Flacara: Future of Dermoscopy

Zhiyou Liu[1], Davood Tashayyod[1], Daniel Mathew[2], Alejandro Martin-Gomez[3]
[1]Lumo Imaging, [2]Johns Hopkins Univerisity, [3]University of Arkansas

INTRODUCTION

Early detection and consistent monitoring of skin lesions are crucial in dermatology practice, directly impacting patient outcomes in skin cancer diagnosis. Traditional documentation methods often result in inconsistent image quality and time-consuming manual processes, potentially affecting the precision of clinical assessments. In this work, we present a medical-grade mobile application that combines professional imaging capabilities with precise anatomical mapping and automated comparative analysis, enabling systematic documentation of skin conditions over time. This innovative solution aims to enhance the efficiency and accuracy of dermatological examinations, supporting better clinical decision-making in skin cancer detection and management.

Clinical Workflow Challenge:
Current practice requires manual documentation with scribes, significantly extending examination time and reducing clinical efficiency

METHODS

Electronic Health Record (EHR) Integration

Flacara App implements a comprehensive data management system (Fig. 1) with bi-directional synchronization capabilities:

- Receives patient data from EHR and LumoScans systems
- Maintains a local secure database of patient information
- Enables patient data updates during clinical examinations
- Synchronizes changes back to EHR and LumoScan systems

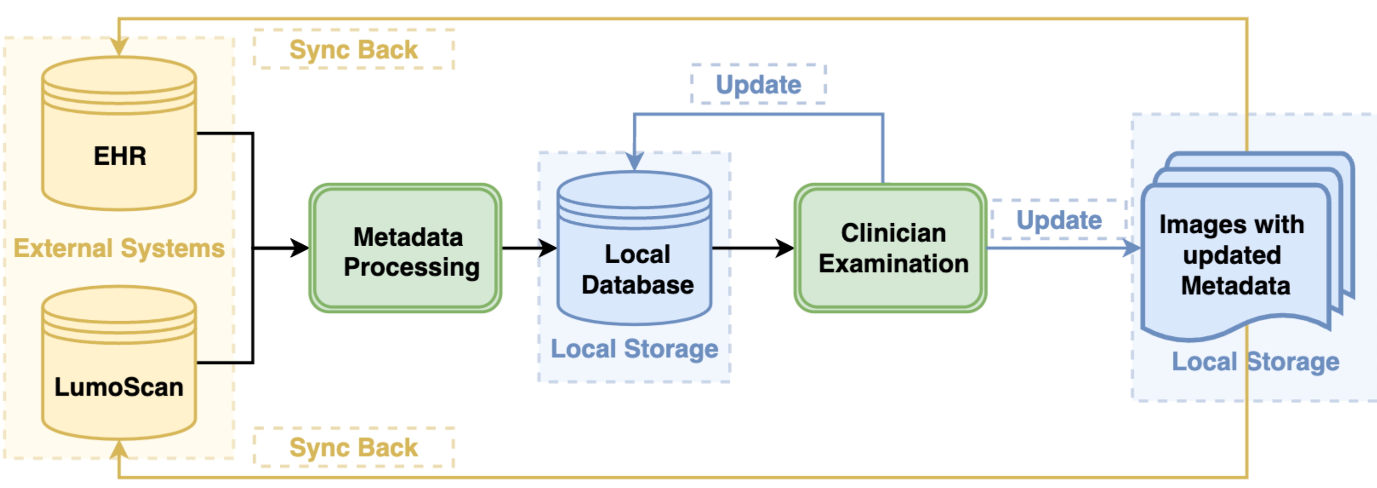

Fig. 1 Metadata Synchronization Pipeline

Current development focuses on secure local storage and efficient data organization. Future development will implement direct EHR integration, enabling seamless data synchronization and enhanced clinical workflow efficiency.

METHODS (Cont.)

Augmented Reality Lesion Mapping & Tracking

Our AR-enabled mapping algorithm creates dynamic correspondence between a 3D atlas and a live patient view (Fig. 2) through the following process:

- Estimates landmark positions in both the 3D atlas and live patient view
- Uses the landmarks as anchor points to align atlas and patient views
- Identifies body segments containing target lesions
- Determines distances from the lesion position to landmarks on the atlas view
- Projects the lesion location on to the live-patient view by employing the same distance ratios as those in the atlas view

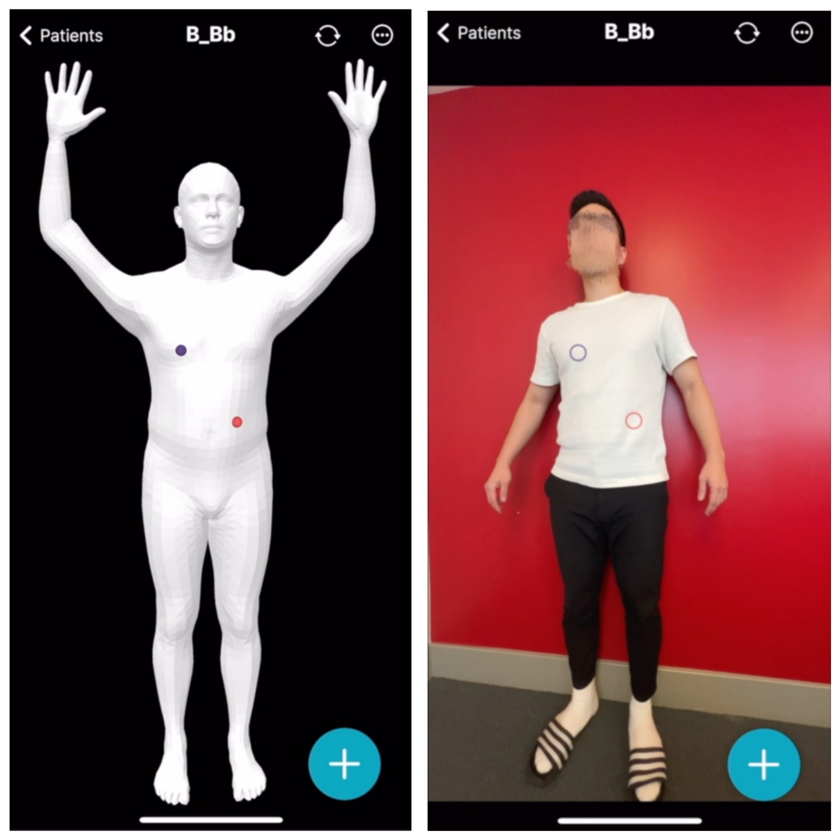

Fig. 2 Demonstration of the mapping system showing corresponding lesion positions (colored dots) between 3D anatomical atlas (left) and real-time patient view (right).

Automated Lesion Alignment

Flacara App employs an automated alignment algorithm that accurately aligns sequential dermoscopic images to enable precise visual comparison of lesion changes over time (Fig. 3). Through sliding window visualization, clinicians can directly observe subtle changes in specific regions of interest. The alignment process[1] consists of several key steps:

- Feature Matching: AKAZE feature detection
- Transformation: Affine transformation estimation using RANSAC
- Image Warping: Transforming the size and orientation of the target image in order to align it with the source image

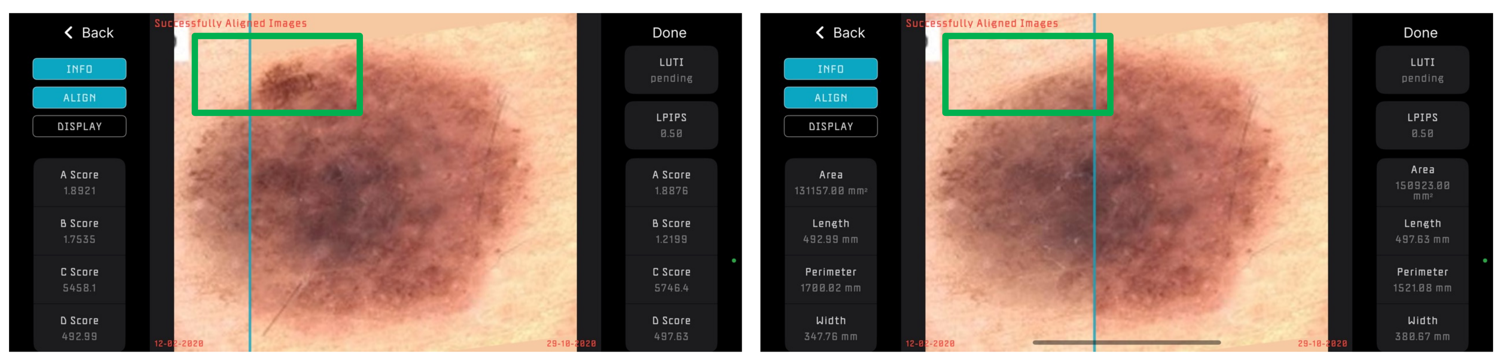

Fig. 3 Sliding window interface demonstrating lesion changes: note the distinct changes within the green bounding box between temporal instances of the aligned lesion.

The alignment method supports dermoscopic images from both dermoscopy devices and Flacara mobile attachment (Fig. 4), with built-in quality checks to ensure reliable comparison.

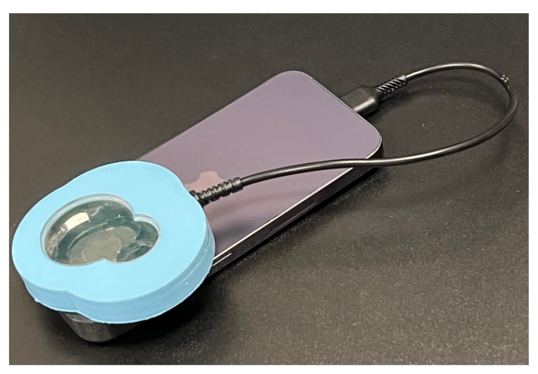

Fig. 4 Flacara iPhone pro attachment includes LEDs and polarization filters but not magnification optics.

METHODS (Cont.)

AI-Powered Lesion Comparison System

Comprehensive lesion analysis is achieved through the following automated tools:

- Aligned Temporal Comparison (Fig. 3)
- Advanced segmentation for lesion boundary detection (Fig. 5)
- True-size measurements (length, width, perimeter, and area)
- ABCD criteria[2] scoring for malignant risk assessment

AI capabilities[3] are being integrated to provide automated lesion descriptions and diagnostic suggestions. Initial implementation shows promising results, as demonstrated in Fig. 6.

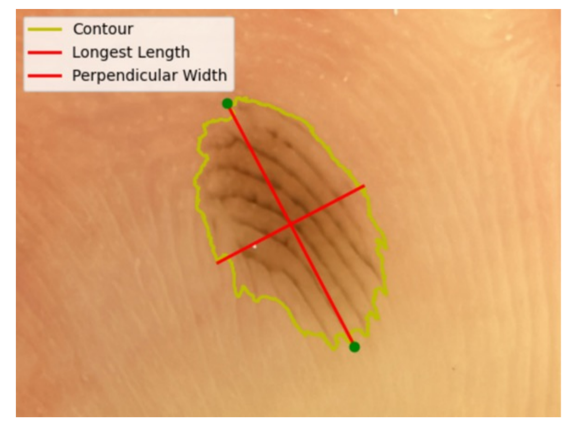

Fig. 5 Lesion Measurements: Contour, Length, and Width

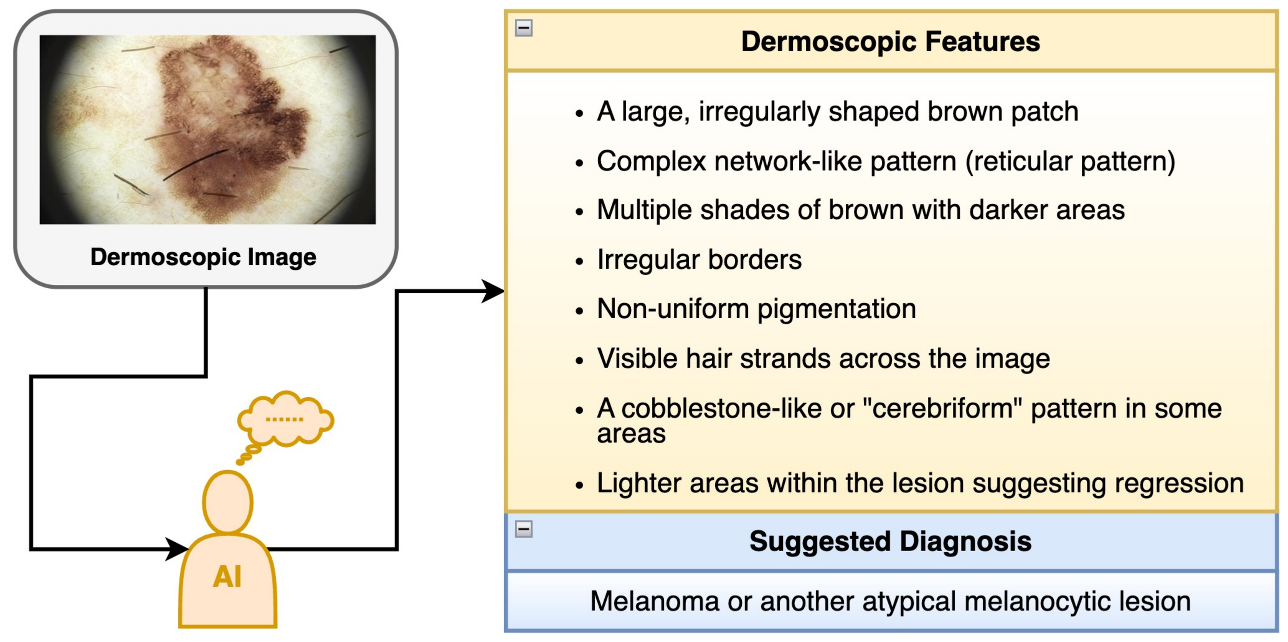

Fig. 6 AI dermoscopic analysis and diagnosis

CONCLUSIONS

Our mobile application demonstrates an efficient approach to clinical dermatology workflow integration. The combination of precise anatomical mapping, automated analysis tools, and AI assistance has been well-received by the dermatology teams from multiple clinical sites. Future work will focus on expanding AI capabilities and enhancing EHR integration.

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