

An AI Agent-Based Framework for Automated Textile Carbon Footprint Accounting

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ABSTRACT

A concise and factual abstract, 11pt Times New Roman is required. The abstract should state briefly the purpose of the research, the key results and major conclusions. It must be able to stand alone, references should be avoided. Non-standard or uncommon abbreviations should be avoided.

The textile industry faces increasing pressure to accurately account for product carbon footprints (PCF) amidst stringent regulations and market demands for sustainability. However, current practices remain largely manual, fragmented, and costly, lacking traceability and efficiency. This study proposes a research framework for a full-process automated PCF accounting system tailored for textile products. The core innovation is an AI Agent-driven architecture that integrates an ontology-based knowledge graph with modular carbon footprint unit (CFU) databases. The agent orchestrates the entire workflow—guiding users through multi-modal data collection (text, images, tables), performing intelligent inference, executing automated calculations, and generating verifiable, traceable reports. A proof-of-concept system has been developed and is undergoing validation in collaboration with leading textile enterprises, including Wensli Group (silk products) and Shenghong Group (printing and dyeing). Preliminary results demonstrate significant improvements in accounting efficiency and data traceability compared to conventional manual methods. The modular design also enables rapid adaptation to different product categories. This framework provides a practical, scalable pathway for enhancing transparency and credibility in textile PCF accounting, supporting informed decision-making for a more sustainable textile supply chain.

Keywords: AI Agent, carbon footprint, textile, life cycle assessment, automated accounting