Cluster and Quadrant Analysis for Thermographic Breast Cancer Detection

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OBJECTIVE
This study aims to develop an algorithm that can effectively and accurately distinguish between tumor-affected and normal breast tissue. This is being achieved by performing cluster and quadrant analysis on the existing dataset to identify key characteristics of tumor-affected tissues.

INTRODUCTION
Thermographic Imaging utilizes an infrared thermal camera to capture the skin temperature and potentially indicate tumors regions of interest based on skin temperature patterns. Prior research indicates that tumor regions are warmer than normal breast tissue, and tumorous tissue cools at a slower rate than normal breast tissue [1].

MATERIALS & METHODS

- Patients were imaged over the course of 15 Minutes with an N2 Infrared Camera with Thermal Resolution of 50 mK / Digital Count.
- Image Processing and Algorithm Development completed in MATLAB.

Cluster Analysis was carried out with two mechanisms:
(1) Statistical Analysis of tumorous regions as indicated by truth data.
(2) Quadrant Analysis of general breast regions for statistical data. Quadrant Origin placed at nipple.

RESULTS
Results displayed are for Patient IRST011, one of 14 patients imaged and one of three selected for the algorithm training set. Patient First and Last Images were used in Cluster Analysis Software.

DISCUSSION & FUTURE WORK
Results confirm findings from prior research that tumor-affected breast tissue is warmer than normal tissue.

For each of the patients evaluated, the tumor region identified by the truth data was significantly warmer than the corresponding region on the opposite (unaffected) breast with a 95% confidence level. This result was confirmed by the Quadrant Analysis, which found that the quadrant containing the tumorous tissue is significantly warmer than the surrounding quadrants and the corresponding quadrant on the opposite breast.

Given these results, the cluster isolation algorithm becomes more significant due to its ability to isolate unilateral regions that are warmer than the surrounding tissue. As more patients are added to the data set, we will continue to train the algorithm. The goal is to provide information for adjunct usage with mammography that may improve the overall accuracy of early breast cancer diagnosis.

CONCLUSION
Given the available data from the 14 patient images thus far, our research indicates that the tumorous breast tissue is noticeably warmer than normal breast tissue. This is evident through the comparison of the tumor-affected tissue with the corresponding region on the opposite breast, which acts as patient-specific baseline. Additionally, these results allow us to train the Cluster Isolation algorithm to identify regions of clinical importance.

REFERENCES