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The Infinite Legal Acumen of an Artificial Mind: How Machine Learning Can Permanently Capture Legal Expertise and Optimize the Law Firm Pyramid

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THE INFINITE LEGAL ACUMEN OF AN ARTIFICIAL MIND: HOW MACHINE LEARNING CAN PERMANENTLY CAPTURE LEGAL EXPERTISE AND OPTIMIZE THE LAW FIRM PYRAMID

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ABSTRACT

As the legal industry gradually integrates artificial intelligence (AI) into its practice, the underlying technology continues to advance at a fever pitch. Machine learning platforms arguably represent the pinnacle of AI development, and this technology currently augments and replicates intelligent human tasks in ways never before conceived. The business applications of machine learning are bearing fruit across a spectrum of industries and professions. Yet despite machine learning's demonstrated promise, its forays into the legal industry have been uneven. In fact, the most advanced forms of machine learning have been relegated primarily to lower-level attorney tasks such as e-discovery, due-diligence, and legal research and, unfortunately, have yet to be embraced by the upper echelon legal decision-makers and strategists. This article explores this technology's underutilization in law and highlights the inroads made by machine learning in other professions such as healthcare. It then provides an illustration of the capacity of machine learning and develops detailed hypotheticals of machine learning's potential impact upon several representative areas of high-level legal decision-making, including lateral hiring, litigation strategy development, cost optimization, and overall law firm management. Finally, this article argues that incorporating machine learning will enable firms to permanently capture attorney expertise and develop deep reservoirs of reputational capital as a source of enduring competitive advantage.

I. INTRODUCTION

After initially resisting artificial intelligence, the legal industry now appears comfortable integrating it into *some* routine legal practices. Natural language processing and manual coded search analytics provide the foundation for widely used e-Discovery practices, legal research aids, and advanced due diligence.[1] These technologies have undoubtedly produced great strides in the delivery and cost of legal services, yet the application of AI in the legal field remains limited in two distinct ways.

First, the most robust applications of artificial intelligence target the low hanging fruit of law firm tasks and focus primarily upon rote tasks or duplicable client matters that have long been the mainstay of junior attorneys. Such applications were well-suited to the early understandings and appetites of legal strategists, but given the growth of AI technology, this limited application fails to capture the possibilities currently at play in other fields. While augmentation of

[1] *See* Harry Surden, *Machine Learning and Law*, 89 WASH. L. REV. 87 (2014). *See also* Michael Mills, *Artificial Intelligence in Law: The State of Play 2016*, THOMSON REUTERS, https://www.neotalogic. com/wp-content/uploads/2016/04/Artificial-Intelligence-in-Law-The-State-of-Play-2016.pdf (last visited Mar. 10, 2018); Dana Remus & Frank S. Levy, *Can Robots be Lawyers? Computers, Lawyers, and the Practice of Law*, 30 GEO. J. LEGAL ETHICS 501 (2016).

lower-level tasks is undoubtedly important, the propensity for utilizing AI to augment high-level legal strategy and firm management holds immense promise. Not only do the upper-echelon strategic activities consume a considerable amount of attorney time, the effect of leadership decisions reverberates through law firms through host of tangential effects.[2]

Second, some of the more advanced forms of AI, such as machine learning (ML), have failed to fully take hold in the industry. This lack of utilization is noteworthy because this frontier technology is being successfully integrated to great avail in other professions—most notably in healthcare. While the practice of law is clearly distinct among professions, meaningful similarities exist between the way machine learning could be used in both contexts, and those similarities may be instructive for paving the way for the future of machine learning in law.

In this article, I begin by defining and explaining machine learning as the current apex of artificial intelligence.[3] I examine the existing applications of this technology to the legal market, and then provide an in-depth look at how machine learning is utilized in healthcare.[4] I provide an assessment of the important similarities, as well as differences, between healthcare and law, and then proceed to illustrate a series of hypothetical applications of machine learning to situations involving law firm management and legal decision-making and strategy.[5] Finally, I argue that integrating such technology at the highest level will enable law firms to create sustainable competitive advantages among their peers—specifically by enabling them to permanently capturing the wisdom and expertise of their leading partners, and then leverage that acumen to the benefit of their attorneys and client alike.[6]

II. MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

Definitions of artificial intelligence abound, and they have changed dramatically over the past decade to reflect advances in technology. At the core of all such definitions, AI may be defined as computer systems that are able to perform tasks normally requiring human intelligence, which can imitate or simulate human intelligence.[7] While artificial intelligence takes many forms, it commonly takes the form of machines or software capable of visual perception, speech recognition, decision-making, and translation between languages.[8] Many iterations of AI depend upon human guidance in the form of code setting or rule making which then

[2] *See* Remus & Levy *supra* note 1, at 534–36.

[3] *See infra* Part II.

[4] *See infra* Parts III–VII.

[5] *See infra* Parts IX; X.

[6] *See infra* Parts XI; XII.

[7] MERRIAM WEBSTER DICTIONARY (2018), https://www.merriam-webster.com/dictionary/artificial %20intelligence; *see also*, Mills *supra* note 1.

[8] Bernard Marr, *What is the Difference between Artificial Intelligence and Machine Learning?*, FORBES (Dec. 6, 2016, 2:24 AM), https://www.forbes.com/sites/bernardmarr/2016/12/06/what-is-the

enables the computer to "act" in a manner that reflects human intelligence, often in a way that imitates or outperforms humans.

Much like AI, conceptions of machine learning also cover a wide swath, but importantly, machine learning may be seen as a distinctive type of AI in which computer systems possess the capability to learn to improve in performance in some task independently of human guidance.[9]

There are competing interpretations of machine learning's place within the development of AI. Some regard machine learning as merely one of many subsets of AI, but a growing consensus views machine learning as the current apex of AI—the current realization of AI at its highest state.[10] This interpretation may reflect the fact that early forays into AI attempted to simulate the complexities of human thought as the means to replicating human task performance or the production of "intelligent" results.[11] By contrast, machine learning reflects an alternative approach that focuses upon creating results that appear "intelligent" or "human-like," without directly trying to mimic the nature of the human mind's activity.[12] In essence, intelligent results are attained through the use of advanced, self-learning algorithms.[13] Therefore the notion of learning present in machine learning refers not to the literal replication of cognitive and neural activity entailed in human learning, but rather the functional improvement of completing tasks or producing analytical outcomes.[14] In this vein, machine learning platforms combine algorithms with statistical analysis of data in order to independently learn meaningful connections, patterns, and relationships.[15]

Machine learning varies in the level of human supervision involved.[16] The most nascent frameworks are heavily supervised by humans, wherein the computer is guided by human rules or search terms and thereafter left to optimize resultant outcomes.[17] On the other side of the spectrum, some machine learning technology utilizes unsupervised learning, in which the machine mines data without an answer-key, so to speak, and identifies meaningful relationships and outcome correlations.[18] Between these two extremes are a multitude of semi-supervised variations of machine learning which involve some balance between human guidance and autonomous machine learning.[19]

-difference-between-artificial-intelligence-and-machine-learning/3/#4cd1e86b2bfc; *see also* Mills, *supra* note 1.

[9] *See* Marr *supra* note 8; *see also* Mills, *supra* note 1.

[10] Surden, *supra* note 1.

[11] *Id.*

[12] For deeper discussion of this distinction, see *id.*

[13] *Id.*

[14] *Id.*

[15] For an excellent discussion of an example of machine learning, see Surden's exposition of how junk e-mail filters operate, in Surden, *supra* note 1.

[16] KIMBERLY NEVALA, THE MACHINE LEARNING PRIMER, 14–18 (2018) (ebook).

[17] *Id.*

[18] *Id.* at 17.

[19] *Id.* at 16.

Machine learning platforms may be particularly effective at a number of useful tasks. Specifically, machine learning may be applied to predict likely outcomes or actions based upon patterns, or to identify patterns and relationships among data variables that are difficult to discern.[20] As such, machine learning is particularly adept at addressing problems that pose unique challenges for traditional analytic techniques, such as when data sets have excessive numbers of variables relative to the number of records.[21] In addition, machine learning is useful in situations where formal rules are difficult to decipher and codify, even by human direction.[22]

Take, for example, the prospect of self-driving cars. As Nevala notes in her primer on machine learning, there are a limited number of actions that a car can take (i.e. forward, reverse, wheel turn, speed, etc.).[23] However, there are nearly infinite variables to interpret when taking those actions; not only are there speed limits and stop signs, but there are variable weather conditions, double-parked cars, pedestrians, and traffic jams to integrate when directing the car.[24] The complexity and fluidity of these various conditions make strict rule-setting for the vehicle nearly impossible, but machine learning platforms may interpret a byzantine array of data, as well as learn from prior decisions to make optimal decisions.[25]

With this distinction in mind, a brief overview of some of the machine learning technology currently at play in the legal industry may not only help clarify these concepts, but also reveal the uneven application of such technology. Remus and Levy provide a cogent analysis of some key categories in which AI is utilized in the legal field, each of which vary in the level of complexity and degree to which it is believed that AI can provide a benefit.[26]

III. E-DISCOVERY

One of the first and most well-established legal applications of AI focuses upon large-scale document review, particularly the application of e-Discovery. Dating back as early as the 1990s, natural language enabled algorithms have allowed attorneys to sift through massive amounts of documents for key words and concepts—a capability which is widely seen as saving mid-level and junior asso-

[20] *Id.*
[21] *Id.* at 8.
[22] *Id.*
[23] *Id.* at 11.
[24] *Id.*
[25] *Id.* at 11, 18.
[26] Remus & Levy, *supra* note 1. Please note that this discussion of AI in law is intentionally abbreviated and not intended to serve as an exhaustive review of the technology at play in the industry. The purpose of this Part is merely to highlight key elements of development in order to highlight gaps and opportunities existing at the highest levels of law firm management. A more complete review of current technology may be found in the work of Remus & Levy, although critical distinctions between AI and machine learning are not emphasized.

ciates from spending innumerable billable hours searching such documents manually.[27] Such technology may be classified as supervised learning, in that an attorney typically guides the process by providing key words and concepts that are then identified via the e-Discovery platform.[28] Similar attorney-guided platforms have been developed with respect to due diligence as well.[29]

IV. DOCUMENT PREPARATION

Beyond the realm of e-Discovery and due diligence, Remus and Levy highlight the development in document preparation and drafting.[30] While not squarely fitting within the purview of artificial intelligence, well-established players such as LegalZoom and Rocket Lawyer have provided individuals with a wide assortment of legal document templates for the general public.[31] This technology has enabled individuals to bypass attorneys in order to create simple wills, powers of attorney, advance medical directives, and a host of corporate filings and other business contracts.[32]

Although the technology underlying these two document preparation programs has made a significant impact upon the legal profession, they do not, as of this article, contain technology that approaches machine learning.[33] However, there are companies that moved beyond mere document preparation to legal document drafting, but such technology is currently in its nascent stages.[34]

V. LEGAL RESEARCH

Perhaps the greatest strides in the application of AI in law may be found in legal research.[35] Over the past two decades, Westlaw and Lexis have honed and expanded their key word and natural language search capabilities in legal research.[36] This has vastly enhanced the speed and accuracy with which attorneys can perform legal research—a fact that both expands the scope and reach of an

[27] *Id.* at 18, 41.

[28] *Id.* at 18.

[29] *Id.* However it should be noted that the vast contextual understanding and recognition required by due diligence as opposed to e-Discovery presents some challenges to fully duplicating human analysis, and as such the level of usage by the legal profession lags behind e-discovery. *Id.*

[30] *Id.* at 22.

[31] *Id.* at 44.

[32] *Id.* at 23.

[33] *See* LEGALZOOM, www.legalzoom.com (last visited June 2, 2018); ROCKET LAWYER, www.rocket lawyer.com (last visited June 2, 2018).

[34] *Id.* at 22.

[35] *Id.* at 24–30.

[36] *Id.* at 24–26.

individual researcher, and increases the speed with which attorneys can answer important legal questions.[37]

Although this supervised learning capability has exponentially expanded the capacity for legal research, the additional injection of unsupervised learning to legal research has provided a potentially game changing quantum leap for legal research. There is perhaps no better example of this technology than IBM's Ross intelligence platform.[38]

Drawing from the success of its Watson AI platform in other business applications, IBM developed Ross to be the quintessential legal research tool. Ross moves well beyond simply identifying legal cases and documents relevant to a legal inquiry, and instead provides a specific answer to a discrete legal question.[39] Importantly, this technology combines both cognitive computing and natural language processing in order to approach coherent answers to legal questions.[40] Not only may law firms be less aware of frontier machine learning technology, they may also not be aware of the potential impact and enhancement available from such technology.[41] The ability to translate new technology into cost savings or enhanced revenue may be critical to the ultimate adoption of such technology, and for this reason, technology may have been slower to develop.

A second possible reason for machine learning's position at the lowest rung of legal tasks may be a general lack of belief that such tasks could be accomplished through automation, no matter how advanced.[42] Closely related to this belief may be a fear of replacement. The prospect of being automated out of a job appeared specious at best to many attorneys when the advent of artificial intelligence emerged.[43] The practice of law—understanding complex legal codes and dicta as well as the nuances of judicial decisions and interpretations—always appeared beyond the reach and comprehension of any automated robot, no matter how advanced.[44] Yet as technology quickly advanced, and IBM Watson began beating humans at chess, and then Go, the prospect of automating legal reasoning

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[37] *Id.* at 43–44. This clearly has impacted the bottom line of law firms who rely upon the billable hour model of revenue.

[38] ROSS, http://www.rossintelligence.com (last visited Mar. 4, 2018); *see also Watson Takes the Stand*, THE ATLANTIC, *http://www.theatlantic.com/sponsored/ibm-transformation-of-business/watson-takes-the-stand/283/* (last visited Mar. 4, 2018).

[39] *Id.*

[40] *Id.*

[41] Tim Sandle, *Lawyers are turning to machine learning to ease caseload*, DIG. JOURNAL (Sept. 4, 2017), http://www.digitaljournal.com/business/lawyers-are-turning-to-machine-learning-to-ease-caseloads/article/501622.

[42] For discussion of attorney responses to technological replacement, see Susskind, Richard. Tomorrow's Lawyers: An Introduction to Your Future., Oxford Press, 2013; *see also* Remus & Levy, *supra* note 1, at 1–3.

[43] Dan Tynan, *Actors, teachers, therapists – think your job is safe from artificial intelligence? Think again*, THE GUARDIAN (Feb. 9, 2017), https://www.theguardian.com/technology/2017/feb/09/robots-taking-white-collar-jobs.

[44] *See* Remus & Levy, *supra* note 1.

and thought became more pronounced.[45] Complicating matters may have been that those most resistant to change occupied the highest positions in law firm hierarchies. The very wisdom, age, and expertise that enabled them to climb the legal ladder also may have entrenched them in a static position resistant to change.

A third possibility may simply stem from the fact that most legal technology companies' opening salvo of machine learning in the practice of law was directed at the lower level tasks of legal work. Whether due to the limitations of the early technology or due to the resistance of early adoption in the legal field, most of the initial inroads of machine learning in law focused on rote tasks that commonly dominated the work of lower level attorneys.

Regardless of the reason for the uneven integration of machine learning in the practice of law, highlighting the misrepresentation of technology at the upper echelon of legal practice provides an opportunity to envision applications that may enhance the practice of law for both legal practitioners and their clientele.

In order to explore the depth of possible applications of machine learning to the highest level of legal strategy and decision-making, we may look to other professional fields for guidance. The following Part explores some current advances taking hold of the healthcare profession, and then provides analogs to the legal industry. While the healthcare industry undoubtedly stands apart from the legal industry in many key ways, there are great similarities between the patient care decision-making and attorney-client decision-making that will be highlighted and expanded upon.

VI. HEALTHCARE AS ORACLE FOR MACHINE LEARNING

The healthcare industry has enjoyed a renaissance of applied AI technology that promises great change in care management and medical practice for years to come.[46] Due to uncontrolled increases in cost of care, political ambiguity regarding regulations and coverage, and a general shift from *payment-for-service* approaches to *payment-for-outcome*, a surge of artificial intelligence and machine learning technology has emerged in the health care industry.[47]

The object of such technology may be conceived in myriad ways: enhancing the efficiency of patient care in hospitals, reducing repeat visits to care facilities, lowering the price of prescription drugs.[48] Yet, at the heart of any technology

[45] Marina Koren, *When Computers Started Beating Chess Champions*, THE ATLANTIC (Feb. 10, 2016), https://www.theatlantic.com/technology/archive/2016/02/when-computers-started-beating-chess-champions/462216/.

[46] Alice Park, *The Computer Will See You Now: Machine Learning Programs Are Helping Doctors and Their Patients*, TIME MAGAZINE, Special Issue, Artificial Intelligence: The Future of Mankind, at 30.

[47] For brief discussion of AI and value-based medicine, *see generally* Khal Rai, *Why Artificial Intelligence Will Be Crucial in Value-Based Care*, HEALTH DATA MANAGEMENT, https://www.healthdata management.com/opinion/why-artificial-intelligence-will-be-crucial-in-value-based-care (Nov. 10, 2017).

[48] *See* Park, *supra* note 46.

within this market is the core goal of increasing the outcomes of medical care, while reducing cost.[49]

A host of artificial intelligence healthcare companies claim to provide such results, including start-ups such as Jvion[50] and Lumiata,[51] alongside larger players such as IBM's Watson.[52] For the purposes of the discussion that follows, I will examine one noteworthy start-up in detail—Raiven Healthcare.

Raiven Healthcare is a relatively new start-up in the healthcare industry that utilizes a distinctive machine-learning platform to optimize health outcomes while simultaneously lowering the cost of care.[53] Raiven will serve as an exemplar for this discussion for several reasons. First, it is unique among its competitors in that it validated its machine technology—the technology is clinically proven to enhance patient outcomes by 40% while lowering the cost of care by 40%,[54] which is particularly noteworthy in the current healthcare marketplace. Second, although Raiven is a relatively new start-up, it has already made inroads in the legal market. Raiven initiated a pilot study with at least one law firm to demonstrate the value of its machine learning platform at the upper level of legal strategy and decision-making.[55]

With this in mind, I will now provide an example of how the Raiven platform works. Its software is designed to augment patient care decisions by providing a constantly updated range of treatment options that is optimized for both patient outcome *and* cost of care.[56] The process and effect of this platform may best be demonstrated by considering a brief example of a mental health patient seeking a physician's help for depression related ailment.[57]

Typically, when a doctor sees a patient, they compile as much information as possible in order to diagnose and treat the patient.[58] As such, the doctor may order a wide array of tests, ranging from simple tests such as blood pressure and temperature, to blood tests for hormone levels and CAT scans.[59] The doctor may submit the patient to an extensive number of tests to acquire data and decipher the

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[49] *Id.*

[50] JVION, https://jvion.com (last visited Mar. 4, 2018).

[51] LUMIATA, https://www.lumiata.com (last visited Mar. 4, 2018).

[52] IBM WATSON, https://www.ibm.com/watson/ (last visited Mar. 4, 2018).

[53] RAIVEN HEALTHCARE, http://raivenhealth.com/solution/ (last visited Mar. 4, 2018).

[54] See *id.*, in which these results are discussed; *see also* Casey Bennett and Kris Hauser, *Artificial intelligence framework for simulating clinical decision-making: A Markov decision process approach*, 57 ARTIFICIAL INTELLIGENCE MED. 9 (2013).

[55] I would like to disclose that I have served on the advisory board for this company during its short tenure. This service provided me with in-depth insight into the inner workings of the company, and, importantly, their intended application of technology to the legal market.

[56] *Our Solution*, RAIVEN HEALTHCARE, http://raivenhealth.com/solution/ (last visited Mar. 4, 2018).

[57] *Id.*

[58] *Id.*

[59] Kimberly Holland & Tim Jewell, *Getting a Physical Exam*, HEALTHLINE (May 2, 2017), https://www.healthline.com/health/getting-physical-examination.

patient's condition or ailment.[60] In addition to the discrete data acquired by traditional tests, the doctor also takes note of meaningful observations derived from the patient interview.[61] Examples of such observational data may include the patient's sleeplessness, their manner of speech, or observations of their mood, among other factors.[62]

Thereafter, the doctor would likely take into account all of this data to make a diagnosis, and then draw upon their expertise, wisdom, and all available outside research and data to prescribe a regimen of treatment for the patient.[63] Finally, the doctor would schedule periodic follow-up appointments with the patient in order to assess the progress of that treatment plan.[64]

In this scenario, the doctor's treatment decision would ideally reflect full consideration of all available information coupled with the doctor's expertise and experience.[65] However, regardless of the expertise of the physician, there may exist limitations that impede optimal decision-making.[66] For instance, increasingly burdensome caseloads coupled with shifting interpretations of the cost and effectiveness of treatment regimens may occasionally impair a doctor's ability to make an optimal decision for patient care.[67] Furthermore, while a physician's expertise is often built upon years of experience, education and intuition, the time-intensive establishment of expertise may unfortunately develop alongside a set of biases and heuristics that limit openness to new patterns of diagnosis or alternative regimens of treatment.[68] In short, doctors may become fixed to a set of treatment options despite the availability of new studies and treatments.

The Raiven platform is designed to augment physician decision-making by continuously and autonomously learning patterns of diagnoses and treatments while optimizing their outcomes alongside cost of care.[69] In the aforementioned example, all available patient data (including individual doctor observations) would be entered into the Raiven platform and compared against all prior available cases, as well as all available external data (including data regarding cost of

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[60] *Id.*

[61] *Id.*

[62] K. Jeffrey Miller, *Filling in for Another Doctor: 20 Questions to Ask Patients*, DYNAMIC CHIROPRACTIC (Oct. 21, 2012), http://www.dynamicchiropractic.com/mpacms/dc/article.php? id=56177.

[63] Anders Baerheim, *The diagnostic process in general practice: has it a two-phase structure?*, 18 FAMILY PRACTICE 243 (2001), https://doi.org/10.1093/fampra/18.3.243.

[64] *Id.*

[65] *Id.*

[66] *See* RAIVEN HEALTHCARE, *supra* note 56.

[67] Sandra G. Boodman, *Misdiagnosis is more common than drug errors or wrong-site surgery*, WASH. POST (May 6, 2013), https://www.washingtonpost.com/national/health-science/misdiagnosis-is-more-common-than-drug-errors-or-wrong-site-surgery/2013/05/03/5d71a374-9af4-11e2-a941-a19bce7af755_ story.html?utm_term=.10cd5222bb9d.

[68] This limitation is certainly not unique to medicine, and the same may limitations may challenge any profession (law included) in which depth of expertise and specialization may conversely limit dynamism of practice.

[69] *See* RAIVEN HEALTHCARE, *supra* note 56.

care).[70] And as a machine learning platform, it can avoid any human bias or erroneous correlations that may impede the optimal proscription of care.

It bears noting that while this platform is designed to optimize patient treatment and cost of care, it is not intended to replace a physician.[71] Although it does independently learn and develop a continually-improving corpus of expertise, human judgment remains the final arbiter of treatment and the interface with patients.

VII. DISTINCTIVENESS OF MACHINE LEARNING IN MEDICINE

The brief description of Raiven above enables us to conclude that the Raiven platform differs from many of its AI and machine learning counterparts in distinct ways. First, and perhaps most importantly, it operates at the highest level of physician decision-making—the prescription of patient care. The machine learning platform not only augments the diagnosis of illness and *predicts* future patient consequences, it *prescribes* an optimal course of care. This distinction is of vital importance because this is arguably the most complex and critical aspect of physician decision-making. In other words, the irreplaceable human expertise of a physician is enhanced by a machine learning platform that learns alongside a physician and backs up his or her course of care.

Secondly, this machine learning platform provides dynamic rather than static recommendations. As such, the software analyzes not just the clusters of information available at the outset of the patient care, but continuously updates at each point of contact or interaction with the patient.[72] In other words, the specific *sequence* of care is the primary determinant of the effectiveness of outcome, not merely the static set of data any one point in time.[73]

Thirdly, and closely related to the second point, the model continuously integrates the cost of treatment into the equation.[74] This aspect of the model provides the physician with the ability the accurately balance the potential benefits of care

[70] *Id.*

[71] *Id.*

[72] *Id.*

[73] To illustrate the importance of this feature, consider a patient who may be treated by three different options: internal medicine, individual talk therapy, or group therapy. Virtually any healthcare analytics company could provide some sort of recommendation given model with enough data points. However, very few models provide adaptive prescriptions at each point of contact along the engagement with the patient. For instance, there could be a very different success probability for group therapy if internal medicine was utilized as the first course of treatment. Similarly, one might imagine a varied probability of success in group therapy if individual therapy was undertaken in advance. Importantly, each of these permutations would likely also have a distinct impact upon the ultimate cost of care as well.

[74] Neel V. Patel, *Why Doctors Aren't Afraid of Better, More Efficient AI Diagnosing Cancer*, DAILY BEAST (Dec. 11, 2017, 9:00 AM), https://www.thedailybeast.com/why-doctors-arent-afraid-of-better-more-efficient-ai-diagnosing-cancer.

options relative to cost.[75] Therefore, if two courses of care are roughly equal in their potential benefit to the patient given their specific circumstances, yet one costs significantly more the other, a doctor can confidently discuss such a recommendation with a patient based not upon anecdotal data, but upon bespoke analytical analysis.[76]

VIII. MACHINE LEARNING OPPORTUNITIES IN LAW

The discussion of machine learning's distinctiveness in the healthcare industry above provides meaningful, though admittedly imperfect, analog to the practice of law.[77] An attorney's advice to a client bears some similarity to a physician's prescription of care in that they both reflect the application of time-honed expertise and education to massive amounts of imperfect data—in essence they represent the highest level of decision-making and strategy in their respective fields.

Likewise, the outcome of a professional engagement with a legal client or medical patient is determined by a dynamic sequence of decisions and events. For instance, in a jury trial, a plea of not guilty may be interpreted differently by a jury if the client originally plead guilty, just as chemo therapy may have a different outcome for a cancer patient if it is preceded by radiation therapy.

Finally, the importance of cost to either course of treatment or strategy of legal representation is paramount. These aggregate costs of medical care or legal representation require dynamic analysis of an entire sequence of decisions rather than the static analysis of any one decision in a vacuum.

Physicians and lawyers must communicate complex, often abstruse, information and reasoning to their constituents while managing their expectations. There exists a clear asymmetry of expertise between both doctor and patient, and lawyer and client. As such, any tool that enhances strategic decision-making provides critical aid to client engagement.

With these similarities in mind, I will now illustrate four hypothetical applications of machine learning to the upper echelon of legal decision-making and strategy development.[78] Specifically, I will describe how such models may en-

[75] Kyree Leary, *AI Can Diagnose Heart Disease and Lung Cancer More Accurately Than Doctors*, FUTURISM (Jan 3. 2018), https://futurism.com/ai-diagnose-heart-disease-lung-cancer-more-accurately-doctors/.

[76] *Id.*

[77] The differences between healthcare and law are immense, ranging from the differing regulatory environment, the degree of consequence (life and death versus determination of legal rights and responsibilities), and notions of access to care and cost of care (there exists legal representation insurance, but it is relatively unknown). *See, e.g.*, Mila Araujo, *Legal Insurance Plans*, THE BALANCE (Sept. 20, 2017), https://www.thebalance.com/legal-insurance-guide-3990192. However, the core of the physician advise and decision-making process may be seen as analog to the central decision-making and strategy development process in the upper echelons of the legal profession, and that serves as the focus for the remainder of this article.

[78] *See generally* Part X.

hance the hiring process for lateral attorneys, followed by a description of machine learning's potential role in litigation matters. Drawing upon the litigation model, I will examine the dynamic nature in which internal legal costs can be predicted and optimized. Finally, I will describe how machine learning can enhance client matter staffing, law-firm pyramid optimization, and ultimately serve as an umbrella technology for effectively managing the integration of other technologies.

A. Effective Hiring of Lateral Attorneys

A wealth of data exists pertaining to the hiring of freshly minted JDs. In addition to data compiled by law firms, information is also compiled by individual law schools, state and local bar associations, and the ABA.[79] However, the calculus surrounding the effective hiring of lateral attorneys remains murky and quite firm-specific.[80] Lateral attorneys presumably come to a new firm bearing "gifts," either in the form of a book of business or in a demonstrated level of expertise that either fills a gap in the law firm's portfolio of services or complements already-existing competencies. However, the ability to effectively vet lateral candidates and determine their short and long-term payoff remains a challenge for many firms.[81] Recent studies show that approximately 50% of lateral hires fail within their first five years, and the cost of a failed lateral partner can be as much as 200-400% of their compensation.[82]

Until relatively recently, a prospective lateral attorney's book of business may have been considered the primary determinant of his or her value in transferring. Yet law firms may now be coming more cognizant of the fact that a book of business does not always transfer linearly to an attorney's new home.[83] Law firms have also become more data driven, a fact that has led firms to collect data regarding a wide range of information.[84]

Firms typically collect a wealth of information that one might intuitively believe contributes to a successful lateral hire. In addition to traditional demographic, educational, and experiential background information, firms also collect information on prior billings and clientele. This information may be classified in greater detail than in the past, delineating billable hours, collections, portable

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[79] Michael Magasin & Jeffrey Schieberl, *What You Need to Know about Attorneys' Fees*, 8 GRAZIADIO BUS. REV. (2005), https://gbr.pepperdine.edu/2010/08/what-you-need-to-know-about-attorneys-fees/.

[80] *See* Scott Flaherty, *Hiring Misfires Show Need for Tougher Law Firm Vetting*, THE AMERICAN LAWYER, https://www.law.com/americanlawyer/almID/1202791035483/?slreturn=20180502153828 (June, 23, 2017).

[81] *See id.*

[82] *Id.*

[83] *Id.*

[84] *See* Jeff Pfeifer, *The Data-Driven Lawyer and the Future of Legal Technology*, LAW TECHNOLOGY TODAY, http://www.lawtechnologytoday.org/2018/01/the-data-driven-lawyer/ (Jan. 15, 2018).

business, numbers and sizes of major clients, contingency fee matter collectables, hours worked, and compensation numbers. Data of this kind may be collected for some period of years prior to lateral consideration, and similarly, such data may be tracked indefinitely after the individual is hired. As one might imagine, an attorney's initial financial impact may differ markedly from their long-term impact.[85]

Machine learning platforms can identify not only the most meaningful determinants of effective hires over time, but they can also identify clusters of related data that together contribute to effective lateral performance.[86] While law firms may have traditionally considered billing history and collections to be primary determinants of lateral success, perhaps those numbers vary given the number and size of the portable clients that the lateral brings with them.

In addition, perhaps other nuances of the data may emerge that would be difficult for traditional analytical methods to uncover. For instance, consider the possibility that the hiring firm knew that clients of lateral attorneys were 80% more likely to stay with their attorney through the transition to a new firm when they were the attorney of record for at least four years with aggregate average billings of at least 400 hours. This sole piece of analysis enables hiring attorneys to analyze a lateral's book of business in an entirely new light.

Perhaps even more important than merely identifying such deep data connections is the capacity of machine learning platforms to continually interpret such data and to advance a corpus of knowledge regarding lateral hires over time.

B. Litigation

Litigation matters run a wide gamut in terms of their complexity, duration, and capacity to be modeled by even the most advanced computational systems.[87] Somewhere in between mundane misdemeanor trials and massive multinational disputes lies a host of litigation matters that may hold promise for the applications of machine learning.

As a brief example, consider the case of a simple family law matter: a divorce case in which the determination of custody and spousal support are the two main issues.

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[85] Some fields of law may be more prone to portable books of business than others, and some contingency fee-based matters may take a period of years to fully utilize the anticipated revenues. *See also* Magasin & Jeffrey, *supra* note 79.

[86] For example, in one pilot study, Raiven's machine learning platform was able to predict above-average performing attorneys with over 80% accuracy. This prediction was based upon the interactions between a host of criterion, including law school attended (and rank), clerkships, geographic location, practice group, prior years of experience, partnership status, prior billings, prior fees collected, as well as host of other variables. See www.Raivenlegal.com.

[87] For example, traffic court trials may possess fewer criterion for disposition than an international patent dispute, and therefore the former may potentially be easier to model and predict than the latter.

At the initial intake interview, a client provides the attorney with a wealth of information regarding her case. As the attorney considers this information, he likely draws upon his past experience and expertise in order to highlight the most relevant aspects of the case. For instance, the attorney may feel that the most important aspects of her case are that she has three children under the age of ten, holds a steady full-time job, and has an amicable relationship with her spouse. From this information, the attorney might make an initial prediction of the most likely outcome of the case, provide the client with a reasonable estimate of costs, and develop a strategy for pursuing the client's objectives. He would likely change his strategy and predictions as the case unfolds and would reassess them at each critical phase of the case.

In the scenario described above, a machine learning platform would work alongside an attorney by providing an integrated analysis of all relevant data from the attorney's (and colleague's) prior cases in order to provide detailed predictions of case outcome and cost (see Figure 1 below).

To demonstrate the capabilities of machine learning further, consider the family law hypothetical above (depicted in Figure 1) which shows the initially favorable set of predictions. Based upon the information provided by the client at the outset of the case, she may be expected to receive $2,400/month in support along with reasonable expectation of sole custody.

However, after the divorce action is filed and the discovery phase begins, new facts emerge that change the analysis. Perhaps the husband provides evidence that casts doubt upon the wife's job stability, as well as allegations of spousal abuse. As new information comes to light, the estimations of custody outcome and spousal support change dramatically (see the area shaded in light grey). As the case unfolds, the machine learning platform could constantly update to integrate any pertinent data point chosen by the attorney.

Importantly, the analysis may also uncover salient data points that the attorney may not have been previously aware of. For example, perhaps an attorney has been overly focused upon the annual salary of a spouse in determining spousal support awards, but the machine learning platform determines that consistency of employment (i.e., holding a job for over two years) plays a significantly greater role in determining such awards. This revelation, among countless others, would likely emerge with continually greater precision as the machine learning platform digests more data and learns more patterns and relationships.[88]

[88] For an excellent explanation of machine learning's potential application to employment law, see Surden, *supra* note 1.

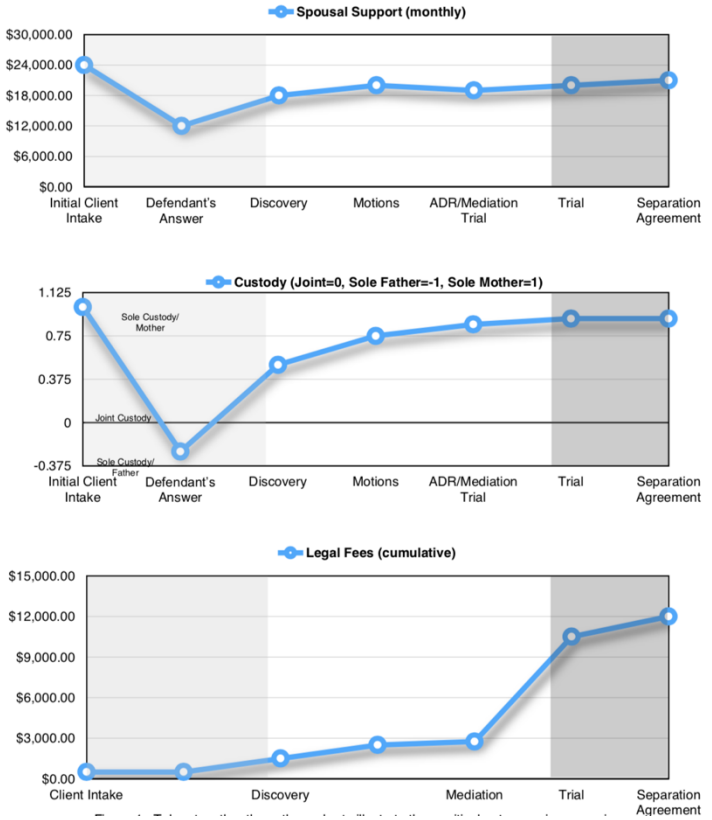

Figure 1: Three variable outcomes of a hypothetical divorce case[89]

C. Continuous Cost Optimization and Client Management

In addition to the prediction of vital case outcomes, machine learning software possesses the potential to integrate estimations of legal costs.[90] Importantly, these predictions may be determined not only from all available data within the firm, but also from aggregate industry-wide data compiled by outside sources. Industry-wide legal cost estimates are now widely available to clients from data aggregation services, however those may provide limited specificity with which

[89] Taken together these three charts illustrate three critical outcomes in a generic divorce case. The shaded areas represent different phases in the case in which strategic decisions may be made based upon the combined outcomes of these variables.

[90] *See, e.g.*, *TyMetrix*, WOLTERS KLUWER, http://www.wkelmsolutions.com/products/T360 (last visited Mar. 11, 2018).

to match the nuances of a client's specific case.[91] In other words, the going rate for a certain type of business acquisition does little to help a firm estimate its own potential legal fees for the specific acquisition being contemplated by the client.

By contrast, internal data generated by a law firm may provide the most detailed assessments of legal costs, which may be precisely matched to the specific details of the matter at hand. An effective machine learning platform may enable law firms to predict internal costs of matter management on the level of the overall firm, each individual branch, or each practice group. This results in a much more precise estimate than external estimates and provides law firms the ability to confidently predict, manage and control their internal cost of engagement.[92]

As a simple example, compare the information revealed by each of the three charts depicted in Table 1 at the time the case would go to trial. Even a cursory evaluation of this data suggests that the client is about to enter a phase of the case in which the costs will dramatically increase. Importantly, the client can also tell that going to trial is likely to generate little if any change in the outcome of the case (in terms of spousal support and custody). As such, the client may be more willing to reach a settlement agreement at this time rather than go to trial. While attorneys frequently counsel their clients regarding such situations based upon their own experience, the continuously updated output of machine learning platforms provides precise estimates rather than anecdotal data. Furthermore, this proscriptive output arms attorneys with a powerful tool for managing client expectations with regard to outcomes of the engagement.

In sum, several distinct implications emerge from this cost prediction capacity. First, attorneys may manage client expectations with precise data generated from their own firm's past matter management.[93] This point takes on particular power considering that clients are increasingly armed with industry-wide aggregate billing estimates provided by firms that scour all available data from law firms and in-house counsel. While clients may have access to industry-wide averages for client matters, a firm possessing a machine learning platform that can continually optimize costs and adaptively manage expectations on a client's specific case stands apart.[94]

In addition, adaptive cost prediction provides firms with greater ability to effectively profit from flat fee arrangements. Being able to effectively predict billable hours and legal costs from firm-specific data rather than industry-wide averages may enable attorneys to confidently price services in a manner that may both land new clients and ensure profitable client matter engagements.

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[91] *Id.*

[92] For a survey of current applications of machine learning to the legal industry, see *Lawyers and Robots? Conversations Around The Future Of The Legal Industry*, LEXISNEXIS (Jan. 2017), http://www. lexisnexis.co.uk/pdf/lawyers-and-robots.pdf.

[93] *See* Surden, *supra* note 1, at 102.

[94] *See generally* Remus & Levy, *supra* note 1.

D. Umbrella Technology for the Perfectly Leveraged Pyramid

Perhaps the most powerful potential application of machine learning lies in the ability to augment law firm leaders' design and management of the law firm pyramid. A mere combination of the aforementioned optimization of hiring, costs, and critical legal decision-making may make this appear intuitive. Yet machine learning software's potential extends far beyond these essential tasks to the highest level of firm management, including extending to the organization of all complimentary legal assets and to the preservation of legal expertise and reputation.

Much of a law firm's success rests upon its ability to properly leverage its legal professionals and staff in an optimal pyramid to serve their current and future clientele.[95] When a pyramid is leveraged too highly, the salaries of underutilized associates may cut into profits. When leveraged too narrowly, the firm lacks the needed associates to address current and future demand, which ultimately limits billables and revenue.

The ideal formula for maximizing this pyramid varies from firm to firm, and is complicated by a host of factors, including the diversity of practice groups, the number and location of firm branches, and the integration of time (and cost) saving technologies such as those mentioned in prior sections of this article. Importantly, one of the key reasons that machine learning may impact the highest level of legal management so profoundly is because it possesses the potential to become an *umbrella* technology—a technology that not only enhances the integration of a firm's human resources, but also all available technological aids that either augment or replace human activity (including task-related AI software such as legal research and discovery).

This would especially be true for large, multi-branch law firms handling complex legal matters. When a law firm allocates resources for a large client engagement (whether it be transactional or litigation-based), it faces the tasks of not only making sure the matter is staffed with enough attorneys, but also of doing so in a cost-effective manner that yields them both an optimal legal outcome and optimal profits.

Doing so may entail integrating the proper size, shape, and constitution of the pyramid of staff and resources devoted to the matter across the entire firm. Typically, this would consist of the optimal mix of partners at the top of the pyramid, and senior, mid-level, and junior attorneys filling out the lower levels of the pyramid. Included in such considerations may be ancillary staff, such as paralegals, administrative support, and technical staff. Furthermore, the threshold points at which it becomes more effective to accomplish a task with human capital rather

[95] The law firm pyramid refers to the triangular organizational structure of law firms in which upper management and partners reside at the pinnacle, and increasingly wide layers of senior, mid-level and junior associates lay beneath. Beneath the junior attorneys lay legal staff such as contract attorneys, paralegals, and administrative staff. Leverage refers to the ratio of junior associates reporting to each partner.

than via technological means (i.e. discovery) may be discerned and integrated into the model. Finally, adding even more complexity to such analysis may be the prospect of utilizing slack resources available at smaller market branches of a law firm where attorneys charge lower billables for completing the same matters and tasks.

Integrating these various considerations is common among law firm leaders, yet the most optimal organization of firm resources may be beyond the scope of even the most experienced and knowledgeable legal professionals.

Just as machine learning may augment the individual legal decision-making of senior attorneys in their practice, it may similarly serve managing partners as a tool to optimize leverage at the firm. And in a manner similar to legal decision-making, the software could continuously learn from the decisions made by managing partners and ceaselessly perfect its ability to provide advice in this regard.

IX. ETERNAL LEGAL ACUMEN—A PERMANENT COMPETITIVE ADVANTAGE

The aforementioned applications of machine learning to the upper echelons of legal decision-making represent merely a sample of its potential, yet one key implication underlying all such applications is the fact that machine learning platforms *permanently capture* the hard-earned wisdom of law firm leaders and experts.

This point cannot be stressed enough: law firms' reputations are undoubtedly their most valuable asset, and that reputation rests upon the wisdom and expertise of their partners. Over time, the composition of a firm's partnership invariably changes, and with it changes the composition of competencies and skill-sets that guide the firm. The traditional apprenticeship law firm model attempts to capture the partners' expertise through the training and tutelage of junior attorneys. This business model is ostensibly designed to continuously preserve senior partners' expertise and transfer that expertise to subsequent generations of attorneys. This model has served the legal profession ably over time, but by any reasonable estimation, the transfer of legal acumen among generations is not clean, linear, or predictable—especially within an individual law firm.

Machine learning platforms promise to memorialize the legal decisions of law firm leaders in perpetuity; a platform that continuously learns from their masterstrokes and follies alike, and ultimately produces a reservoir of institutionalized expertise. This cache of wisdom and expertise may eventually provide law firms with a permanently sustainable competitive advantage among peers.

This permanent capture of legal wisdom and institutionalization of attorney expertise promises to change the long-standing conception of law firms. Instead of viewing a firm as a temporary clustering of legal minds aligned to serve their current clientele base, firms may start being viewed as the house in which the minds of current and previous famed legal experts live on for time immemorial. As such, law firms might become known for being the firm in which the expertise

of David Boies, Ted Olson, or Vanita Gupta might be forever memorialized and leveraged for the benefit of their clientele.

X. CONCLUSION

The legal industry possesses vast opportunities for application of machine learning, opportunities that, if seized, may change the effectiveness of law firm management and legal services delivery for the foreseeable future. This article presents a mere sampling of the possibilities for the future of machine learning in law based upon established work in healthcare. The technologies and companies included herein are not intended to be an exhaustive list of those advancing the field of machine learning in law, nor is the discussion positioned as an authoritative treatise on machine learning. The present goal is to provide a brief primer on machine learning and illustrate the detrimental effects of its absence in the legal field, and to present a clear vision of its future in law. Ultimately, machine learning holds the potential to not only enhance legal decision-making and law firm management, but to transform the reputational capital of law firms into a sustainable, and perhaps permanent, competitive advantage.