Quantitative thermal imaging biomarkers to detect acute skin toxicity from breast radiation therapy using supervised machine learning

SAEDNIA, Khadijeh, TABBARAH, Sami, LAGREE, Andrew, WU, Tina, KLEIN, Jonathan, GARCIA, Eduardo, HALL, Michael, CHOW, Edward, RAKOVITCH, Eileen, CHILDS, Charmaine <<http://orcid.org/0000-0002-1558-5633>>, SADEGHI-NAINI, Ali and TRAN, William

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Data Acquisition

Segmentation/Feature Extraction

Analysis

Outcomes

Ipsilateral

Contralateral

Experiment One

Optimal Feature Set:

Max. Temp($^{\circ}$ C), Median Temp($^{\circ}$ C),
Mean Temp($^{\circ}$ C) Skewness, Kurtosis

Experiment Three

Optimal Feature Set:

Mean Temp($^{\circ}$ C), GLCM-COR,
GLCM-ENE, GLCM-HOM, GLRLM-GLN

Baseline

5th Fraction10th Fraction15th FractionCTCAE (≥ 2) CTCAE (≤ 1) 26.8 °C 38.0 °C**Supplementary Figure A.**

Representative images of the skin reaction of the irradiated breast across RT treatment for a patient with an end-of-treatment score of CTCAE ≥ 2 (top) and for a patient with a score of CTCAE ≤ 1 (below). The CTCAE ≥ 2 patient demonstrates noticeable dermatological changes and erythema which is most noticeable starting at the 10th fraction. A temperature scale bar is presented for the thermograms.

Supplementary Figure B
Temperature and first order features of the ipsilateral (irradiated) breast. Statistical significance was found for temperature between the patient groups at the 10th and 15th fractions. There was no statistically significant difference found between our patient groups for any of the first order features.

Supplementary Figure C

Temperature value distribution for GLCM features of the ipsilateral (irradiated) breast. There was no statistically significant difference found between our patient groups for any of the GLCM textural features.

Supplementary Figure D

Temperature value distribution for GLRLM features of the ipsilateral (irradiated) breast that demonstrated good predictive value. There was no statistically significant difference found between our patient groups for any of the GLRLM textural features, except for GLRLM-SRE (10th fraction).

Supplementary Figure E

Temperature value distribution for GTDM features of the ipsilateral (irradiated) breast. There was no statistically significant difference found between our patient groups for any of the GTDM textural features.