

Fingerprint Evidence: A Critical Analysis of Its Reliability and Admissibility in Forensic Science

Aditi Nimse

Student, Symbiosis Law School, Pune.

Abstract—Fingerprint evidence has long been a cornerstone of forensic science, widely used for its perceived uniqueness and reliability in criminal investigations. Even the cleverest criminals frequently leave their fingerprints at crime sites, which has forced forensic specialists worldwide to investigate forensic fingerprints. Additionally, ‘Forensic Fingerprints’ has received much-needed attention due to its accuracy and the prosecution’s strong reliance on it to establish the accused’s guilt in the context of the criminal justice system.

However recent developments in forensic science and legal scrutiny have raised concerns regarding its accuracy and the potential for human error. This paper critically analyses the reliability and admissibility of fingerprint evidence in the criminal justice system highlighting scientific advancements and other challenges.

By reviewing existing literature, examining case laws and analysing the forensic methodology, this research paper aims to evaluate the strengths and weakness of fingerprint evidence and its role in the courtroom. It further discusses the evolving relationship between forensic science and law, proposing suggestions for improving the use of fingerprint evidence in legal proceedings to ensure justice.

Index Terms—Admissibility, Challenges, Fingerprint Evidence, Future trends, Reliability.

I. INTRODUCTION

“No two fingerprints are alike”

Henry Faulds

Throughout history, the uniqueness of fingerprints has made them a reliable source in criminal justice systems. Fingerprint evidence has been often regarded as conclusive proof of identity. The Patna High Court stated in *State v. Karugope* that the fingerprint expert’s

judgment is recognized and considered a sufficient piece of evidence for the accused’s conviction.¹

However, recent scholarly analysis and judicial scrutiny has cast a doubt on the absolute reliability upon fingerprint evidence. Even though advances in automated fingerprint identification systems have enhanced the speed and scope of matching techniques, the process still heavily relies on human interpretation, which introduces a risk of error.

Further questions have been raised about the admissibility of such evidence, particularly in jurisdictions requiring scientific validation, like under the Daubert standard in the United States.

In India, although admissibility provided under Section 45 of the Indian Evidence Act, courts have increasingly called for a higher level of scrutiny for expert testimony.² This paper aims to critically evaluate the scientific, procedural and legal dimensions of fingerprint evidence.

II. RESEARCH OBJECTIVES

This research paper aims to critically examine the reliability and admissibility of fingerprint evidence in forensic science and legal proceedings. The key objectives are:

- 1) To trace the historical evolution and study the scientific foundation behind fingerprint identification.
- 2) To analyse the legal framework and judicial trends that reflect the evolving attitude towards fingerprint evidence.
- 3) To suggest reforms for enhancing the accuracy and evidentiary value of fingerprint analysis.

¹ State v. Karugope, A.I.R. 1954 Pat. 131.

² Prakash v. State of Karnataka, (2014) 12 SCC 133.

III. LITERATURE REVIEW

A. *Evidentiary value of Forensic Fingerprints in India*³

Chinmayanand

The paper states that fingerprint evidence, though widely accepted for its uniqueness, must be scrutinised for procedural integrity. It highlights the concerns around how evidence is collected and the risk of tampering it in police custody. The paper emphasizes that courts must critically examine the expert opinion and avoid relying solely on fingerprint evidence.

Research Gap: While the research paper offers case-based analysis, it lacks the statistical analysis of the bias by examiner and also does not study the role of emerging technologies.

B. *Expert Opinion and Fingerprint Evidence*⁴

Juhi Mittal & Darshan Patankar

This research paper emphasizes that even though fingerprint evidence was historically seen as reliable, courts need to approach it with caution. The evidence is not substantive on its own and needs to be corroborated with other evidence. They also highlight concerns regarding expert bias and improper data collection.

Research Gap: While the paper critically analyses the evidentiary value of fingerprint analysis, it doesn't address the impact of inter-expert variability or the absence of empirical error rate studies in India.

C. *The value of fingerprint evidence in detecting crime*⁵

John W. Bond

This paper highlights the operational efficiency of the fingerprint evidence in detecting various crimes. The paper emphasizes procedural consistency and investigator training as key factors in maximizing the evidentiary value of fingerprints.

Research Gap: The paper focuses on operational efficiency but lacks the critical analysis and evaluation of fingerprint evidence. It does not study the legal threshold for admissibility.

IV. CRITIQUE

In an era where forensic science is held to rigorous empirical standards and judicial scrutiny, fingerprint evidence which was once considered the gold standard of identification, is facing critical examination.

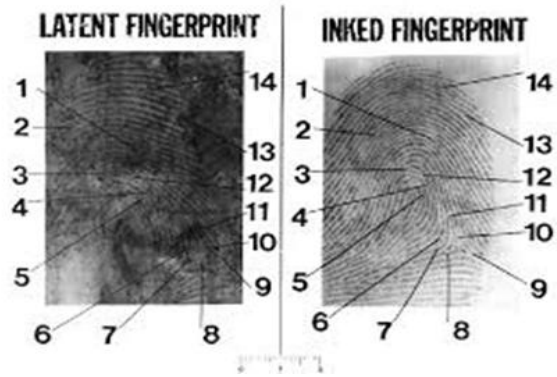
A. *Challenges of fingerprint evidence*

1. *Quality of the print*

The most fundamental source of uncertainty arises from the quality of the mark.

Unlike the samples taken from persons of interest (POI) under controlled conditions, latent prints recovered from the crime scene often vary greatly in clarity and viability.

They can very easily be smudged or present partially with overlapping ridge details. When the prints are only partially available, the experts are forced to make judgments based on the limited data.



2. *Distinction between the fingerprints*

The second uncertainty arises from the foundational concept that all fingerprints are unique. Even if it is statistically proven, it does not necessarily mean that the examiner can distinguish between every individual fingerprint, especially in cases of degradation.

3. *Examiner bias and subjectivity*

Thirdly, the uncertainty involves fingerprint examiner and the comparison process itself. Despite the reputation for objectivity, it involves considerable human judgment. Each step can be influenced by individual interpretation. Critically, there is *no universal threshold* for how many matching features are 'enough' to declare a positive identification.

³ CHINMAYANAND, 'Evidentiary value of Forensic Fingerprints in India,' INTERNATIONAL JOURNAL OF LAW MANAGEMENT & HUMANITIES (2020).

⁴ Juhi Mittal & Darshan Patankar, Expert Opinion and Fingerprint Evidence, 6 SUPREMO AMICUS 164 (2018).

⁵ Bond, J. W, The Value of DNA Evidence in Detecting Crime. Journal of Forensic Science, 52, 128-136 (2007).

Therefore, the courts need to examine and decide whether the expert report can be relied upon.⁶

Therefore, the strength of fingerprint analysis does not lie in its precision, but in the cautious use. The process is riddled with multiple challenges and it may risk turning a tool of justice into a medium for wrongfully convicting.

B. Expert Opinion

Since judges lack the necessary skills or expertise to derive conclusions from facts in some technical subjects, expert witnesses have an advantage. When there is disagreement over specific scientific or technical knowledge, expert testimony is sought. The main purpose of an expert opinion is to help the court reach a decision.

Like any other expert, the *validity of the reasons* supporting a fingerprint expert's judgment determines the quality of that opinion.⁷ Crucially, a fingerprint expert's testimony is not admissible as proof and can only be utilized to support a few substantive pieces of evidence that are already in the record.⁸

Although experts are frequently questioned in court, it is particularly crucial in situations where the *expert's report is vague and ambiguous*, as failing to question him or her in such circumstances would definitely make the expert's opinion unreliable.⁹

According to *Bhaluka Behra v. State*, the weight and significance assigned to an expert's opinion are two different things. In actuality, a fingerprint is an unforgeable signature. Thus, the fingerprint expert's testimony is likewise accorded a lot of weight.¹⁰

Limitation: Expert opinions are useful, but they are not always reliable and are seen as less reliable than direct evidence like eyewitness reports. Experts are not firsthand witnesses to the events in question; instead, they offer interpretations based on the evidence at their disposal.

As a result, a judge ought to take into account other substantial evidence in addition to an expert's view.

C. The Daubert Standard

Also known as '*the Daubert Test*', the Daubert Standard is a rule used in courts to evaluate the admissibility and reliability of expert witness testimony. It is one of the most significant developments in assessing forensic evidence. Under the Daubert standard, the court provided guidelines for determining whether an expert's methodology is valid.¹¹

The five aspects of consideration in the Daubert rules are as follows:

1. Whether or not the expert's method or hypothesis is testable and reliable.
2. Whether the method or theory has undergone publication and peer review.
3. The theory's known or possible rate of error.
4. The presence and upkeep of norms and regulations.
5. Whether the scientific community has widely embraced the method or theory.

D. AI and Fingerprint

AI has multiple uses in forensics, including digital forensics, crime scene reconstruction and evidence analysis.¹² AI speeds up evidence interpretation and lowers human error by automating difficult activities, which improves the effectiveness of forensic investigations. AI-driven technologies, for example, can enhance biometric identification techniques like fingerprint and face recognition.¹³

The integration of Artificial Intelligence into fingerprint analysis is revolutionizing forensic science. AI powered systems can detect minute patterns, ridge flow with far greater speed and consistency than human examiners.

Limitation: However, AI models rely on the data they are trained with and even these technologies are not completely free from bias. The use of AI to compare fingerprints raises concerns about transparency and admissibility in India, where forensic facilities are still developing. The risk of becoming overly reliant on AI which mirrors the human errors it aims to replace,

⁶ Ranjit Singh Brahmajeet Singh Sharma v. State of Maharashtra, (2005) 5 SCC 294.

⁷ State of Maharashtra v. Sukhdev Singh, (1992) 3 SCC 700.

⁸ Musheer Khan v. State of M.P., (2010) 2 SCC 748.

⁹ Manu Sharma v. State (NCT of Delhi), (2010) 6 SCC 1

¹⁰ Bhaluka Behra v. State: AIR 1957 Ori 172.

¹¹ Daubert vs Merrell Dow Pharmaceuticals, Inc., 509 U.S. 579 (1993).

¹² Becker, S., Heuschkel, M., Richter, S., & Labudde, D. (2022). COMBI: Artificial Intelligence for Computer-Based Forensic Analysis of Persons. KI - Künstliche Intelligenz, 36(2), 171–180. DOI:10.1007/s13218-022-00761-x

¹³ Lodhi, K., & Kassem, M. A. (2024). Revolutionizing Forensic Science: The Role of Artificial Intelligence and Machine Learning. International Journal of Data Science, 10–18. DOI:10.5147/ijds.vi.255.

exists in the absence of regulatory guidelines and inadequate research. Consequently, even if AI can improve forensic efficacy, its use should be carefully considered within ethical and legal bounds.

V. LEGAL ANALYSIS

1. Legislative Framework

a) *Indian Evidence Act: Section 45*: When the Court has to form an opinion upon a point of foreign law or of science, or art, or as to identity of handwriting, [or finger impressions], the opinions upon that point of persons specially skilled in such foreign law, science or art, [or in questions as to identity of handwriting] [or finger impressions] are relevant facts. Such persons are called experts.¹⁴

This section allows for the fingerprint evidence to be treated as reliable when accompanied by expert testimony.

Section 51: Whenever the opinion of any living person is relevant, the grounds on which such opinion is based also becomes relevant.¹⁵

Section 159: An expert may also refresh his/her memory by reference to professional treatises.¹⁶

b) *Identification of Prisoners Act, 1920*: This act provides the statutory authority for law enforcement to collect fingerprints from individuals under conviction or arrest. However, it lacks modern safeguards like the Right to privacy.¹⁷

c) *The Criminal Procedure Identification Act, 2022*: It replaced the previous Identification of Prisoners act. The term ‘measurements’ under section 2(b)(1) of this new act,¹⁸ includes finger-impressions, palm-print impressions and foot-print impressions along with others. It authorises the investigating agencies for taking such measurements.

2. Judicial Background

a) *Emperor v. Sahdeo, 1904*.¹⁹

It is one of the earliest cases in India to admit fingerprint evidence. It established the precedent for treating fingerprint evidence as reliable in criminal trials.

b) *State of Bombay v. Kathi Kalu Oghad, 1961*²⁰

The Supreme Court clarified that compelling an accused to provide specimen handwriting, signature or fingerprints for investigation does not violate their right against self-incrimination under the Constitution.

c) *Mahmood v. State of U.P., 1976*²¹

In this case, the expert did not give any reasons for his conclusions in that case. Therefore, the Court did not accept the fingerprint evidence and it was considered as a fragile ground for conviction.

d) *Jaspal Singh v. State of Punjab*²²

The Court has held that science of fingerprint identification is an exact science and does not admit of any mistake or doubt.

e) *Ritesh Sinha v. State of UP, 2019*²³

The Supreme Court broadened the parameters of handwriting samples to include voice samples, adding that this would not violate the right against self-incrimination.

It can be seen from the evolution of judicial trends that the fingerprint evidence which was historically considered of critical importance, is now applied with caution. Even though there are contradicting view points within the judiciary at times, it is now established that the fingerprint evidence shall not always be the sole basis of conviction.

3. Fingerprints and Fundamental Rights

The primary issue surrounding fingerprint collection is whether doing so violates the accused person’s fundamental right under Article 20(3) of the Indian Constitution²⁴ and if it forces a testify against himself.²⁵

The Evidence Act’s Section 73 gives a court the authority to order anyone, including an accused

¹⁴ The Indian Evidence Act, 1872, § 45, No. 1, Acts of Parliament, 1872 (India).

¹⁵ The Indian Evidence Act, 1872, § 51, No. 1, Acts of Parliament, 1872 (India).

¹⁶ The Indian Evidence Act, 1872, § 159, No. 1, Acts of Parliament, 1872 (India).

¹⁷ Justice K.S.Puttaswamy (Retd) And anr. vs Union of India and Ors., AIR 2017 SUPREME COURT 4161.

¹⁸ The Criminal Procedure Identification Act, No. 11 of 2022, § 2(b)(1), Gazette of India, 2022 (India).

¹⁹ Emperor v. Sahdeo 3 Nagpur, L.Rep. 1.

²⁰ State of Bombay v. Kathi Kalu Oghad, AIR 1961 SC 1808.

²¹ Mahmood v. State of U.P., AIR 1976 SC 69.

²² Jaspal Singh v. State of Punjab, 1998 AIR SCW 3983.

²³ Ritesh Sinha v. State of UP, AIR 2019 SUPREME COURT 3592.

²⁴ INDIA CONST., Art 20(3).

²⁵ RAO ET. AL, EXPERT EVIDENCE 1297 (4th ed. 2010).

present in court to consent to the taking of his finger prints.²⁶ Nevertheless, a number of arguments were made to the courts, stating that no law could permit a court to require an accused person to do anything that could lead to his incrimination and that such a practice would be incompatible with the idea of a fair trial.

Given this ambiguity, the Supreme Court had the responsibility of conclusively resolving this problem. As a result, an 11-judge panel authoritatively resolved the dispute and established the current legal position, ruling that taking impressions of the thumb, finger, and foot is acceptable and not prohibited by Article 20(3).²⁷ Even in *State of Kerala vs. Sankaran Nair*, the Court concluded that the right against self-incrimination isn't violated by fingerprint records even if they are not voluntary.²⁸ Court directions to collect fingerprint do not violate the rights.²⁹ In a variety of other cases also it was held the same.³⁰

VII. CONCLUSION AND SUGGESTIONS

Fingerprint evidence remains one of the most frequently used forms of forensic identification in criminal investigations and trials. Its perceived uniqueness made it scientifically sound and certain. However, this research paper highlighted that the reliability is not absolute and is influenced by a variety of factors.

The legal framework supports this evidence, but courts have been cautious in its application. It reveals a critical gap in the forensic infrastructure. The assumption of fingerprint evidence reliability is now being replaced with an understanding that it is only reliable along with other evidence supporting it.

As forensic science faces growing scrutiny, fingerprint evidence can not be treated as precise either. It can be treated as a strong piece of evidence on its own and courts need to consider it with reference to other factors.

VIII. SUGGESTIONS

1. *Standard national guidelines*: Implementing uniform guidelines for collection, analysis and

reporting can make a huge difference and may solve problems like variations in data collection.

2. *Enhanced judicial training*: It can help the judges to critically evaluate forensic expert testimony.
3. *Training and Accreditation*: Doing this in both law enforcement and private practice for fingerprint analysts, will increase their credibility.

REFERENCES

- 1) Online Databases
 1. Hein Online
 2. SCC OnLine
- 2) Statutes
 1. The Indian Evidence Act, 1872.
 2. The Identification of Prisoners Act, 1920.
 3. The Constitution of India, 1950.
 4. The Criminal Procedure Identification Act, 2022.
- 3) Research Articles
 - [1] Setia, H, Evidentiary Value of Forensic Reports in Indian Courts, Vol. 4(6), Research Journal of Forensic Sciences, 1-7 (2016).
 - [2] Morgan, RM, et al., A systematic analysis of misleading evidence in unsafe rulings in England and Wales, Vol. 40, Science and Justice, 128-137 (2018).
 - [3] Areti, KK, Evidentiary Value of Expert Opinion Under Indian Evidence Act, SSRN Electronic Journal (2007).
 - [4] Dinkar, VR, Forensic Scientific Evidence: Problems and Pitfalls in India, Vol. 3(2), International Journal of Forensic Science and Pathology 79-84 (2015).
 - [5] CHINMAYANAND, 'Evidentiary value of Forensic Fingerprints in India,' INTERNATIONAL JOURNAL OF LAW MANAGEMENT & HUMANITIES (2020).
 - [6] Juhi Mittal & Darshan Patankar, Expert Opinion and Fingerprint Evidence, 6 SUPREMO AMICUS 164 (2018).
 - [7] Bond, J. W, The Value of DNA Evidence in Detecting Crime. Journal of Forensic Science, 52, 128-136 (2007).

²⁶ The Indian Evidence Act, 1872, § 73, No. 1, Acts of Parliament, 1872 (India).

²⁷ *State of Bombay v. Kathi Kalu Oghad*, AIR 1961 SC 1808.

²⁸ *State of Kerala vs. Sankaran Nair*, AIR 1960 Ker 392.

²⁹ *Gulzhar Khan v. State*: A.I.R. 1962 Pat. 255

³⁰ *Delhi Administration v. Pali Ram*: A.I.R. 1979 S.C. 14.