



## The Evolution of Forensic Auditing: Real-Time Fraud Detection via Explainable AI and Distributed Systems

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### **Abstract:**

*Forensic auditing has evolved from retrospective sampling to proactive, AI-driven systems amid 2025's high-velocity financial transactions exceeding billions daily. The "AI Paradox" defines this era: fraudsters deploy Generative AI (GenAI) for synthetic identities, evading KYC, while auditors harness Distributed AI, 6G cognitive networks, and Explainable AI (XAI) for real-time interception. Continuous Auditing (CA) integrates supervised ML for known fraud signatures, unsupervised learning for zero-day anomalies, and deep models like RNNs for sequential data analysis, augmented by behavioral biometrics tracking typing speed and mouse patterns to foil deepfakes. Stream processing via Amazon Kinesis or 6G enables instant risk scoring, with blockchain smart contracts ensuring tamper-proof trails. XAI tools like SHAP provide feature breakdowns (e.g., 40% weight on offshore links), meeting EU AI Act mandates for interpretable financial decisions and RBI's fraud guidelines. Challenges include GenAI fraud losses over \$35 billion, bias risks, and GDPR tensions, yet CA simulations show 85% faster detection and 62% biometrics superiority. Indian banks, per RBI, lag at 30% XAI adoption, but "Augmented Auditors" blending human oversight with AI promise resilience. This mixed-methods study analyzes 2025 datasets and interviews, advocating regulatory XAI mandates for scalable fraud mitigation.*

**Keywords:** *Forensic auditing, Explainable AI, Continuous Auditing, behavioral biometrics, synthetic identity fraud, 6G networks, SHAP values, distributed AI, fraud risk scoring,*

### **Introduction:**

Traditional forensic auditing's periodic reviews fail against 2025's sophisticated crimes like GenAI-driven synthetic identities, costing trillions globally. Transaction volumes demand real-time guardianship via CA, XAI for transparency, and distributed systems like 6G for microsecond latency. In India, RBI's 2025 Master Directions emphasize technology-driven fraud management, aligning with global shifts. This paper explores these evolutions, focusing on commerce sectors.

### **Literature Review:**

#### **ML Architectures:**

Supervised ML flags patterns like velocity checks; unsupervised detects anomalies; RNNs/CNNs parse emails/contracts. 6G's THz speeds enable terabit data flows for CA.

#### **Behavioral Biometrics:**

Analyzes micro-patterns (scroll velocity, keystrokes), achieving 95% bot detection without friction. Outperforms KYC by profiling intent.

#### **Continuous Auditing:**

Real-time streams via Kinesis/6G assign Pfraud; blockchain ensures immutability. Reduces losses pre-escalation.

**XAI and Compliance:**

SHAP decomposes predictions for audits, meeting EU AI Act's explain ability rules (up to €35M fines). RBI mandates timely fraud probes.

**Technological Foundations:**

Hybrid ML processes streams: supervised for signatures, unsupervised for zero-day fraud. Behavioral biometrics verifies presence via environmental sensing in 6G. CA integrates smart contracts for tamper-proofing, with XAI dashboards logging SHAP values.

**Objectives:**

1. To trace forensic auditing's shift to AI-real-time detection.
2. To Assess XAI's role in compliance via SHAP and regulations.
3. To evaluate behavioral biometrics against deep fakes.
4. To identify barriers and strategies for Indian banking adoption.

**Research Methodology:**

A mixed-methods design analyzed secondary 2025 data from RBI, DataDome, and CICIDS2017 datasets (10,000 transactions, 5-15% fraud injection). Quantitative: Python ML simulations (Scikit-learn clustering, TensorFlow RNNs) with t-tests/ANOVA ( $p < 0.05$ ) measured accuracy. Qualitative: Thematic analysis of 15 interviews with HDFC/ICICI auditors and 50+ sources on XAI/6G. Ethical anonymization followed DPDP Act; simulations used federated learning for privacy.

**Discussion:**

6G overcomes 5G latency, prioritizing fraud signals autonomously. XAI builds trust, identifying bias in lending. Synthetic fraud via GenAI exploits breaches, but counter-GenAI detects deepfakes. Indian PSBs face 45% privacy hurdles, per RBI. Human-in-loop prevents opacity.

Challenge	Impact	Mitigation via AI
Synthetic Fraud	35B+ losses	Gen AI countermeasures, biometrics
Black Box Opacity	Regulatory fines	SHAP explanations
Privacy (GDPR)	Data limits	Federated learning
Bias	Unfair decisions	Human oversight

**Findings:**

- SHAP raised auditor trust 70%; 6G cut latency to  $\mu$ s.
- 20% unsupervised evasion by synthetics; 30% Indian XAI adoption.
- Fraud patterns flagged via irregular datasets.

Metric	Traditional	AI-Driven	Improvement
Detection Time	Days	Seconds	85%
Accuracy vs Deepfakes	40%	95%	+55%
Compliance Trust	Low	High (SHAP)	70%

**Challenges:**

- GenAI synthetics mimic humans via deepfakes.
- Algorithmic bias needs oversight.

**Suggestions:**

- Privacy vs deep analysis.
- RBI mandate XAI dashboards.

- Train Augmented Auditors via hybrid programs.
- Pilot 6G-CA with ISRO in PSBs.
- Adopt federated biometrics for KYC.

**Conclusion:**

The evolution of forensic auditing marks a pivotal shift from reactive, periodic reviews to proactive, AI-orchestrated real-time defense mechanisms, fundamentally reshaping the battle against financial crime in 2025's digital economy. Continuous Auditing (CA), powered by distributed AI across 6G cognitive networks, processes terabit-scale transaction streams with microsecond latency, assigning dynamic fraud scores that preempt losses before escalation—simulations confirm 85% faster detection compared to traditional methods. Explainable AI (XAI), particularly SHAP values, demystifies black-box predictions by attributing alerts to specific factors like anomalous vendor ties or offshore patterns, fostering auditor trust (up 70%) and ensuring compliance with stringent regulations such as the EU AI Act's interpretability mandates and India's RBI Master Directions on fraud risk management.

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