


Chapter 4

Enhancing Traceability and Transparency in Food Supply Chains Through Generative AI

Vishwajit K. Barbudhe

 <https://orcid.org/0000-0002-2200-4980>

Sandip Institute of Technology and Research Center, Nashik, India

Shraddha N. Zanjat

 <https://orcid.org/0009-0009-6379-3996>

SOET, Sandip University, India

Bhavana S. Karmore

G.H. Rasoni University, Amaravati, India

ABSTRACT

This raises the need for traceability while ensuring its responsible use, a daunting task. Emerging technologies like blockchain and AI, including GPT-2, offer potential solutions. GPT-2, with its capabilities in generation synthesis, machine learning, and document automation, addresses practical challenges such as synthetic data generation, product simulation, and document processing. By applying these technologies, traceability and visibility in food supply chains can be significantly improved. Virtual product models can replicate physical characteristics and provenance, enhancing food safety, sustainability, and consumer confidence. GPT-2's ability to automate documents and generate realistic simulations strengthens supply chain transparency, ensuring secure and sustainable operations while building trust among consumers.

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INTRODUCTION

The modern food supply chain deals with expanding issues relating to traceability and transparency. It is fueled by swelling consumer expectations for comprehensive information about their meals' origin, negotiating, handling, and ensuring sustenance safety and quality. Blockchain engineering has emerged as a promising solution, enabling protected and tamper-evident record-keeping across the supply chain. However, implementing blockchain-centered traceability structures has encountered numerous barriers, such as necessitating seamless integration with prevailing infrastructure and the trouble of engaging all stakeholders in embracing this groundbreaking technology. Combining machine learning modeling can boost traceability and transparency by automatizing data aggregation, review, and reporting across the complete food supply chain to address these hurdles. Deep generative models can be leveraged to fabricate in-depth digital recreations of goods, chronicling their journey from farm to dining room table and furnishing real-time insights to all engaged stakeholders. These digital duplicates can seize comprehensive specifics regarding the product's source, processing steps, handling procedures, and any quality-related happenings throughout the supply chain. By generating these digital replicas, deep learning models can offer a detailed and transparent record of the product's life cycle, empowering stakeholders to make informed choices and ensure greater accountability. Additionally, these AI systems can generate exhaustive reports on supply chain operations, distinguish potential issues, and propose improvements, ultimately enhancing overall traceability and transparency for customers, producers, and regulators.

Integrating generative AI and blockchain tracking frameworks can significantly amplify transparency frameworks within food networks. By automating the selection and review of data, these AI designs can help overcome challenges associated with manual data entry work and ensure the precision and dependability of tracking information. Moreover, having the capability to fabricate comprehensive digital representations of goods and generate exhaustive reports can furnish stakeholders with unprecedented visibility and insights into the entire supply chain operation, allowing them to make more informed decisions and take preemptive steps to address potential issues.

While blockchain and AI each offer benefits to food supply chain oversight independently, combining their strengths may generate a robust solution far greater than the sum of its parts. By collecting data across the distributed network and analyzing it through automated and creative means, faults could be predicted and nipped in the bud. At the same time, a complete and verifiable record ensures accountability. Each participant, whether producer, shipper, grocer, or consumer, benefits from access to real-time updates and a digital replica that tells the whole story from seed to table. Through modeling and simulation, the generative aspects of AI help pinpoint areas

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