Design of Tactile Method for Breast Lump Detection

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Introduction

• According to the American Cancer Society, 1.6 million women will be diagnosed with breast cancer in 2018. The causes for lumps in breast are:
  - fibrocystic changes 33%
  - no major pathology (i.e. normal) 24%
  - benign diseases 13%
  - cancer 23%
  - fibroadenoma 7%
• The breast is made of non-homogeneous tissues and glands.
• Cancerous lumps are approximately 16 times stiffer than normal tissue while benign lumps are about 7 times stiffer.

Motivation

• The available screening methods X-ray mammogram uses low dose radiatin which increases the risk of cancer.
• MRI, Ultrasound and Molecular based detection are expensive and time consuming.
• Clinical examination methods are uncomfortable and painful for some women.
• Third world countries lack the expertise and the technology for diagnostics.

Project Aim

• Develop a simple, low-risk method for the detection of breast lumps.
• Develop a tactile imaging method for the detection of the location and the type of lumps.

Tactile Imaging Method

Sensing Vest ➔ Readout circuit ➔ Data processing ➔ Tactile Image

Sensor Design:

• Textile bi-directional force sensitive resistor (FSR) was used
• Contains piezo resistive fabric sandwiched between conductive fabric
• Output Voltage at each intersection decreases with increasing pressure.

Resolution: 0.06N
Sensitivity: 0.1N
Operating Range: 0-30N
Maximum output Voltage: 5 V
Spatial Resolution: 05mm

Tactile Sensor Design

Readout Circuit:

• Resistance at intersection is measured by measuring the potential difference.
• Standard multiplex followed by AD conversion circuit.

Data Processing Model:

Results

F = 0 N , 0.8 N , 1.5 N
Size : d = 10mm
20x20mm

Matlab Visual
Sensitivity: depth d = 0 - 6mm: 78 %
6-10mm: 37%

Material Width [mm] Area [mm2] Stiffness [N/mm]
Gelatin 5001 10 1
Tea 2001 10 1
Bread 2001 10 1

Future Work

• Develop the imaging system (garment) and explore possibilities for a imaging glove and probe.
• Collect data for the prediction model and tune the algorithm parameters to make the model robust.
• Test the developed method on different tissue samples and lump models.

Reference


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