



DermaVision

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Project Goal:

An estimated 10 million people in the United States experience domestic violence (DV) every year, with 4 out of 10 cases affecting people of color [1][2]. Law enforcement and healthcare providers visually inspect injuries and document bruising using a commercially available camera. While this method is highly effective on lighter skin tones, it fails to account for pigmentation levels on the skin (Figure 1).

Increased melanin concentrations make it more difficult to detect bruising on darker skin tones (Figure 2), which can lead to unreliable measurement and thus disparities in legal and medical outcomes. Without firsthand evidence to identify when the bruising event occurred, the age cannot be reasonably determined earlier than 18 hours [3][4].



Figure 1. A. Contusion on dark skin (Massey-Martin rating of 6). B. Contusions on light skin (Massey-Martin rating of 1) [5]

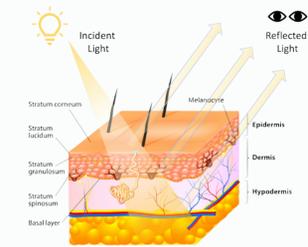


Figure 2. Melanocytes and the Layers of the Skin. [6]

Objectives:

1. To develop a reliable imaging tool capable of detecting bruise injuries across all skin tones.
2. To incorporate a quantitative measurement of the age of the injury.

Solution:

Employ multi-spectral imaging techniques to capture and process images across a wide range of wavelengths. This method generates a spectral signature or "fingerprint" of the chemical components of blood present in bruises (Figure 3).

As these components vary in concentration during the healing process of a bruise, the device can effectively detect bruise injuries regardless of skin tone, while also quantitatively determining bruise age.

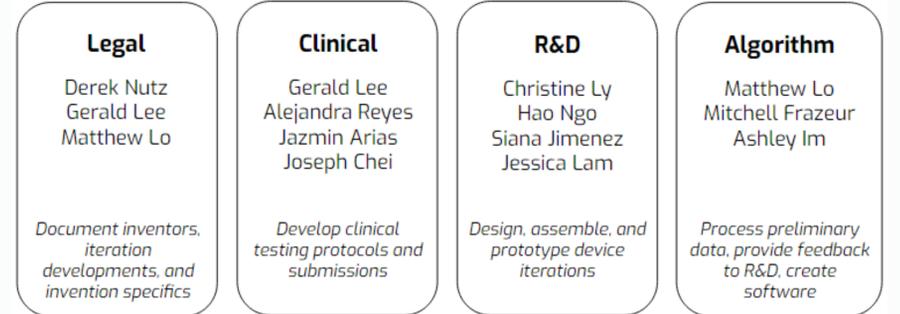


Figure 3. Variance in Bruise Chromophores [7]

Team Organization Chart

Project Mentor: Elliot Botvinick, PhD

Project Managers: Christine Ly, Matthew Lo, Gerald Lee



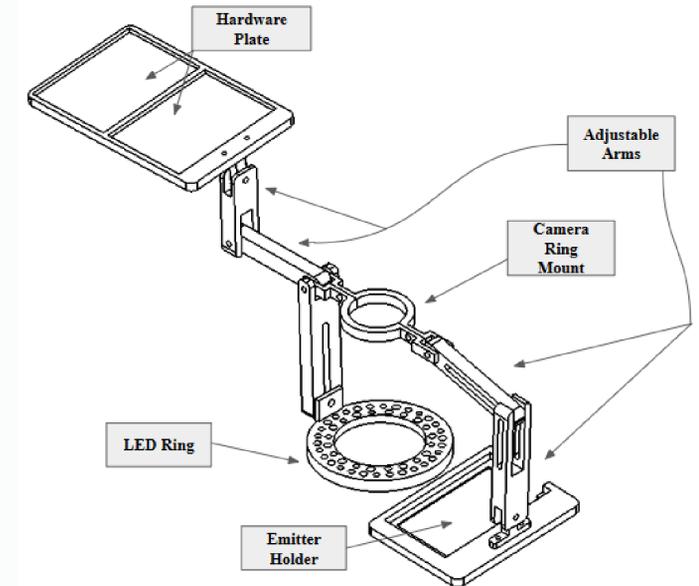
Project Design and Device Validation/Verification Plans

FDA Standard: Class 1 Medical Device, CPC subclass A61b/0075, and 510(k) exempt
In compliance with: ISO 14971, ISO 1099, IEC 60601

DMADV



Once verified, the prototype will be validated through testing by imaging clinical patients in a hospital setting. Ensure that the prototype meets the criteria outlined in the CTQs. Thoroughly assess the performance against the intended objectives using real-world clinical data. Use the results to inform any necessary refinements or improvements before making decisions about scaling up the design for production.



Timeline

Activity	Fall 2023										Winter 2024										Spring 2024										
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	
Test images with various LED setups																															
Process/compare initial image sets																															
Develop clinical device: CAD modeling, circuit design, prototyping																															
Develop smartphone attachable miniaturized device																															
Submit IRB proposal for imaging human subjects																															
IRB revisions, clinical protocol																															
Collect clinical bruise image sets, verify clinical device																															
Process clinical image sets																															
Develop algorithm that correlates spectral data to bruise marker																															
Supplemental algorithms, developing time-to-injury correlation																															
Conduct customer discovery interviews with law enforcement personnel																															

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Jiixin Luo

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BEAMSLAB

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