IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 6, May 2025
Impact Factor: 7.67

Healthcare Data Security using Federated Learning and Blockchain Technology

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Abstract: *This paper presents a secure, scalable, and privacy-preserving framework for automated skin cancer detection by integrating Federated Learning (FL) and Blockchain technology. A pre-trained ResNet50 convolutional neural network is fine-tuned using the HAM10000 dataset to classify dermoscopic images into seven distinct skin lesion categories. FL enables decentralized model training by allowing multiple healthcare institutions to collaboratively improve model performance without transferring sensitive patient data to a central server. Instead, only model parameters are exchanged, preserving data locality and confidentiality.To ensure transparency and trust among participants, a Blockchain-based infrastructure is employed to immutably log model updates. Smart contracts, deployed on the Ethereum blockchain using Ganache and MetaMask, manage authentication, access control, and validation of contributions from participating nodes. A decentralized ledger stores hashed model updates, ensuring data integrity and resistance to tampering. The system also incorporates cryptographic mechanisms to secure communication channels and maintain model authenticity during transmission.A user-friendly web interface, developed with Flask and HTML, facilitates interaction with the system, while MetaMask integration enables secure, blockchain-backed user verification. The proposed architecture supports interoperability and scalability, making it well-suited for deployment in smart healthcare ecosystems. Experimental results, evaluated using metrics such as classification accuracy, communication latency, and privacy protection, demonstrate the effectiveness of the proposed approach. This work contributes a robust and transparent AI-driven solution tailored for privacy-aware, decentralized digital healthcare environments.*

Keywords: Federated Learning, Blockchain Technology, Privacy-Preserving Healthcare, Skin Cancer Detection,ResNet50,Smart Contracts, Secure Model Aggregation

DOI: 10.48175/IJARSCT-26737