Similarly, the team that worked on AlphaGo is an example of the power of collective human achievement.[228]

Why is it important to remember the human effort that created such technological marvels? For one, it reaffirms the ingenuity and creativity of humans as a species. It is a subtle reminder that given proper motivation and resources, the collective ability of humans can do amazing things. These ideas are incredibly important in this era of AI enthusiasm. We must keep in mind that humans were capable of creating the technological marvels that we now rely on for day to day tasks and to make life-changing decisions alike. So, when we think that these technological advances are beyond reproach, it is worth remembering that they themselves were created by equally brilliant and flawed human beings.[229]

C. The Patent System's Enthusiasm for Artificial Intelligence

The last section illustrated that there is much to be excited about concerning AI. The USPTO's interest in artificial intelligence signals a critical moment for U.S. innovation. Evidence suggests that the patent system is becoming less accessible to small businesses, women, and minorities.[230] Research from other

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[223] *Id*. at 36.

[224] *See generally* ADAM TANNER, OUR BODIES, OUR DATA: HOW COMPANIES MAKE BILLIONS SELLING OUR MEDICAL RECORDS (2017) (explaining how companies make millions of dollars selling customers medical information).

[225] *See* BROUSSARD, *supra* note 35 at 32.

[226] *See generally* RICHARD RHODES, THE MAKING OF THE ATOMIC BOMB (1986).

[227] *See id*. *at* 561–63.

[228] *See* BROUSSARD, *supra* note 35, at 36 (explaining that it took decades of human labor to solve the math problem that allowed AlphaGo to be successful).

[229] *See id*. at 199 (arguing that technology should serve humans).

[230] *See* NAGER ET AL., *supra* note 4, at 5–6 (finding that only eight percent of U.S. innovators born in the United States are minorities and that women represent twelve percent of U.S. innovators); Jensen et al., *supra* note 18, at 307 (concluding that women patent applicants have less favorable outcomes than male applicants); Chien, *supra* note 1, at 25 (citing statistics that challenge the view that patenting is a meritocracy).

domains reveals that artificial intelligence, when applied to a problem with blind technological optimism, furthers disparities in power.[231] If the U.S. ignores these trends, then it risks further alienating small businesses and innovators that have been integral to the story of U.S. innovation. This section describes the problem in further detail.

1. Underrepresented Innovators and the Patent System

In the last several decades patent activity has become concentrated among certain groups. Large corporations patent more than small businesses.[232] Men patent more than women.[233] White Americans patent more than other minority groups.[234]

Recently, researchers have begun to ask why? For small businesses, one of the most common rationales given is that they lack the resources to successfully acquire patents.[235] A common rationale given for low female and minority participation is that there is a small number of women and minorities in the STEM fields.[236] It is helpful to take a closer look at some of the data and question whether lack of resources and the STEM pipeline tell the complete story. They do not.

2. Patent Concentration

Patent activity is coalescing around large corporations.[237] One rationale for this trend is that large firms are better suited to devote significant resources to research and development of new technologies.[238] The same corporations also have significant resources that they can devote to marketing and commerciali-

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[231] *See* BROUSSARD, *supra* note 35, at 53 (arguing that biased algorithms help the rich get richer).

[232] Ebrahim, *supra* note 25 (noting that the majority of patents that are granted are assigned to large corporations).

[233] NAGER ET AL., *supra* note 4, at 5.

[234] *Id*. at 5, 26 (reporting that 88 percent of U.S. innovators are male and 92.4 percent are white).

[235] *See* Sichelman, *supra* note 160, at 367; Todd Hixon, *For Most Small Companies Patents Are Just About Worthless*, FORBES (Oct. 4, 2013, 12:57 AM), https://www.forbes.com/sites/toddhixon/2013/10/04/for-most-small-companies-patents-are-just-about-worthless/ [perma.cc/U99X-2Q75].

[236] *See* NAGER ET AL., *supra* note 4, at 59 (recommending that the U.S. STEM pipeline be strengthened). *See generally* SHAW & HESS, *supra* note 21 (listing several programs that are meant to address the minority and women STEM pipeline problem).

[237] Ebrahim, *supra* note 25 (noting that the majority of patents that are granted are assigned to large corporations).

[238] *See* Freilich, *supra* note 103 (relating the story of an entrepreneur attempting to partner with a corporation to commercialize an invention).

zation.[239] On one hand, this trend follows a natural evolution of innovation in the United States.

On the other hand, small businesses and independent inventors have certain advantages that are not available to large firms. Small businesses are nimbler and in many cases can take more risk than larger firms.[240] In addition, small businesses are more likely to be engaged in endeavors that have not yet drawn the interest of larger corporations.[241] But, despite these advantages, small business patenting activity seems to be stagnating.[242] This trend is alarming because many of the most significant innovations in the last several decades have been patented by independent inventors or small businesses.[243] Less patent activity by small businesses could lead to less innovation.

Another notable trend is that the large businesses that are involved in patenting are increasingly foreign corporations.[244] From one perspective, this signals that the U.S. is an important country for securing patent rights. But the trend also suggests that innovative activity is moving out of the U.S. When innovation leaves, important indicators of a healthy economy such as jobs, investment and innovators themselves follow.

3. Access to Legal Resources

One issue that restricts access to the patent system is the availability and affordability of professional services. Potential patent applicants have a few choices. They can represent themselves *pro se*, they can hire a patent agent or they can hire a patent attorney. Despite the resources the USPTO makes available to *pro se* applicants, this group is historically not very successful at obtaining a patent.[245] The patenting process is simply too complex for the average lay inventor to navigate.

Due to its complexity, the best way for an inventor to obtain a patent is with the help of a person that is licensed to practice before the USPTO. In order to represent an inventor before the USPTO, a service provider must pass the patent bar.[246] To qualify for the patent bar, a service provider does not have to be a lawyer, but the individual must meet educational or experiential requirements set forth by the USPTO's Office of Enrollment and Discipline

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[239] *See* Arora et al., *supra* note 42, at 30 (finding that commercially viable inventions are most often assigned to small firms).

[240] Devra Gartenstein, *Advantages Small Have Over Large Companies*, HOUSTON CHRON. (Mar. 04, 2019), https://smallbusiness.chron.com/advantages-small-companies-over-large-companies-23667.html [perma.cc/VZK7-MPSB].

[241] *Id*.

[242] Chien, *supra* note 1, at 36.

[243] THE SMALL BUSINESS ECONOMY: A REPORT TO THE PRESIDENT, *supra* note 27, at 185–87.

[244] Chien, *supra* note 1, at 10, 13, 15.

[245] *See, e.g.*, McDowell & Vishnubhakat, *supra* note 138, at 48.

[246] *See* USPTO OFF. ENROLLMENT & DISCIPLINE, *supra* note 136, at 3–7.

("OED").[247] These individuals are referred to as patent agents (non-attorneys) or patent attorneys.[248]

Similar to the legal profession in general, many inventors find the prospect of hiring an attorney or patent agent daunting. The layperson or small business owner may have little guidance in where to start. Then, there is of course the cost of hiring a patent agent or attorney. To draft and file a patent application can cost anywhere from $5000–$30,000 dollars.[249] Costs vary based on the technology and the service provider's hourly rates.[250] In sum, the cost and unfamiliarity with service professionals in the industry can be a significant barrier to entry.

The USPTO has launched several initiatives to lower this barrier to entry. One way in which the USPTO attempts to lower the barrier to entry is to reduce filing fees for entities based on size.[251] However, because the primary costs of obtaining a patent is attributed to professional services, the fee reduction does little to address the affordability issue.[252] Further, while the USPTO has championed pro bono efforts at the state level and the existence of patent law clinics at law schools across the country, there is little evidence that these programs are more than just window dressing.[253] The reality is that the patent system remains inaccessible to those without financial resources and the personal networks necessary to find competent assistance.

U.S. women and minorities patent less than white American men.[254] While not that surprising, a recent study by the ITIF on American innovators includes some very alarming numbers.[255] The study found that although they make up half of the population, only about 12 percent of American innovators are women.[256] The numbers for non-white innovators were also shockingly low. The study found only 0.4 percent of innovators were African American and only 3.3 percent were of Hispanic dissent.[257] Generally, the study concludes that the numbers for women and minorities are caused by these populations' lack of participation in the STEM fields.[258] This explanation tells only part of the story.

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[247] *Id*.

[248] *General Information Concerning Patents*, USPTO (Apr. 22, 2021, 9:09 AM), https://www.uspto.gov/patents-getting-started/general-information-concerning-patents [perma.cc/9HSZ-K9XH].

[249] *See* AM. INTELL. PROP. L. ASS'N, REPORT OF THE ECONOMIC SURVEY 2019, at 35–44 (2019).

[250] *See generally id*. at 15–44.

[251] *See* Act of Aug. 27, 1982, Pub. L. No. 97-247, § 1, 96 Stat. 317, 317.

[252] *See* AM. INTELL. PROP. L. ASS'N, *supra* note 249.

[253] *See Law School Clinic Certification Program*, *supra* note 179.

[254] W. Michael Schuster et al., *An Empirical Study of Patent Grant Rates As a Function of Race and Gender*, 57 AM. BUS. L.J. 281, 281–82, 303 (2020).

[255] NAGER ET AL., *supra* note 4, at 5–6, 25–26.

[256] *Id*. at 5.

[257] *Id*. at 25.

[258] *See id*. at 59.

Historically, white men in the U.S. had a head start on patenting. The first patent was issued in 1790 to Samuel Hopkins.[259] The first patent granted to a woman was issued in 1809.[260] While there is a record of slave inventors,[261] the first patent granted to an African American was issued in 1821.[262] In 2020, the fact that women and African Americans fell behind several years in acquiring patents seems less significant. What then accounts for such a significant disparity in the number of inventions granted to underrepresented innovators?

Many view the low number of patents granted to women and minorities as a function of less women and minorities participating in businesses or careers that file patents.[263] A more accepted rationale is that the social dynamics detailed in Section I.A, *supra*, are a primary contributor. Thus, a common argument put forward to address the disparity in patenting activity is to take actions that improve the networks of underrepresented innovators and give them access to the resources they need to develop, patent, and commercialize their inventions. That is, once the network is in place, underrepresented innovators will have a fair shake at obtaining a patent.

However, a recent article by Jensen et al. casts some doubt on this sentiment. The article concludes that women patent applicants were treated different than their male counterparts by the patent office.[264] The researchers found that patent applications filed by women were more likely to be rejected, more likely to have claims added during prosecution and more likely to have more language added to their claims.[265] More research needs to be done to figure out if there is a concrete reason for the discrepancy. However, it certainly calls into question whether the patent examination process is gender neutral.

Another study on patent examiners also hints that the patenting process is susceptible to gender differences.[266] In this study, researchers studied the work performance of female examiners.[267] The study found that women examiners

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[259] Kara W. Swanson, *Authoring an Invention: Patent Production in the Nineteenth-Century United States*, *in* MAKING AND UNMAKING INTELLECTUAL PROPERTY: CREATIVE PRODUCTION IN LEGAL AND CULTURAL PERSPECTIVE 41, 42 (Mario Biagioli et al. eds., 2011); David W. Maxey, *Samuel Hopkins, the Holder of the First U.S. Patent: A Study of Failure*, 122 PA. MAG. HIST. & BIOGRAPHY 3, 6 (1998).

[260] Patricia Carter Ives, *Patent and Trademark Innovation of Black Americans and Women*, 62 J. PAT. OFF. SOC'Y 108, 114 (1980).

[261] *See* Brian L. Frye, *Invention of a Slave*, 68 SYRACUSE L. REV. 181, 187–88 (2018) (explaining an attempt by slave owners to apply for patents on inventions invented by their slaves).

[262] *Id*. at 185 (noting that Thomas Jennings was awarded a patent for a "dry scouring" method).

[263] *See generally* SHAW & HESS, *supra* note 21 (listing several programs that are meant to address the minority and women STEM pipeline problem).

[264] Jensen et al., *supra* note 18 (concluding that women patent applicants have less favorable outcomes than male applicants).

[265] *Id*.

[266] Hegde & Raj, *supra* note 73, at 1, 20–22.

[267] *Id*. at 20–22 (documenting female examiner work quality).

were clustered in art units.[268] For example, a higher percentage of women patent examiners work in the art units that examine biology and chemical patents.[269] The study also found that women examiners were more diligent in carrying out their required tasks.[270] If patent examination is subject to gender bias it is not a difficult leap to wonder whether the process is also biased with respect to minority patent applicants. More research needs to be done, however, as we have seen in other domains where bias exists, AI technology tends to further bias instead of eliminate it.[271]

4. AI Enthusiasm

Given the current environment for underrepresented innovators, AI enthusiasm threatens to make the patent system even less accessible. AI models can exhibit bias that concentrates power around market incumbents.[272] In addition, leaders overestimate the ability of AI models to solve human issues.[273] This Article refers to these problems collectively as "AI enthusiasm." Artificial intelligence is a remarkable achievement but like any other tool or mathematical model it is not a cure-all.

The idea of AI enthusiasm permeates through recent literature on the subject of AI.[274] AI enthusiasm is placing an irrational amount of confidence in a technological solution. Irrationality causes the creators of the technology and those who put it to use to not question the results.[275] Not questioning AI, especially when it is deployed to solve social problems, can have unintended consequences.[276] AI can exacerbate social issues and further concentrate power dynamics that might already exist.[277] Once we understand AI enthusiasm, we can then put systems in place to combat its negative side effects.

On August 22, 2019, the USPTO issued a Request for Comments ("RFC") regarding issues surrounding artificial intelligence.[278] The questions raised in

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[268] *See id*. at 10, 12–13, 24.

[269] *See id*. at 24.

[270] *See id*. at 20, 24.

[271] *See, e.g*., Steve Nouri & Forbes Tech. Council, *The Role of Bias in Artificial Intelligence*, FORBES (Feb. 4, 2021, 8:00 AM), https://www.forbes.com/sites/forbestechcouncil/2021/02/04/the-role-of-bias-in-artificial-intelligence/?sh=f1f7f51579d8 [perma.cc/STC6-MSC4].

[272] *See* BROUSSARD, *supra* note 35, at 53 (arguing that biased algorithms help the rich get richer).

[273] *See id*. at 7–8 (coining the term "technochauvinism" for the belief that technology is always the solution for any problem).

[274] *See id*.; NOBLE, *supra* note 38 (defining the phrase "technological redlining" as the way in in which technology "reinforces oppressive social relationships"). *See generally* O'NEIL, *supra* note 36, at 3 (referring to biased models as "Weapons of Math Destruction").

[275] BROUSSARD, *supra* note 35, at 44.

[276] *Id*.

[277] *See id*. at 53.

[278] Request for Comments on Patenting Artificial Intelligence Inventions, 84 Fed. Reg. 44,889 (Aug. 27, 2019).

the RFC reflect how USPTO leadership is thinking about artificial intelligence. Some of the questions asked how AI should be used for patent examination.[279] Other questions concerned how the USPTO should deal with inventions that were created wholly or in part by artificial intelligence.[280]

In a speech given in January of 2019, the director of the USPTO also mentioned artificial intelligence and how it may impact how the USPTO examines patent applications.[281] In fact, the USPTO has experimented with, to a limited extent, technology that helps patent examiners complete more thorough searches.[282] The office has also experimented with other technologies that will speed up the work that is involved with examination such as document automation applications.[283] One other notable question related to the USPTO's desire to receive comments about how other countries might be deploying AI in their patent examination process.[284] In his January speech, Director Iancu hinted that the motivation for this question may be one of competitive advantage.[285]

Using AI-assisted patent examination promises great things. It may make examiners more efficient. It may also improve the quality of patent examination. Both outcomes are good for the USPTO. Further, these benefits have been touted by commentators as reasons why the USPTO should embrace AI technology.[286]

For example, in a forthcoming paper, professor Arti Rai endorses the use of artificial intelligence to assist in the examination of patents.[287] She argues that efficiency concerns make the adoption of AI a no-brainer for the USPTO.[288] One rationale for her endorsement is that the social problems that have tripped up AI in other domains, such as sentencing guidelines, simply do not exist in the patenting context.[289]

Similarly, professor Tabrez Y. Ebrahim argues for the USPTO to adopt AI technology.[290] Ebrahim warns of an AI arms race between the USPTO and corporations.[291] His rationale is that corporations will adopt AI to gain a competi-

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[279] *See id*.

[280] *See id*.

[281] Remarks by Director Iancu, *supra* note 5.

[282] *Id*.

[283] *Id*.

[284] *See* Request for Comments on Patenting Artificial Intelligence Inventions, 84 Fed. Reg. at 44,889 (listing a number of questions from the USPTO regarding artificial intelligence).

[285] *See* Remarks by Director Iancu, *supra* note 5.

[286] *See, e.g*., Rai, *supra* note 24, at 2624 (arguing that deploying AI in "patent examination should represent a relatively easy case").

[287] *Id*.

[288] *Id*.

[289] *Id*. at 2618–20 (arguing that the use of machine learning in patent examination does not raise concerns about individual rights).

[290] Ebrahim, *supra* note 25, at 1188 (arguing that the USPTO needs "to take proactive measures" regarding AI).

[291] *Id*. at 1188.

tive advantage over patent examiners.[292] Thus, in order to level the playing field, the USPTO must also adopt AI technology.[293]

While these efficiency and competitiveness concerns are valid, they fail to address what, if any, negative harms using AI may cause for stakeholders. Obtaining a patent is a social endeavor fraught with the same perils as in any other context. If bias exists in the patenting process, AI could exacerbate the situation.[294] Further, an AI arms race between the government and large corporations would seem to further disadvantage innovators with less resources such as small businesses, women, and minorities.[295] Moreover, given what researchers have learned about the effect of AI in other domains,[296] it is clear that the use of AI could have a significant impact on the accessibility of the patent system.

The current patent accessibility problem is in part due to historical bias. For humans, bias is in part, instinctual. In the beginning of human history, bands of hunter gatherers were more justified in being weary of other humans that did not look like them.[297] This instinctual function kept them safe.[298] Today, humans still possess these same instincts.[299] However, they play out differently in modern society. In the modern workday setting, this takes the form of bias that can disadvantage one group such as women or minorities.[300]

Presumably, AI should be completely objective because a computer is not susceptible to hundreds of years of instinctual training.[301] Or is it? Researchers have found in many domains that AI models possess the same bias that humans do.[302] More concerning is that several commentators have argued that AI furthers the imbalance of pre-existing power dynamics.[303]

Why is AI not the cure-all we thought it would be? One reason is that AI is created by humans. Those human creators, despite their best intentions, imbue their technological children with the same bias they possess.[304] In addition, the decisions AI models make are based on the data that they are provided. Human

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[292] *Id*. at 1188. (arguing that the private sector will use AI to "gain an advantage over the USPTO").

[293] *See id*. at 1191–92.

[294] *See* MEREDITH WHITTAKER ET AL., AI NOW INST., DISABILITY, BIAS, AND AI 7–10 (2019).

[295] *See id*.

[296] *See id*.

[297] *See generally* YUVAL NOAH HARARI, SAPIENS: A BRIEF HISTORY OF HUMANKIND (2015).

[298] *See id*.

[299] *See id*.

[300] *See* Joan C. Williams & Sky Mihaylo, *How the Best Bosses Interrupt Bias on Their Teams*, HARV. BUS. REV. (2019), https://hbr.org/2019/11/how-the-best-bosses-interrupt-bias-on-their-teams [https://hbr.org/2019/11/how-the-best-bosses-interrupt-bias-on-their-teams].

[301] *See, e.g*., BROUSSARD, *supra* note 35, at 44 (describing an AI model that was supposed to allow judges to make more objective decisions).

[302] Bolukbasi et al., *supra* note 219, at 3 (exploring how machine learning can amplify biases in data).

[303] *See, e.g*., O'NEIL, *supra* note 36, at 3.

[304] *Id*.; BROUSSARD, *supra* note 35, at 157.

systems will likely generate biased data. When a new AI solution is deployed, it will train on biased data to model its problem domain. Unfortunately, this leads to biased outcomes and the vicious cycle continues.[305]

D. Why Is Artificial Intelligence a Threat to Patent Accessibility?

Little is known about the impact artificial intelligence will have on patenting. This part has discussed the current state of the patent system. It has also discussed the emergence of artificial intelligence. It is important to understand that the underlying way of thinking about AI technology can be dangerous. That is, assuming that technology is a cure-all for any problem. We know that technology can improve efficiency and allow people to devote time to more meaningful tasks. However, faster does not mean better or fairer.

In fact, several commentators have linked the emergence of big data or artificial intelligence with the furtherance of inequality.[306] This Article attempts to answer the question, what impact will AI enthusiasm have on the accessibility of the patent office? Given the current body of research in other domains, it is hard not to conclude that the use of AI will further increase the lack of participation and inequalities experienced by small businesses, women, and minority innovators.

As Professor Chien has reported, patenting activity continues to become more concentrated.[307] Underrepresented inventors seem to be in danger of disappearing from the innovation landscape. However, there is a bright spot. We can learn from the mistakes made by others. Part II discusses possible interventions that may be available to policy makers.

II. ARTIFICIAL INTELLIGENCE, INTERRUPTED

Part I of this Article explored the impact AI will have on the U.S. patent system. It concluded that AI-assisted patent examination and AI inventions threaten to further centralize patenting activity among large corporations and disadvantage underrepresented innovators. Underrepresented innovators such as small companies, women, and minority inventors are an important cross section of the U.S. innovation economy. This part now shifts toward inventor-centric interventions to reduce the negative impact of AI on the patenting activity of these groups. First, AI-assisted patent examination should be limited in scope. Second, in examining AI patent applications, the USPTO should impose requirements on applicants that are informed by best practices proven to reduce incidents of AI bias. Finally, AI should be deployed to assist underrepresented

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[305] *See* O'NEIL, *supra* note 36, at 27 (explaining a pernicious feedback loop created by biased AI models).

[306] *Id*. at 3; NOBLE, *supra* note 38; BROUSSARD, *supra* note 35, at 194.

[307] *See* Chien, *supra* note 1, at 5 (noting that the increase in foreign patenting may be responsible for the decrease in the patenting activity of U.S. inventors).

innovators in patenting. The goal of these proposals is to proactively interrupt potential AI bias and to reverse the patent system's inaccessibility problem.

A. Best Practices for AI-Assisted Patent Examination

In the near future, the USPTO will likely use AI to assist with patent examination.[308] This section explains how the patent office can deploy AI technology in a responsible and effective way. A successful deployment would result in a more efficient and equitable examination process. Moreover, AI-assisted patent examination should be deployed by the USPTO in a way that improves the patenting process for applicants across the economic and demographic spectrum.

Underrepresented innovators need help. The patenting activity of small businesses has declined over the last several decades.[309] According to a 2016 ITIF study, only 12 percent of American born innovators are women.[310] In addition, the study found that an alarming 0.4 percent of American innovators are African American.[311] The underrepresentation of women, minorities, and small businesses in patenting is a social issue.[312] Unfortunately, there are numerous examples of AI being deployed to help solve problems in social systems with disastrous results.[313]

Policymakers have the opportunity to avoid similar outcomes in the patenting context. As evidenced by its recent request for comments, the USPTO is at the early stages of determining how the office will use AI technology.[314] The USPTO is uniquely positioned to incorporate the additional objective of inclusiveness into its AI deployment strategy. Improving the patenting experience for women, minorities, and small businesses—in addition to increasing raw production numbers—should be the goal. This section explains how the USPTO might accomplish both.

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[308] *See generally* Rai, *supra* note 24 (advocating for the use of AI in patent examination). *See also* Ebrahim, *supra* note 25, at 1236 (also advocating for the use of AI in patent examination).

[309] *See* Chien, *supra* note 1, at 5 (explaining increase in patenting activity among corporations and decline among smaller entities).

[310] *See* NAGER ET AL., *supra* note 4, at 5.

[311] *See id*. at 25.

[312] *See* FOUCHÉ, *supra* note 12 (explaining how racial discrimination affected black inventors after the era of Reconstruction); *see also* Burk, *supra* note 22 (asserting that women have been socialized to solve problems differently than men).

[313] NOBLE, *supra* note 38 (defining the phrase "technological redlining" as the way in in which technology "reinforces oppressive social relationships"); O'NEIL, *supra* note 36, at 3 (noting that many existing algorithmic models are encoded with bias).

[314] *See* Request for Comments on Patenting Artificial Intelligence Inventions, 84 Fed. Reg. 44,889 (Aug. 27, 2019).

1. Creator Values

AI models are created by humans. The characteristics of the humans that create an AI model play a critical role in how well that model will perform in the real world.[315] Some evidence suggests that an AI model will adopt the values of its creators.[316] Thus, it is critical that the vendor the USPTO uses to develop its AI tools is properly vetted. At a minimum, the vendor must be professional and technically competent. However, the vetting process must go well beyond that.

The creator of AI used by the USPTO should possess characteristics that will make it less likely that its AI models will further exhibit bias in the patent prosecution process. For example, Cathy O'Neil has proposed AI creators be governed by a set of principles similar to that of a professional oath.[317] These principles accomplish several goals. First, they establish the human creator as the party responsible for an AI model's behavior.[318] Second, they impress upon creators a sense that their work has the ability to change lives for better or worse.[319] Often, creators are so enthralled with technology tools, they forget to consider the impact of that technology on the population. Finally, they provide creators of AI with a sense of duty and purpose.[320]

Vetting AI creators beyond basic competence will likely be more costly from a time and resources perspective. However, the cost of the suggested vetting is likely less than correcting a flaw after the fact. A bias flaw in examination software will likely become public knowledge and therefore the subject of embarrassment for the USPTO. In addition, an incident may delay examination of current applications and cause past applicants to question whether their examination was biased. Indeed, if the USPTO is to remain at the "cutting edge of the nation's technological progress"[321] sound policy supports the idea of vetting potential AI vendors in the manner suggested.

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[315] *See* BROUSSARD, *supra* note 35, at 150, 156–57 (describing the effect of unconscious bias on software).

[316] O'NEIL, *supra* note 36, at 20, 22 (arguing that the characteristics of a model reflects the priorities of its creators).

[317] *Id*. at 206 (proposing an oath for AI creators similar to that of the Hippocratic Oath).

[318] *See id*.

[319] *See id*.

[320] *See id*.

[321] *U.S. Patent and Trade Office (USPTO)*, NAT'L NANOTECHNOLOGY INITIATIVE, https://www.nano.gov/USPTO#:~:text=The%20U.S.%20Patent%20and%20Trademark,guidance%20to%20the%20Executive%20Branch [perma.cc/YM2V-624Z].

2. Transparency

AI-assisted examination technology must be transparent.[322] Outside observers should be able to easily discern how a specific AI model works. Transparency is desirable because it allows stakeholders to identify problematic models and openly challenge the model's process.[323] When an outcome seems wrong or unfair, nontransparent AI models may raise procedural concerns.[324] When stakeholders do not know how a model made its determination, then there is no way to know whether the decision was based on sound logic. More importantly, for repeat players, there is no way to determine how to arrive a successful outcome in the future.

Patent examination in the U.S. is a relatively transparent process. Generally, most communication between a patent applicant and the USPTO is in writing and made publicly available.[325] In the future, when patent examiners are assisted by AI, the process should look very similar to the current one. For example, when an application for a patent is rejected, the patent examiner explains her reasoning in writing.[326] This document is referred to as an Office Action. Generally, in the Office Action, the examiner will note any prior art references they deem relevant and explain the rationale for the rejection.[327] In most cases, upon reviewing an Office Action, the applicant has an understanding of why their application was rejected and can formulate a strategy for how to move forward.[328]

Even though an Office Action may contain a negative result, it seems less troubling when accompanied by an explanation. Perhaps this is because, in the U.S., we agree that decisions regarding legal rights should be transparent.[329] A transparent process and an effective process are not mutually exclusive. Transparency does not necessarily lead to the ability of someone to game the system. Instead, in the patent examination context, transparency allows an applicant to understand any problems that exist with her application and identify steps to fix those problems. AI-assisted examination should be no different in that regard.

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[322] *See* O'NEIL, *supra* note 36, at 17 (arguing that transparent models are fair models). *But see* Rai, *supra* note 24 at 2628 (arguing that explainability is more important than complete transparency).

[323] *See* O'NEIL, *supra* note 36, at 17.

[324] BROUSSARD, *supra* note 35, at 194–95 (calling for transparent models in criminal justice, healthcare, and education).

[325] The public can access the file wrapper for most patent applications through the USPTO's Public PAIR system. *See Check the Filing Status of Your Patent Application*, USPTO (Mar. 19, 2021, 11:21 AM), https://www.uspto.gov/patents-application-process/checking-application-status/check-filing-status-your-patent-application [perma.cc/T7VY-RYLC].

[326] *See* Hegde & Raj, *supra* note 73, at 14–15 (describing the patent examination process).

[327] *See id*.

[328] *See id*.

[329] *See* Lynn M. LoPucki, *Court-System Transparency*, 94 IOWA L. REV. 481, 484–85 (2009) (listing the benefits that follow from a court-system transparency).

3. Proxies

The data used by AI models to assist in patent examination should not be used as proxies for other determinations. Historically, proxies are a way in which AI models have furthered bias and the imbalance of power dynamics in social systems.[330] For example, financial models have used zip codes as a proxy for the race of an individual.[331]

In the patent examination context, it's possible to imagine that certain information could be used as a proxy to draw conclusions about the applicant or the invention. Take the number of claims, for example. Applicants must pay an additional fee if their application contains more than twenty total claims or more than three independent claims.[332] An AI model could use the number of claims in a patent application as a proxy for determinations about an inventor's financial resources. Further, the number of patents cited by a patent application could be used as a proxy to make determinations about statutory requirements such as novelty or obviousness.[333]

In the U.S., the purpose of requiring an applicant to fully disclose her invention is to evaluate whether the invention is worthy of a patent. A patent applicant should not expect that the information they disclose to the USPTO will be used for any other purpose than the examination of her application. Generally, the Manual for Patenting Examination and Procedure ("MPEP") lists what information an applicant must provide and why.[334] The information provided will be used by the USPTO to determine whether the invention disclosed in the application meets the necessary requirements for patenting. Using the information provided for anything else would seem to contradict the rationale provided by the MPEP.

One drawback of limiting the use of data proxies is that it limits the number of determinations an AI model can make.[335] This problem can be addressed by obtaining more data that will allow the model to make better determinations. Moreover, stakeholders must acknowledge the limitations of a particular AI model. If a properly understood model is used in the correct way there is no need to use data as a proxy for other information.

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[330] *See* O'NEIL, *supra* note 36, at 165 (summarizing report that found insurance companies used credit scores as a proxy for safe driving).

[331] *See id*. at 78; Alexandra George, *Thwarting Bias in AI Systems*, CARNEGIE MELLON U. SCH. COMPUT. SCI. (Dec. 20, 2018), https://engineering.cmu.edu/news-events/news/2018/12/11-datta-proxies.html [perma.cc/T6XV-YEVD].

[332] *See* 37 C.F.R. § 1.16 (2020).

[333] *See* James H. Richardson, *Are Prior Art Citations Determinative of Patent Approval?: An Empirical Analysis of the Strategy Behind Citing Prior Art*, 7 HASTINGS SCI. & TECH. L.J. 25, 30–31 (2015) (finding that the number of patents cited by the examiner is related to the number of patents cited by the applicant).

[334] *See* USPTO, MANUAL OF PATENT EXAMINING PROCEDURE § 600 (9th ed. Rev. June 2020) [hereinafter "MPEP"].

[335] *See* O'NEIL, *supra* note 36, at 17 (explaining that models use proxies for unavailable data).

4. Continual Updates

Continuously updating AI models is a best practice.[336] Continuous updates allow programmers to modify the AI model to deal with edge cases as they arise. The ability to deal with edge cases or boundary problems is a hallmark of a well-developed AI model.[337] Thus, AI models that are continually updated are less likely to further bias or the imbalance of power dynamics within the social systems that they operate.

This demonstrates that the USPTO's AI models should be subject to continuous update and improvement. In patent prosecution, continuous updates are needed to keep pace with technology and legal developments. The USPTO often issues updated guidance to examiners regarding technology or legal developments.[338] Updating the AI models used in patent examination would be a natural extension of the procedures the USPTO already has in place. It is likely that continuously updating the USPTO's AI models will be costly. However, the benefit arguably outweighs the cost of using outdated models that would be more likely to cause an error or lead to an irrevocable outcome.

5. User Consent

Patent applicants should have the option to provide their consent to be subject to AI-assisted examination. At the USPTO, this recommendation could be implemented in several ways. First, the USPTO should alert applicants that AI-assisted examination is being used to examine their patent application. Alternatively, the USPTO could give applicants the option of opting in for AI-assisted examination. The USPTO has incentivized certain applicant behaviors by offering different tracks of examination. For example, applicants can have their patent examined at an expedited rate if they pay a fee and meet other substantive requirements.[339] The idea is that this additional effort on behalf of the applicant will speed up the examination process. Similarly, in order to acquire the feedback necessary to continually improve its AI models, the USPTO could incentivize applicants to subject their applications to AI-assisted examination.

Requiring consent accomplishes two objectives. First, it forces transparency upon the service provider. This Article discussed the benefits of transparency *supra*. Second, it provides the user with notice and possibly a choice. For example, in some applications the user can either decide to be subjected to the AI model or opt out.

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[336] *See id*. at 22 (explaining that models will grow stale if not updated).

[337] *But see* BROUSSARD, *supra* note 35, at 177.

[338] *See, e.g*., Press Release, USPTO, U.S. Patent and Trademark Office Announces Revised Guidance for Determining Subject Matter Eligibility (Jan. 4, 2019), https://www.uspto.gov/about-us/news-updates/us-patent-and-trademark-office-announces-revised-guidance-determining-subject [perma.cc/BJ6M-U92K].

[339] *See* MPEP, *supra* note 334, at § 708.02 (2020).

The cost of disclosing this information is minimal. Further, an applicant having the knowledge that their application is being examined with the assistance of AI is a natural extension of the information that is already readily available to them. Applicants are aware of who their patent examiner is.[340] There are also services that provide applicants with data on examiners.[341] Because much of what an examiner does is publicly visible, that data can be collected and analyzed to develop a patent prosecution strategy for each examiner. In fact, repeat players in a certain art unit may get to know patent examiners well.

6. Subject to Legal Challenge

Ensuring that AI-assisted examination can be subjected to legal challenges may reduce the likelihood that underrepresented innovators will be disadvantaged during the patent examination process. When AI makes a mistake, a familiar pattern of reactions emerge. First, laypeople react with shock and disbelief.[342] Second, the company that owns the AI may issue an apology.[343] More importantly, the company may claim that the mistake was unintentional and beyond their control.[344] The company then assures the public that the problem is being addressed.[345] But what recourse is there for people that may have been harmed by an AI model's determination?

This demonstrates that AI-assisted patent examination should not be exempt from procedural and legal challenges. A number of AI models are black boxes.[346] Information is provided to the model and it spits out an answer. In contrast, the current patent prosecution procedure allows applicants to interact with their patent examiner through written correspondence as well as through oral or in-person communication in the form of interviews.[347] These interactions allow space for explanation, understanding and negotiation. If an applicant disagrees with an examiner's decision, an applicant may appeal a second rejection of her application to the USPTO Board of Patent Appeals.[348] The appeals process provides examiner oversight and another level or review. Similarly, any determination made with the assistance of an AI model should be subject to legal oversight.

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[340] *See* Hegde & Raj, *supra* note 73, at 11.

[341] BigPatentData is a software tool that offers metrics on examiners. *See* BIGPATENTDATA, https://bigpatentdata.com [perma.cc/UN6B-A98K].

[342] *See* NOBLE, *supra* note 38, at 3 (describing her reaction to the results produced by Google when using the term "black girls").

[343] *See* BROUSSARD, *supra* note 35, at 115 (describing how the CEO of Amazon apologized for experimenting with charging customers different prices for the same products).

[344] *See* O'NEIL, *supra* note 36, at 10.

[345] *See id*.

[346] *See id*. at 8 (discussing the Mathematica algorithm).

[347] *See* Hegde & Raj, *supra* note 73, at 11; MPEP, *supra* note 334, § 713.

[348] *See* 37 C.F.R. § 41.31(a)(1) (2020).

The decisions made by administrative agencies should be reviewable. Despite the deference given to agencies, their decisions cannot be unreasonable.[349] It is clear from this that any patent office decision made with the assistance of an AI model would be subject to a reasonableness test. Determining what might be reasonable in this context is beyond the scope of this Article. That is best determined under specific facts. What is important is the notion that AI should be held accountable when it makes mistakes. A logical question raised by this specific proposal is whether an AI model will be able to defend itself. This question actually leads to the next proposal. That is, that patent examination remain a "human-in-the-loop" system.

7. Human-in-the-loop Systems

Historically, "human-in-the-loop" systems outperform AI-only models.[350] "Human-in-the-loop" systems are models that combine AI with human decision-making.[351] Human-in-the-loop systems result in better outcomes for users because humans can better identify bias and deal with edge cases.[352] Current AI technology is not good at handling edge or boundary cases.[353] On the margins are where humans can add significant value. Take Google's visual search algorithm for example. If it were a human-in-the-loop system, a human could have intervened when the model incorrectly identified an African American person as a gorilla.[354]

This suggests that the USPTO should use a human-in-the-loop system for patent examination. Patent examiners perform complex tasks.[355] They must interpret complex technical language.[356] They must compare and contrast what is known about a technology with what the applicant says is their invention.[357] Examiners must also evaluate an applicant's arguments as to why their invention is patentable.[358] These are tasks that should not be left to AI-only models.

Many AI experts agree that AI models fall short of their desired goals when confronted with unique problems.[359] Human-in-the-loop systems are a way to account for the shortcomings of AI models while still benefiting from their power and speed. Because of wages, human-in-the-loop systems are clearly

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[349] *See* Chevron, Inc. v. Nat. Res. Def. Council, Inc., 467 U.S. 837, 843 (1984).

[350] *See* BROUSSARD, *supra* note 35, at 175, 177.

[351] *See id.* at 177.

[352] *See id.*

[353] *See id.*

[354] Jana Kasperkevic, *Google Says Sorry for Racist Auto-Tag in Photo App*, GUARDIAN (July 1, 2015, 1:52 PM), https://www.theguardian.com/technology/2015/jul/01/google-sorry-racist-auto-tag-photo-app [perma.cc/FGE6-7XHD].

[355] *See* Hegde & Raj, *supra* note 73, at 11 (describing the patent examination process).

[356] *See id.*

[357] *See id.*

[358] *See id.*

[359] *See* BROUSSARD, *supra* note 35, at 177.

more costly than AI-only models. They are also not infallible since they are subject to human error. Nevertheless, the use of such systems should be encouraged based on their results as compared to AI-only models.

8. Clear Conclusions and Assumptions

The conclusions reached by AI models must be clear.[360] Clear conclusions influence several parts of the AI modeling process. For example, clear conclusions can be used as feedback to continuously update and improve an AI model.[361] In addition, requiring clear conclusions forces AI creators to think more deeply about how their model will work.[362] Users of AI models that provide clear conclusions benefit as well. For example, if the user is a repeat player, clear conclusions may provide the user with the information they need to change behavior that has an impact on the AI model's future determinations.[363]

This demonstrates that AI models that reach clear conclusions will likely create a more inclusive patenting process for underrepresented innovators. Clear conclusions benefit both the examiners and applicants. From an examiner standpoint, when its AI tool's conclusions are clear it will likely help the examiner provide a better examination. Further, a patent applicant armed with concrete conclusions can provide a more complete response to an office action or provide a more detailed argument on appeal. The cost of providing a clear conclusion is likely to be minimal. Further, the patent examination process requires clear conclusions. That is, an examiner must notify an applicant of whether or not the patent application will be granted and the reasons for the examiner's decision.[364]

The assumptions AI models use should also be clear.[365] When the assumptions are clear, the AI model's determinations are easier to understand. Further, it is easier to evaluate the ability of an AI model to deal with edge cases.[366] Edge cases are historically the most difficult for AI models to process.[367] Even though edge cases exist at the margins, the consequences of AI models improperly handling edge cases can be extraordinary.

This demonstrates that identifying clear assumptions are essential for AI-assisted patent examination. During patent prosecution, a number of assumptions exist. For example, an applicant assumes that the patent examiner is evaluating the patent application based on current agency rules and understanding

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[360] *See* O'NEIL, *supra* note 36, at 27 (explaining how a baseball model has clear conclusions).

[361] *See id*. at 18.

[362] *See id*. at 205 (suggesting that the regulation of models begin with the creators).

[363] *See id*. at 142 (describing how the credit score model allows for consumers to modify their behavior to produce changes to their score).

[364] *See* MPEP, *supra* note 334, at § 706.

[365] *See* O'NEIL, *supra* note 36, at 27.

[366] *See id*. at 20.

[367] *See id*. at 20.

of the law. However, during examination, the law can change. It may take weeks for the USPTO to issue examiner guidance on a particular case. Therefore, even now it can be hard for an examiner to determine how applicable caselaw should be applied.

When the errors of AI models appear in the news, it is likely the case that the model did not handle an edge case well due to assumptions either made by the AI developer or assumptions built into the training data.[368] Sometimes assumptions will be hidden. Nevertheless, identifying assumptions at the outset can avoid costly errors and negative publicity.

9. Successful AI-Assisted Patent Examination

When stakeholders define what success looks like for an AI model, the model's outcomes are less likely to be biased or further an imbalance of power. Success could be defined in how the model will operate.[369] It could also be defined by the outputs the model provides.[370] When AI is used without a clear understanding of what is a successful outcome, it can lead to unintended consequences and disastrous results.

This demonstrates that the USPTO should clearly define successful outcomes for AI-assisted examination. A clear understanding of what is a successful outcome will serve as a guide for those tasked with creating and updating the USPTO's AI models. In addition, it is important for the USPTO to include qualitative as well as quantitative measures of success. For example, one quantitative goal might be to reduce the time it takes to examine a patent application. Qualitatively, the USPTO might gage the success of examination on how well any rejections made during the prosecution process hold up if challenged on appeal.

In patenting, how do we define success? The goal of patent examination is to award patents to worthy inventions.[371] As mentioned above, success can be measured by the patent office in many ways. Overall, the definition of success for AI-assisted examination should align with the primary goal of awarding patents to worthy inventions.

B. Best Practices for AI Inventors

The USPTO has used its resources to incentivize inventive activity in various industries such as cancer drugs.[372] The patent system also has a unique opportunity to incentivize patent applicants to create better AI models. The

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[368] *See* Kasperkevic, *supra* note 354 (describing the failure of Google's photo algorithm to properly identify dark-skinned people as human).

[369] *See* BROUSSARD, *supra* note 35, at 21 (success is a key component of AI models).

[370] *See id.*

[371] MERGES ET AL., *supra* note 68, at 29 (listing requirements that must be met to obtain a patent).

[372] *See* Cancer Immunotherapy Pilot Program, 81 Fed. Reg. 42,328 (June 29, 2016).

USPTO can encourage the use of better AI models by placing specific requirements on inventions where AI is a named inventor. These requirements should be informed by best practices and align with existing statutory requirements. This section of the Article discusses ways in which the USPTO could impose requirements on AI-assisted inventions during the patent examination process.

1. AI and Patent Eligibility

The patent office should limit the patent eligibility of AI-related inventions. Specifically, inventions that are created with the assistance of AI technology should be patent eligible. AI technology, in its simplest form, should be viewed as a tool like a saw or a hammer.[373] In other contexts, inventions that are created by a person using rudimentary tools are considered eligible for patenting. At a basic level, AI makes humans faster.[374] Further, AI-assisted inventions satisfy the current interpretation of the statutory text by naming at least one natural person as an inventor.[375]

In contrast, inventions that are created solely by AI technology should not be eligible for patenting. The clearest rationale for not allowing AI inventions is statutory interpretation. According to the statute, only humans can be inventors.[376] Copyright law has come to a similar conclusion.[377] In 2014, David Slater applied for a copyright registration on a photograph that was "taken" by a monkey, i.e., a monkey selfie.[378] The copyright office determined that the monkey could not obtain a valid copyright in the photograph.[379] Thus, U.S. law has rejected initial opportunities to award intellectual property ownership rights to non-human creators.

Similarly, the U.S. should not succumb to external pressure to allow patents for AI inventions. A Chinese court recently granted copyright protection to an article that was wholly generated by artificial intelligence.[380] A next logical step for China IP policy may be to consider patent protection for inventions

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[373] *See* O'NEIL, *supra* note 36, at 207 (arguing that mathematical models should be used as tools not as masters).

[374] *See* BROUSSARD, *supra* note 35, at 187 (explaining that AI is good at helping humans speed up tasks).

[375] *See* 35 U.S.C. § 116.

[376] *See* 35 U.S.C. § 115 (referring to inventors as individuals that must submit an oath or declaration with their patent application).

[377] *See* U.S. COPYRIGHT OFF., COMPENDIUM OF U.S. COPYRIGHT OFFICE PRACTICES § 313.2 (3d ed. 2017) (stating that works of authorship must be created by a human being).

[378] *See* Samuel Gibbs, *Monkey Business: Macaque Selfie Can't Be Copyrighted, Say US and UK*, GUARDIAN (Aug. 22, 2014, 12:01 PM), https://www.theguardian.com/technology/2014/aug/22/monkey-business-macaque-selfie-cant-be-copyrighted-say-us-and-uk [perma.cc/BHF3-RCX3].

[379] *See id*.

[380] *Court Rules AI-written Article Has Copyright*, ECNS.CN (Jan. 9, 2020, 8:18 AM), http://www.ecns.cn/news/2020-01-09/detail-ifzsqcrm6562963.shtml [perma.cc/FZ9L-N3AL].

created wholly by AI. Organizations are also advocating for the recognition of AI inventors. In 2019, The Artificial Inventor Project filed two patent applications it claimed were invented by AI in several foreign patent offices and the U.S.[381] The Artificial Inventor Project stated purpose is to force these offices to take a definitive position on AI inventors.[382] But, one must ask what is the significance of acknowledging AI as an inventor? This and other questions that cut to the heart of the theoretical rationale for intellectual property are beyond the scope of this Article. At best, acknowledging that an AI can invent indirectly compliments the team of humans that created the AI.

2. Human-in-the-loop AI Inventors

One requirement that follows naturally from the proposal that only AI-assisted inventions be eligible for patenting is that AI models that are named inventors must be human-in-the-loop systems. Evidence suggests that human-in-the-loop systems are more reliable and less biased than AI-only models.[383] Current AI technology is not good at handling edge or boundary cases.[384] Further, AI models' recommendations may lead to absurd or undesirable results.[385] On the margins are where humans can add significant value.[386]

A recent change in Major League Baseball illustrates this point. In recent seasons, baseball managers have used models to assist them in making pitching substitutions. In some cases, this led to managers inserting a pitcher in the game to face one batter. This practice slowed the game down significantly. In response, Major League Baseball instituted a new rule for the 2020 season that requires a pitcher to face at least three batters.[387] Similarly, the USPTO must also endorse a world where AI technology keeps humans in the loop.

The USPTO can incentivize human-in-the-loop systems in several ways. Currently, the USPTO requires each inventor submit an oath or declaration.[388] In a similar manner, the USPTO could require the disclosure of information about an AI model that is a named inventor on a patent application. For example, the USPTO could ask the owner of the AI model to affirm that the AI model is a human-in-the-loop system. Other things the USPTO could do include

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[381] *See* Ryan Abbott, *The Artificial Inventor Project*, WIPO MAGAZINE (Dec. 2019), https://www.wipo.int/wipo_magazine/en/2019/06/article_0002.html [perma.cc/ZL2V-AFBD].

[382] *See id*.

[383] *See* BROUSSARD, *supra* note 35, at 177.

[384] *See id*.

[385] *See* Kasperkevic, *supra* note 354 (noting that Google says sorry for racist auto-tag in photo app).

[386] *See* BROUSSARD, *supra* note 35, at 177.

[387] *See* David Adler, *These Are the Rule Changes for 2020 Season*, MLB (Feb. 14, 2020), https://www.mlb.com/news/mlb-rule-changes-for-2020-season [perma.cc/68ML-Q5YK] (describing the three-batter minimum rule).

[388] *See* 35 U.S.C. § 115.

prioritizing the examination of applications with a named human-in-the-loop AI model or use the examination fee structure to incentivize the use of human-in-the-loop systems in inventing.

Many AI experts agree that AI models fall short of their desired goals when confronted with unique problems.[389] Human-in-the-loop systems are a way to account for the shortcomings of AI models while still benefiting from their power and speed. Not all named AI inventors must be human-in-the-loop systems. Nevertheless, the use of such systems should be encouraged based on their results as compared to AI-only models. If the patent system will allow AI to be a named inventor, that AI should be designed to produce optimal results.

3. Transparent AI Inventors

The USPTO should require any AI inventor to be transparent. AI models that are transparent are less likely to be biased.[390] That is, outside observers should be able to easily discern how a specific AI function works. Transparency is desirable because it allows stakeholders to identify problematic models and openly challenge the model's process.[391] Black box AI models raise procedural concerns.[392] People affected by black box AI do not know how the AI made its determination. Thus, that decision is more difficult to question and challenge.

This suggests that in addition to some version of an inventor oath and declaration, patent applications with named AI inventors should include a sufficient description of the inventing AI model. That description should allow stakeholders to understand how the AI model functions and makes its determinations.

Nontransparent AI models are problematic for society. The USPTO has a unique opportunity to ensure that patented AI models are less problematic. Critics may argue that certain AI may be subject to trade secret protection and therefore cannot be disclosed in a patent application.[393] This concern does not outweigh the collateral benefits of a disclosure requirement. One alternative to transparency may be an "explainability" requirement as defined in a recent paper by Professor Arti Rai.[394] "Explainability" is arguably a less significant step than transparency. However, the goals of transparency and "explainability" align in that they seek to make AI models accountable and reviewable.

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389 *See* O'NEIL, *supra* note 36, at 20 (discussing the danger of AI model blind spots).

390 *See id.* at 17 (arguing that transparent models are fair models).

391 *See id.* at 8.

392 BROUSSARD, *supra* note 35, at 195 (calling for transparent models in criminal justice, healthcare, and education).

393 *See* O'NEIL, *supra* note 36, at 29 (claiming that companies hide their models).

394 *See* Rai, *supra* note 24, at 109 (arguing for AI used in patent examination be explainable).

C. Empowering Underrepresented Innovators

Thus far, the proposals in Part II have focused on ways in which the patent system can integrate AI to deter bias, avoid the centralization of power amongst incumbent actors, and encourage the creation of better AI models. This section suggests ways in which the patent system can empower underrepresented innovators. Historically, underrepresented innovators have been an important part of the U.S. story of innovation.[395] The lack of small businesses, women, and minorities that invent is not simply a pipeline problem.[396] Lack of access to resources and bias also play a role.[397] This section discusses two strategies to help underrepresented innovators.

AI tools should be made publicly available to assist underrepresented innovators in the patenting process. Providing the public with access to AI models and tools to create AI models could help level the playing field between the have and the have-nots.

The USPTO already makes patent search systems available to the public.[398] Anyone may access these systems in tech resource centers across the country.[399] Similarly, the AI technology that will be used in the patent examination process should be made publicly available. Equipped with similar search technology, for example, applicants could file better applications that could overcome potential prior art rejections. Better patent applications would make the patent examination process more efficient.

The USPTO's pro bono initiative and programs for *pro se* inventors evidence the importance of making legal resources available to the public.[400] Further, lawyers and patent agents have access to paid analytical tools that help navigate the patent prosecution process.[401] Providing similar AI driven tools to the public would be a natural extension of what the USPTO is already doing.

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[395] *See* Ives, *supra* note 260, at 108 (documenting the early history of black and women inventors in the U.S.); *see also* Castelluccio, *supra* note 44, at 437 (arguing that small businesses are the source of the U.S. economy's innovation and opportunity).

[396] *See* Saurabh Vishnubhakat, *Gender Diversity in the Patent Bar*, 14 J. MARSHALL REV. INTELL. PROP. L. 67, 69–70 (2014) (citing the pipeline problem as reason for lack of diversity in IP).

[397] *See* HICKS, *supra* note 59, at 238 (arguing that fixing the pipeline problem cannot undo decades of discrimination).

[398] *See PubEAST and PubWEST*, USPTO (June 12, 2017, 3:05 PM), https://www.uspto.gov/learning-and-resources/support-centers/patent-and-trademark-resource-centers-ptrc/resources/pubeast [perma.cc/ZJ2W-8X4B] (noting PubEAST and PubWEST are the public examiner automated search tool and web search tool respectively).

[399] *See Patent and Trademark Resource Centers*, USPTO (Feb. 26, 2019, 3:01 PM), https://www.uspto.gov/learning-and-resources/support-centers/patent-and-trademark-resource-centers-ptrcs [perma.cc/VSP2-95RP].

[400] *See generally* McDowell & Vishnubhakat, *supra* note 138, at 4–5 (describing the beginning of the patent pro bono program).

[401] *See* BIGPATENTDATA, *supra* note 341 (exemplifying a software tool that offers metrics on examiners).

Professor Tabrez Ebrahim would likely argue that opening up the USPTO's examination AI would disadvantage the USPTO strategically. In his view, the primary reason the USPTO must adopt AI is to insure the integrity of the examination process against applicants that may be using their own proprietary AI to assist them in patent prosecution.[402] Making the USPTO system available to the public may allow these commercial actors to determine how best to circumvent it. Although this is a valid concern, gamesmanship in patent prosecution will always exist in one form or another. Further, the benefit of providing technological resources to all potential patent applicants outweighs the cost of having to deal with savvy applicants.

Finally, the USPTO must eliminate bias that already exists in its patent examination process. In a legal system that purports to uphold equality, bias in a legal administrative process is undesirable. Recent studies have suggested that women and minorities experience the patent system differently than white men.[403] Further, there are plenty of examples where AI has been deployed in a way that furthers bias and an imbalance of power dynamics.[404]

Thus, before the USPTO deploys AI solutions to assist in the examination of patents, it must investigate how and why bias exists in the current patent examination process. A starting point for this analysis is to obtain more accurate demographic data. Professor Colleen Chien has called for the USPTO to collect demographic data on patent applicants.[405] Researchers equipped with this data could then track applications filed by minorities and women. This information may allow the USPTO to identify how bias enters the prosecution process.[406]

The Office can then implement some best practices to combat bias. Recent scholarship suggests that the prevention of bias before it happens is almost impossible.[407] Instead, a best practice is to equip decision-makers with the skills to identify bias and then give them the power to intervene to avoid undesirable results.[408] The USPTO could equip its senior examiners and management with tools and techniques to avoid outcomes in the patent prosecution process caused by bias.

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[402] *See* Ebrahim, *supra* note 25, at 1188 (arguing that AI magnifies information asymmetry between the USPTO and applicants).

[403] *See* Jensen et al., *supra* note 18, at 309 (concluding that women patent applicants have less favorable outcomes than male applicants).

[404] *See* NOBLE, *supra* note 38, at 1 (defining the phrase "technological redlining" as the way in in which technology "reinforces oppressive social relationships"); O'NEIL, *supra* note 36, at 3 (noting that many existing algorithmic models are encoded with bias).

[405] *See* Colleen Chien, Increasing Diversity in Innovation by Tracking Women, Minority, and Startups Innovators that Patent and Supporting Experimentation in Inclusive Innovation 3 (2019) (unpublished manuscript) (on file with Santa Clara University School of Law) (suggesting that the USPTO collect demographic information of patentees, including characteristics such as race).

[406] *See id*. at 5.

[407] *See* Williams & Mihaylo, *supra* note 300 (explaining that bias is hard to eliminate).

[408] *See id*. (explaining several ways managers can interrupt bias in the workplace).

At this point in history, we assume that bias on the basis of characteristics such as gender should not be determinative in whether one obtains a property right. In the last century, drastic changes have been made to the legal system to promote equality. Despite tremendous progress, harmful bias still exists. When identified, it must be confronted.

CONCLUSION

If approached with care, AI presents a tremendous opportunity for the patent system. This Article described the current patenting environment for women and underrepresented minorities. It concluded that the patent system is not accessible to underrepresented innovators. In addition, the Article explored the history of AI and bias. It further discussed the USPTO's current interest and plans with respect to AI. Given that framework, this Article outlined three proposals for increasing the accessibility of the patent system. The following summarizes the important themes of the Article and suggests avenues for future research.

In the United States, the innovation ecosystem is less accessible to small businesses, women, and minorities.[409] Since it is the government agency that grants patents, the USPTO plays a critical role in underrepresented populations' accessibility to the innovation ecosystem. Unfortunately, the patenting process is less accessible and might be biased against underrepresented innovators such as women.[410] Since bias has been a significant problem in other domains that use AI, it is important for the U.S. Patent system to understand how deploying AI in its processes or granting patents on inventions created with the assistance of AI will impact an already fragile innovation landscape. Fortunately, patent stakeholders can attain a great deal from the lessons learned in other areas.

Artificial intelligence is a marvelous human achievement that holds incredible promise. However, history tells us that when decision makers possess blind optimism for a technological solution, human social structures suffer.[411] AI is no different. This Article has discussed numerous examples of how human bias has manifested itself in AI models which have led to absurd, insulting, and, in some cases, life changing results.[412] More importantly, the impact of AI bias on a social environment helps those already in power and disadvantages those that lack power and resources.[413] In order for the U.S. Patent system to avoid these pitfalls, it must not let its "AI enthusiasm" override fairness, logic, and its mission to encourage innovation at all levels in the U.S.

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[409] *See supra* Part I.

[410] *See* Jensen et al., *supra* note 18, at 307 (concluding that women patent applicants have less favorable outcomes than male applicants).

[411] *See* HICKS, *supra* note 59, at 239 (explaining how a social problem of inequality became a technical problem as it relates to the history of British computing).

[412] *See supra* Part I.

[413] *See* O'NEIL, *supra* note 36, at 3 (arguing that biased algorithms help the rich get richer).

First, the USPTO should implement best practices that limit bias in its deployment of AI tools that will assist with patent examination.[414] The goal of this proposal is to combat the bias that might already exist in patent examination. At a minimum, the hope is that implementing these best practices will not further compound the perceived bias problem during patent examination. This first proposal is internal to the USPTO.

The second proposal recognizes that the U.S. Patent system has a unique opportunity to be a world leader on AI. This Article suggests that in reviewing AI-assisted patent applications, the USPTO impose examination requirements informed by best practices for combating AI bias.[415] That is, in order for patentees to obtain a patent on inventions created with the assistance of AI, in addition to the statutory patentability requirements, those applications must include information that communicates that the AI adheres with agreed upon best practices. The goal of this proposal is to encourage innovators to use AI in a responsible way that will not negatively impact society.

Finally, the USPTO should make AI tools that assist in patent prosecution available to the public.[416] Big law firms have the ability to pay for and access vast amounts of data on patent prosecution at the USPTO and analytical tools that assist in prosecution strategy. In a way, the USPTO is in an arms race with these technologies.[417] It will no doubt need to develop its own internal tools. The USPTO should make similar diagnostic tools available to the public. This will give inventors at all levels of the innovation ecosystem important information that will assist in their patenting activities.

One area this Article suggests is ripe for further investigation is confirming whether the patent examination process is biased against underrepresented innovators. Some evidence to that effect exists for women.[418] If confirmed, policymakers may be able to identify specific solutions. Providing better assistance to underrepresented innovators and training primary examiners to identify bias and intervene are possible solutions that come to mind.

Innovation is a social endeavor that has its human flaws and advantages. The patenting process does not seem to be the neutral and objective process we would like it to be. AI enthusiasm threatens to make the patenting process less accessible. Further, it could encourage the irresponsible use of AI. But, the U.S. patent system has an opportunity. We must enter the era of AI with eyes wide open. We must learn from the mistakes of the past. In order for the U.S. to flourish, we must continue to rely on human ingenuity. While AI can help, we must not place more faith in technology than we do in humanity. Until AI ad-

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414 *See supra* Part II.

415 *See supra* Part II.

416 *See supra* Part II.

417 *See* Ebrahim, *supra* note 25, at 1188 (arguing that AI magnifies information asymmetry between the USPTO and applicants).

418 *See* Jensen et al., *supra* note 18, at 307 (concluding that women patent applicants have less favorable outcomes than male applicants).

vances well beyond its current state, the path forward is clear and people must lead the way.

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