

Emerging Technologies and the Courts

Gary E. Marchant

The world is changing at a faster pace today than ever before, in large part fueled by an unprecedented rate of technology advances. This pace of technological change will only accelerate going forward. We all must take this reality of unprecedented change into account as we plan our futures, perform our professional duties, and in the case of judges, write judicial opinions. As Chief Justice of the U.S. Supreme Court John Roberts stated in an interview at the time of his appointment, “politicians – and judges for that matter – should be wary of the assumption that the future will be little more than an extension of things as they are.”¹ It is human nature to perceive the world today the same as it was yesterday, and the same as it will be tomorrow. This static view of the world is an illusion, however, and masks the unprecedented disruptive change going on in the world around us.

Technology is the key driver of much of the rapid change we are experiencing today. An unprecedented number of emerging technologies are moving simultaneously from the laboratory or even science fiction into real-life applications. Examples include artificial intelligence, robotics, synthetic biology, 3D printing, nanotechnology, brain-computer interfaces, genetic sequencing, human gene editing, Internet of Things, RFID chips, mobile health, drones, virtual reality, and blockchain. Each of these technologies has already spawned real companies, real products, and real lawsuits, with much more to come over the next couple of decades. Every one of these technologies will have enormous impacts on our individual lives, as well as creating widespread beneficial and disruptive effects for our social, economic, and legal systems.

One thing these new emerging technologies don't have is effective regulatory systems. These technologies have emerged so fast that our legislative and regulatory branches of government have been caught flat-footed and have not been able to put in place comprehensive government oversight. This inaction might be a blessing in disguise, since any regulatory enactment would likely be obsolete by the time the ink dried, given that these technologies are developing and evolving so rapidly.

The result is that courts are often on the front line in addressing the inevitable conflicts and potential harms that may be side effects of emerging technologies. In theory, courts may not be the optimal branch of government to address the societal impacts of emerging technologies. Courts lack the technological staff and resources available to the other branches of government, and must address problems in the context of the facts in individual cases rather than taking a broader, more comprehensive approach. Most judges lack technological expertise, and are lim-

ited in what information they are permitted to consult. Moreover, judges are more comfortable enforcing statutes and rules adopted by other branches of government, rather than having to forge for themselves the new rules of the road for emerging technologies.

But courts do not have the luxury that the other branches of government usually have of postponing decisions when issues relating to new technologies appear on their docket. Courts are already being, and will even more in the near future be, called upon to adjudicate complex and unprecedented issues raised by emerging technologies. So like it or not, judges will have to get used to being on the front line of new technologies, and to have a basic understanding of both the technical and legal dimensions of these technologies. In this article, I preview some of these issues, organized into categories of new substantive claims and defenses, evidentiary aspects, and impacts on the judicial process and court operations.

NEW SUBSTANTIVE CLAIMS AND DEFENSES

The many emerging technologies disrupting commerce and society are not surprisingly presenting courts with novel claims and defenses. No technology is more disruptive than **artificial intelligence** (AI), and it is already presenting the legal system with new challenges about responsibility and culpability. In the past era of rule-based AI, a human programmer pre-programmed every decision an AI would make in response to certain inputs or events, and thus the human programmer could explain and be held responsible for the actions of the AI system. Modern AI is mostly based on machine learning, a form of data-based AI, in which the AI system learns itself by trial and error from data, with no human programming the AI what to do. This creates new issues for courts. No human can explain why the machine learning AI did what it did, it is a black box. So when such an AI system causes harm, who is responsible?

This dilemma was illustrated by a recent case in Switzerland where art gallery owners created a machine-learning bot and released it on the web with some bitcoins and the instruction to go purchase interesting items for the art gallery.² All was going fine until one day the police knocked on the art gallery door, and said they had intercepted parcels that contained a pound of the drug Ecstasy and a stolen passport, both of which were criminal acts to purchase. After discussing the matter with the art gallery owners who claimed that they neither intended nor anticipated the purchase of the illegal goods, the police eventually confiscated the computer that controlled the naughty bot. Sometime later the police sheepishly returned the computer and did not file any charges.³ This example portends a bigger issue as AI bots

Footnotes

1. Jeffery Rosen, *Roberts v. The Future*, N.Y. TIMES, Aug. 28, 2005.
2. Victor Luckerson, *A Drug-Buying Robot Has Been Freed from Police Custody*, TIME, Apr. 21, 2015, available at <https://time.com/>

3. *Id.* 3829874/random-darknet-shopper-drug-buying-robot-freed/.

assume a larger and larger role in society, and will inevitably commit some crimes and torts, but who (or what) will meet the traditional legal requirements of *mens rea*, negligence, and foreseeability when it is the machine rather than a human programmer making the decisions?⁴

Genetic evidence has been introduced in some cases to show a genetic predisposition to criminality. A common mutation in the MAOA-A gene, which codes for an enzyme that breaks down brain hormones such as serotonin, may significantly increase the probability of criminality, especially if it is combined with an abusive early background.⁵ A number of criminal defendants have attempted to introduce evidence of such a genetic influence as mitigating evidence in capital murder cases.⁶ Judges have differed on whether such evidence is admissible, and juries have varied in how much weight, if any, they give to such evidence as a mitigating factor in sentencing.⁷ The new type of genetic defense raises profound issues about guilt, culpability, and punishment, for which there are no simple right answers.⁸

Privacy cases present many new technology questions for judges. For example, does a property owner have a privacy claim against a neighbor who flies a drone above his swimming pool taking video footage of a private pool party? Numerous claims have been presented to courts about this and many other alleged privacy intrusions involving **drones**.⁹ There have even been cases where the landowner shoots down the neighbor's drone – is the privacy invasion a legitimate defense for such self-help measures?¹⁰ Courts have also been asked to decide issues of the legal restrictions, if any, on the use of GPS location tracking on a phone or car for employers to track their workers, parents to track their kids, spouses to track their partners, and stalkers to track their victims.¹¹ Although the FCC has been requested for many years to issue rules on the use of location data generated by smart phones, the absence of such rules leaves judges on their own to craft appropriate rules to balance the conflicting interests at issue in such cases.¹²

A final example is a whole spectrum of cases involving **reproductive technologies**. Courts have been confronted with cases involving the disposition of embryos when the couple who cre-

ated the embryos divorce or are killed, or what custody rights do a genetic versus a non-genetic parent have when a family breaks up.¹³ Other cases have required courts to decide what happens if embryos are accidentally destroyed,¹⁴ what limitations (if any) can state legislatures put on parents' rights to genetically test (and abort) an embryo or fetus,¹⁵ and what rights do a child produced by in vitro fertilization where anonymous donors provided half or all of the genetic input have to recover in the estate or insurance policy of their social parent.¹⁶

The Massachusetts Supreme Judicial Court complained that courts are being stuck with tough technology issues that should be decided in the first instance by publicly accountable legislatures:

For the second time this term, we have been confronted with novel questions involving the rights of children born from assistive reproductive technologies.... As these technologies advance, the number of children they produce will continue to multiply. So, too, will the complex moral, legal, social, and ethical questions that surround their birth. The questions present in this case cry out for lengthy, careful examination outside the adversary process, which can only address the specific circumstances of each controversy that presents itself. They demand a comprehensive response reflecting the considered will of the people.¹⁷

NEW TYPES OF EVIDENCE

Judges are already confronting new types of evidence enabled by technology coming into their courtrooms, whether it be social media evidence, images from surveillance cameras, facial recognition evidence, or forensic DNA in criminal cases. This is just the beginning, however, of a coming tsunami of novel technological evidence. Emerging technologies are providing many new types of evidence that are challenging judges and juries.

“There have even been cases where the landowner shoots down the neighbor’s drone”

4. For a deeper analysis of such issues, see Mark A. Lemley & Bryan Casey, *Remedies for Robots*, 86 U. CHI. L. REV. 1311 (2019).
5. A. Caspi et al., *Role of Genotype in the Cycle of Violence in Maltreated Children*, 297 SCI. 851 (2002).
6. Sally McSwiggan, Bernice Elgerab & Paul S. Appelbaum, *The Forensic Use of Behavioral Genetics in Criminal Proceedings: Case of the MAOA-L Genotype*, 50 INT'L J. L. & PSYCHIATRY 17 (2017).
7. *Id.*
8. See, e.g., Nigel Eastman & Colin Campbell, *Neuroscience and Legal Determination of Criminal Responsibility*, 7 NATURE REV. NEUROSCIENCE 311 (2006).
9. See Rupperecht Law, *Drone Lawsuits & Litigation Database* (2019), available at <https://rupprechtlaw.com/drone-lawsuits-litigation/>.
10. Jamie Nafziger, *To Shoot or Not to Shoot? The Legality of Downing a Drone*, Sept. 25, 2017, available at <https://www.dorsey.com/newsresources/publications/client-alerts/2017/09/the-legality-of-downing-a-drone>.
11. See, e.g., Kendra Rosenberg, *Location Surveillance by GPS: Balancing an Employer's Business Interest with Employee Privacy*, 6 WASH. J. L. TECH. & ARTS 143 (2010-2011); Justin Scheck, *Stalkers Exploit*

Cellphone GPS, WALL ST. J., Aug. 3, 2010.

12. Harold Feld, *Will the FCC Keep Ignoring Carriers That Sell Your GPS Data?*, Public Knowledge, Mar. 13, 2019, available at <https://www.publicknowledge.org/blog/will-the-fcc-keep-ignoring-carriers-that-sell-your-gps-data/>.
13. Mary Ziegler, *Beyond Balancing: Rethinking the Law of Embryo Disposition*, 68 AM. U. L. REV. 515 (2018-2019).
14. Dov Fox, *The Legal Limbo of Lost Embryos*, VOX, July 3, 2019, available at <https://www.vox.com/the-highlight/2019/6/26/18744249/fertility-clinic-destroyed-embryos-lawsuits>.
15. Jonathan Stempel, *Ohio Ban on Down Syndrome Abortion Blocked by U.S. Appeals Court*, REUTERS, Oct. 11, 2019, available at <https://www.reuters.com/article/us-usa-ohio-abortion/ohio-ban-on-down-syndrome-abortion-blocked-by-u-s-appeals-court-idUSKBN1WQ2FL>.
16. See, e.g., Paul Sullivan, *Fertility Treatments Produce Heirs Their Parents Never Knew*, N.Y. TIMES, Aug. 30, 2013.
17. Woodward v. Commissioner of Social Sec., 760 N.E.2d 257 (Mass. 2002).

“[J]udges without advanced neuroscience training will be hard-pressed to decide [neuroimaging] cases in a scientifically credible and consistent manner.”

For example, **neuroimaging** is increasingly being used in court cases for a variety of potential uses. In several hundred cases, brain-imaging evidence was produced to show that a criminal defendant allegedly lacked the cognitive capability to have the requisite *mens rea*, or more commonly to show some type of alleged brain damage that might mitigate the defendant's criminal culpability.¹⁸ Courts

and juries are all over the map in receiving such evidence – some judges allow it to be introduced while others do not, some juries find the evidence to be persuasive mitigating evidence, others do not.¹⁹ Other attempted or potential uses of neuroimaging in court cases include brain scans for lie detection,²⁰ pain,²¹ post-traumatic stress disorder,²² recidivism,²³ and subclinical traumatic brain injury.²⁴ Given the complicated technical issues of how such brain-scanning evidence is conducted and represented, along with the uncertain ethical and legal significance of brain lesions or aberrations, judges without advanced neuroscience training will be hard-pressed to decide such cases in a scientifically credible and consistent manner.²⁵

Genetics is another source of scientific evidence that is having enormous legal implications. Most judges are already familiar with the use of forensic DNA for identification in criminal law, but that is just the first of many diverse applications of genetic evidence in court cases. DNA is already having dramatic impacts on paternity cases,²⁶ immigration cases,²⁷ and food-poisoning cases,²⁸ in which DNA provides a highly accurate and legally salient map for quantifying both human and microbial relationships. Genetic mutations

are also being used to identify exposures in toxic tort cases, and differences in genetic susceptibilities to chemical and pharmaceutical exposures are increasingly being used by defendants in some cases and plaintiffs in others to argue for or against causation in personal injury cases.²⁹ Judges are now being called upon to determine whether a defendant can undertake intrusive genetic testing of a plaintiff to discover genetic traits relevant to causation, taking into account the same type of information may be used by the plaintiff when helpful to their case.³⁰ In at least one case, the genetic testing of the plaintiff revealed genetic risk information that was crucial to the health of the plaintiff and his family, but because the testing was done by a testing lab contracted by the defendant, no one associated with the case had a physician-patient relationship with the plaintiff.³¹ In that case, the judge felt compelled to take on the task of trying to genetically counsel the plaintiff, a skill that is not taught in judges' school!

Location-tracking technology raises many evidentiary issues for courts. A person's location is often tracked and recorded by the GPS chip in their cell phone and by cell tower triangulation. The U.S. Supreme Court in its 2018 *Carpenter* decision held that police needed a warrant to access continuous location data over many days using cell tower records.³² The Court left undecided whether less prolonged continuous location monitoring also required a warrant. In most states, there are no laws about private use of cell phone location data, so courts are called upon to decide whether GPS evidence can be used in a variety of contexts, such as divorce cases. In several cases with contradictory outcomes a defendant has attempted to use GPS cell records to contest a speeding ticket based on police radar – judges are required to decide in such cases whether GPS phone records or police radar is more accurate, not an easy technical issue to resolve, especially considering there is usually no expert testimony in these cases in which only a couple of hundred dollars are at stake.³³

18. Lyn M. Gaudet & Gary E. Marchant, *Under the Radar: Neuroimaging Evidence in the Criminal Courtroom*, 64 *DRAKE L. REV.* 577 (2016).

19. *Id.*

20. Anthony Wagner et al., fMRI and Lie Detection, A Knowledge Brief of the MacArthur Foundation Research Network on Law and Neuroscience (2016), available at <https://www.macfound.org/press/grantee-publications/applying-neuroscientific-lie-detection-court/>; Frederick Schauer, *Can Bad Science Be Good Evidence? Neuroscience, Lie Detection, and Beyond?*, 95 *CORNELL L. REV.* 1191 (2010).

21. See, e.g., Kevin Davis, *Personal Injury Lawyers Turn to Neuroscience to Back Claims of Chronic Pain*, ABA J., March 2016, available at http://www.abajournal.com/magazine/article/personal_injury_lawyers_turn_to_neuroscience_to_back_claims_of_chronic_pain; Karen D. Davis et al., *Brain Imaging Tests for Chronic Pain: Medical, Legal and Ethical Issues and Recommendations*, 11 *NATURE REV. NEUROLOGY* 624 (2017).

22. Betsy J. Grey, *PTSD, Biomarkers, and Rape Prosecutions*, 48 *ARIZ. ST. L.J.* 935 (2016).

23. Eyal Aharoni et al., *Neuroprediction of Future Arrest*, 110 *PROC. NAT'L ACAD. SCI.* 6223 (2013).

24. Betsy J. Grey & Gary E. Marchant, *Biomarkers, Concussions, and the Duty of Care*, 2015 *MICH. ST. L. REV.* 1911 (2015)

25. See, e.g., Owen Jones et al., *Neuroscientists in Court*, 14 *NATURE REV.*

NEUROSCIENCE 730 (2013).

26. Christine Rosen, *Daddy's DNA*, *WALL ST. J.*, Feb. 22, 2008.

27. Rachel L. Swarnsaprill, *DNA Tests Offer Immigrants Hope or Despair*, *N.Y. TIMES*, Apr. 10, 2007.

28. Mike Stobbe, *Disease Hunters Using DNA to Investigate E. coli Outbreak Linked to Romaine Lettuce*, *CHI. TRIB.*, Apr. 30, 2018.

29. Gary E. Marchant, *Genetic Data in Toxic Tort Litigation*, 14 *J. L. & POL'Y* (2006).

30. Jennifer M. Champagne, *Genetic Testing and Testimony in Toxic Tort Litigation: Admissibility and Evaluation*, 13 *N.C. J. L. & TECH.* 1 (2011).

31. This anecdote was reported by an audience member at an ABA conference in which the author was speaking about genetic testing and toxic torts.

32. *Carpenter v. U.S.*, 138 S.Ct. 2206 (2018).

33. Derek Moore, *GPS or Not, Teen Must Pay \$190 Speeding Ticket*, *PRESS DEMOCRAT* (Santa Rosa, Calif.), Nov. 4, 2009, available at <https://www.pressdemocrat.com/news/2276077-181/gps-or-not-teen-must> (holding that police radar trumps GPS); Sahas Katta, *How My Smart Phone Got Me Out of a Speeding Ticket in Traffic Court*, *SKATTERTECH.COM*, Feb. 21, 2011, available at <https://skatter.com/2011/02/how-my-smart-phone-got-me-out-of-a-speeding-ticket-in-traffic-court/> (holding that GPS trumps police radar).

Justice Alito, in another location-tracking case, pointed out that legislatures not courts should be deciding these issues in the first place:

In circumstances involving dramatic technological change, the best solution to privacy concerns may be legislative.... A legislative body is well situated to gauge changing public attitudes, to draw detailed lines, and to balance privacy and public safety in a comprehensive way. To date, however, Congress and most States have not enacted statutes regulating the use of GPS tracking technology for law enforcement purposes.³⁴

Unfortunately, such judicial pleas for legislative guidance have fallen on deaf ears, and federal and state legislators have failed to provide courts with clear rules to decide these location privacy issues.

The **Internet of Things (IOT)** is another technology that will increasingly generate new types of evidence that will be used in court cases. The IOT consists of networks of sensors connected to the Internet. For example, the “smart” devices responsible for smart homes and smart cities are examples of IOT sensors. There are now over 6 billion such smart devices connected to the Internet, with more than 5 million new devices being connected every day.³⁵ In the home alone, these smart devices include home security systems, home speakers, garage doors, heating and air-conditioning systems, refrigerators, ovens, ranges, washers and dryers, televisions, home entertainment, lighting, outlets, and switches.³⁶ Each of these smart devices collects and stores data that is communicated over the Internet.

Already, we have started to see cases of evidence from such devices being sought to help prove events or communications. For example, the Amazon Echo device, often known as Alexa, has already been subpoenaed in a couple of murder cases based on the possibility that the Alexa device may have heard and recorded events in the home where the murder took place.³⁷ In one of these Alexa cases, data from a smart water meter may have provided even more relevant evidence to help solve the murder.³⁸ IOT devices in the home have also been used to provide evidence of a software or sensor malfunction that results in a fire and other types of property damage.³⁹

As with so many of the technologies now entering society, there are not yet any rules or laws governing access to IOT devices. The bipartisan Electronic Privacy Information Center sent a widely cited letter to the U.S. government in July 2015 calling for the establishment of some rules of the road for the smart IOT devices being installed in our homes – “Americans do not expect that the devices in their homes will persistently record everything they say. It is unreasonable to expect consumers to monitor their every word in front of their home electronics. It is also genuinely creepy.”⁴⁰ Despite this and other requests for rules to govern these devices, none have yet been enacted, and courts are left on their own to try to figure out the appropriate rules of the road for IOT devices.

A special type of IOT device increasingly used to provide evidence in courts are **wearables** such as Fitbits and smart watches. These devices collect and store data on the activity and location of its owner, which turn out to be relevant in a variety of court cases. The first such case was a workers’ compensation case where the injured worker used her fitbit data to prove how her lifestyle changed dramatically after a workplace injury.⁴¹ Fitbit data has also been used in a number of motor vehicle and accident cases to show the relative positions and the speeds of the parties involved in the collision.⁴² Perhaps most significantly, such wearable data has been used to solve several murder and rape cases.⁴³ This has led to what is probably my favorite title of all time for a student law review note: “Wearable Devices as Admissible Evidence: Technology Is Killing Our Opportunities to Lie.”⁴⁴

3D Printing is yet another emerging technology that is already starting to be used in court evidence. 3D printing has advanced rapidly in recent years – from printing relatively simple three-dimensional plastic objects such as an animal figurine, to now printing more complex objects using metals, composites, and even living cells. The era of 3D printing is already presenting many legal issues, such as the potential to print contraband items such as guns or recreational drugs in one’s own home, to intel-

“the Internet of Things (IOT) ... will increasingly generate new types of evidence that will be used in court cases.”

34. U.S. v. Jones, 565 U.S. 400, 429-30 (2012) (J. Alito, concurring opinion).

35. H. Michael O’Brien, *The Internet of Things*, DRI FOR THE DEFENSE, Dec. 2016.

36. *Id.*

37. Christopher Mele, *Bid for Access to Amazon Echo Audio in Murder Case Raises Privacy Concerns*, N.Y. TIMES, Dec. 28, 2016; Zack Whittaker, *Judge Orders Amazon to Turn over Echo Recordings in Double Murder Case*, TECHCRUNCH, Nov. 14, 2018, available at <https://techcrunch.com/2018/11/14/amazon-echo-recordings-judge-murder-case/>.

38. Alfred Ng, *Police Request Echo Recordings for Homicide Investigations*, CNET, Dec. 27, 2016, available at <https://www.cnet.com/news/police-request-echo-recordings-for-homicide-investigation/>.

39. O’Brien, *supra* n. 35.

40. Letter from EPIC to Attorney General Loretta Lynch & FTC Chairwoman Edith Ramirez, Sept. 25, 2015, available at

<https://epic.org/privacy/internet/ftc/EPIC-Letter-FTC-AG-Always-On.pdf>.

41. Kate Crawford, *When Fitbit Is the Expert Witness*, THE ATLANTIC, Nov. 19, 2014, available at <https://www.theatlantic.com/technology/archive/2014/11/when-fitbit-is-the-expert-witness/382936/>.

42. Doug K. W. Landau, “Smart” Evidence Tracking, TRIAL, Aug. 2018, available at <https://www.justice.org/magazine-article/trial/2018-august%E2%80%94get-ready-trial/smart-evidence-tracking>.

43. See, e.g., Lindsey Beever, *The “Dangerous Science” that Helped Convict a 14-year Old Girl’s Killer*, WASH. POST., Feb. 9, 2016; Christine Hauser, *Police Use Fitbit Data to Charge 90-Year-Old Man in Stepdaughter’s Killing*, N.Y. TIMES, Oct. 3, 2018; Modal Trigger, *Victim’s Apple Watch Data Used as Evidence in Murder Trial*, N.Y. POST, Apr. 2, 2018.

44. Nicole Chauriye, *Wearable Devices as Admissible Evidence: Technology Is Killing Our Opportunities to Lie*, 4 CATH. U. J. L. & TECH. 495 (2015-2016)

“[F]eatures of the blockchain make them very attractive for a growing number of legal and illegal applications.”

lectual property issues associated with printing patented, copyrighted, or trademarked items. Attorneys and their experts are now starting to use 3D printing to create visual aids for trial presentations that could provide judges and jurors a better representation of an object important to the case.⁴⁵ The fact-finder can handle and inspect the 3D-printed object from various perspectives, and evidence suggests that this helps the

judge or juror better understand and remember the object.⁴⁶ Police are also using 3D scanners to recreate a crime or accident scene, which can then be used to produce exhibits that can demonstrate key elements of the case to the jury with unprecedented accuracy and vividness.⁴⁷

Blockchain will be yet another evidentiary challenge for courts. Blockchain is the technology underlying cryptocurrencies such as Bitcoin, but it also has dozens of other applications such as smart contracts, financial services, supply chains, health, energy, real estate, and even government services such as elections. The blockchain is a distributed ledger, which means there are many computers (or “nodes”), each of which has a complete copy of the ledger, providing both greater security and participation compared to a centralized database with a single entity and a single point of attack. The other key feature of the blockchain is that the entries on the ledger are cryptographically “hashed” into blocks of encrypted records that are both anonymous and immutable. While each transaction on the blockchain can be tracked by any authorized user, the identity of the parties involved in each transaction is kept private using a private “key.”⁴⁸

These features of the blockchain make them very attractive for a growing number of legal and illegal applications, including many applications by courts themselves in court recordkeeping and managing court judgments, warrants, and criminal histories.⁴⁹ However, blockchain evidence is already presenting unique challenges for parties and courts in criminal investiga-

tions and civil discovery given the quasi-anonymity of the owners of the encrypted data and assets.⁵⁰ The admissibility of blockchain evidence may also be an issue because of hearsay problems.⁵¹ Already, judges are being called upon to address such blockchain discovery and admissibility disputes, and these issues will rapidly proliferate going forward as every major company in the country is already implementing blockchain projects. Resolving such issues requires judges to have a basic familiarity with blockchain technology, which most judges currently lack.

Artificial intelligence **algorithms** will also increasingly be used as evidence in courts. An algorithm is essentially a formula for predicting a result from a set of data – most algorithms today are implemented by AI machine learning. Many AI algorithms are developed by private entities and require significant investment to collect a robust and representative data set and then develop an algorithm that optimizes its output. Not surprisingly, the developers of such algorithms seek to keep the data and underlying software program for the algorithm proprietary. This can present a problem if the algorithm is then used in court as evidence.

Many states use algorithms in criminal cases to determine the need for pretrial detainment or to estimate the risk of recidivism during sentencing or probation determinations. The Wisconsin Supreme Court held that a court could rely on a proprietary sentencing algorithm, without disclosing the underlying data and formula to the defendant and his counsel, provided that the court used the algorithm as just one input and did not rely on the algorithm exclusively.⁵² The defendant had argued that it was a due process violation to deny him access to the algorithm so he could have his counsel or an expert test the algorithm for validity or bias. Other courts have held that it would be a due process violation for government entities to rely on proprietary algorithms in a variety of other contexts, such as determining Medicaid benefits⁵³ or teacher ratings.⁵⁴ The European Union has published an 80-page manual for European courts on how to handle AI evidence,⁵⁵ but no such guidance exists at this time for U.S. judges, who are thus required to decide these issues on their own on a case-by-case basis.

Perhaps the greatest evidentiary threat to the courts is the rise

45. Joris Peels, *3D Printed Visual Aids for the Courtroom*, 3dPrint.com, Oct. 4, 2019, available at <https://3dprint.com/254098/3d-printed-visual-aids-for-the-courtroom/>.

46. *Id.*

47. Bridget O’Neal, *Today’s 3D Virtual Reality Scanners by FARO Can Be Used to Understand and Make or Break a Courtroom Case*, 3DPrint.com, Jan. 15, 2016, available at <https://3dprint.com/115609/faro-virtual-reality-scanners/>.

48. An excellent overview of blockchain technology has been published by the National Institute of Standards & Technology (NIST). Dylan J. Yaga et al., *Blockchain Technology Overview*, NIST Interagency/Internal Report (NISTIR)-8202 (Oct. 3, 2018), available at <https://www.nist.gov/publications/blockchain-technology-overview>.

49. Di Graski & Paul Embley, *When Might Blockchain Appear in Your Court?*, TRENDS IN STATE COURTS 2018, at 62-66 (D. W. Smith, C. F. Campbell, B. P. Kavanaugh eds., 2018), available at <https://cdm16501.contentdm.oclc.org/digital/collection/tech/id/907>.

50. Christina M. Jordan, *Navigating Discovery with Blockchain Discovery*, LITIG. (ABA), Summer 2019, at 2-3; Stuart D. Levi et al., *Emerging Discovery Issues in Blockchain Litigation*, LEGALTECH NEWS, Apr.

3, 2019, available at <https://www.law.com/legaltechnews/2019/04/03/emerging-discovery-issues-in-blockchain-litigation/>.

51. Angela Guo, *Blockchain Receipts: Patentability and Admissibility in Court*, 6 CHI.-KENT J. INTELL. PROP. 440, 444-46 (2016).

52. *Loomis v. Wisconsin*, 881 N.W.2d 749 (Wis. 2016), cert. denied, 137 S.Ct. 2290 (2017).

53. *K.W. v. Armstrong*, 789 F.3d 962 (9th Cir. 2015).

54. *Houston Federation of Teachers v. Houston Independent School District*, 51 F. Supp. 3d 1168 (S.D. Tex. 2017). See generally Rashida Richardson, Jason M. Schultz & Vincent M. Southerland, *LITIGATING ALGORITHMS 2019 U.S. REPORT: NEW CHALLENGES TO GOVERNMENT USE OF ALGORITHMIC DECISION SYSTEMS* (AI Now Institute, September 2019), available at <https://ainowinstitute.org/litigatingalgorithms-2019-us.html>.

55. European Commission for the Efficiency of Justice (CEPEJ), *European Ethical Charter on the Use of Artificial Intelligence in Judicial Systems and Their Environment* (2018), available at <https://www.coe.int/en/web/cepej/cepej-european-ethical-charter-on-the-use-of-artificial-intelligence-ai-in-judicial-systems-and-their-environment>.

of “*deep fakes*.”⁵⁶ Deep fakes are photographs or videos manipulated using AI to make it appear that someone is saying or doing something that they did not say or do. This deep fake technology has quickly gotten very good, and it often takes an expert considerable time to determine that a video or photo is fake. Some experts believe that within a year or less it will become impossible to determine whether a picture or video is fake. This technology presents a grave threat to our political and national security systems, as a fake and sensational fabrication of a politician or soldier could be highly disruptive.⁵⁷ As courts increasingly utilize as evidence videos from smart phones, CCTV surveillance cameras, and police body cams, this threat to the trustworthiness of photographs and videos will present a major challenge to courts.⁵⁸ If we can no longer believe what we see, the privileged position that photographs and videos have had in our litigation system will disappear. Not only will we not know that a fake video or photo has been fabricated, but it will be easy to claim that a real video or photo is fake. Judges, juries, and litigators will all be tested as we enter the “post-truth” society, and new rules and strategies for authenticating visual evidence will be needed.

IMPACTS ON COURT OPERATIONS AND JUDICIAL PROCESS

Over the past decade or so, technology has significantly changed courtrooms and the judicial process. Online filing, digital evidence, e-discovery, courtroom presentation technologies, as well as remote communication and even testimony have evolved the courtroom and the profession of being a judge in ways that were not anticipated when most current occupants of the bench were in law school. However, the technological change experienced so far will pale compared to the coming impact of emerging technologies on courtrooms and emerging technologies, which will be more revolutionary than evolutionary.

For example, some future cases may be litigated using *virtual reality*. As one analysis recently concluded, “both VR [virtual reality] and AR [augmented reality] will become part of the litigation process. The only question is when.”⁵⁹ Such evidence could provide a much more realistic and impactful view of a crime or accident. As one scientist working in this field projected, “Imagine you could transport the entire jury, the judge, the litigators – everybody – back to the crime scene during the crime. That would be the best thing possible for any trial.”⁶⁰ A

prominent plaintiffs’ lawyer predicts that “in 10 years, most trial lawyers will be using VR just like they’re using laptops today. VR will be the norm, not the exception.”⁶¹ VR has already been used in courtrooms in China,⁶² and several U.S. companies claim to be developing a VR tool for use in courtrooms in this country.⁶³

Use of VR in the courtroom would raise several procedural issues for judges and courts. First, given the persuasive power of being immersed in a VR experience, how can courts ensure that VR presentations accurately represent the facts of a given case? Simulations are sometimes used in courts today, but are subject to rigorous evidentiary scrutiny. The same would be required for VR, especially when one party has the technological sophistication to produce and assess such representations, where the other party may not. Also, some people who encounter VR experience dizziness and motion sickness⁶⁴ — how should a court deal with a situation where a minority of jurors are not able to continue with a VR presentation that their fellow jurors experience in full? Finally, immersing jurors in realistic VR re-enactments of violent crimes or grisly accidents may be traumatic for some jurors. Would jurors need to be psychologically screened and counseled before being selected for juries that will be exposed to such VR evidence?

Legal analytics are also increasingly used in the litigation process. This technology uses the vast quantities of data now available online (“big data”) to predict results or recommend strategy in the litigation process. Many vendors are now marketing such legal analytical tools to law firms. Of greatest relevance to judges, some commercially available tools attempt to predict or influence the decisions of individual judges. The tool collects all available data on that judge’s previous decisions and opinions, supplemented with any secondary information about that specific judge available from media stories, social media, and other sources, and then applying AI to process the data, it predicts not only the likely outcome and timing of the judge’s opinion, but also provides customized advice on specific arguments, precedents, and even phrases to use or not use based on the particular

“If we can no longer believe what we see, the privileged position that [images] have had in our litigation system will disappear.”

56. Britt Paris & Joan Donovan, *Deepfakes and Cheap Fakes* (Data and Society, Sept. 18, 2019), available at <https://datasociety.net/output/deepfakes-and-cheap-fakes/>; Angela Chen, *Three Threats Posed by Deepfakes That Technology Won’t Solve*, *TECH. REV.*, Oct. 2, 2019, available at <https://www.technologyreview.com/s/614446/deepfake-technology-detection-disinformation-harassment-revenge-porn-law/>.

57. Robert Chesney & Danielle Keats Citron, *Deep Fakes: A Looming Challenge for Privacy, Democracy, and National Security*, *CAL. L. REV.* (forthcoming 2019), available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3213954##.

58. Riana Pfefferkorn, “*Deepfakes*”: A New Challenge for Trial Courts, *NWSIDEBAR*, Mar. 13, 2019, available at <https://nwsidebar.wsba.org/2019/03/13/deepfakes-a-new-challenge-for-trial-courts/>.

59. Arash Homampour, *VR in the Courtroom*, *LEGALTECHNEWS*, Feb. 2018, at L11.

60. Jessica Hamzelou, *Forensic Holodeck to Transport Jury to the Crime Scene*, *NEW SCIENTIST*, Jan. 9, 2015, available at <https://www.newscientist.com/article/dn26764-forensic-holodeck-to-transport-jury-to-the-crime-scene/> (quoting Jeremy Bailenson of the Virtual Human Interaction Lab at Stanford University).

61. Bruce Kaufman, *The Next Frontier for Virtual Reality: Courtrooms*, *BIG L. BUS.* (Bloomberg Law), Nov. 18, 2017, available at <https://biglawbusiness.com/the-next-frontier-for-virtual-reality-courtrooms> (quoting Mitch Jackson, a senior partner at Jackson & Wilson in Laguna Hills, Calif.).

62. Jiayun Fen, *Virtual Reality Technology Enters a Chinese Courtroom*, *SUPCHINA*, May 1, 2108, available at <https://supchina.com/2018/03/01/virtual-reality-technology-enters-a-chinese-courtroom/>.

63. Homampour, *supra* n. 59, at L12.

64. *Id.*

“The ultimate disruption of the judicial process would be the rise of robo-judges.”

judge’s own expressed predilections. These large data sets can also be used to identify potential biases and influences of individual judges or judges as a group. For example, one recent study found that judges who graduated from LSU handed out, on average, harsher sentences to juvenile defendants the week after the

LSU football team lost a game.⁶⁵ These types of correlations affecting the judgment of individual judges or judges as a group revealed by big data and AI have the potential to reveal patterns that may discredit or embarrass the judiciary. France has responded to this new reality by criminally banning the use of judicial analytics software – punished by up to five years in prison. Such a solution is unlikely to be adapted in the United States under our First Amendment, so judges should be prepared for a future where their decisions, both individually and collectively, are sliced and diced by new data analytic tools to provide new insights and surprises.

Various **big data** tools are also being applied to jurors. Courts can take advantage of the more accurate and up-to-date online information now available to achieve more accurate and efficient summoning of jurors.⁶⁶ At the same time, parties can use those same databases and more to better characterize prospective and selected jurors with respect to their opinions, biases, and values. Vendors are now offering digital tools that allow lawyers to profile an individual juror prospect in real time, using predictive analytics to integrate and evaluate all the data available on a juror derived from demographic data, vital statistics, juror questionnaires, and social media postings.⁶⁷ These services even integrate data on the juror’s purchase decisions and other behaviors that are obtained by data brokers.⁶⁸ Such intrusive searches into the personal data and history of prospective jurors may create a backlash against jury service by many citizens. These juror “big data” tools are not only being used for jury selection, but can also guide attorneys on what arguments will be most effective with jurors, and have even been used to obtain litigation funding based on a favorable jury profile.⁶⁹

As decisions are increasingly made by **AI algorithms** that are not programmed by humans but rather make their own “decisions” based on their machine learning, how will such algorithms be interrogated in trials? Scholars are beginning to take seriously and start thinking through the implications of having machines serve as witnesses in trials.⁷⁰ One insightful exploration of this issue concluded that “certain machine evidence implicates the readability of a machine source, that the black box dangers potentially plaguing machine sources trigger the need for credibility testing beyond what is contemplated by existing law, and that accusatory machine conveyances can be ‘witnesses against’ a defendant under the Confrontation Clause.”⁷¹ The concept of a machine testifying in a court trial is truly a revolutionary change to our legal system.

Brain-machine interfaces (BMI) will profoundly affect future society, including the judicial system. BMI involves linking computers directly to our brains – to either collect information from our mental process, and perhaps someday to insert ideas and instructions directly into the brain. Major companies and research institutes in the United States, China, and Japan, including Facebook and Elon Musk’s Neuralink, have been reporting significant advances in BMI, particularly in deciphering what a brain is thinking.⁷² This has produced claims that BMI technology powered by artificial intelligence will soon be able to “read” our thoughts.⁷³

The ultimate disruption of the judicial process would be the rise of **robo-judges**. We are already seeing some early examples of AI systems participating in the judicial process. In Argentina, a software program named Prometea is used to generate draft judicial opinions on various types of routine cases such as public-housing or taxi license disputes – the overseeing judge has approved 100 percent of these draft decisions as written to date.⁷⁴ China is now using AI judges to handle routine and small cases, “featuring an artificially intelligent female judge, with a body, facial expressions, voice, and actions all modeled off a living, breathing human (one of the court’s actual female judges, to be exact).”⁷⁵ An Ohio judge is using the Watson artificial intelligence system to help him read through and process the large paper records in many juvenile cases.⁷⁶

U.S. Supreme Court Justice John Roberts was recently asked, “Can you foresee a day when smart machines, driven with artificial intelligences, will assist with courtroom fact-finding or, more controversially even, judicial decision-making?”⁷⁷ Chief Justice

65. Ozkan Eren & Naci Mocan, *Emotional Judges and Unlucky Juveniles*, 10 AM. ECON. J.: APPLIED ECON. 171 (2018).

66. Leslie Gordon, *Big Data Juries*, ABA J., Sept. 2016, at 16, 16-17.

67. *Id.* at 17-18.

68. *Id.* at 17. This data can include gun ownership, the profession of the juror’s relatives, magazine prescriptions, TV shows viewed, and political affiliation. *Id.*

69. Brian Focht, *What Big Data Can Tell You About Your Jury Pool*, CYBER ADVOC., May 10, 2016, available at <http://www.thecyberadvocate.com/2016/05/10/what-big-data-can-tell-you-about-your-jury-pool/>.

70. Andrea Roth, *Machine Testimony*, 126 YALE L. J. 972 (2017).

71. *Id.* at 2051.

72. Sigal Samuel, *Brain-reading Tech Is Coming. The Law Is Not Ready to Protect Us*, VOX, Aug. 30, 2019, available at <https://www.vox.com/2019/8/30/20835137/facebook-zuckerberg-elon-musk-brain-mind-reading-neuroethics>.

73. Adam Jezard, *This Mind-Reading AI Can See What You’re Thinking—and a Draw Picture of It*, WORLD ECON. F., Feb. 5, 2018, available at <https://www.weforum.org/agenda/2018/02/mind-reading-ai-creates-images-from-your-thoughts/>.

74. Patrick Gillespie, *When AI Writes the Court Ruling*, BLOOMBERG BUSINESSWEEK, Oct. 29, 2018, at 29.

75. Monisha Pillai, *China Now Has AI-Powered Judges*, RADII, Aug. 16, 2019, available at <https://radiichina.com/china-now-has-ai-powered-robot-judges/>.

76. Chris Stewart, *Hey Watson: Local Judge First to Use IBM’s Artificial Intelligence on Juvenile Cases*, DAYTON DAILY NEWS, Aug. 3, 2017, available at <https://www.daytondailynews.com/news/local/hey-watson-local-judge-first-use-ibm-artificial-intelligence-juvenile-cases/InVqz6eeNxvFsMVAe5zrbL/>.

77. Adam Liptak, *Sent to Prison by a Software Program’s Secret Algorithms*, N.Y. TIMES, May 1, 2017.

Roberts replied: “It’s a day that’s here, and it’s putting a significant strain on how the judiciary goes about doing things.”⁷⁸ While some scholars are already exploring the implications of AI judges,⁷⁹ AI will not replace all judges anytime soon. Like every other sector in the economy, AI will increasingly play a role in almost everything we do, and those who reject or ignore the technology will soon be displaced by those who utilize and try to harness the incredible power of new disruptive technologies such as artificial intelligence.

CONCLUSION

As this extremely brief incursion into a large number of complex and disruptive technologies has hopefully demonstrated, these emerging technologies will dramatically change all aspects of our lives and society, including the practice and profession of judging. Because these technologies are advancing too fast for legislatures and regulatory agencies to effectively regulate the technology, courts by default will be on the front line in resolving the conflicts, risks, rights, and responsibilities that these technologies present, often writing on a blank slate of relevant rules and precedent. As such, judges will have no choice but to become knowledgeable about the new technologies underlying novel legal claims and defenses, new types of technology evidence, and the systemic changes to the courtroom and judicial process driven by new technologies. This will not be an easy task given the lack of technical training for most judges, the lack of trained scientific and engineering staff assistants, and the limitations placed on judicial decisions by the specific parties and record in front of the judge. Yet, just as lawyers are now required to demonstrate a minimum level of technological competency by the ABA (and most state bar associations) in its Model Rules of Professional Responsibility,⁸⁰ so too judges will need to have a basic level of scientific and technological knowledge and understanding to perform their jobs competently in the new era of emerging technologies.⁸¹

It will be tempting for judges to try to avoid these tough technological and scientific issues by deciding cases on legal technicalities or other grounds that judges are more familiar with. But as federal judge Jed Rakoff, who has long been actively involved in court-science issues, has pleaded, society urgently needs judges to step up the plate and provide some clarity and certainty about the legal aspects of emerging technologies:

[I]f I had a magic wand, I would say to my fellow judges, “I know that when you have a case that involves a scientific issue and a technical legal issue, your natural instinct may be to see if you can resolve the case on the technical legal issue, but you’re not really advancing the

law as well as could be done if you would take the time to address the scientific issue. The technical legal issue may never come up again; and even if it does, it doesn’t really get to the merits. The scientific issue is much closer to the merits of the case. If you can advance how judges think about science on any particular issue, you will be doing well, and it’s a great service.”⁸²

On the other hand, judges don’t want to get too far out in front of technology, given how fast technology changes often in unpredictable ways. Justice Kennedy warned about this danger in his decision in the *City of Ontario v. Quon* case,⁸³ which dealt with a public employee’s privacy rights in communication technologies. He warned that “the judiciary risks error by elaborating too fully” on the legal aspects of a rapidly evolving technology, and that “prudence counsels caution before the facts in the instant case are used to establish far-reaching premises” that “might have implications for future cases that cannot be predicted.”⁸⁴

So judges must walk a fine line between ducking the scientific issues altogether versus overreaching beyond their current knowledge to the murky unpredictable waters of future technologies. There is no question that judges will be challenged by the many new emerging technologies now starting to pervade their courtrooms and dockets. But on the positive side, these technologies are immensely important and fascinating to our own individual lives, those of our children and grandchildren, and the substance and process of judging.



Gary Marchant is a professor of emerging technologies, law, and ethics at the Sandra Day O'Connor College of Law, Arizona State University. In addition to his J.D. from Harvard Law School, Prof. Marchant holds a doctorate in genetics from the University of British Columbia. His research interests include the use of genetic information in environmental regulation, risk and the precautionary principle, legal aspects of personalized medicine, and regulation of emerging technologies.

78. *Id.*

79. See, e.g., Eugene Volokh, *Chief Justice Robots*, 68 DUKE L.J. 1135 (2019).

80. ABA, Model Rule of Professional Responsibility 1.1, comment 8 (2012).

81. Frederic I. Lederer, *Judging in the Age of Technology*, JUDGES' J., Fall

2014, at 6, (“technological competence is or soon will be a requirement for judges”).

82. Ashish Joshi, *Interview with Judge Jed Rakoff*, LITIG. (ABA), Fall 2019, at 15, 21.

83. 560 U.S. 746 (2010).

84. *Id.* at 759-60.