

Chapter 9

Forensic Ballistics and Artificial Intelligence: Legal Challenges and Enhancing International Framework for Scientific Evidence

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ABSTRACT

Forensic ballistics, the study of firearms and ammunition, is critical in criminal investigations. However, the legality of the evidence, its reliability, and admissibility are defending the evidence against legal challenges. The potential for AI to enhance forensic ballistics is a collaborative effort and allows for more efficient crime-solving techniques, which will, in turn, reinforce public confidence in the judicial process. The chapter discusses how AI might compensate for these legal challenges, while also improving international standards for forensic ballistics and, by extension,

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helping a judiciary system with reliable evidence from a scientific perspective during the quest of reaching justice.

1. INTRODUCTION

Forensic ballistics is a field within forensic science that deals with the examination of firearms, ammunition, and the paths of projectiles. AI can improve global standards for forensic ballistics by promoting collaboration among experts, legal experts, and policymakers to ensure the reliability of scientific evidence and increase public confidence in the judicial process. Not only does this field help to identify criminals, but it also provides a great amount of evidence in court as well. Forensic ballistics is a scientific study of the properties of firearms and their effects (discharged bullets); it includes the analysis of firearms (e.g., to determine the specific firearm used in a specific crime), ballistic trajectories (e.g., entering/exiting angles), and, in general, the behavior of fired projectiles. Forensic ballistics is a specialized field that draws on diverse principles of science and technology, illustrating how the legal system incorporates scientific expertise, and in particular, expertise that is potentially problematic in terms of evidential reliability and admissibility. Although long accepted into the judicial process, forensic ballistics has increasingly come under scrutiny through the years. More recently, courts have started to doubt the scientific legitimacy of ballistic evidence, especially when it comes to linking a single bullet taken from a crime scene directly to a particular gun (Lodhi & Kassem, 2024).

The advent of forensic ballistics and artificial intelligence (AI) integration in criminal investigations is a breakthrough in the legal domain, while also addressing longstanding legal challenges ushering in new frameworks of scientific proof globally. Forensic ballistics, the study of firearms, ammunition, and the paths they take, is an important part of how a weapon is traced to a crime and a suspect linked to that crime. However, the reliability and admissibility of ballistic evidence have been challenged in courts, with questions raised about the scientific basis for such testimony as well as possible biases in how such evidence is interpreted (Piraiyanu et al., 2023). Innovative AI technologies provide solutions to these challenges through improved accuracy and efficiency of ballistic analyses. Machine learning algorithms trained on millions of images can help forensic experts identify previously unseen markings on bullets and cartridge cases more rapidly and accurately than in the past. Moreover, AI can also be used to reconstruct trajectories, enabling investigators to accurately recreate shooting scenarios. Beyond better understanding the dynamics of shooting incidents, it can also improve the presentation of evidence in a courtroom (Richmond, 2020).

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