Chapter 3
Ai-Powered Promotional Campaigns, Fraud Detection and Security Enhancement

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ABSTRACT

This chapter explains how artificial intelligence can upgrade point-of-sale (POS) systems by joining three goals—smarter promotions, stronger fraud detection, and tighter security—into one decision layer at checkout. It first describes the AI-enabled POS landscape and the data foundations needed for reliable learning, including clean event streams, privacy-safe identity, feature stores, and delayed labels. It then shows how uplift-based personalisation, basket-aware recommendations, and guardrailed dynamic incentives raise incremental margin without adding friction. For fraud, the chapter combines supervised models with anomaly, sequence, and graph methods to spot refund abuse, coupon misuse, and organised schemes in real time while keeping false positives low. For security, it presents adaptive authentication, endpoint and network analytics, cryptography and tokenisation health checks, and device integrity monitoring, all designed to react quickly and safely.

1 INTRODUCTION

Point-of-sale systems have moved from simple billing terminals to intelligent, connected touchpoints that influence what customers buy, how payments are pro-

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tected, and how stores defend themselves against threats. As retail becomes more digital and omni-channel, the POS is no longer the end of the journey; it is a live decision surface where pricing, promotion, fraud screening, and security controls must operate together in real time. This chapter examines how artificial intelligence strengthens that surface by improving promotional effectiveness, detecting fraud with speed and precision, and enhancing the security posture of the entire POS ecosystem.

AI adds value at the POS because it can learn from high-velocity data without slowing down checkout. Transaction logs, item attributes, loyalty profiles, device signals, and store context form patterns that are too complex for static rules. Machine learning models can recognise who is likely to respond to an offer, which items tend to be purchased together, and when a sudden change in behaviour hints at misuse or collusion. At the same time, threat-detection models watch the health of terminals and networks, noticing anomalies in firmware, keys, or connections that may indicate tampering or intrusion (Dey et al. 2019). These capabilities turn a traditionally reactive function into a proactive one, where the system adapts to each basket, each customer, and each risk condition.

Promotional optimisation, fraud detection, and security enhancement are interdependent in practice. A personalised discount that increases basket size is valuable only if it does not trigger false fraud declines or expose sensitive data. Fraud controls that aggressively block transactions may reduce chargebacks but will also reduce revenue and harm customer trust if they are not calibrated with marketing goals in mind. Security controls that add friction can frustrate shoppers and staff unless AI tailors the level of authentication to the risk of the moment. Thinking about these three areas together helps retailers design a single intelligence fabric at the POS, rather than three separate systems that work at cross-purposes.

The promise of AI at checkout comes with constraints. Inference must be fast enough to keep queues short. Models must be resilient to seasonality, assortment changes, and data drift across stores and regions. Privacy and consent requirements limit how personal data can be used, and explainability matters when a transaction is declined or when an offer appears at the till. Small retailers often rely on vendor platforms and need simple, trustworthy options; large enterprises must integrate AI into complex estates with legacy POS software, multiple payment processors, and strict governance (Santos & Bacalhau, 2023). These differences affect how solutions are selected, deployed, and measured.

This chapter sets out a practical path. It begins by mapping the AI-enabled POS landscape and the data foundations needed for safe and effective learning. It then details how AI powers promotional campaigns at the point of decision, covering segmentation, propensity and uplift modelling, and basket-aware offers. Next, it explains real-time fraud detection methods, from supervised models to anomaly and graph approaches, and how to balance precision with customer experience. The