INTRODUCTION

- Early detection of breast cancer is directly correlated to increased survival, with a maximal survival index of 95%.[1]
- Dense breasts have relatively more breast tissue than fat in composition and when imaged in mammography, the fat appears black while both breast tissue and tumors appear white.
- Lack of contrast makes it difficult for radiologists to detect small tumors.[2]
- Thermography utilizes infrared wavelengths (8-12μ) to create an image that correlates object temperature with image intensity.

HYPOTHESIS

- In breast cancer, cells often experience vasodilatation, a process that increases the blood supply to the tumor. This increased blood supply can create a difference in energy dissipation between the normal and cancerous tissue, indicating a higher local temperature.[3]
- The region of the breast with a tumor will have a higher local temperature than the surrounding breast and corresponding region on the non-cancerous breast due to the lack of vasoconstriction.
- Therefore, the breast with a tumor will have a higher cooling curve than the non-cancerous breast.

METHODS

- Patients with known unilateral breast cancer and volunteers with no known tumors were imaged with an N2 Infrared camera for a total of 15 minutes.
- Patients and volunteers both sat upright in a chair with their arms held up with arm rests for the duration of the imaging session.
- Imaging started shortly after the volunteers removed their tops to obtain the greatest change in temperature.
- 16 bit thermal images were obtained during the imaging process.
- For this experiment, one thermogram was analyzed per minute for a total of 15 images per patient.
- Each thermal image was cropped and manually segmented using MATLAB to separate the breasts from surrounding body regions and background.
- The manually segmented patients and volunteers were cropped and sorted into healthy or tumorous and left or right breasts, respectively following truth data provided by surgeons after surgery.
- Using MATLAB, the average pixel values of each breast were converted to temperatures.
- The difference in temperature between the patient and volunteer breasts was calculated and averaged for both sets of data for each of the 15 minutes.
- These average temperatures were graphed with standard error bars calculated.

RESULTS

- Figure 2. a. Contrast in thermal signatures shown when comparing tumorous and healthy breasts in patients and left and right breasts in volunteers
- Figure 2. b. Example thermogram from patient at time 0 (upper) and time 15 (lower)

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REFERENCES