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Proposed Android Based Mobile-Application for Breast Cancer Diagnosis

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Abstract – Breast cancer is the second most common cause of death in women in the world. Early detection of this disease increases the survival rate. To determine the status of the affected patient, tests are usually carried out by radiologists. However, the classification of breast cancer has been a problem for oncologists with available facilities in the medical field, especially when medical professionals are not available. Therefore, there is a need for the design of a mobile application to determine the level of severity of breast cancer and also to reduce false negative and true positive results. Breast images used in this study were obtained from the MIAS database and were uploaded into the Android mobile app developed using Android studio. Java Programming language was written for the proposed mobile application. The mammograms were pre-processed after which the region of interest of the breast images was extracted. The processed images will be classified into either Benign or Malignant. The proposed application was able to load and process breast images and achieve early detection of normal or abnormality in the breast. The processed images will be classified to the level of severity of the cancer (either Benign or Malignant) and enable users to know cancer status with the use of an android smartphone hence appropriate treatment will be employed.

Keywords: Classification, Mammogram, Mobile-Application, Pectoral muscle, Preprocessing, Segmentation.

1. Introduction

Breast cancer is the most frequently diagnosed form of cancer in women. Yearly, more than 1.3 million women all over the world are diagnosed with breast cancer and it is the worlds' most common cause of death after cervical cancer. According to the World Health Organization (WHO), the number of cancer cases expected in 2025 will be 19.3 million cases, and as studies reveal, in Egypt, cancer is an increasing problem especially breast cancer (Ragab, 2019). Due to the analysis given by WHO combined with advanced treatments, the cancer mortality rate has reduced as it has been discovered that early detection and efficient treatment of breast cancer could increase the treatment options and reduce the mortality rate and although this is a huge development, issues such as technical reasons, which are related to imaging quality and human error have increased the misdiagnosis of breast cancer in radiologists' interpretation. In a bid to enhance this early detection process, medical researchers have leverage on the development of technological equipment that will help their work. This rapid development in technology has had a great deal of positive impact on the health care sector and has led to the discovery and development of various procedures and systems such as Computer-Aided Detection system (CAD) which can be used to automate breast cancer detections and classification.

However, as one is thinking of computerized detection systems and procedures, there is a need to take into account the type of technology that will be used to support detection hence the introduction of the use of mobile applications as a means of carrying out these detections and analysis on patients and for medical personnel respectively. This mobile application is a model that utilizes Information and Communication Technology using handheld technology devices such as Personal Digital Assistant (PDA), smartphones, laptops, and tablet PC in receiving and processing data.

Poor mammographic image quality and fatigue on the part of radiologists can affect the accurate detection of cancer from mammogram images with the eye by the radiologist. In the early 1980s, there was a significant increase in the use of Neural Networks (NN) in the field of image and signal processing. Since the diagnosis of breast cancer is very difficult, statistical methods and artificial intelligence (AI) techniques can be used in this regard. The AI is said to be an artificial intelligent machine in various situations (Chandra, 2016). These systems can respond to similar conditions such as an intelligent human, including understanding complex situations, simulating thinking processes and human reasoning methods, and demonstrating accurate responding, learning, and ability to acquire knowledge, and reasoning for solving problems. For example, Dheeba and Selvi used a particle swarm-optimized wavelet neural network (PSOWNN) to identify breast cancer on the mammogram (Wu, 2015).

Recently, one of the efforts of the Ministry of Health is the campaign of breast cancer awareness through breast self-examination program, and has since made October as "Breast Cancer Awareness Month". The positive impact of this entity has led to a mobile application for online learning on early detection of breast cancer. Pink Band from Indosat and Love Pink Breasties from Love Pink Indonesia community developed a mobile application for early detection of breast cancer using iOS and Android. Both applications are developed for the general public in Indonesia but this information provided has also been adjusted to be used for all areas of life. (Hery, 2018). Medical image processing requires prior knowledge of the content and nature of the image to select appropriate methods to implement the CAD system.

To achieve a high level of efficiency for automated diagnosis, it is significant to employ efficient image processing approaches in the main steps of the CAD system. Commonly, the CAD system consists of four stages which are pre-processing, segmentation, feature extraction, and classification. The pre-processing stage is performed to remove noise and defect caused in the acquisition of the mammogram image, image resizing, and image intensity enhancement (Olalekan, 2012). Segmentation is used to find the ROI (Chen and Zwiggerlaar, 2010). Segmentation techniques help to highlight significant regions and extract various structures such as organs or tumors for further examination (Liu et al., 2011). Feature extraction is the transformation of original data to a dataset with a reduced number of variables, which contains the most discriminatory information. It is an important step in breast cancer detection and classification. It is used in extracting useful and important features that can be used to distinguish between benign and malignant (Adepoju et al., 2015). At the classification stage, the ROI is classified as either benign or malignant according to the features. There are lots of classifier techniques such as Linear Discriminant Analysis (LDA), Artificial Neural Networks (ANN), Binary Decision Tree, and Support Vector Machines (SVM) (Adepoju et al., 2015).

To enhance early detection of breast cancer, determine the cancer status (normal or abnormal) and level of severity of abnormal patients, where there are no medical personnel, a medical mobile application is required.

2. Materials and Methods

Flow chart of the proposed methodology of the mobile app development is as shown in Fig 1.

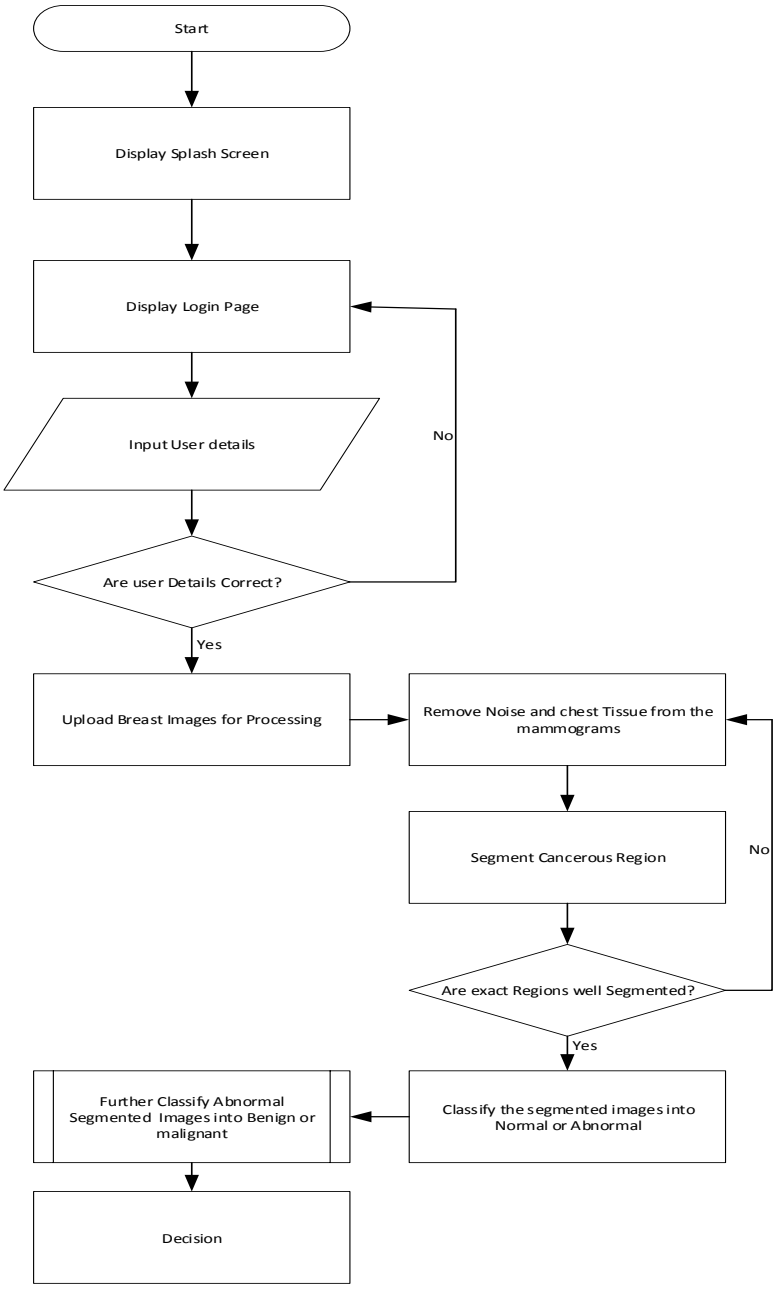
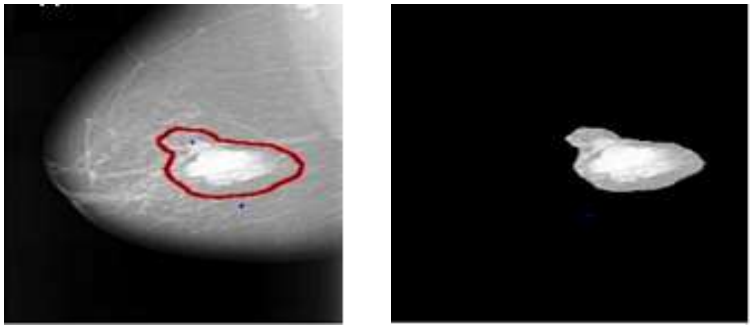


Fig 1. Flow Chart of the proposed Mobile App

Breast images were acquired from the public (MIAS) database and uploaded into the application. The mammograms were preprocessed to remove noise, artifacts, and suppression of pectoral muscle. The preprocessed images were segmented into the breast region and background. This helps to focus and limit the search for abnormality in the breast region without the effect of the background on the results for detection as shown in fig 2 (a) and (b).



(a) (b)

Fig 2. (a) Actual mammogram (b) Segmented mammogram

The software part of the proposed application consists of two main components: Programming language and Android studio application software. Java programming language was used for the design of the proposed system.

3. Results and Discussion

Fig 3. Splash screen

Fig 3 is the splash screen where the user can choose from the available options “Log-In” and “Sign-Up”. For the user to log in, he must have registered and supplied the log-in details to the system while the new users will click on sign up and register as an authorised user before getting access to the system.

Fig 4. Breast images uploading and preview interface

Fig 4 was used to load and preview breast images from the database before the processing for further diagnosis.

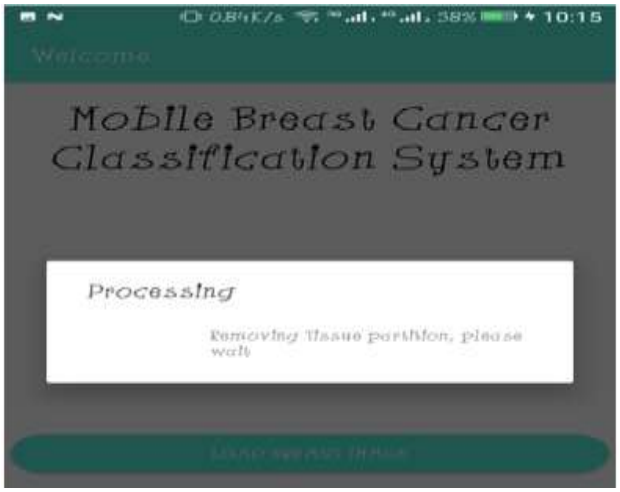
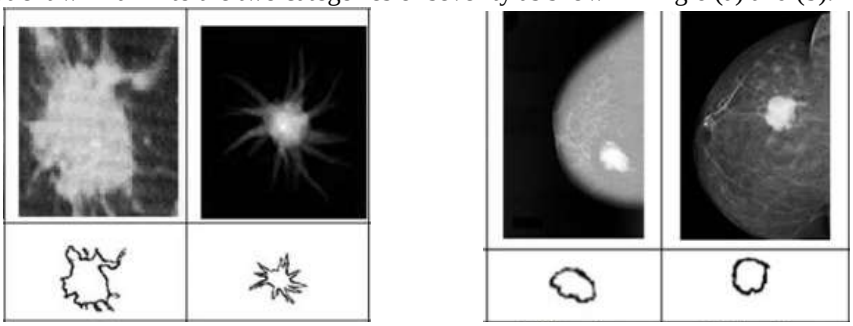


Fig 5. Breast images processing interface

Fig 5 shows the processing interface where the proposed mobile-App will remove artifacts, noise, and pectoral (Chest) muscle for proper segmentation and classification of breast cancer. The final expected output of any registered patient will fall into the two categories of severity as shown in Fig 6 (a) and (b).



(a) (b)

Fig 6. (a) Malignant (b) Benign

The first image of the irregular-shaped classification in Fig 6 is a malignant (hazardous) class of breast cancer while the second image with a round or well-defined shape is a benign (non-hazardous) class of breast cancer.

4. Conclusion

The proposed application can load and process breast images hence achieve early detection of normal or abnormality in the breast. The processed images will be classified to the level of severity of the cancer (either Benign or Malignant) and enable users to know cancer status hence appropriate treatment will be employed.

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