Chapter 7
Forensic Linguistics and DBN:
Automating the Analysis of Witness Statements and Testimonies in AI-Driven Policing

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ABSTRACT

The integration of Deep Belief Networks (DBNs) into forensic linguistics enhances AI-driven policing in smart cities by automating witness testimony analysis. DBNs

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address limitations of traditional methods, such as subjectivity and inefficiency, by detecting linguistic markers of deception and inconsistency. AI tools have accelerated investigations by analyzing digital evidence, though specific architectures like DBNs were not disclosed in these cases. Ethical considerations, including algorithmic bias and data privacy, are addressed through strategies like adversarial debiasing and synthetic data augmentation. Collaboration between law enforcement, AI experts, and policymakers ensures ethical deployment and inclusive dataset curation. Future directions include expanding DBN applications to real-time threat detection and multilingual forensic analysis. DBNs improve urban security by enhancing testimony credibility assessments, fostering community trust, and aligning AI-driven policing with ethical standards.

INTRODUCTION

The field of forensic linguistics has long been a valuable tool in criminal investigations and Artificial intelligence (AI) technologies have advanced so rapidly that they have created a new innovative phase for police work which specifically benefits smart city operations(Dunsin et al., 2024). Urgent need exists for innovative advanced tools which improve public safety because urban centres are becoming more complex. The critical but unexplored area of using AI for witness testimony analysis ranks among numerous police applications of this technology(Mishra et al., 2022). The scientific study of legal language known as forensic linguistics finds new possibilities through advanced AI Deep Belief Networks (DBNs) to improve law enforcement agency evaluation of witness statements. Traditional legal investigations depend on forensic linguistics to reveal authenticity together with statement consistency and potential lies present in witness testimonies. The analysis of linguistic patterns that includes word selection and syntax and semantic forms allows forensic linguists to detect the possible signs of bias and inconsistent or dishonest content(Juola, 2019). Traditional techniques for linguistic analysis require extended periods of time and depend heavily on human judgement while human analysts also bring their cognitive biases to the evaluation process. The fast-moving environment of smart cities requires law enforcement agencies to find objective and efficient approaches for testimony analysis due to these present limitations.

Deep Belief Networks represent a learning algorithm class that achieved strong results in both natural language processing and pattern detection tasks(Deep Belief Networks for Phone Recognition, 2023). DBNs serve as layered generative models that discover how data builds its hidden structures during the learning process. The technology of Deep Belief Networks lets police forces quickly examine speech patterns across many testimonies at once(Mohamed et al., 2011). DBNs need different