

Georgia Institute of Technology

Xia, Hui

903459648

Case Study #2 – Mammography

CS6440 Intro Health Informatics, 2020 Spring

1. What types of data do we (as a health data analyst) need to capture in order to generate better evidence regarding mammograms? Provide examples and detail how it could be used to generate better evidence.
   1. **Data with more information.**

Mammography imaging is to generate cross-section image using X-ray [ref]. Generally, as other X-ray imaging methods, mammograms prefer higher resolution images, which provides the possibility of discovering abnormalities among the surrounding breast tissue. For the conventional transmission X-ray mammography, the detection of tumors tissue with time-resolved imaging relies essentially on blood absorption - the tumor tissue in general contains more vessels and thus tend to have higher absorption. Taroni et al. reasoned that, using shorter X-ray wavelengths than presently used (680–780 nm) could improve the resolution of the mammography. Their study further proves that the optical contrast increased when X-ray wavelengths decreases, thus gaining a higher mammography resolution [ref]. Griffiths et al. have implemented an X-ray diffraction method, and noticed that using the said method, they can generate X-ray images with a higher resolution than the images generated using conventional transmission X-ray mammography [ref]. Other than purely image-based mammography, Sinkus et al. implemented a device to also measure the viscoelastic shear properties of breast lesions to improve the specificity of mammography. They reason that the shear modulus healthy breast tissue have a range of frequency range when measured by dynamic MR elastography. Exploiting this feature, and combining it with conventional X-ray image, they could shorten diagnosis time, and improve diagnosis specificity and sensitivity [ref].

* 1. **More organized and better analyzed data**.

For some health data analyst, the resolution of the X-ray image is fixed. Thus, methods will need to be implemented to exploit the image, targeting to gain more, and more accurate information from data analysis. Conventionally, one method to obtain more accurate mammography is double-reading. That is, two independent health data analysts to analysis the exactly same X-ray image independently [4]. Other than relying on human analysts, breast cancer screening has been widely adopted by the world, the increased need for mammography resulted the invention of computer-aided diagnosis (CAD) systems to help the health data analysts to generate better evidence [ref].

Recently, machine learning has been applied in mammograms. Cardoso et al. and Domingues et al. utilized support vector machine (SVM) to differentiate muscle tissue from the rest of the breast in a classification process.

CAD systems should include multiple different possibilities for image enhancement, automatic segmentation, and registration, and, in the ideal scenario,

1. automatic detection algorithms for various possible features
2. that could indicate an abnormality. The main preprocessing
3. technique in CAD applications is defining the
4. proper region of interest which implies some sort of image
5. segmentation and object detection. After the segmentation,
6. the user of a CAD system can start all other automatic
7. detection and diagnosis tools on the way to bring a reliable
8. and quick diagnosis.
   1. Early detection data.
   2. Double reading of mammograms (two radiologists read the same mammograms) [4] has been advocated to reduce the proportion of missed cancers
   3. Different angles?
9. PCP's may recommend a screening based on USPTF guidelines, however patients are not obliged to heed such recommendations. What types of “decision support” could help patients decide if mammograms are right for them?
   1. Tell them people with screening based on USPTF guidelines has a longer life expectancy
   2. Tell them Harms Associated With Mammography Screening is low

Screening for Breast Cancer: An Update for the U.S. Preventive Services Task Force

1. If patients who have received mammograms (like LS) wished to share their data for research, how could they do it?