

Poster 19

The power of DNA and fingerprint databases

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Abstract

Background: Recent advancements in various scientific fields (e.g., next-generation DNA sequencing, AI-driven biometrics, rapid DNA, enhanced fingerprint systems, cloud-based digital forensics) resulted in the emergence of different branches within Forensic Sciences, which provide comprehensive support to the justice system [1-3]. The present work specifically focuses on two areas of criminalistics: Forensic Genetics (DNA profiling) [4,5] and Lophoscopic Analysis (mainly fingerprint analysis), both essential for human identification. **Objective:** Analyze the evolution of forensic databases in Portugal and other countries. **Methods:** A systematic review was carried out in publicly available databases (PubMed, Scopus, Google Scholar) using the following keywords: "Fingerprint analysis", "Technological advances in forensic science", "DNA databases", "Forensic genetics", "Forensic legislation", and "Personal data protection". **Results:** The worldwide rising trends in crime rates reflect the necessity for reliable forensic databases, often aided by advanced software and technologies, that expedite Justice and enhance crime resolution due to the database's ability for high search speed and accuracy in identifying individuals. Over the years, the observed evolution in technology and legislation aimed to counterbalance investigative efficiency and personal data protection. These efforts differ among countries: the US and the UK favor technology and oversight, while the EU prioritizes privacy. Moreover, if China rapidly expands with minimal safeguards, developing nations such as India are still building their legal frameworks. Despite all efforts, operational challenges related to security, access control, and citizens' privacy persist. Therefore, law enforcement authorities are constantly implementing stricter data protection laws, encrypting sensitive information, enforcing access controls, enhancing audit trails, and promoting transparency through oversight bodies to overcome these challenges. **Conclusion:** The continuous development of DNA and Fingerprint databases, coupled with clearer regulations and technological advancements, strengthens the Judicial System and ensures Justice through the conviction of the guilty and the exoneration of the innocent.

Keywords: biological criminalistics; legal framework; individual identification

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References

- Haddrill, P. R. Developments in forensic DNA analysis. *Emerging Topics in Life Sciences* **2021**, 5(3), 381-393, doi: 10.1042/ETLS20200304.
- Butler, J. M. Recent advances in forensic biology and forensic DNA typing: INTERPOL review 2019–2022. *Forensic Science International: Synergy* **2023**, 6, 100311, doi: 10.1016/j.fsisy.2022.100311.

3. Morrison, G. S. Advancing a paradigm shift in evaluation of forensic evidence: The rise of forensic data science. *Forensic Science International: Synergy* **2022**, *5*, 100270, doi: 10.1016/j.fsisyn.2022.100270.
4. Gomes, F. M. et al. Study of latent fingerprints—a review. *Forensic Chemistry* **2023**, *35*, 100525, doi: 10.1016/j.fore.2023.100525
5. Budowle, B. et al. The forensic genomics toolbox is expanding. *BioTechniques* **2022**, *72*(1), 5-7, doi: 10.2144/btn-2021-0103.



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