

Journal Article

The integration and implications of artificial intelligence in forensic science

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The Integration and Implications of Artificial Intelligence in Forensic Science

Abstract

This commentary explores the integration of Artificial Intelligence (AI) in forensic science and its potential implications. The applications of AI in forensic disciplines such as medicine, forensic anthropology, digital forensics, and taphonomy has enhanced the accuracy and efficiency of identification processes and the analysis of digital evidence. However, this rapid advancement prompts critical considerations in privacy, data protection, bias and fairness, and the accuracy and reliability of AI systems. The inherent challenges of the "black box" nature of AI algorithms call for transparency and accountability to maintain trust and uphold the integrity of forensic investigations. Ethical use, legal compliance, interdisciplinary collaboration, education, data integrity, standardization, human oversight, societal impact, along with sustainability are identified as pivotal areas requiring urgent attention. The discussion underscores the need for rigorous scrutiny, standardized operating procedures, and proactive dialogue to ensure the responsible advancement of AI in forensic science.

Keywords: Artificial Intelligence, Forensic Science, Ethical considerations, Bias, Miscarriages of Justice.

Introduction

Artificial Intelligence (AI) is a rapidly evolving field and has demonstrated its huge potential in several forensic disciplines (1–4). Forensic medicine among many other fields has seen AI revolutionize workflow. Forensic Anthropologists are using AI for sex and age estimation through diagnostic imaging tools, showcasing its role in enhancing the accuracy and efficiency of forensic identification processes (5). AI has also had an impact on digital forensics by advancing automation and intelligence, thereby improving the analysis of digital evidence (6). The application of AI in digital forensics has the potential to address complex investigative problems and enhance the efficiency of forensic analysis (6). In Forensic Taphonomy, AI has been used to estimate the post-mortem interval using microbial data (7). These are just a few examples of the current capabilities the integration of AI has already seen in forensic science, which sets a positive tone of the future. However, as this technology rapidly evolves, it is essential that the integrity of forensic science is upheld along with the judicial system it serves. Outlined below are several critical issues that warrant our collective reflection and action.

Privacy and Data Protection

The application of AI in forensics involves handling sensitive personal data, raising sizeable concerns about both privacy and data protection. As AI increases in capability, extracting and analyzing minute details, the risk of disregarding individual's privacy escalates. It is imperative to ensure the use of AI in forensic science is used only with stringent data protection regulations, to ensure robust safeguards are in place to protect everyone's privacy.

Bias and Fairness

Another pivotal concern in the utilization of AI algorithms within forensic science is the potential exaggeration of existing biases. These biases could complicate the processes of identifying individuals causing miscarriages of justice or making inference-based decisions, which may lead to unjust legal implications. Ensuring fairness and reducing the bias in AI

systems is not only a technical obligation but also a moral commitment to prevent the exacerbation of societal inequalities.

Accuracy and Reliability

The credibility of AI in forensic science hinges on both its accuracy and reliability. Incorrect or unreliable outputs could potentially lead to miscarriages of justice. Thorough validation and rigorous testing of AI algorithms are required to ensure their dependability, particularly when the stakes involve legal consequences.

Transparency and Accountability

Transparency and accountability in AI decision-making processes are both fundamental in maintaining public trust in forensic inquiries. The "black box" nature of many AI systems conceals the rationale behind certain decisions, making it challenging to scrutinize outputs and hold the technology accountable. It is imperative to advocate for transparent AI systems where decision-making processes are clear and auditable to both practitioners and the public. Public engagement and transparency around the use of AI in forensics can help build trust and understanding.

Legal and Regulatory Compliance

Legal and regulatory frameworks governing the use of AI in forensic science must be both robust and adaptive to ensure they keep up with rapid technological advancements. Transdisciplinary collaboration between computer scientists, forensic practitioners, legal professionals, and ethicists are essential to ensure that AI tools are implemented in a manner that serves the judicial system fairly and effectively. Standards and guidelines that are scientifically sound and legally admissible should be developed collaboratively.

Training and Education

An investment in the training of forensic professionals in the uses and limitations of AI should be considered. Furthermore, legal professionals, including judges and lawyers, must be educated on the capabilities and potential pitfalls of AI in forensics to ensure informed decisions are made. Standard protocols for the development, validation, and implementation of AI in forensic applications should be developed to ensure consistent and reliable results are achieved across different jurisdictions and cases.

Data Quality and Integrity

The quality and reliability of data used to train AI systems in forensics is of the utmost importance. Poor quality or unrepresentative data has the potential to lead to inappropriate conclusions. The provenance, handling, and how the data has been processed should be documented and accessible, to ensure the integrity of the data.

Human Oversight

AI should not replace human judgement in the forensic sciences. A qualified professional should have oversight in the interpretation of AI outputs, particularly when it comes to evidential matters that may considerably affect the outcome of legal proceedings.

Sustainability

The environmental impact of running powerful AI algorithms should be considered and minimized, as some powerful AI systems require significant computational resources, which could negatively impact the environment.

Conclusion

While the adoption of AI in forensic science demonstrates significant advancements in investigatory capabilities, it also introduces complex ethical, legal, and technical challenges that must be addressed. Privacy, bias, and accuracy concerns impose challenges. Therefore, robust frameworks for data protection and non-bias algorithms are needed to prevent any potential miscarriages of justice. Transparency, accountability, and human oversight are essential to foster trust and ensure the responsible application of AI. Collaborative efforts across various disciplines are required to establish standards and educate stakeholders on the potential and limitations of AI. By providing cautious scrutiny and open dialogue, the forensic community can harness the potential of AI responsibly, ensuring that its integration into forensic science continues to serve the cause of justice effectively and ethically.

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