### Abstract Title:
Rise of the (Learning) Machines: Artificial Intelligence for the Assessment of Adult Thermal Burns

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### Objective:
Assess burn wounds using novel technologies

### Abstract:

**Introduction:**
In the US there are 450,000 hospitalized burns each year that require assessment by a trained medical professional with over 1.1 million seeking medical assistance. The estimation of burn severity is critical for managing the care of the patient. However, these estimates depend on the assessor’s training and judgment with burn specialist reporting 70-80% accuracy and non-burn specialists a 50-60% accuracy. A reliable standard for the accurate assessments of burn severity is needed. A new non-invasive imaging technology called Multispectral imaging (MSI), combined with a machine learning algorithm is being developed as a rapid tool for accurate burn assessment. We present the results of the first multi-center study using this technology in adult burn injuries.

**Methods:**
In a multi-center IRB-approved study, an MSI device was used to image subjects 18 years and older with thermal burn injuries. The imaging device captured a set of images measuring the reflectance of visible and near-IR light within a 23 cm by 23 cm field-of-view. Images were collected from one to four burned regions of subjects with thermal burns up to 50 % TBSA. Subjects were enrolled and imaged within 72 hours and then serially imaged until 7 days post injury. The images collected were used to develop a type of machine learning algorithm called a convolutional neural network (CNN) that could automatically identify the regions of non-healing burn within an image. Prior to algorithm development, the actual regions of non-healing burn within every MSI image were identified by a panel of three burn surgeons. To accurately identify these non-healing regions, the panel of surgeons were given access to one of two clinical reference standards: a) the 21-day healing assessments for burns allowed to heal spontaneously; or b) pathology reports detailing histologic changes from multiple punch biopsies taken prior to burn excision and grafting. From this data, an ensemble of eight separate CNN algorithms was used to automatically identify non-
The ensemble comprised a set of CNNs that were variations on the U-Net, fully connected CNN, and SegNet architectures. Training and test accuracies of the ensemble CNN were calculated using cross-validation at the level of the subject.

**Results:**
One hundred (100) adults were enrolled and imaged. The population had a mean age 45.6 ± 16.7; mean TBSA 13.0 ± 9.3; and was 31% female. From these adults, 210 burn regions were serially imaged. The estimated performance result from the ensemble CNN for identification of non-healing burn regions was AUC of 0.96. Based on the ROC curve, an ideal threshold showed an accuracy of 92.0%, sensitivity 91.9%, and specificity 92.0%.

**Conclusions:**
Our study demonstrates a dramatic improvement in accuracy of burn wound severity assessment over traditional bedside exam. More accurate burn wound assessment could lead to avoiding unnecessary surgeries or delays in treatment or referral, reduced length of stay, and dramatic cost savings. Use of such a device in a disaster has additional value to better align resources with clinical needs. Technologies such as this offer great potential in burn care and will require strategic incorporation into practice once commercially available.

**Disclosures:**
Jeffrey Eric Carter, MD, SpectralMD|Stockholder|SpectralMD|Consultant|Avita Medical|Consultant|PolyNovo Consultant|Consultant
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