

CHAPTER 1

Introduction

Zeno Geradts¹ and Katrin Franke²

¹ *Netherlands Forensic Institute, Laan van Ypenburg 6, GB Den Haag, Netherlands*

² *Norwegian Univ of Science & Technology, Høgskoleringen 1, Trondheim, Norway*

This book is in the AAFS Reference Series Library and serves as a guide on using artificial intelligence (AI) in forensic science. In Zeno's year of Presidency of the AAFS, one of the topics was AI and the impact it can have on forensic science. In many forensic products AI and deep learning is already included without the user being aware of it. Examples are software for facial and speaker comparison, and in many digital forensic software packages one can search for images, for instance of firearms. Furthermore, its use is increasing in chemometrics and many other fields. Also, the use of AI can impact forensic science, for instance on easier to make deepfakes, so spoofing evidence becomes easier. Different jurisdictions will handle the use of AI differently, depending on their laws.

Examples are provided of good use of AI, where the expert should be in the loop. Experts as well as the courts also need to know the limitations of the approach.

The book is comprised of chapters which can be used as a reference for lectures, and ends with the newest research in developing approaches with graph neural networks. The book first provides an introduction to the field, it then goes deeper into the legal issues associated with AI and the need for developing a standard. Many examples of using AI are discussed and presented, such as smart cities, IoT in Hansken and finally, the use of AI for making deepfakes will be discussed as well as how to detect them.

The field is developing rapidly, and increasing awareness is also being created by the European Commission on the regulation of AI in practical use. In the United States NIST is working on standards for using AI. New legislation is expected in many states, for example Colorado has legislation on the use of facial recognition services and Vermont has legislation enacted on the ethical use of AI.

One of the most significant applications of AI in forensic science is in the analysis of DNA evidence. DNA sequencing technology has advanced significantly in recent years, allowing scientists to analyze large amounts of genetic data quickly and accurately. However, the sheer volume of data generated by these techniques

can be overwhelming for human analysts. AI algorithms can be used to quickly and accurately identify genetic markers that are associated with specific individuals or groups, making it easier for forensic scientists to identify suspects or eliminate suspects from an investigation.

AI is also being used in the field of fingerprint analysis. Fingerprint analysis is a crucial aspect of forensic science, as fingerprints are unique to each individual and can be used to identify suspects. However, the process of manually analyzing fingerprints can be time-consuming and is prone to human error. AI algorithms can be used to quickly and accurately analyze fingerprints, reducing the time and resources required for this task.

Another area where AI is being used in forensic science is in the analysis of video and audio evidence. Video and audio recordings are often used as evidence in criminal investigations, but the process of analyzing these recordings can be labor-intensive and time-consuming. AI algorithms can be used to quickly identify and analyze key features in video and audio recordings, such as faces, voices, and other relevant details, making it easier for forensic scientists to identify suspects or gather important evidence.

In conclusion, AI is rapidly becoming an essential tool in the field of forensic science. It enables forensic scientists to analyze large amounts of data quickly and accurately, making it easier to identify suspects, establish facts, and gather evidence in criminal and civil legal matters. As technology continues to advance (such as we have seen with ChatGPT), it is likely that we will see even more applications in the near future.

Additionally, AI is also being used in the field of digital forensics. Digital forensics is the process of identifying, collecting, analyzing, and preserving electronic evidence in order to establish facts in criminal and civil legal matters. The increasing amount of digital data and the rapid pace of technological change make it difficult for human analysts to keep up with the volume and complexity of digital evidence. AI algorithms can be used to quickly and accurately identify and analyze digital evidence, such as email, text messages, and other forms of electronic communication.

This book aims to provide a foundation for using AI in forensic science, and describes issues, risks, and solutions.