Integrating Artificial Intelligence in Forensic Science

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A Introduction

Artificial intelligence (AI) and criminology are two interdisciplinary fields that significantly impact each other. AI has the potential to revolutionize criminology by enabling analysts to rapidly and precisely process vast amounts of data, thereby detecting crucial evidence.

B Thesis

The article aims to explore integrating AI methodologies in forensic science, particularly in crime scene investigation, and assess their implications for improving investigative processes and outcomes.

C Methods

A scoping review was conducted across PubMed, ResearchGate, IOS Press, Springer Link MDPI, Nature, Science Direct, and through Scholar, focusing on the applications of artificial intelligence in forensic sciences and their on-site deployment. Artificial intelligence methodologies were summarized and categorized to identify synergies, patterns, and trends informing future research.
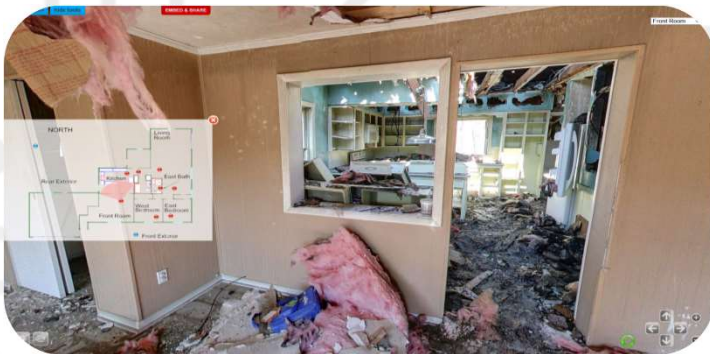
Pic.1. A shot from the reconstruction of the scene where the arson occurred. CSI:360. (2024). Forensic scene investigation with AI technology. Retrieved from https://www.vpix360.com/csi360/ai-forensic-scene-investigation/

C RESULTS

Machine Learning (ML) and Deep Learning (DL) play a crucial role in forensic science. ML, a subset of artificial intelligence, learns from data without explicit programming, using methods such as classification and regression to analyze and interpret vast datasets. DL, a technique within ML, constructs neural networks with multiple layers akin to the human brain, facilitating tasks such as image processing and text generation Natural Language Processing (NLP) delves into human-computer interaction, enabling translation, document analysis, and text generation (El-Din, 2022; LeCun et al., 2015).

Artificial intelligence aids in crime scene analysis by utilizing algorithms to enhance image and video quality, which is crucial for analyzing surveillance footage and adjusting brightness and compression artifacts, improving evidence interpretation (Xiao et al., 2019; Liu et al., 2019).

3D reconstruction integrates artificial intelligence-based analysis. Utilizing advanced software tools like CSI:360 Crime Scene Reconstruction Software helps annotate crime scenes and overlay maps and plans to provide a broader perspective and context for investigators (Sheppard, Cassella & Fieldhouse, 2016).

Pattern and trace analysis utilize artificial intelligence-based machine learning algorithms and computer vision to enhance evidence classification, image, and object recognition. Automatic recognition of DNA traces, fingerprints, and shoeprints is supported by ML algorithms predicting familial relationships based on DNA profiles, CNN matching fingerprints to existing databases, and computer vision techniques identifying unique tread patterns to aid in suspect identification (Aradhya, 2019; Pandey et al., 2015).

D Conclusions

The utilization of artificial intelligence (AI) in contemporary reality plays a cardinal role in forensic sciences and the justice system. AI technologies enable the optimization of procedures, enhance accuracy, and increase the efficiency of forensic sciences, thereby allowing for a transformation of the landscape of forensic analyses. The use of AI necessitates the implementation of appropriate legal regulations, both at the national and international levels, to minimize abuses and ensure the protection of ethical standards. Preserving harmony between these elements will enable the safe utilization of artificial intelligence tools and contribute to the development of forensic sciences and the justice system.

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