



ASOCIACIÓN NACIONAL  
DE  
MÉDICOS FORENSES

# Spanish Journal of Legal Medicine

## Revista Española de Medicina Legal

[www.elsevier.es/mlegal](http://www.elsevier.es/mlegal)



### EDITORIAL ARTICLE

## Artificial intelligence in forensic sciences: The future is now ☆

## Inteligencia artificial en las ciencias forenses: el futuro ya está aquí

Carles Martin-Fumadó<sup>a,b,\*</sup>, Eneko Barbería-Marcain<sup>c,d</sup>, Josep Arimany-Manso<sup>a,e</sup>

<sup>a</sup> Servicio de Responsabilidad Profesional, Colegio oficial de Médicos de Barcelona, Barcelona, Spain

<sup>b</sup> Facultad de Medicina y Ciencias de la Salud, Universitat Internacional de Catalunya, Sant Cugat del Vallès, Barcelona, Spain

<sup>c</sup> Instituto de Medicina Legal y Ciencias Forenses de Catalunya, Barcelona, Spain

<sup>d</sup> Facultad de Medicina y Ciencias de la Salud, Universitat Rovira i Virgili, Reus, Tarragona, Spain

<sup>e</sup> Cátedra de Medicina Legal, Responsabilidad Profesional y Seguridad Clínica, Universidad de Barcelona, Barcelona, Spain

We are currently witnessing a dizzying and inexorable technological revolution in our lives with the artificial intelligence (AI) explosion. AI is defined as the ability of a machine, understood as any digital-technological tool, to perform tasks that would normally require human intelligence, such as learning, reasoning, pattern recognition, decision-making, and problem-solving through the use of algorithms. In the field of computing, AI refers to systems that perceive their environment and are able to provide solutions to modify it, i.e., they make decisions that maximise the chances of achieving a goal.<sup>1</sup>

Regardless of which of the many existing definitions will become established in the long term, the fact is that AI is already present in many areas of our daily lives. Moreover, unlike other revolutions, it is being implemented at a dizzying speed, with all that this implies. The amount of data and processing power used to train AI systems has increased by a factor of 100 million in the last 10 years.<sup>2</sup> Safe to say, things will have changed between the time this manuscript is accepted until it is published.

Medicine, because of the potential benefits of using AI to improve population health, has for years been an attractive field for emerging intervention initiatives, from information management through deep learning to the control of health management systems, including electronic health records and active guidance for doctors in their treatment decisions.<sup>3</sup> To date, AI-driven health interventions fit into 4 categories relevant to global health researchers: diagnosis, patient morbidity or mortality risk assessment, disease outbreak prediction and surveillance, and health policy and planning.<sup>4</sup> Forensic medicine should not be unaffected by this revolution. In recent years, AI-based studies have been conducted in forensics, raising new challenges, and demonstrating the advantages and disadvantages of using AI methodologies to solve well-known forensic problems.<sup>5</sup>

AI exploits any data (data here extending the concept of classical symptoms and signs, either from the 5 senses of the human observer, amplified or not by technical means, or complementary examination tools such as diagnostic imaging). Thanks to its ability to combine varied and voluminous

☆ Please cite this article as: Martin-Fumadó C, Barbería-Marcain E, Arimany-Manso J. Artificial intelligence in forensic sciences: The future is now. *Revista Española de Medicina Legal*. 2024. <https://doi.org/10.1016/j.remle.2024.09.001>.

\* Corresponding author.

E-mail address: [carles.martin@comb.cat](mailto:carles.martin@comb.cat) (C. Martin-Fumadó).

data sources, and its capacity to discover unsuspected associations, AI can redefine diagnostic categories, use new signs, and apply new diagnostic approaches.<sup>6</sup>

Therefore, there are endless possibilities for the use of AI in forensic sciences.<sup>7</sup> Some of them have already been presented in this journal, related to toxicology,<sup>8</sup> gender-based violence,<sup>9</sup> or post-mortem interval,<sup>10</sup> and the fields of application range from forensic dentistry<sup>11</sup> to psychiatry<sup>12,13</sup> (prediction of the risk of recidivism), forensic imaging,<sup>14</sup> biomechanical analysis, virtopsies, assessment of professional liability,<sup>15</sup> or identification<sup>16</sup> (facial recognition, dactyloscopy, DNA, etc.). And in the legal field, AI is revolutionising the way legal management and decision-making is approached. From automating routine tasks to predicting legal outcomes, AI brings efficiency, accuracy, and agility to the legal sector.

We are aware that AI is not without its critics, controversial ethical issues, limitations, and even discussions that border on the realm of philosophy. We know that the crucial challenge of AI is not technical, but human. Its applications will depend on our ability to design prosperous futures.<sup>1</sup> Nevertheless, much of the research on AI-driven interventions in global health does not describe the ethical, normative, or practical considerations necessary for its widespread use or large-scale deployment.<sup>4</sup> In this regard, it is worth recalling that while the WHO is an enthusiastic supporter of the appropriate use of technologies, including large language models in support of health workers, patients, research, and science, it has expressed concern that the precautions normally taken with any new technology are not consistently applied with large language models. This includes widespread adherence to fundamental values such as transparency, inclusiveness, public collaboration, expert oversight, and rigour in evaluations.<sup>17</sup> Thus, we understand that the 6 principles proposed by the WHO should be taken into account to ensure that AI is used in the public interest in all countries: protect human autonomy, promote human well-being, human safety, and the public interest, ensure transparency, explainability, and intelligibility, foster responsibility and accountability, ensure inclusiveness and equity, and finally, promote AI that is responsive and sustainable.<sup>18</sup>

That said, we understand that, in the practice of forensic science and forensic medicine, it is up to each and every forensic science professional and the IMLCF and other forensic organisations, to detect those areas, aspects, and unresolved issues that could be improved with the use of AI, fostering their research. We cannot afford to lag behind. However, we should not confuse what we are talking about. We are not talking about mimicking in the digital environment what we have been doing in the physical environment for 300 years, as happened with the poorly named hybrid education in the pandemic.<sup>1</sup> Neither are we talking exclusively about data-driven decision-support. AI is about a new and efficient way of solving problems, largely through as yet unknown technology. AI should help us to make decisions, research, and transfer knowledge more reliably and efficiently than we can now do or imagine. Finally, it is necessary to remember that the goal of forensic medicine is to resolve biological questions raised by the law, and AI can help us in this task.

## Funding

This research received no specific funding from public sector agencies, commercial or non-profit organisations.

## Declaration of competing interest

The authors have no conflict of interests to declare.

## References

1. Agell N, Prat-Pubill Q. La inteligencia artificial: ¿revolución tecnológica o amenaza existencial? El momento de la inteligencia artificial. Informe económico y Financiero. ESADE; 2023 [consulted 17 Jul 2024]. Available in: [https://www.esade.edu/itemsweb/wi/Prensa/InfoEco33\\_FINAL.pdf](https://www.esade.edu/itemsweb/wi/Prensa/InfoEco33_FINAL.pdf).
2. Hogarth I. We must slow down the race to god-like AI. Financial Times; 2023 [consulted 17 Jul 2024]. Available in: <https://www.ft.com/content/03895dc4-a3b7-481e-95cc-336a524f2ac2>.
3. Hamet P, Tremblay J. Artificial intelligence in medicine. *Metabolism*. 2017;69S:536–40. <https://doi.org/10.1016/j.metabol.2017.01.011>.
4. Schwalbe N, Wahl B. Artificial intelligence and the future of global health. *Lancet*. 2020;395:1579–86. [https://doi.org/10.1016/S0140-6736\(20\)30226-9](https://doi.org/10.1016/S0140-6736(20)30226-9).
5. Galante N, Cotroneo R, Furci D, Lodetti G, Casali MB. Applications of artificial intelligence in forensic sciences: current potential benefits, limitations and perspectives. *Int J Legal Med*. 2023;137:445–58. <https://doi.org/10.1007/s00414-022-02928-5>.
6. Lefèvre T, Tournois L. Artificial intelligence and diagnostics in medicine and forensic science. *Diagnostics (Basel)*. 2023;13:3554. <https://doi.org/10.3390/diagnostics13233554>.
7. Volonnino G, De Paola L, Spadazzi F, Serri F, Ottaviani M, Zamponi MV, et al. Artificial intelligence and future perspectives in forensic medicine: a systematic review. *Clin Ter*. 2024;175:193–202. <https://doi.org/10.7417/CT.2024.5062>.
8. Soria ML. Avances en toxicología forense y su papel en el proceso forense (I). *Rev. Esp Med Legal*. 2023;49:107–17. <https://doi.org/10.1016/j.reml.2022.03.004>.
9. Trias Capella ME, Guardia Villalba R, Trias Capella R. Tratamiento de la información de violencia de género. Con aportaciones de la inteligencia artificial. *Rev Esp Med Legal*. 2024;50:29–39. <https://doi.org/10.1016/j.reml.2023.04.002>.
10. Aragonés AM, Tapia-Paniagua ST. Revisión sobre las nuevas perspectivas de datación cadavérica desde el necrobioma. *Rev. Esp Med Legal*. 2022;48:30–5. <https://doi.org/10.1016/j.reml.2021.05.001>.
11. Khanagar SB, Vishwanathaiah S, Naik S, Al-Kheraif A, Devang Divakar D, Sarode SC, et al. Application and performance of artificial intelligence technology in forensic odontology. A systematic review. *Leg Med (Tokyo)*. 2021;48:101826. <https://doi.org/10.1016/j.legalmed.2020.101826>.
12. Parmigiani G, Meynen G, Mancini T, Ferracuti S. Applications of artificial intelligence in forensic mental health: opportunities and challenges. *Front Psychiatry*. 2024;15:1435219. <https://doi.org/10.3389/fpsy.2024.1435219>.
13. Tortora L. Beyond discrimination: generative AI applications and ethical challenges in Forensic Psychiatry. *Front Psychiatry*. 2024;15:1346059. <https://doi.org/10.3389/fpsy.2024.1346059>.
14. Gómez Ó, Mesejo P, Ibáñez Ó, Valsecchi A, Bermejo E, Cerezo A, et al. Evaluating artificial intelligence for comparative radiography. *Int J Legal Med*. 2024;138:307–27. <https://doi.org/10.1007/s00414-023-03080-4>.

15. Mello MM, Guha N. Understanding liability risk from using health care Artificial Intelligence tools. *N Engl J Med.* 2024;390:271–8. <https://doi.org/10.1056/NEJMhle2308901>.
16. Fang YT, Lan Q, Xie T, Liu YF, Mei SY, Zhu BF. New opportunities and challenges for forensic medicine in the era of artificial intelligence technology. *Fa Yi Xue Za Zhi.* 2020;36:77–85. <https://doi.org/10.12116/j.issn.1004-5619.2020.01.016>.
17. La OMS propugna un uso seguro y ético de la inteligencia artificial para la salud. Organización Mundial de la Salud. [consulted 17 Jul 2024]. Available in: <https://www.who.int/es/news/item/16-05-2023-who-calls-for-safe-and-ethical-ai-for-health>
18. La OMS publica el primer informe mundial sobre inteligencia artificial (IA) aplicada a la salud y seis principios rectores relativos a su concepción y utilización. Organización Mundial de la Salud. [consulted 17 Jul 2024]. Available in: <https://www.who.int/es/news/item/28-06-2021-who-issues-first-global-report-on-ai-in-health-and-six-guiding-principles-for-its-design-and-use>