Minnesota Journal of Law, Science & Technology

Volume 21
Issue 2 *Symposia*

Article 2

7-13-2020

Law, Technology, and Pedagogy: Teaching Coding to Build a "Future-Proof" Lawyer

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"If legal work will be dependent on and performed by algorithms in the future, it is crucial for the future lawyers (and lawyers who are at the start of their careers) to get a better understanding of 'data analytics' and 'artificial intelligence.' Since all of these near-benefits technologies are code based, the benefits of understanding code will be of value in the medium to long-term."[1]

"Learning to effectively use technology is to ensure that future graduates will be technologically confident and proficient, but a law graduate is not, nor needs to be, an expert in technology. We should also recognise that nothing can be future-proof . . . ."[2]

INTRODUCTION

Imagine your typical day. Your virtual assistant, Alexa, wakes you up in the morning to your programed alarm, and you ask her to turn on the wireless thermostat. You put on your Fitbit or Apple Watch and go for a run. You return and play your favorite music on Spotify. You jump in your car, and you program Google Maps to take you to work along the fastest route. Your license plate was scanned by CCTV on your way to work. You read your preferred newspaper online at lunchtime, eating a sandwich you bought with your credit card, and you buy the new book by your favorite author on Amazon. You later message your partner on Facebook to tell them what time you will be home that evening. On your way, you pick up a bottle of wine in the local supermarket and scan your loyalty card. Before going to bed, you watch Netflix and tweet about your favorite show. It's a regular day, but an enormous amount of data has been gathered on your routines, movements, health, fitness, finances, and relationship. You wittingly and unwittingly shared data points about your private life within a technological structure of code, the "unseen and unnoticed architecture

1. Mark Fenwick, Wulf A. Kaal & Erik P.M. Vermeulen, *Legal Education in a Digital Age: Why Coding for Lawyers' Matters*, (Lex Research Topics in Corp. Law & Econs. Working Paper No. 2018-4; U of St. Thomas (Minn.) Legal Studies Research Paper No. 18-21, 2018), https://papers-ssrn-com.ezp1.lib.umn.edu/sol3/papers.cfm?abstract_id=3227967.

2. Zhiqiong June Wang, *Between Constancy and Change: Legal Practice and Legal Education in the Age of Technology*, 36(1) L. CONTEXT 64, 75 (2019).

structuring our whole existence[,]"[3] which raises a variety of legal and ethical issues.

To what extent should lawyers understand and appreciate coding if they are to meaningfully engage with these issues? This article analyzes the pedagogical benefits of teaching "Coding for Lawyers" at law school. It also outlines the practical challenges in doing so. Drawing on legal research in this field, the experiences of others in delivering similar modules, and the experience of delivering lectures on coding for lawyers at the University of Minnesota School of Law, this article provides a first-hand account of where theory meets practice in delivering cutting-edge tech education courses. Given the increasing role that technology is playing in legal practice, this article argues that a knowledge and appreciation of coding, though not necessarily an expert ability to code, may be necessary to build a more "future-proof" lawyer who can navigate emerging developments and those yet to come.

I: THE EVOLUTION OF LEGAL EDUCATION: FROM CASES TO CODE

Various intellectual movements have informed legal education. A century ago, Christopher Columbus Langdell developed the case method at Harvard Law School.[4] It became the modern basis for the study of law in common law jurisdictions, when legal training in universities replaced apprenticeships as the primary form of legal education. Instead of learning an abstract list of rules and principles, students learned how rules and principles were applied to particular fact patterns in real cases.[5] The case method became a valuable tool of instruction because it allowed students to reason from first principles, reason by analogy, and realize how slightly different fact patterns can result in different legal outcomes.[6] The case method of instruction emphasized certainty, consistency, and

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3. Fenwick et al., *supra* note 1 at 2.

4. M.H. Hoeflich, *Law and Geometry: Legal Science from Leibniz to Langdell*, 30 AM. J. LEGAL HIST. 95, 95 (1986).

5. *See id.* at 120 (describing the deductive nature of the case method).

6. *See* Áine Hyland & Shane Kilcommins, *Signature Pedagogies and Legal Education in Universities: Epistemological and Pedagogical Concerns with Langdellian Case Method*, 14 TEACHING HIGHER EDUC. 29, 32–34 (2009) (describing the case method and its impact on American legal teaching).

predictability, but instructors using this method often considered law to be a closed normative system in which law was shorn of its social, cultural, and economic context.[7] By contrast, the subsequent "legal realism" movement challenged the formalism of black letter law and highlighted the important role that non-legal factors play in legal decision-making.[8] Fact sceptics argued that facts were elusive and contestable, while rule sceptics argued that legal rules were indeterminate and not the decisive factor in reaching decisions.[9] The Critical Legal Studies Movement challenged the existing hegemony of legal education.[10] Scholars "thrashed" the incoherency of law, noting that decision-makers were often from higher social classes and served these interests. They showed that law was uncertain because precedents were not always followed, deconstructing law to reveal the unconscious biases behind it.[11] Critical Race Theory complimented this movement and highlighted the power and privilege possessed by white middle-classes, contrasting their privileges with the difficulties that ethnic minorities had in asserting their rights.[12] Feminist and queer theorists

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7. *Id.* at 29 ("[The case method] emphasizes objective formal knowledge, the empiricism and rationalism of law, library learning, case law, and the operation of legal principles in a closed system . . . It encourages the coherency and determinacy of law, and its separateness from social, moral, and political determinants.").

8. *See* Oliver Wendell Holmes, *The Path of the Law*, 110(5) HARV. L. REV. 991, 1000 (1997) ("I cannot but believe that if the training of lawyers led them habitually to consider more definitely and explicitly the social advantage on which the rule they lay down must be justified, they sometimes would hesitate where now they are confident, and see that really they were taking sides upon debatable and often burning questions.").

9. *See, e.g.*, Jerome Frank & Brian H. Bix, LAW AND THE MODERN MIND (2009).

10. Ian Grigg-Spall & Paddy Ireland, THE CRITICAL LAWYERS' HANDBOOK, 50 (1992) (Arguing that "traditional legal education can be said to be both a training in subordination and a training for subordination" and stating that the goal of critical legal thinking is "to empower teachers and students with the necessary critical weapons with which to mount an attack upon [traditional legal education and practice]").

11. *See, e.g.*, Duncan Kennedy, *Legal Education and the Reproduction of Hierarchy*, 32 J. LEGAL EDUC. 591, 596–600 (1982) (denouncing the traditional method of teaching legal rules and reasoning).

12. *See* Derrick A. Bell, *Who's Afraid of Critical Race Theory*, 1995 U. ILL. L. REV. 893, 898, 900–01 (1995); *see also* Cornel West, *Foreword* to CRITICAL RACE THEORY: THE KEY WRITINGS THAT FORMED THE MOVEMENT, xi–xii (Kimberlé Crenshaw et al. eds., 1995) ("[L]ike all bold attempts to reinterpret

similarly exposed the systemic biases experienced by these marginalized communities.[13]

The "law and society" movement, composed of criminologists, political scientists, psychologists, and others, urged that the law be understood in its social, political, and economic context, sometimes with empirical data, from the perspective of these disciplines.[14] In particular, the "law and economics" movement rose in prominence within the academy to champion the virtues of efficiency, rationality, and wealth maximization, remaining highly influential in American law schools to this day.[15] The movement would subsequently entwine with the behavioral sciences and the behavioral economics movement,[16] though it would, in some circumstances, rediscover and re-tread old ground covered by criminologists and psychologists.[17] Law schools also emphasized the importance of

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and remake the world to reveal silenced suffering and to relieve social misery, Critical Race Theorists put forward novel readings of a hidden past that disclose the flagrant shortcomings of the treacherous present in the light of unrealized—though not unrealizable—possibilities for human freedom and equality."); Richard Delgado & Jean Stefancic, *Critical Race Theory: An Annotated Bibliography*, 79(2) VA. L. REV. 461 (1993) (providing a bibliography of works that focus on critical race theory).

13. *See, e.g.*, Andrea Dworkin, *Against the Male Flood: Censorship, Pornography, and Equality*, 8 HARV. WOMEN'S L.J. 1, 22 (1985) ("Still, equality is what we want, and we are going to get it. What we understand about it now is that it cannot be proclaimed; it must be created. It has to take the place of subordination in human experience: physically replace it."). *See generally* Carrie Menkel-Meadow, *Feminist Legal Theory, Critical Legal Studies, and Legal Education or 'The Fem-Crits Go to Law School*,'" 38 J. LEGAL EDUC. 61 (1998) (noting how the feminist critique starts from the experiential point of view of the oppressed whereas the critical legal studies critique starts from a male-dominated point of view).

14. *See generally* Lawrence M. Friedman, *The Law and Society Movement*, 38 STAN. L. REV. 763 (1986) (discussing the movement's history, nature, strengths, weaknesses, and context).

15. *See* William M. Landes & Richard A. Posner, *The Influence of Economics on Law: A Quantitative Study*, 36 J.L. & ECON. 385 (1993); *see also* Richard A. Posner, ECONOMIC ANALYSIS OF LAW 3, 2d ed. (1977) ("[E]conomics is a powerful tool for analyzing a broad range of questions of legal interpretation . . . ").

16. *See* Richard H. Thaler, *Behavioral Economics: Past, Present, Future*, 106(7) AM. ECON. REV. 1577, 1578–79 (2016) (summarizing the history of behavioral economics).

17. *See generally* Colin Camerer, *Behavioral Economics: Reunifying Psychology and Economics*, 96 PROC. NAT'L ACAD. SCI. 10575, 10575 (1999) ("In fact, behavioral economics represents a reunification of psychology and

clinical legal education, bridging the gap between town and gown by establishing clinics and full-time clinical professors to train, guide, and supervise students in specific fields of law, particularly in areas where clients were vulnerable, of modest means, and had other difficulties accessing justice.[18] Clinical education, particularly when combined with classes on legal ethics and professional responsibilities,[19] provided students with more chances to think and act like a lawyer but did not replace the case method as the primary method of legal instruction.[20] Legal educators increasingly embraced international, transnational, and comparative law, both because students studied abroad more often and because faculty also increasingly researched and taught in other countries. The practice of law also increasingly crossed borders and was globalized, as multinational companies extended their reach. Moreover, technology played an important role in the globalization of legal education because the internet facilitated distance learning and large scale, inexpensive methods of legal instruction, like Massive Online Open Courses (MOOCs). At present, law schools may now draw on real-time international expertise in co-located classes around the world. Commencing in Spring 2020, for example, the Sutherland School of Law at University College Dublin and the University of Minnesota School of Law will run a co-located module on Comparative Business Regulation, delivered through blended learning from both campuses.[21]

With more virtual platforms available it is not surprising that the legal academy is increasingly relying on electronic

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economics, rather than a brand new synthesis, because early thinking about economics was shot through with psychological insight.").

18. *See, e.g.*, *Clinics*, U. MINN. L., https://www.law.umn.edu/academics/experiential-learning/clinics (last visited Mar. 1, 2020) (offering various clinic courses including Detainee Rights and Indian Child Welfare).

19. *See generally* Anthony T. Kronman, THE LOST LAWYER: FAILING IDEALS OF THE LEGAL PROFESSION 1 (1993); *see also* David Luban & Michael Millemann, *Good Judgment: Ethics Teaching in Dark Times*, 9 GEO. J. LEGAL ETHICS 31 (1995) (discussing the benefits and disadvantages of employing the case method and clinical education classes together).

20. *See e.g.*, Mark Spiegel, *Theory and Practice in Legal Education: An Essay on Clinical Legal Education*, 34 UCLA L. REV. 577 (1987).

21. *Comparative Business Regulation—6927*, U. MINN. L. SCH., https://www.law.umn.edu/course/6927/comparative-business-regulation (last visited Mar. 8, 2020).

resources to deliver course content. Students now seem less likely to visit the library to access books and journal articles when these materials are available online through databases accessible via the library website and other sources.[22] Increasingly, instructors rely on video-casts and podcasts which can be uploaded and downloaded with ease by users, lay or expert, not least because some education experts believe that audio-visual media have the potential to convey more meaning than the written word.[23] Academics are also experimenting more with technology to foster innovation. For example, faculty are more willing to podcast their lecturers and upload videos to the internet (sometimes for free). Given the ubiquitous nature of iPhones, iPads, and other media-playing devices, these recordings have the potential to appeal to busy students, as well as a wider audience beyond the classroom.[24] In Ireland, faculty have collaborated with students to generate video case notes in lieu of written research assignments, a student-produced teaching-aid which can be used in class, "re-invigorat[ing] the case method by placing students at the center of the learning process."[25] Technology, thus employed, makes students take ownership of their own learning and moves lectures away from the didactic method of information dissemination towards an inclusive approach that encourages students to be integrative thinkers and learners.[26]

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22. *See generally* Thomas Pfeffer, *Open Knowledge Resources for Higher Education: Scholarly Publications, Course Materials, Academic Software*, *in* THE CHALLENGE OF ECOMPETENCE IN ACADEMIC STAFF DEVELOPMENT (Iain Mac Labhrainn, et al. ed., 2006) (discussing the transition from print to online education).

23. *See generally* Carie Windham, *Confessions of a Podcast Junkie: A Student Perspective*, EDUCAUSE L. REV., May/June 2007, at 50 (discussing the advantages of podcasts over in-class lectures).

24. *See, e.g.*, Michael Sandel, *Justice*, HARV. U., https://online-learning.harvard.edu/course/justice (last visited Mar. 8, 2020) (containing Michael Sandel's "Justice" course at Harvard, which is available for free online and has been viewed by tens of millions of people); *see also*, *Michael J. Sandel*, HARV. U., https://hls.harvard.edu/faculty/directory/10761/Sandel/ (providing biography of Professor Sandel) (last visited Mar. 8, 2020).

25. Joe McGrath and Diarmuid Griffin, *Reinvigorating the Case Method by Giving Students Ownership*, THE IRISH TIMES, May 13, 2013, at 7, *available at* https://www.irishtimes.com/news/crime-and-law/reinvigorating-the-case-method-by-giving-students-ownership-1.1388976.

26. *See* Keith Trigwell and Michael Prosser, *Development and Use of the Approaches to Teaching Inventory,* 16(4) EDU. PSYCHOL. REV., Dec. 2004, at 420

Of course, technology in one form or another has long since been a feature of legal education, even before the internet was adopted. In Ireland, the technologies of information dissemination were once knives and forks, not algorithms and Boolean algebra. Established in 1541, the Honorable Society of King's Inns is the oldest law school in Ireland and requires barristers to dine there a number of times a year as a condition of their license to practice.[27] In an age long before the internet, a practice developed where barristers would dine together, providing the opportunity to tell each other about the cases in which they had acted. This process might have functioned as a crude method of disseminating precedents. Though considered quaint in the current age of Westlaw and LexisNexis, dining at King's Inns remains a mandatory condition of practice to this day.

Legal education is often criticized for being backwards-looking.[28] Legal education uses historical analysis and precedent to understand contemporary issues, on the theory that "one can solve future problems by applying old doctrines in a new situation."[29] Such an approach, however, may merely reinforce the status quo rather than prompt lawyers to be critical and independent thinkers who are agents of change.[30] This is not the only criticism of legal education. While the case method is designed to be Socratic, it can be didactic in that faculty often

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(determining that adoption of a "Conceptual Change/Student-focused approach to teaching is more likely to lead to high quality student learning.").

27. *See Members' Dining*, THE HONORABLE SOCIETY OF KING'S INNS, https://www.kingsinns.ie/members/dining (last visited Mar. 8, 2020) (describing dining at the Honorable Society of King's Inns). See also: http://elixir.bham.ac.uk/Country%20information/Ireland/Governing_Bodies/admission_rules_of_Kings_Inns_ruleski.htm#PART%20II

28. *See*, *e.g.* Erik Vermeulen, *Education in a Digital Age: How to Prepare the Next Generation for the Uncertain Things to Come*, HACKERNOON, Aug. 11, 2017, https://hackernoon.com/education-in-a-digital-age-db3063214407 (arguing that a "whole new approach to education" is needed due to "fast-paced, technology-driven social change.").

29. Elena Merzon and Oscar Raif-Riabov, *Indefinite "Coup" of Digital Education and Certainty of Reality*, INT'L CONF. ON PEDAGOGY, COMM., & SOC. *in* 315 ADVANCES IN SOC. SCI., EDUC., & HUMAN. RES., 2019, at 16.

30. *See generally* Martha C. Nussbaum, *Why Lawyers Need a Broad Social Education*, CONF. ON THE FUTURE OF AUSTRALIAN LEGAL EDUC., Aug. 11–13, 2017 (cautioning that legal education must be interdisciplinary or it will produce lawyers that merely reinforce the status quo).

see themselves as experts at the center of the learning process, with passive students at the periphery. There is an inherent information asymmetry between the teacher and the student in which information flows in one direction in this hierarchical relationship. In this way, the attempt to make students "think like lawyers" may actually foster "lazy thinking."[31] Still, this is arguably less true today as information is now freely available on the internet. The relationship between teacher and student has become "flatter," and students may actually be more tech-savvy than some of their professors.[32]

Moreover, technology is not just transforming the delivery of legal education, it is informing course content. Many law schools offer modules on intellectual property law, information technology law, and data privacy law, among others.[33] The next movement along these lines appears to emphasize the importance of teaching modules like coding, machine learning, and artificial intelligence, as the language of law moves "from Latin to JavaScript."[34] A coding for lawyers module, for example, is already offered at Harvard Law School, the University of Melbourne, Tilburg University, and now at the University of

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31. *See* Carrie Menkel-Meadow, *Thinking or Acting Like A Lawyer? What We Don't Know About Legal Education and Are Afraid to Ask*, *in* IMPERATIVES FOR LEGAL EDUCATION RESEARCH: THEN, NOW, AND TOMORROW 223 (Ben Golder et al. eds., 2019).

32. *See e.g.*, Michele Pistone, *Law Schools and Technology: Where We Are and Where We Are Heading*, 64 J. OF L. EDUC. 586, 591 (2015), available at https://jle.aals.org/cgi/viewcontent.cgi?article=1297&context=home ("This generation and the generations coming after them are and will be digital natives, born into a world that has embraced technology").

33. *See, e.g.*, *Academic Offerings: Law Science, and Technology*, HARVARD LAW SCHOOL, https://hls.harvard.edu/dept/academics/programs-of-study/law-science-and-technology/academic-offerings-law-science-and-technology/ (last visited Mar. 6, 2020) (describing course offerings in intellectual property law, health law, biotechnology, bioethics, internet law, and technologies and civil liberties).

34. Cat Walker, *From Latin to JavaScript: The Future of Legal* Education, at 10–12 (June 2019), https://www.researchgate.net/profile/Cat_Walker/publication/333968644_From_Latin_to_JavaScript_The_Future_of_Legal_Education/links/5d0fc4f9458515c11cf2dd0b/From-Latin-to-JavaScript-The-Future-of-Legal-Education (discussing implementation of "practical courses in technology," such as coding, in law schools).

Minnesota, among others.[35] Harvard Law School championed their offering, arguing their students "must understand what it means at a technical level to 'speak' online, to 'sign' a digital contract, to 'search' a computer, or to 'delete' evidence,"[36] and that "law firms must understand what tasks can be most efficiently done by custom software and what are best left to human beings."[37] Adding computer science to the syllabus also adds value and promise for greater collaboration involving science and humanities, and furthers the interdisciplinarity that the law and society movement supported.[38]

The foregoing demonstrates that legal education has undergone considerable development in the last century. Though the case method remains popular, it has been developed and applied in novel ways. Nevertheless, it has been criticized for being regressive, supporting and maintaining hegemony, and fostering uncritical thinking that is insufficiently reform-oriented.[39] If legal education must transition from a backwards-looking, content-based model to a more forward-looking, progressive and ambitious skills-based model, a greater emphasis should be placed on skills-based problem-solving. This change is already underway. Legal education has moved beyond

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35. *See, e.g.*, *Coding Classes*, THE UNIVERSITY OF MELBOURNE: MELBOURNE LAW SCHOOL, https://law.unimelb.edu.au/about/technology-innovation-and-the-law/coding-classes (last visited Mar. 6, 2020) (discussing the availability of coding classes for law students); *Coding for Lawyers*, UNIVERSITY OF MINNESOTA LAW SCHOOL: COURSE GUIDE, https://www.law.umn.edu/course/6959/coding-lawyers (last visited Mar. 6, 2020) (providing course description for "Coding for Lawyers"); *Programming for Lawyers*, HARVARD LAW SCHOOL: COURSE CATALOG, https://hls.harvard.edu/academics/curriculum/catalog/default.aspx?o=71516 (last visited Mar. 6, 2020) (providing course description for "Programming for Lawyers").

36. *Programming for Lawyers*, HARVARD LAW SCHOOL: COURSE CATALOG, https://hls.harvard.edu/academics/curriculum/catalog/default.aspx?o=71516 (last visited Mar. 6, 2020).

37. *Id.*

38. *See* Ton Wilthagen et al., *A Time for Interdisciplinarity: An Essay on the Added Value of Collaboration for Science, University, and Society*, TILBURG UNIVERSITY (Nov. 2018), https://research.tilburguniversity.edu/files/28373248/180464_Essay_Tijd_voor_Interdisciplinariteit_EN_finalproof_1_.pd (describing the benefits of interdisciplinary courses to academia and to society as a whole).

39. *Cf.* Orin S. Kerr, *The Decline of the Socratic Method at Harvard*, 78 NEB. L. REV. 113, 118–22 (discussing various criticisms of the Socratic method).

the mere analysis of cases and statutes to an interdisciplinary approach, which also emphasizes skills-based education, and on-the-job clinical training.[40] Computer code-based learning may merely represent the next jolt forward in skills-based education. As Menkel-Meadow observes, instead of asking, "Is there a cause of action for that?" faculty may in the future ask "is there an APP for that?"[41] This may be the biggest disruption to Langdell's case method yet. The Miranda App, for example, provides "constitutionally adequate warnings, clarifying answers, contextual information, and age-appropriate instruction to suspects before interrogation."[42] This app was developed by lawyers and tested by police. Students are also developing legal apps as part of their legal education. At the University of Limerick, students have developed an app which assists company directors in assessing their knowledge of legal duties.[43] Rather than being replaced by technology, these students are producing it. They are not suffering from technological disruptions; they are innovating through them.

Greater technological innovation does not herald the "end of lawyers."[44] Instead, legal technology can heighten a lawyer's command over familiar territory: guarding against the interference with rights, informing people of their responsibilities, and facilitating transactions with efficacy and efficiency. Technology can empower the vulnerable and disenfranchised, especially when lawyers are clever enough to exploit it for them. Gowder, for example, envisages a technological class action, whereby a breach of rights or of contract, or the imposition of an unfair term in a one-sided

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40. Mike Stetz, *Best Schools for Practical Training*, PRELAW MAGAZINE, Spring 2019, at 20–32, available at https://mydigitalpublication.com/publication/frame.php?i=578230&p=20 (listing the best law schools for practical training).

41. Menkel-Meadow, *supra* note 31.

42. Andrew Guthrie Ferguson & Richard A. Leo, *The Miranda App: Metaphor and Machine*, 97 B.U.L. Rev. 935, 938 (2017).

43. *See Legal Tech App for Directors' Duties Developed by UL Law*, Law Society GAZETTE (May 7, 2019), https://www.lawsociety.ie/gazette/top-stories/legal-tech-app-for-directors-duties-developed-by-ul-law-faculty-students/ (discussing four legal apps developed by final year law students).

44. *See* RICHARD SUSSKIND, THE END OF LAWYERS?: RETHINKING THE NATURE OF LEGAL SERVICES 32, 50 (2010) (proposing ways in which technological innovation could reduce the need for lawyers).

contract, for customers over a particular threshold in number, might trigger an automatic breach of all such contracts, and the loss of business for the rogue company.[45] Such an initiative, he reckons, would empower individuals in circumstances where a large number of people have suffered a small amount of harm, where collective action difficulties would inhibit formal legal actions.[46] Legal tech offers both promise and pitfalls; it is important that law students appreciate both. These promises and pitfalls are discussed immediately below.

II. THE IMPACT OF TECHNOLOGY ON LEGAL PRACTICE: WHY LAWYERS NEED TO UNDERSTAND CODE

Technology is also changing the practice of law and the performance and enforcement of laws in society. New methods of billing and information storage are making lawyers more efficient.[47] Cases, statutes, and scholarship are easily accessible at the touch of a button, obviating the need to physically visit a library. Innovations in data processing have been assisting lawyers in conducting due diligence and discovery. More recently, however, technology has assumed more disruptive force in the legal profession. Fenwick *et al*. identify four new types of "disruptive" legal tech initiatives. They identify: (1) the rise in prominence of online legal services which do not require face-to-face meetings between lawyers and clients; (2) matching platforms which connect clients with appropriately skilled lawyers; (3) AI tools which conduct legal research and review activities in ways that are faster and cheaper than human lawyers; and (4) blockchain technologies that replace lawyers in conducting other tasks.[48] Blockchain, discussed further below, is being used to verify, process and enforce legal transactions. It is a shared "digital ledger" which records assets and information

45. *See* Paul Gowder, *Transformative Legal Technology and the Rule of Law*, 68 U. Toronto L.J. 82, 92–98 (2018) (discussing collective action technological solutions for class action-type scenarios).

46. *Id.*

47. *See* Julia Greenberg, *Tech Will Force Lawyers to Do More for Those Billable Hours*, WIRED (Feb. 8, 2016 10:00 AM), https://www.wired.com/2016/02/lawyers-fear-that-tech-will-make-their-jobs-too-easy/ (describing trends in legal technology which may lead to law practices becoming more efficient).

48. *See* Fenwick et al., *supra* note 1, at 13–14 (detailing four types of disruptive legal tech initiatives for startups).

to which new "blocks" are added, and shared on public or private networks with participants called "nodes."[49] These nodes verify the record and add new blocks to the chain, thereby auditing transactions and recording these audits on the ledger, increasing transparency.[50] This technology is powering "smart contracts" which are self-executing and do not rely on individual lawyers and contracting parties for performance or enforcement.[51] Smart contracts were originally envisaged by Szabo as digitally performed promises, operating in a similar way to vending machines that provide goods and services on receipt of payment.[52] Blockchain technologies "transfer assets, services, and currencies into a program that automatically validates a condition and determines whether the predefined asset should be transferred or refunded. The trust or validation of the lawyers in this framework is replaced by the numerous people potentially witnessing the events in question."[53] A typical smart contract, Fenwick *et al.* note, is the purchase of music through Apple via a program that only plays the music on a limited number of devices.[54]

Other scholars point to the multi-faceted role that "algorithmic regulation" is playing and will play in society, in standard-setting, information gathering, monitoring,

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49. *See id.* at 20–21.

50. *See id.*

51. *See generally* Mark D. Flood & Oliver R. Goodenough, *Contract as Automation: The Computational Representation of Financial Agreements*, OFFICE OF FINANCIAL RESEARCH, Mar. 27, 2017, available at https://ideas.repec.org/p/ofr/wpaper/15-04.html (applying computational principles to contracts); *see also* Harry Surden, *Computable Contracts*, 46 U.C. Davis L. Rev. 629 (2012) (explaining "data-oriented contracting").

52. *See* Ameer Rosic, *Smart Contracts: The Blockchain Technology That Will Replace Lawyers* (2017), https://blockgeeks.com/guides/smart-contracts/ ("The best way to describe smart contracts is to compare the technology to a vending machine."); *see also* Roberto Pardolesi & Antonio Davola, What is Wrong in the Debate About Smart Contracts 1 (Feb. 21, 2019) (working paper), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3339421 (discussing Szabo's definition of smart contracts).

53. Sari Graben, Teaching Emerging Technologies as Legal Systems: Proposals for a Changing Law School Curriculum 7 (Feb. 21, 2019) (working paper), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3339363.

54. *See* Mark Fenwick, Wulf A. Kaal & Erik P. M. Vermeulen, *Legal Education in the Blockchain Revolution*, 20 VAND. J. ENT. & TECH. L. 351, 368 (2017) ("An often-cited example for smart contracts is the purchase of music through Apple's iTunes platform.").

sanctioning and changing behavior.[55] For example, algorithms can detect unusual spending patterns on your credit card and react by issuing an alert for fraud detection. Algorithms can also predict the capacity and willingness to pay for a particular service and charge customers differently for the same service. Some insurers, for example, use algorithms to determine which customers are unlikely to switch providers if they increase premiums on renewal, and charge those customers higher prices than those customers who are more likely to switch providers.[56] Algorithms can even enforce the law. Computer-mediated contracts monitor and enforce contractual terms to ensure that rental cars are being driven in a safe way under the terms of the agreement, and can even repossess cars for missed payments, remotely locking and immobilizing them.[57] Yeung notes:

> Algorithmic systems are vastly more powerful than traditional forms of architectural regulation (e.g. the speed hump or the door lock) because machine learning algorithms, networked communications infrastructure, and cloud computing make it possible to track and intervene in the behavior of not just a single user, but an entire population of users across a widely dispersed geographic area while collecting and analyzing population-wide data on an almost instantaneous basis . . . .[58]

Gathering these threads together, it is clear that technology is no longer restricted to a supporting role for lawyers, and exercises control over populations in new ways. In light of such significant recent developments we argue that code, the generative force behind these developments, needs to be recognized as a fundamental aspect of the legal skills toolkit.

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55. *See, e.g.*, Karen Yeung, *Algorithmic Regulation: A Critical Interrogation*, 12 REG. & GOVERNANCE 505, 505–06 (2018).

56. The Central Bank of Ireland has launched an inquiry into this practice. *Cf.* Charlie Weston & Shawn Pogatchnik, *Pressure Mounts on Insurers to End the 'Dual Pricing' Method That Punishes Loyalty* (Oct. 5, 2019, 1:30 AM), https://www.independent.ie/business/personal-finance/pressure-mounts-on-insurers-to-end-the-dual-pricing-method-that-punishes-loyalty-38564527.html (noting how Oireachtas Finance Committee members want "to have the Central Bank hauled before the committee to explain why it is not clamping down on dual pricing").

57. *See* Hal R. Varian, *Computer Mediated Transactions*, 100 AM. ECON. REV. (PAPERS & PROC.) 1, 3 (2010) (using a rental car with a monitoring system in place as a form of enforcement as an example of a computer-mediated contract in action).

58. Yeung, *supra* note 55, at 509.

A. SMART SEARCHING, RESEARCH AND ANALYSIS

The electronic storage of information facilitates searching and sorting of documents for the purposes of discovery in litigation. However, predictive coding represents a leap forward which could facilitate an even faster, more efficient, and cost-effective way to manage this process. What if, for example, a senior lawyer was able to code a small pool of documents and then employ predictive software to code the rest of the files for search and analysis? While such practices may be viewed with skepticism, some scholars note that other technological advances, like eDiscovery, were also first viewed with suspicion before ultimately being adopted.[59] eDiscovery conducted through keyword searches on databases like Google, LexisNexis, Westlaw, and many others, has developed into a conventional analytical tool since it was first advanced in the 1970s.[60] Predictive coding, however, represents a more significant leap forward in that it uses algorithms to conduct analytical searches. This strategy has risen in prominence as more lawyers "discover" coding and increasingly employ it.[61]

Algorithms may reduce the great volume of electronically stored data,[62] separate duplicate files,[63] and find deleted files

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59. *See, e.g.*, Nicholas Barry, Note, *Man Versus Machine Review: The Showdown Between Hordes of Discovery Lawyers and a Computer-Utilizing Predictive-Coding Technology*, 15 VAND. J. ENT. & TECH. L. 343, 350 (2013) ("E-discovery has come a long way since the 1970s, whe[n] courts were reluctant to find opposing counsels' computer systems discoverable.").

60. *Cf.* Edward F. Sherman & Stephen O. Kinnard, *The Development, Discovery, and Use of Computer Support Systems in Achieving Efficiency in Litigation*, 79 COLUM L. REV. 267, 268 (1979) (giving a perspective on the issues that had arisen with computerized litigation in the 1970s, such as "the degree to which parties should be able to discover each other's computer-based litigation support systems, and [. . .] the extent to which courts should play a role in the creation and control of a system available to all parties.").

61. *See* Marilyn Odendahl, *Attorneys Discover Predictive Coding*, IND. LAW. (Oct. 9, 2012), https://www.theindianalawyer.com/articles/29842-attorneys-discover-predictive-coding/ (giving different lawyers' opinions on predictive coding).

62. *See* Victor Li, *Georgetown 2013: Building a Better Info Governance Practice*, LEGAL TECH. NEWS (Nov. 22, 2013), LEXIS LNSDUID-ALM-LAWTNW-1202629213326 ("A defensible deletion policy, combined with use of technology assisted review, can reduce documents by up to 40 percent . . . .").

63. *See, e.g.*, Arman Gungor, *Frequently Asked Questions About De-Duplication*, MERIDIAN DISCOVERY LLC (Apr. 24, 2012), https://www.meridiandiscovery.com/articles/frequently-asked-questions-about-

that were not fully destroyed. Predictive coding could make more files available for discovery.[64] Keyword searches are more limited by nature.[65] Some search methods similar to predictive coding, like clustering and categorization, have already received judicial approval.[66] Clustering allows for similar files to be grouped together while categorization catches files that say the same things in different ways.[67] If predictive coding in more forms is permitted, this may obviate the need for lawyers to read thousands of pages of documents. It may even reduce or replace the role of the conventional reviewing attorney. Some have suggested that machines will replace the "armies of expensive lawyers" currently engaged in this process. This may be an initiative with promise, or a threat with menace, depending on your perspective.[68] Further demands to modernize the legal system, with increased reliance on e-filing and paperless courts, as currently being advanced in the United Kingdom,[69] are likely

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de-duplication/ (answering common questions surrounding de-duplication software).

64. *See* John Hopkins, *Keyword Searches vs. Predictive Coding: Who Wins the Discovery Battle?*, JDSUPRA (Jul. 12, 2013), https://www.jdsupra.com/legalnews/keyword-searches-vs-predictive-coding-27635/ (comparing keyword searches and predictive coding).

65. *Cf. id.* (noting that predictive coding may provide additional search power above and beyond keyword searches alone).

66. *See* Barry, *supra* note 59, at 353 ("Both of these processes are similar to predictive coding."). The United States District Court for the District of Maryland assessed both "clustering" and "categorization" in the discovery context. *Id.* (citing Victor Stanley, Inc. v. Creative Pipe, Inc., 250 F.R.D. 251, 260 (D. Md. 2008)).

67. *See id.* ("[C]lustering, where similar documents are placed together, and categorization, where a search captures documents that express the same thoughts in alternate ways.").

68. *See* John Markoff, *Armies of Expensive Lawyers, Replaced by Cheaper Software*, N.Y. TIMES, (Mar. 4, 2011), https://www.nytimes.com/2011/03/05/science/05legal.html (discussing the benefits of software-based analysis compared to "a platoon of lawyers and paralegals . . . [working] at high hourly rates").

69. *See* Monidipa Fouzder, *Paperless Justice Expands to Tax Bill Appeals*, L. SOCIETY GAZETTE (Feb. 17, 2018), https://www.lawgazette.co.uk/law/paperless-justice-expands-to-tax-bill-appeals/5064867.article (discussing modernization reforms "allowing online appeals to the first-tier tax tribunal"); *see also* Press Release, Ministry of Justice & HM Courts & Tribunal Service, New Legislation Will Modernise the Court (May, 23, 2018), https://www.gov.uk/government/news/new-legislation-will-modernise-the-courts (extolling the "fully paperless system" created by court reform and modernization investment).

to increase demand for more innovative legal tech solutions which streamline these processes.

B. VIRTUAL FIRMS AND ROBOTIC ADVICE

Virtual law firms now exist where legal professionals with a variety of skills can collaborate with each other in an Uber- or Airbnb-style arrangement that matches lawyers with particular skills for specific tasks. Digitorney is one such online forum that advertises itself as an online marketplace connecting lawyers to cases, a kind of eBay or Alibaba for lawyers. The service also offers AI tools employing "deep learning technologies to extract, structure and manage data from corporate documents."[70] Some physical law firms are also using AI to provide professional legal services. Described variously as the Siri for tax lawyers or the law firm without lawyers,[71] Ailira (short for "Artificially Intelligent Legal Information Research Assistant") is a chatbot that provides advice on federal tax law in Australia, "reduc[ing] research time from hours to minutes" for lawyers seeking answers to complex tax questions.[72]

In the aforementioned circumstances, where non-traditional law firms exist virtually, with robots dispensing advice, future-proof lawyers may need to develop greater project management skills, work in more interdisciplinary teams, and work with unconventional new clients. This is a principal argument advanced by Fenwick *et al.*[73] They argue that future-proof lawyers must facilitate new forms of business as "transaction engineers" who operate as "crucial intermediaries that [bring] together in a 'safe' environment various parties with different but mutually compatible interests and expertise."[74] They cite, as examples, the lawyers who facilitated innovation in Silicon

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70. *FAQ*, DIGITORNEY, https://plus.digitorney.com/faq/ (last visited Feb. 20, 2020).

71. *See* Paul Caron, *Siri for Tax Lawyers, Accountants, and Students*, TAXPROF BLOG (Feb. 14, 2017), https://taxprof.typepad.com/taxprof_blog/2017/02/siri-for-tax-lawyers-accountants-and-students.html (describing Ailira as "Siri for lawyers and accountants").

72. Artificially Intelligent Legal Information Research Assistant. CARTLAND L., https://cartlandlaw.com/ailira-3/ (last visited Feb. 20, 2020) (describing the functionality of Ailira).

73. *See* Fenwick et al., *supra* note 1, at 9–10.

74. *Id.* at 4, 9–10.

Valley, drafting creative contracts that protected investors who founded high risk start-ups.[75] Bleakly, Fenwick *et al.* suggest that legal innovation and creativity has dimmed due, in part, to standard form contracts.[76] They note, however, that lawyers may find their way again though a knowledge of coding that they will use to cut costs, boost efficiencies, and facilitate new relationships.[77] They will work in new interdisciplinary teams, through new platforms, with clients that have limited budgets and hire few staff.[78]

C. AUTOMATION: ACCURACY WITH EFFICIENCY

Machine learning is already replacing lawyers in limited, specific contexts, where certain legal tasks are automated, like contract drafting and dispute resolution. More colorfully, at least one robotic law firm promises landlords it can evict tenants at knock-down prices.[79] The "robot lawyer" at donotpay.com promises it can "fight corporations," "beat bureaucracy," and "sue anyone . . . at the press of a button,"[80] which might be useful if you want to challenge that eviction. There is reason to believe that many other mundane tasks performed by lawyers will also

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75. *See id.* at 9 (footnote omitted) ("[T]he lawyers' involvement in both non-legal and legal activities, such as deal making, matchmaking, gatekeeping, and conciliating, served as an important sorting device for entrepreneurs that needed more than just an investor to start and develop their start-up businesses.").

76. *See id.* at 10 ("The problem, however, is that lawyers have often failed to perform this function of being active transaction engineers" for example "employ[ing] standard form 'templates' is one major factor.").

77. *Cf. id.* at 27–31 (describing the benefits of teaching coding for lawyers).

78. *See id.* at 29–30 ("The understanding of code creates a new level of experience, which serves as the essential first step for the students to participate in multi-disciplinary teams that will develop the software that (ideally) has a positive economic and social impact and contributes to a better digital future.").

79. *See* Frank Pasquale, *Is Eviction-As-a-Service the Hottest New #LegalTech Trend?*, CONCURRING OPINIONS (Feb. 26, 2016), https://concurringopinions.com/archives/2016/02/is-eviction-as-a-service-the-hottest-new-legaltech-startup.html [https://webarchive.loc.gov/all/20190220052716/https://concurringopinions.com/archives/2016/02/is-eviction-as-a-service-the-hottest-new-legaltech-startup.html] (citing CLICKNOTICES, http://www.clicknotices.com (last visited Feb. 22, 2020)) (hypothesizing that "the digital reputation economy can synergistically interact with the new eviction-as-a-service approach.").

80. DONOTPAY, https://donotpay.com (last visited Feb. 20, 2020).

be automated. Different studies suggest that as much as twenty-two percent or twenty-three percent of a lawyers job can currently be automated,[81] and that as many as thirty-nine percent of legal sector jobs will disappear through automation.[82] Wang has suggested that it is "not unreasonable to ask whether legal practice and, by implication, legal education is doomed" while noting that the answer to this question depends on the extent to which practitioners and academics respond to the challenges posed by legal tech.[83] In addition, AI tools appear to be outperforming human lawyers, at least in certain specific legal tasks. In one study, an AI tool designed by LawGeex, a leading AI contract review platform, was pitted against twenty lawyers to review five nondisclosure agreements for potential issues, over a two-month period of testing.[84] The AI accurately predicted issues in ninety-four percent of cases while the human lawyers accurately identified issues in eighty-five percent of cases. More startlingly, however, the human took ninety-two minutes, on average, to review the contracts while the AI could

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81. *See, e.g.*, Erin Winick, *Lawyer-Bots Are Shaking Up Jobs*, MIT TECH. REV. (Dec. 12, 2017), https://www.technologyreview.com/s/609556/lawyer-bots-are-shaking-up-jobs/ (citing JAMES MANYIKA ET AL., JOBS LOST, JOBS GAINED: WORKFORCE TRANSITIONS IN A TIME OF AUTOMATION 30 (2017)) ("22 percent of a lawyer's job and 35 percent of a law clerk's job can be automated . . . ."); *cf., e.g.*, THE LAW SOCIETY OF WESTERN AUSTRALIA, THE FUTURE OF THE LEGAL PROFESSION 7 (2017), https://www.lawsocietywa.asn.au/wp-content/uploads/2015/10/2017DEC12-Law-Society-Future-of-the-Legal-Profession.pdf (predicting the impact of artificial intelligence automation on professional growth and development).

82. *See* Jeremy Hill, *Deloitte Insight: Over 100,000 Legal Roles to be Automated*, LEGAL INSIDER (Mar. 16, 2016), https://legaltechnology.com/deloitte-insight-100000-legal-roles-to-be-automated/ (citing DELOITTE, DEVELOPING LEGAL TALENT: STEPPING INTO THE FUTURE LAW FIRM 4 fig.4 (2016), https://www.deloitte.com/content/dam/Deloitte/uk/Documents/audit/deloitte-uk-developing-legal-talent-2016.pdf) ("39% of jobs (114,000) in the legal sector stand to be automated . . . ."); *cf.* Joshua Krook, *Teaching Law Students Creative Skills Could Save the Profession From Automation*, CONVERSATION, (June 21, 2018), http://theconversation.com/teaching-law-students-creative-skills-could-save-the-profession-from-automation-97615 ("Around 40% of all law jobs are at risk of automation . . . .").

83. Wang, *supra* note 2, at 64–79.

84. Kyree Leary, *The Verdict Is In: AI Outperforms Human Lawyers in Reviewing Legal Documents* FUTURISM (Feb. 27, 2018), https://researchdirect.westernsydney.edu.au/islandora/object/uws:53036/datastream/PDF/view.

perform the same task in twenty-six seconds. It also seems likely that human lawyers might take even longer in non-controlled conditions, when they are not singularly focused on this task but are also juggling work obligations with other commitments.

In another contest, an AI tool developed by four Cambridge students was pitted against lawyers to predict whether the Financial Services Ombudsman would allow a claim for the mis-selling of Payment Protection Insurance (PPI). The AI accurately predicted the right outcome in 86.6 percent of cases, though human lawyers accurately predicted the correct results in just 66.3 percent of cases.[85] This is not just bad news for human lawyers. A report by Frey and Osborne in 2013 predicted that forty-seven percent of employment in the U.S. is at risk of automation.[86] Employing the same methodology as this report, the website willrobotstakemyjob.com predicts that the likelihood of lawyers being replaced by robots is just four percent, but forecasts "a higher chance of automation: a thirty-seven chance of automation within the next 2 decades."[87] This distinction may reflect how certain parts of a lawyer's job may be automated (researching and writing documents) while others cannot (representing a client in court, cross-examining a witness, etc.).[88] Moreover, while some will worry that automation will reduce some jobs to obsolescence, it is also likely that new jobs will be

85. Rory Cellan-Jones, *The Robot Lawyers Are Here - and They're Winning*, BBC (Nov. 1, 2017), https://www.bbc.com/news/technology-41829534.

86. Carl B. Frey& Michael A. Osborne *The Future of Employment: How Susceptible Are Jobs to Computerisation?* 254–80 (Oxford Martin Programme on Technology and Employment, 2013), http://sep4u.gr/wp-content/uploads/The_Future_of_Employment_ox_2013.pdf.

87. *See* https://willrobotstakemyjob.com/23-1011-lawyers (last viewed Mar. 18, 2020). It predicts a forty percent chance that judges will be replaced by robots. *See* https://willrobotstakemyjob.com/23-1023-judges-magistrate-judges-and-magistrates (last viewed Mar. 18, 2020). Law professors are not on the list.

88. See generally Marie Boran, *Making a Case for Artificial Intelligence in the Legal Profession*, IRISH TIMES (June 21, 2018, 04:05), https://www.irishtimes.com/business/technology/making-a-case-for-artificial-intelligence-in-the-legal-profes- sion-1.3533815 (stating "AI may not lead to a widespread loss of jobs in the legal profession" but "AI is already being used in states for [the purpose of discovery]" because discovery can be easily automated).

created which may offer new opportunities to lawyers, legal analysts, and legal project managers, among others.[89]

D. PREDICTIVE POLICING

Ferguson extols the virtues and warns of the dangers of predictive policing.[90] He notes the practice of the Los Angeles Police Department's (LAPD) "Real Time Analysis Critical Response Division" (RACR) of pulling together information from various traditional policing data sources, to analyze the use of "big data" to forecast crime "hotspots." Ferguson notes that soon, however, this information will no longer just be pulled from ordinary policing data, but from video surveillance cameras, biometric databases, social media feeds, otherwise anonymous consumer transactions, and personal communications. With this data, police could potentially predict where a crime will occur, who will be shot, and who the prosecution should target to destabilize a crime network. "Math," he predicts, "provides the muscle to prevent and prosecute crime."[91] Big-data policing offers promise in that it increases efficiency for police operating with more constrained resources, can be used to monitor police conduct, and identifies the generative social and economic conditions that lead to crime. This form of policing also carries risks. While data analytics seems race-neutral, this work can directly affect black and other marginalized communities (immigrants, critics of government, etc.) and the data can be used to justify existing practices which unfairly target them. Such concerns are not limited to Los Angeles and have been reported elsewhere.[92] It might also give the reader pause, if one

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89. *See generally* RICHARD SUSSKIND, TOMORROW'S LAWYERS: AN INTRODUCTION TO YOUR FUTURE (2017).

90. ANDREW G. FERGUSON, THE RISE OF BIG DATA POLICING: SURVEILLANCE, RACE, AND THE FUTURE OF LAW ENFORCEMENT (2017).

91. *Id.* at 3.

92. *See* Matt Stroud, *The Minority Report: Chicago's New Police Computer Predicts Crimes, but Is it Racist?* THE VERGE BLOG (Feb. 19, 2014), https://www.theverge.com/2014/2/19/5419854/the-minority-report-this-computer-predicts-crime-but-is-it-racist (detailing Chicago's new "heat list" and why it could be discriminatory). *See generally* Michael L. Rich, *Machine Learning, Automated Suspicion Algorithms, and the Fourth Amendment*, 164 U. PA. L. REV. 871 (2016); *see also* Sharad Goel et al., *Combatting Police Discrimination in the Age of Big Data*, 20 NEW CRIM. L. REV. 181, 224–26 (2017)

reflects on how the data we surrender in the typical day might be used.

E. RISK ASSESSMENT

Algorithmic justice is also delivered in the courtroom where computer models are being used to predict offenders' likelihood of committing more crimes, events foretold by criminologists who worried about the rise of "actuarial justice" in which proactive, risk-based methods manage dangers to society.[93] These risk assessments are already factored into sentencing decisions in Arizona, Colorado, Delaware, Kentucky, Louisiana, Oklahoma, Virginia, Washington, and Wisconsin.[94] In 2016, watchdog group *ProPublica* accessed the risk scores for 7,000 offenders in Broward County, Florida. *Propublica* determined that the algorithm used by the state of Florida to predict whether offenders would commit another offense within two years was correct in only twenty percent of cases. Only twenty percent of the offenders which the model predicted would commit another violent crime within two years actually did so.[95] The algorithm was also much more likely to wrongly predict that black offenders would commit more crimes and much more likely to underestimate the risk posed by white offenders.[96]

Algorithms are only as good as the data on which they base their assumptions, making them fertile ground for inadvertent racial bias. Programmers may build their models using unrepresentative samples, resulting in erroneous feedback loops that skew results. When biases are programmed in by the frail decision-making capacities of humans, this transforms benign

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(describing how police rely on empirical data to continue aggressive policing in high crime areas predominately populated by minorities).

93. *See* Malcolm M. Feeley & Jonathan Simon, *The New Penology: Notes on the Emerging Strategy of Corrections and Its Implications* 30(4) CRIMINOLOGY 449, 463–65 (1992) ("In the actuarial criminology of today, by contrast, the numbers generate the subject itself (e.g., the high-rate offender of incapacitation research). In short, criminals are no longer the organizing referent (or logos) of criminology.").

94. *See* Julia Angwin et al., *Machine Bias*, PROPUBLICA (May 23, 2016), www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing.

95. *Id.*

96. *Id.*

tools into what O'Neill terms "weapons of math destruction[.]"[97] This is all the more true, however, when the bias is unintentional, making it difficult to discover and understand, and much more difficult to explain in court, if it gets that far.[98] More likely, when someone adversely affected by a decision attempts to challenge a finding or determination, they are raising the issue with an administrator, not a computer programmer. Latent biases might only be discovered when programmers explain the weighting of data points and sample demographics to a tech-savvy lawyer. Discovery may not be possible at all in systems which employ machine learning, where algorithms learn from each other with minimal interactions and involvements with humans.

F. FRAUD DETECTION

The field of fraud detection is also plagued with problematic algorithms. A computer program called MiDAS falsely accused 34,000 unemployed people after it was employed as "robo-adjudication" to detect employment fraud in Michigan. Some of those people who were falsely accused had to hire lawyers, go through stressful court battles, and pay compensation, before being exonerated.[99] Similarly, activists have raised human rights concerns about the use of predictive analytics in Canada to automate the evaluation of applications for immigration and tourist visas and asylum claims, though ostensibly their purpose is to eliminate backlogs and delays in the system.[100]

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97. CATHY O'NEIL, WEAPONS OF MATH DESTRUCTION: HOW BIG DATA INCREASES INEQUALITY AND THREATENS DEMOCRACY 115–116 (2016) (explaining how big data is inherently biased by the programmers and the inputs that are used to train the algorithms).

98. *See* Solon Barocas & Andrew D. Selbst, *Big Data's Disparate Impact*, 104 CALIF. L. REV. 671, 698 (2016) (describing the difficult problem courts have when trying to "reconstruct the numerous biased evaluations and perceptions that ultimately resulted in adverse employment.").

99. Robert N. Charette, *Michigan's MiDAS Unemployment System: Algorithm Alchemy Created Lead, Not Gold*, IEEE SPECTRUM (Jan. 24, 2018), https://spectrum.ieee.org/riskfactor/computing/software/michigans-midas-unemployment-system-algorithm-alchemy-that-created-lead-not-gold.

100. Petra Molnar & Lex Gill, *Bots at the Gate: A Human Rights Analysis of Automated Decision-Making in Canada's Immigration and Refugee System*, IHRP 1 (2018), https://ihrp.law.utoronto.ca/sites/default/files/media/IHRP-Automated-Systems-Report-Web.pdf ("The nuanced and complex nature of many refugee and immigration claims may be lost on these

More recently, journalists have raised concerns that algorithms are making critical decisions which refuse or restrict unemployment benefits, child support, housing, and food subsidies. Some suggest that governments are "automating poverty" and "punish[ing] the poor," particularly when the science behind these processes is difficult to comprehend or appeal.[101] Philip Alston, the UN Special Rapporteur on extreme poverty and human rights, has argued that governments are increasingly "stumbling zombie-like into a digital welfare dystopia"[102] in the name of cost-cutting, where technology is employed to "surveil, target, harass[,] and punish beneficiaries, especially the poorest and most vulnerable among them."[103] These forms of "cyber delegation" are particularly problematic when they are not overseen by humans who can manage them and challenge them effectively.[104] Lawyers with appropriate training in coding, and some appreciation of these risks, may be ideally placed to perform this function, or advise on such matters to prevent them from occurring.

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technologies, leading to serious breaches of internationally and domestically protected human rights, in the form of bias, discrimination, privacy breaches, due process and procedural fairness issues, among others. These systems will have life-and-death ramifications for ordinary people, many of whom are fleeing for their lives.").

101. Ed Pilkington, *Digital Dystopia: How Algorithms Punish the Poor*, THE GUARDIAN (Oct. 14, 2019), https://www.theguardian.com/technology/2019/oct/14/automating-poverty-algorithms-punish-poor (explaining that the poor are being increasingly disparaged because "AI innovations . . . are explosively recasting how low-income people interact with the state.").

102. OFFICE OF THE HIGH COMMISSIONER, *World Stumbling Zombie-Like into a Digital Welfare Dystopia, Warns UN Human Rights Expert*, (Oct. 17, 2019), https://www.ohchr.org/EN/NewsEvents/Pages/DisplayNews.aspx?NewsID=25156&LangID=E.

103. General Assembly, *Report of the Special Rapporteur on Extreme Poverty and Human Rights*, ¶ 59, U.N. Doc. A/74/48037 (Oct. 11, 2019). https://www.ohchr.org/Documents/Issues/Poverty/A_74_48037_AdvanceUneditedVersion.docx.

104. *See* Mariano-Florentino Cuéllar, *Cyberdelegation and the Administrative State* 17–23 (Stanford Pub. Law, Working Paper No. 2754385, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2754385 (describing problems and concerns associated with the nuances of decision-making a computer must perform when making value-based decisions of complicated issues).

All of the foregoing reflects how technological tools can serve lawyers better through greater efficiency in performing mundane tasks. It also demonstrates that emerging technologies require legal and ethical oversight. Moreover, the ethical challenges posed by emerging technology cannot be fully understood without an understanding of their constituent operations. Digital literacy must be embedded and networked in legal education because lawyers who understand the principles, positives, and pitfalls of coding are arguably better equipped to monitor and mediate this technology and may even be able to better inform its design.[105] Lawyers who were traditionally concerned with keeping clients out of physical custody should now also ensure their clients are not "virtually incarcerated in 'algorithmic prisons,'"[106] in which big data profiles are pulled from social media accounts and elsewhere, where they are denied or restricted in their abilities to access financial services, social welfare, and more. Big data profiling raises important legal issues pertaining to distributive justice, data protection, privacy, due process rights and the right to fair procedures, and therefore the rule of law itself. Moreover, the parties most likely to be adversely affected by algorithmic injustices are those least able to challenge them.[107]

III. WHAT IS CODING FOR LAWYERS?

Our coding for lawyers module is based on a combination of theoretical and practical lectures. It begins with three theoretical topics: an introduction to legal tech, an overview of lawyers as project managers, and an overview of artificial intelligence and its impact on legal tech. Then, it presents three practical topics and their fundamentals: introduction to programming in Python, machine learning, and natural language processing techniques as part of legal tech solutions. Finally, the course ends with a theoretical topic: insights into the latest trends in "legal tech," the combination of technology and

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105. *See* Kate Galloway, *A Rationale and Framework for Digital Literacies in Legal Education*, 27 LEGAL EDUC. REV. 117, 125 (2017).

106. Yeung, *supra* note 55, at 515 (critiquing the legal ramifications of algorithmic power).

107. *See* Barocas & Selbst, *supra* note 98, at 694–712 (detailing the disparate treatment and disparate impact of data mining).

software to provide legal services.[108] The number of legal tech companies is increasing significantly and most of these companies are start-ups that are aimed to disrupt the legal sector.[109] As previously mentioned, start-ups have used artificial intelligence to assist lawyers in due diligence, e-discovery, invoice review and legal research, among other applications. Most of them develop their technologies based on sub-fields of AI, such as supervised machine learning, unsupervised machine learning, and natural language processing techniques. Some start-ups aim to assist legal professionals with analytics so that they may be more efficient in performing their tasks, and in facilitating research and the review of activities.[110] Other start-ups: provide traditional legal research platforms to find answers to legal questions; offer the latest innovations, such as visual search results engines, to show "the relationships among cases and their relative importance to each other[;]"[111] and advance context analytics engines to "analyze the language of specific judges' opinions to identify the cases and arguments each judge finds persuasive."[112] With these applications in mind, the course begins by asking: what is legal tech? What is the distinction between sustaining and disruptive technologies? What are the key aspects of disruptive technologies? What types of legal tech start-ups exist? Moreover, what can they do?

Algorithmic systems and processes are playing an important role in law and this is opening "new jobs for those lawyers who are sufficiently flexible, open-minded, and

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108. *See* Fenwick et al., *supra* note 1, at 12 ("Legal Tech can generally be defined as information technology services and software, as well as platforms and their applications.").

109. *See* SUSSKIND, *supra* note 89, at 43–44.

110. *See, e.g.*, Robert Ambrogi, *The 20 Most Important Legal Technology Developments of 2018*, LAWSITES (Dec. 26, 2018) https://www.lawsitesblog.com/2018/12/20-important-legal-technology-developments-2018.html (discussing the proliferation of startups within the legal technology sector).

111. Robert Ambrogi, *Lexis Advance Will Now Fully Integrate Ravel Visualizations in Search Results,* LAWSITES (Jun. 28, 2018) https://www.lawsitesblog.com/2018/06/lexis-advance-will-now-integrate-ravel-visualizations-search-results.html.

112. Robert Ambrogi, *'Context,' Launching Today from LexisNexis, Applies Unique Analytics to Judges and Expert Witnesses,* LAWSITES (Nov. 29, 2018) https://www.lawsitesblog.com/2018/11/context-launching-today-lexisnexis-applies-unique-analytics-judges-expert-witnesses.html.

entrepreneurial to adapt to changing market conditions."[113] As noted previously, future lawyers might work in collaboration with multidisciplinary teams to develop products or services in legal tech enterprises. In some cases, legal professionals with experience in systems engineering might work as legal technologists to bridge the gap between law and technology or as legal process analysts to analyze and source an important piece of legal work.[114] They might work as project managers. A project manager has to plan, manage and report on a project's progress and completion,[115] and has to ensure the success of multi-sourcing.[116] To work efficiently in this role, legal professionals need to understand the key responsibilities of a project,[117] and need to be able to adapt project management techniques in a legal and technological context. By elaborating the increasingly prominent role technology plays in legal practice, the coding for lawyers course presents an overview of the changing role of lawyers, the role of lawyers as project managers, the key responsibilities of a project manager, and the organizational and operational structure of a legal tech project.

Artificial Intelligence (AI) is now among the most dominant technologies in the legal field; it has become mainstream, accepted as essential and commonplace.[118] Of the $1 billion invested in legal technology in 2018, $362 million was invested in legal solutions based on AI.[119] Indeed some technologies based on machine learning have already overtaken some tasks conducted by junior lawyers (for example in invoice review and e-discovery), and some systems are already making better

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113. *See* SUSSKIND, *supra* note 89, at 109.

114. *Id.*

115. *See generally* PROJECT MANAGEMENT MANUAL (Bowen, H.K., 1996) (detailing a project manager's responsibilities).

116. *See* Antony Smith, *Legal Project Management: An Overview,* THOMSON REUTERS PRACTICAL LAW, https://uk.practicallaw.thomsonreuters.com/w-005-3765?transitionType=Default&contextData=(sc.Default)&firstPage=true&bhcp=1 (detailing a project manager's responsibilities).

117. *Id.*

118. *See generally* Ambrogi, *supra* note 112 (listing the 20 most important technology advances in law).

119. *Legaltech Hits $1 Billion Investment as Lawyers Embrace Automation,* LAWGEEX (Oct. 19, 2019), https://blog.lawgeex.com/legaltech-hits-1-billion-investment-as-lawyers-embrace-automation/.

predictions than expert lawyers.[120] In the long term, will lawyers compete with machines or build the machines? Should they be involved in the development and delivery of new legal technologies and systems? At least for now, it seems that AI technologies are being created to reduce costs and promote efficiency.[121] Nevertheless, as we noted, there are also concerns that some AI technologies are making biased decisions in matters of social importance. For example, big data is being used to predict crime hotspots and algorithms are being used to predict the likelihood that offenders will commit more crimes, which could affect marginalized communities. Furthermore, there are also concerns about the ethics of artificial intelligence, in circumstances where questions are asked as to "who is the owner of the piece of work that was not created by man as a result of his creativity or intelligence."[122] In short, who owns what? Take, for example, the case of the macaque named Naruto, the photographer David Slater, and the famous selfie.[123] Upon befriending a group of macaques, Slater set up his camera to enable their taking of 'selfies.' The selfie taken by Naruto subsequently generated significant publicity. Did the macaque or the owner of the camera, photographer David Slater, own the rights and profits? In the case of artificial intelligence, for example, if an algorithm comes up with a solution to fight cancer, who owns the solution? Is it the AI or the programmer or company who developed it? By engaging students on these issues in a coding for lawyers course, students are encouraged to reflect on the nature of artificial intelligence and its impact on the practice of law and ethics.

As the course advances, students progress to practical sessions in which they learn the fundamentals of coding. Students are not expected to be fluent coders by the end of the course, but to have an appreciation and understanding of the capabilities of coding. Firstly, the course provides an introduction to the Python programming language. Students learn different data types and functions that can be used in

120. *See* SUSSKIND, *supra* note 89, at 81–82.

121. *Id.* at 59.

122. Tomas Hauer, *Society and the Second Age of Machines: Algorithms Versus Ethics*, 55 SOCIETY 100, 105 (2018).

123. *See, e.g.*, Mike McPhate, *Monkey Has No Rights to Its Selfie, Federal Judge Says,* N.Y. TIMES (Jan. 8, 2016), https://www.nytimes.com/2016/01/09/business/media/monkey-has-no-rights-to-its-selfie-federal-judge-says.html.

Python. They learn, for example, how to construct a program from a series of simple instructions. Once they understand how Python works, they learn how to use it to access web data. This enables them to identify and use online data sources for research. Upon completing the sessions on this topic, students are encouraged to consider how technology and data might be employed to facilitate access to legal services with greater ease.

Once students understand how Python works, they learn the fundamentals of machine learning. They learn what machine learning is and why it is used. They also navigate through the various types of machine learning models that may be employed. Students are expected to explain what it means for machines to learn something and to understand the main challenges regarding the operation of machine learning. At this point, students complete code-based exercises using Python to demonstrate their understandings of different models of machine learning and how they work. They also learn how to select a machine learning algorithm and to train it using data. Furthermore, students reflect on what can go wrong when developing an AI model. They are taught to appreciate, for example, the implications that go with having a badly designed algorithm, with providing bad data, and the resulting adverse impacts that arise when these biased technologies are applied to social matters. Moreover, students are shown how to prevent these problems from arising. In particular, students complete a code-based guided tutorial of an end-to-end machine learning project to understand the steps involved in the creation of this technology.

Natural language processing techniques analyze the use of words and phrases to make inferences about the content of a document or a spoken language.[124] These techniques involve different approaches, such as keyword searches, named entity recognition, sentiment analysis, speech-to-text, and sensing the tone of a document, among others. These techniques are used when evaluating or processing a large amount of unstructured data. They can be used to retrieve information, to identify the

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124. *See* Benjamin Alarie, Anthony Niblett & Albert Yoon, *How Artificial Intelligence Will Affect the Practice of Law*, 68 U. TORONTO L. J. 106, 113–14 (Supp. 2018) ("[N]atural language processing allows the user to identify materials that are likely relevant to her search, even if the materials do not contain words or phrases expressly within her list of keywords.") .

relevance of a document, and to determine keywords or terms from a document. Also, they can be used to reduce a text to a numerical form to quantitatively analyze it, to identify patterns, and to apply machine learning models.[125] Furthermore, natural language processing techniques can be applied to research legal documents, including judicial opinions, regulatory filings, and administrative proceedings, among others.[126] Nevertheless, textual data also presents numerous challenges, and difficulties may arise where, for example, multiple intentions exist, where misspellings arise, and where the same word has different meanings. However, students can learn how to overcome these challenges with the use of natural language processing techniques. With this in mind, students are taught to understand natural language processing techniques, the means to process text using NLP, and the way in which NLP may be applied in legal practice, and the use of legal text as data for research purposes. Students complete code-based exercises using Python to understand the techniques and the application of NLP.

"Blockchain is a decentralized and data management technology" developed originally for Bitcoin.[127] This technology "groups and compiles data into a chain of multiple blocks that offers transparency and decentralization."[128] It processes transactions quickly, distributes a ledger for these transactions to boost transparency, and it excludes third party involvement to reduce transaction costs. There is a mechanism through which a blockchain network reaches consensus to agree on the validity of transactions. For example, the "Proof of Work" algorithm is one of the most commonly used consensus algorithms in

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125. *See* MICHAEL A. LIVERMORE & DANIEL N. ROCKMORE, LAW AS DATA (2019).

126. *See e.g.*, John Nay, *Natural Language Processing and Machine Learning for Law and Policy Texts* (2018) https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3438276 (discussing the use of natural language processing in legal contexts).

127. Jesse Yli-Huumo et al., *Where Is Current Research on Blockchain Technology?*, PLOS ONE (OCT. 3, 2016), https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0163477.

128. Ahmad Firdaus et al., *The Rise of "Blockchain": Bibliometric Analysis of Blockchain Study*, 120 SCIENTOMETRICS 1289, at 1230 (2019).

blockchain technology.[129] It works by using special nodes called miners to verify chain transactions and the creation of new blocks. While useful and easy to implement, it is costly to operate, raising security concerns, and consumes a lot of power.[130] Blockchain technology has applications in the fields of security and healthcare, among others.[131] In security, for example, researchers used a system called ShadowEth to put the process of verification on a blockchain technology for the execution and storage of private contracts.[132] In healthcare, researchers proposed using smart contracts to facilitate secure analysis and management of medical sensors to protect the information generated by these devices.[133] Furthermore, blockchain technology has been applied in finance, peer-to-peer collaboration, machine-to-machine communication, and other important areas.[134] Blockchain technology "ha[s] introduced the ability for people to upload small snippets of code (so-called *smart contracts*) directly onto the blockchain."[135] This code is executed by every node in the network and is enforced by the technology itself. The code (the smart contract) can be a technical rule or an actual legal rule that can be used to simulate the function of a legal contract and it can create a contractual relationship.[136] Discussions along these lines in the coding for lawyers module allow students to learn the nature and operation of blockchain, the algorithms and techniques underpinning it,

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129. *See* Professor Blockchain, *Blockchain Algorithms 101: A Introduction to Consensus Protocols*, HACKERNOON (July 3, 2019) https://hackernoon.com/blockchain-algorithms-101-a-introduction-to-consensus-protocols-c00f884a01fb ("The most widely utilized and well-known consensus algorithm throughout the Blockchain ecosystem is the Proof of Work algorithm.").

130. *Cf. id.* (explaining that bitcoin mining "takes numerous, extremely powerful and highly specialized, computers to create.").

131. *See generally* Firdaus, *supra* note 128.

132. *See* Rui Yuan et al., *ShadowEth: Private Smart Contract on Public Blockchain*, 33 J. Comp. Sci. & Tech. 542, 547-54 (2018).

133. *See generally* Kristen N. Griggs et al., *Healthcare Blockchain System Using Smart Contracts for Secure Automated Remote Patient Monitoring*, 42 J. Med. Systems 130 (2018).

134. *See* Primavera Di Filippi & Samer Hassan, *Blockchain Technology as a Regulatory Technology: From Code is Law to Law is Code*, FIRST MONDAY, Nov. 2016, at 2.

135. *Id.* at 2 (emphasis in original).

136. *See id.* ("[F]rom a purely technological standpoint, smart contracts can be used to emulate, or at least simulate the function of legal contracts through technology, thereby effectively turning law into code.").

and the existing and potential applications of blockchain technology, particularly as they relate to the employment and operation of smart contracts.

IV. HOW DO YOU TEACH CODING FOR LAWYERS?

This section outlines a subjective account of teaching coding for lawyers, based on a series of face-to-face lectures given at the Law School at the University of Minnesota in the Spring semester of 2019. The lectures combined theoretical and practical exercises. The content of the first lecture involved an overview of legal tech, the legal tech start-up landscape, the role of lawyers in the digital age, and an introduction to the Python programming language. The content of the rest of the sessions included a continuation of practical exercises based on Python and covered the fundamentals and practical exercises of machine learning and natural language processing techniques. The methodology used to teach the practical sessions was based on approaches used to teach an object-oriented programming language,[137] and included reasoning based on induction and deduction, techniques which are used in ordinary life to think, understand and reason something intuitively.[138] It also included approaches from the problem-solving field such as top-down design and bottom-up design.[139] The aim of using these methodologies was to stimulate students' active thinking and to

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137. *See generally* Haibin Zhu & Mengchu Zhou, *Methodology First and Language Second: A Way to Teach Object-Oriented Programming*, OBJECT-ORIENTED PROGRAMMING, SYSTEMS, LANGUAGE & APPLICATIONS, Oct 2003, at 140 (discussing methods to teach C++, an object-oriented language).

138. *See id.* at 141 ("Induction means an abstraction process from the special to the general, e.g., one can compose a term "dog" after one knows many different real dogs. Deduction means a process from the general to the special. For example, in school, one learns the word "mammal" first, and then he or she can know if a dog is a mammal or not by testing if a dog has the properties a mammal should possess.").

139. For an explanation *see id.* ("In a problem-solving field exist two basic design methodologies. One is functional decomposition, or called top-down design. Another is functional composition or bottom-up design. In functional decomposition, a whole system is characterized by a single function, and then the function is decomposed into a set of sub-functions in a process of stepwise refinement. At last, one can design or implement each small function and then complete the entire system design. In functional composition, one can have different components of functions such as those from a function library at first, then one can compose them into a module with a more significant function. At last, one can compose many modules into one large system.").

promote high readability, maintainability, and reusability of the code. Students were taught to program by executing lines of code, observe the results, and answer questions about what happened when executing it. Students did not need to have previous experience in programming to attend or complete the sessions. Furthermore, the concepts and principles of Python, machine learning, and natural language processing techniques, were introduced with the help of examples based on legal tech applications.

Initially, students were instructed to install the programming language Python 3 on their computers. To do that, they had to install a free open-source distribution called Anaconda which provided the Python programming language.[140] This was a simplified way of managing and deploying the software.[141] Students were provided with instructions to install it on Windows, macOS, and other operating systems before attending class. During the first class, although half of the attendees had installed Anaconda without any problems, some students faced difficulties related to the installation which introduced some delays into the class. Once problems related to the initial installation of Anaconda were overcome, students were provided with code examples that they had to execute in Python. Before running the code examples, however, they had to install libraries that allowed the code to be executed and some students faced problems related to the installation of these libraries. In some cases, installing a library can be a tedious task and can fail if the library's version doesn't match the version of the program, among other reasons. The class continued only after the necessary preparatory steps were completed.

The installation problems faced during the first lecture demonstrated that the course required a platform that allowed for the creation of code-based assignments and projects, and one that was easy to use for the students. That would enable the lecturers to run the subsequent practical sessions successfully. To facilitate further lectures, instructors set up a virtual classroom using a platform called repl.it. Repl.it, which stands for read-eval-print-loop, is an integrated development

140. *Anaconda Distribution*, ANACONDA https://www.anaconda.com/distribution/ (last visited Feb. 28, 2020).

141. *Id.*

environment (IDE) that allows users to write their code to learn or teach a programming language without complicated installations and set up procedures.[142] Students can access it from any internet-enabled device by typing the name directly into the browser. Repl.it also supports coding in different programming languages such as JavaScript, PHP, and Python, among others. It has been used by institutions such as Harvard University to run a coding for lawyers workshop,[143] and by IT facilitators to teach Python programming language.[144] It is easy to get started; users sign up by creating a free account. It also provides a virtual classroom, the mechanism to enroll users, and the installation of libraries is done automatically. However, users must have a premium account to set up a private virtual classroom, which involves recurring costs depending on the pricing plan, and the execution of code can be slow.

Once instructors established the virtual environment, code-based activities and two projects were created using the platform and were available for the students once they log-in into the platform. The activities were low-to-moderate in complexity, as the main goal of the course was for students to understand the code, what coding offers, and what is involved in operating certain technologies. Some activities included basic Python-related programming exercises, involving data types and types of functions that promoted the construction of a program from a series of simple instructions. Other activities were based on machine learning exercises to promote an understanding of how machine learning works, its capabilities, and its limitations. These exercises involved data preparation, model selection, and evaluation. Furthermore, other activities included natural language processing techniques which aimed to elicit inferences about the content of a document. Assessments required the completion of projects based on natural language processing techniques and machine learning.

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142. *See* Fredric Lardinois, *Repl.it Lets You Program in Your Browser*, TECH CRUNCH (Mar. 15, 2018), https://techcrunch.com/2018/03/15/repl-it-lets-you-program-in-your-browser/.

143. *See Coding for Lawyers*, ACCESS TO JUSTICE LAB (Oct. 31,2019), https://a2jlab.org/coding-for-lawyers/.

144. *See* Veroniiiica, *Why I Use Repl.it IDE for My Coding Assignments,* PERKINS SCHOOL FOR THE BLIND (Dec. 3, 2018), https://www.perkinselearning.org/technology/blog/why-i-use-replit-ide-my-coding-assignments.

CONCLUSION

This article argued that lawyers should exercise some appreciation and understanding of coding to meaningfully engage with the ethics of emerging technologies and it sought to elaborate the pedagogical benefits of teaching coding for lawyers. While no lawyer can be completely "future-proof," upskilling law students in the technological architecture of code may help lawyers navigate imminent technological disruptions. Legal education has not proven itself entirely unresistant to change. While the case method from a century ago still plays an important role, legal education increasingly embraces interdisciplinary perspectives and increasingly exercises an appreciation for clinical experiences and skills-based learning. Understanding coding, machine learning, and artificial intelligence may assist in further emphasizing skills-based learning and problem solving, facilitating a further shift away from backwards-looking content-based learning. This does not signify the end of law or lawyers. Technological skills are merely additional tools which facilitate the practice of law, reducing costs, increasing efficiencies, and facilitate access to justice.

Algorithmic justice, however, is not without its drawbacks, particularly, as noted above, where decision making is automated, where it has been found to adversely affect ethnic minority and marginalized communities in crime detection, policing and sentencing contexts. In other contexts, computer programs have been accused of automating poverty, when they wrongly restrict access to welfare entitlements or immigration status. Such decisions can be especially difficult to understand and challenge when human oversight is limited and when those who are most likely to be adversely affected are the least likely to be able to contest them. Technologically savvy lawyers may, however, be able to empower the victims of such abuses or even prevent them from happening if included in early design conversations.

Emerging technologies require legal oversight, and this is most likely to be effectively supplied when some knowledge of how they operate is acquired. To this end, the latter two sections of this article also provided a practical, albeit subjective, account of the experience of teaching coding for lawyers at the University of Minnesota Law School.

As outlined, the syllabus emphasized the importance of combining theoretical overview with practical case studies and

code-based exercises to teach the programming language Python, machine learning, and natural language processing. On the use of practical code-based exercises, it argued, for example, that there is no better way for a lawyer to understand the implications of a faulty algorithm than to require them to design it with bad data. It also articulated how practical problems were overcome in the delivery of the course through the use of a virtual classroom which provided an integrated development environment, without complicated installations, through which hands-on projects could be completed. These discussions were provided in the hope that they may provide guidance for those thinking of teaching in this field, and to provide some instruction on how to design a functioning and cohesive syllabus, thereby translating the world of ideas to the world itself. Gathering these threads together, it is argued that while there is no such thing as an entirely future-proof lawyer, it makes the modest argument that lawyers equipped with some knowledge of coding are more likely to be able to navigate disruptive legal technologies with greater ease than those without these skills. Coding for lawyers is the compass which makes navigation to the future of legal education possible and those who prepare today will be better equipped for tomorrow.