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SKINALYZER

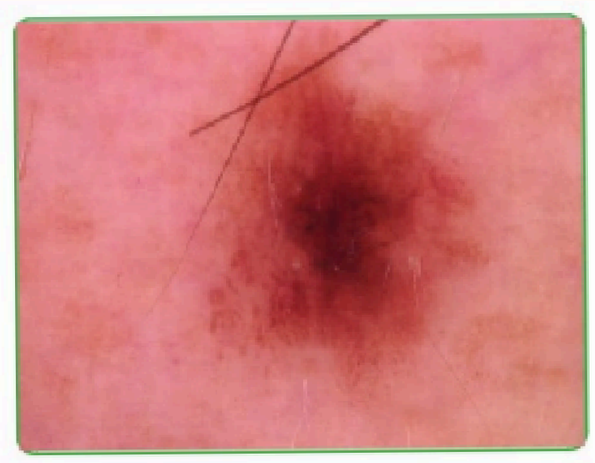
Power in Privacy, Speed in Early Diagnosis!

Abstract

This project introduces Skinalyzer, a desktop AI application that employs federated learning and incremental learning to perform skin lesion classification without centralizing user data. Trained on the HAM10000 and ISIC2019 datasets, Skinalyzer delivers real-time predictions of lesion type and risk level, while preserving privacy through on-device processing. Continuous model improvement is achieved by incrementally incorporating new data, and an intuitive interface allows users to upload images, view confidence scores, and track their analysis history.

Introduction

Skin cancer incidence has been rising rapidly in recent years, and early detection directly influences treatment success. However, in rural and underserved regions, the shortage of specialist dermatologists and patient privacy concerns hinder widespread screening. Skinalyzer addresses these challenges through federated learning and incremental learning approaches, enabling clinicians and individuals to store and analyze dermatoscopic images locally on their devices.



How It Works

1 User Interaction
- Secure sign-up & role-based access
- Select skin tone & upload dermatoscopic image
- Automatic quality & format check

2 Federated Learning
- The model is trained locally on user devices, and user data never leaves the device.
- Raw images are not shared; only model updates (gradient values) are transmitted.
- The central server aggregates all received updates and redistributes the updated global model to all devices.

3 Incremental Learning
- New labeled cases added seamlessly
- Prevents “forgetting” while boosting accuracy

4 Results & History
- Instant lesion type, confidence & risk score
- Chronological analysis log for self-monitoring

Result & Conclusion

- Model Performance: By combining federated and incremental learning, the system achieved high diagnostic accuracy of approximately 80% while preserving user data privacy.
- Test Coverage: All core functionalities were validated through 15 test cases, with a 93.3 % overall success rate; only the password-reset link failed, guiding targeted improvements.
- User Accessibility: The intuitive PyQt-based interface enabled non-expert users to perform self-screening with minimal training.
- Scalability & Privacy: The decentralized architecture scales across many devices and ensures raw medical data never leaves users’ machines.

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