Non-invasive Imaging Device for Classification of Non-healing Burns: An Initial Clinical Case Series

Saturday, November 10, 2018
10:00 – 10:15 am

Author and Co-authors:

Ronald D. Baxter, Jr, MD[1]; Jeffrey E. Thatcher, PhD[2]; Amy Nussbaum, PhD[2]; Faliu Yi, PhD[2]; Aadeesh Shringarpure, MS[2]; Kevin Plant, BS[2]; Emily Eggert, MS[2]; Brian McCall, PhD[2]; Wensheng Fan, MS[2]; Jeffrey Carter, MD[3]; James H. Holmes, IV, MD[4]; J. Michael DiMaio[1,2]

[1]Baylor Heart Hospital, Plano, TX
[2]SpectralMD, Dallas, TX
[3]UMCNO Burn Center, New Orleans, LA
[4]WFBMC Burn Center, Winston-Salem, NC

Objective:

Upon completion of the lecture, attendees should be better prepared to:
- Describe the use of artificial intelligence in predicting burn healing potential
- Discuss the results of a proof-of-concept study

Abstract:

Introduction: Non-burn practitioners, such as general surgeons and emergency providers, are called upon for the initial evaluation of burn victims. However, these same assessors are highly prone to making errors in identifying patients that need specialized care, which burdens burn centers and often results in overly conservative and costly care. We are developing a device to aid practitioners in predicting severity of a burn using multispectral imaging and machine learning (ML) algorithms. We present current results of an ongoing proof-of-concept (POC) clinical study and demonstrate methods for training ML algorithms to classify areas of non-healing burn. Initial results for subjects that have completed the study are presented.

Methods: In an IRB-approved study, multispectral images were collected from subjects covering the full range of burn severities. Subjects were enrolled within 72 hours of injury and imaged daily for up to 7 days post injury. True severity of burn injuries in each image, or ground truth, is determined using 21-day healing assessments and punch biopsies. Using the imaging data and ground truth, we trained an ensemble of deep learning algorithms to identify non-healing burn tissue.

Results: Data were collected from 25 subjects, with 43 total burns and 303 images. The ensemble classifier showed 83.2% sensitivity and 90.6% specificity in identifying individual pixels representing non-healing burn tissue. Furthermore, analysis shows that time-since-injury did not significantly impact algorithm accuracy (p-value = 0.84).

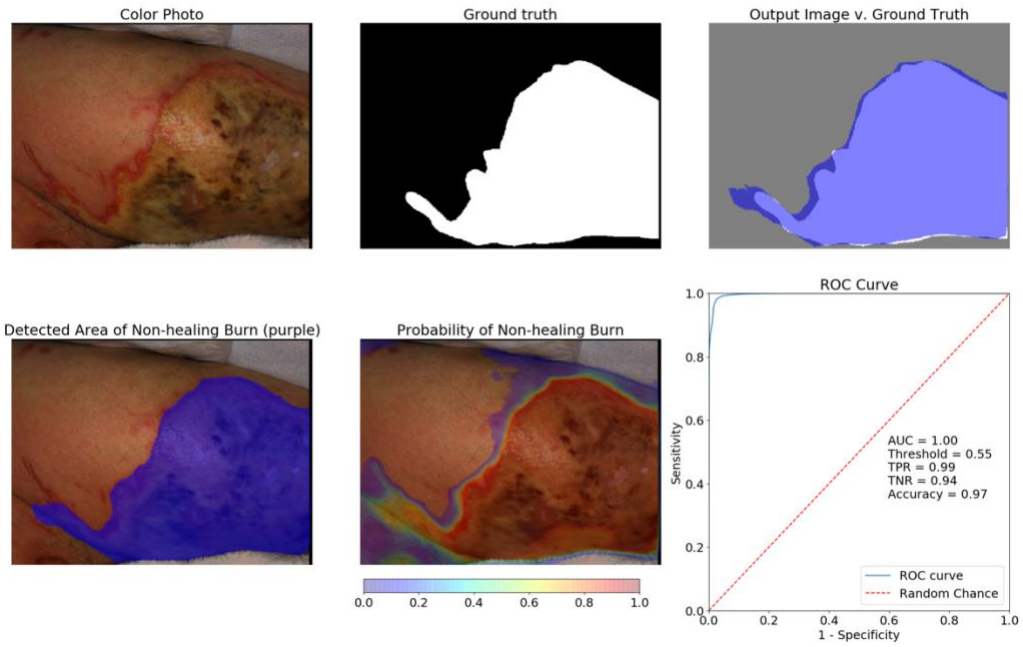

Figure 1: A non-healing burn on the anterior left thigh of an 86-year-old male taken 4 days post-burn injury.

Conclusions: The most effective algorithm technique, an ensemble of deep learning classifiers weighted by sensitivity trained on n = 25 subjects, had 0.940 AUC compared to 0.850 AUC for n = 10 subjects. While multispectral data is known to change as the burn undergoes physical changes during the first week of healing, the ensemble classifier was able to account for this variation and still provide accurate predictions. Future work is aimed toward collecting data from subjects representing diverse sub-groups in the burn population. Upon completion of this study, we plan to begin a multi-center study to collect a representative training database.

Applicability of Research: This study shows results from an ongoing POC study for developing an aid to burn assessments. The performance of classifier algorithms trained on the data collected using our multispectral imager gives high confidence that clinically relevant classifications of burn healing potential are feasible using this technology.

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