



Expert System on Breast Cancer Diagnosis

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ABSTRACT

Breast ailments have affected women since the time of the pharaohs, and can be traced back to the beginning of recorded medical history. It still poses a significant threat to the population. Statistics from the National Cancer Institute place breast cancer at the top of the list of all forms of cancers afflicting women and treated there. A prototype (website) was designed which allows the interaction between the patient and the expert system through system's interface. The system approach includes collaborative information provisioning by the community members in additions to other sources of information like online organizations and the experts in the field. Health care facility should be accessible by all at all time. But some of the people that should access these facilities are far removed from these facilities. It would be of great necessity to provide a computerized system that will provide a complementary medical service, such as medical disease diagnosis in places where accessibility is a problem as well as health care facilities where qualified experts are lacking. The new system is designed using MYSQL (my structured query language) server side language for the database, PHP for the programming and authentication aspect and HTML (hypertext mark-up language) for the graphical view of the system.

Keywords: Education, Data Mining, Prediction, Students' Performance & K-Nearest Neighbour Technique Models.

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1. INTRODUCTION

Breast cancer is a malignant tumor (a collection of cancer cells) arising from the cells of the breast. Although breast cancer predominantly occurs in women it can also affect men [3]. Breast cancer is on the rise. Big countries have the most cases but not always the highest incidences and rates in the developing world may be even higher than the official data suggest. Ezzat et.al have discussed in their work about the complete breast cancer statistics of women in Kingdom of Saudi Arabia (KSA) in comparison with the western countries. The data collected by them as per the records from the National Registry of Cancer Tumors under the supervision of the Ministry of Health, it is found that, the infection rates is more in the eastern province when compared to the other major cities in the kingdom. Furthermore, 70% of those infected reach late stages of cancer, reducing the chances of cure and recovery. The reason behind delay in receiving treatment and medical care is the lack of public knowledge about its symptoms, which has created an impact on the overall country resources [3].

Dr. Dalal Tamimi, an award-winning doctor who is working to build a breast cancer research center in Saudi Arabia, confirms the Cultural stigma attached to the disease: "Once [women] know the diagnosis, they keep it as a secret. They don't want anybody to know it, and they don't want to talk about it." [2]. Until recently, the clinical classification of breast cancer has been based on morphologic characteristics of the tumor such as size, lymph node status, histology as well as the expression of particular bio- markers. The high incidence for breast cancer is not unique in Middle East. Study reveals that in USA, most of the women have Breast cancer as a common ailment, which has further focused more to educate the women about early detection, and prevention [4]. Breast cancer has plenty of myths and facts surrounding its causes and risk factors. Although the exact cause has not been identified, several risk factors have been determined

for this disease. Age, hereditary factors, carcinogenic elements, weight, race, age at pregnancy, smoking, alcohol consumption, abortions, and even night shift work are one of the reasons said to have caused breast cancer or increased the risk [4]. Certain changes in DNA can cause normal cells to turn malignant. These alterations to the DNA can be the result of one high risk factor or a combination of multiple risk factors. The problem addressed in this work is the development of expert system for the diagnosis of breast cancer. Artificial intelligence method are to the employed in the development of the system and sub problem can be stated as follow; The need for early diagnosis of breast cancer, the diagnosis of breast cancer require expert skill which are short supply, the need to reduce the mortality and incidence rate by breast cancer and need to improve the overall quality of health through early expert diagnosis of breast cancer.

The main objectives of this work include awareness through education, and providing diagnostic breast care services for those in need. And focus to promote good breast health through breast cancer awareness, education, and research, providing diagnostic breast care service, and to support to women in all social and economic strata.

2. RELATED WORKS

In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert (Jackson, Peter, 1998). Expert systems are designed to solve complex problems by reasoning about knowledge, represented mainly as if-then rules rather than through conventional procedural code. The first expert systems were created in the 1970s and then proliferated in the 1980s [5]. Expert systems were among the first truly successful forms of artificial intelligence (AI) software.

According to [7], the most common form of expert system is a computer program, with a set of rules that analyses information (usually supplied by the user of the system) about a specific class of problems, and recommends one or more courses of user action. The expert system may also provide mathematical analysis of the problem(s). The expert system utilizes what appears to be reasoning capabilities to reach conclusions.

A related term is wizard. A wizard is an interactive computer program that helps a user solves a problem. Originally the term wizard was used for programs that construct a database search query based on criteria supplied by the user. However, some rule-based expert systems are also called wizards. Other "Wizards" are a sequence of online forms that guide users through a series of choices, such as the ones which manage the installation of new software on computers, and these are not expert systems. Breast cancer is on the rise. Big countries have the most cases but not always the highest incidences and rates in the developing world may be even higher than the official data suggest.

The simplest definition of breast cancer is the uncontrolled growth of breast cells. It is found that one out of every seven women will be diagnosed with breast cancer if all live to their full life span in a well-developed country like USA alone, [4].). Ongoing focused research for breast cancer causes and cure is offering new hope for effective treatments that attack the tumor without destroying the surrounding tissue.

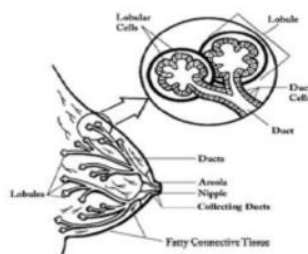


Fig. 1: Normal Breast Structure

2.1 Types of breast cancer

Breast cancer can be subdivided into various classes based on the cells that are affected, the origin of the malignancy and the size and spread of the cancer. The different types of breast cancers can be listed as follows:

1. Ductal carcinoma in situ (DCIS): Most common type of non-invasive breast cancer in which only the duct walls are affected. This type of cancer does not spread through the walls of the duct to the outer tissue and hence is the most curable type of breast cancer.
2. Lobular carcinoma in situ (LCIS): The glands are affected in this particular type of cancer but the cancer is contained within the lobules and does not spread to the outer tissue.
3. Invasive ductal carcinoma (IDC): The most common form of breast cancer in which the malignancy starts in the duct and further invades the tissue from where it can be spread to the distal parts of the body.
4. Invasive lobular carcinoma (ILC): In this type the malignancy originates in the lobules or milk glands and further invades the wall to spread to the rest of the body.
5. Inflammatory breast cancer (IBC): This is a very uncommon type of invasive breast cancer in which there is no defined lump in the breast. Instead the breast skin has a thick red inflammatory look which is actually caused by cancer cells blocking lymph vessels in the skin. Instead, inflammatory breast cancer (IBC) makes the skin of the breast look red and feel warm and gives the skin a thick, pitted appearance that looks a lot like an orange peel. Pathologic changes such as cancer cells in the lymph ducts in the skin (dermal lymphatic) are characteristics of inflammatory breast cancer.

2.2 Diagnosis of breast cancer

Cancer of any type is usually asymptomatic and does not show significant symptoms until it is well advanced. Hence the need to perform a routine screening test is vital in diagnosing cancer at an early stage. Breast cancer if diagnosed well within an early period of time offers high chances of survival for the patient. There are numerous diagnostic procedures and screen tests currently carried out for screening and diagnosis of breast cancer. The screen procedures include:

1. Mammogram: It is a type of imaging technique that uses a low dose x-ray system to examine the breast tissue.
2. Clinical Breast Exam (CBE): A clinical breast examination is a physical examination of the breasts by a certified health professional. These examinations are used in conjunction with mammograms to detect the presence of lumps and also to check for other breast abnormalities such as mastitis or fibro adenoma [6].
3. Breast Self-Exam (BSE): In this test the individual is asked to self-examine the breast for changes in texture, appearance, weight and volume.
4. Magnetic Resonance Imaging (MRI): MRI comprises of powerful magnets that act in conjunction with radio waves to produce computer images showing differences in the number of blood vessels in various types of the tissues in the body. The radioactive dye is picked up faster by cancerous tissue than normal or benign ones. This test is used in conjunction with a mammogram for a full body screen for a complete diagnosis [8].
5. Genetic Test: In case of patients with a strong background history of ovarian and breast cancer a gene test is carried out in which the mutations if any on genes BRCA1 and BRCA2 are studied to predict the risk factor for malignancy.
6. Positron-Emission Tomography (PET): PET is similar to X-rays where instead of cell structure the cell activity is shown. Cancer cells use up sugar faster than normal cells do. PET is highly accurate at diagnosing whether a tumor is cancerous.

2.3 Treatment options for breast cancer

1. Surgery: Surgery is usually the first treatment option for any stage or kind of cancer. The kind of surgery depends on the size of the tumor, the spread of the cancer, the age and sex of the patient. In case the tumor is under 2cms and the cancer is not determined as aggressive, then a more conservative approach for surgery is approached called as lumpectomy. In this kind of surgery only the tumor and affected nodes are removed whereas the breast mass is kept [1].
Chemotherapy: Chemotherapy is the process of administering drugs through the bloodstream and affects the entire system. The treatment is used to target and eliminate the fast growing cancer cells. Unfortunately since these drugs cannot differentiate between healthy and cancer cells but eliminate only fast dividing cells, it also causes considerable damage to healthy cells. For example the cells which are responsible for hair growth or nails [1].
Radiation Therapy: Unlike chemotherapy radiation therapy is more targeted and localized only to affected areas. The radiation treatment can be either external



- or internal. In internal radiation catheters are used to administer the drugs at the specific area. The type and amount of radiation is usually determined by the time of the surgery performed.
2. Hormonal Therapy: Hormonal therapy also involves the whole body and it involves medicine which is used to lower the risk of hormone receptor positive breast cancer. The hormonal treatment is based on the age of the woman and her menstruation and menopausal stages.
 3. Targeted Therapies: These are highly focused treatments in which the protein that enables the rapid growth of the cancer cell is inhibited. This is less harmful to healthy cells in comparison to chemotherapy. These drugs modify the properties of cancerous cells and try and contain the growth.
 4. Complementary and Holistic Medicine: Even though this stream is not considered to be an integral part of medical sciences, it still is an effective option for breast cancer treatment. This treatment is used in complement with surgical procedures or chemotherapy and radiation procedures. Complementary medicine involves a wide range from yoga and meditation to nutrition science and herbal medicines [1].3. System Analysis

In view of the problems inherent in the existing system, it is important to seek for an improvement. This improvement is computerization of the diagnosis system. This new system will be equipped with the following advantages:

1. Proper backup of the knowledge of the human expert
2. Elimination of possible human error, since several experts are involved in the design of such system
3. Distance and accessibility is not a problem
4. The machine does not die
5. The machine is always there to render services
6. Medical history can always be stored and retrieved with ease.

3. TECHNOLOGY OVERVIEW

The technology selected for implementing this paper work is PHP/MYSQL. Apache is used as the HTTP server. The development was done in a windows' environment using Dreamweaver CS5.

PHP

PHP is a server-side scripting language designed primarily for web development but is also used as a general-purpose programming language. Originally created by Rasmus Lerdorf in 1994, the PHP reference implementation is now produced by The PHP Group. PHP originally stood for Personal Home Page, but it now stands for the recursive acronym PHP: Hypertext Preprocessor. PHP code may be embedded into HTML code, or it can be used in combination with various web template systems, web content management systems and web frameworks.

MYSQL

MYSQL is a relational database management system (RDMS) that runs as a server providing multi-user access to a number of databases. MySQL is a popular choice of database for use in web application and is an open sources product.

XAMPP

XAMPP is a free and open source cross-platform web server solution stack package developed by Apache Friends, consisting mainly of the Apache HTTP Server, MariaDB database, and interpreters for scripts written in the PHP and Perl programming languages. XAMPP stands for Cross-Platform (X), Apache (A), MariaDB (M), PHP (P) and Perl (P).

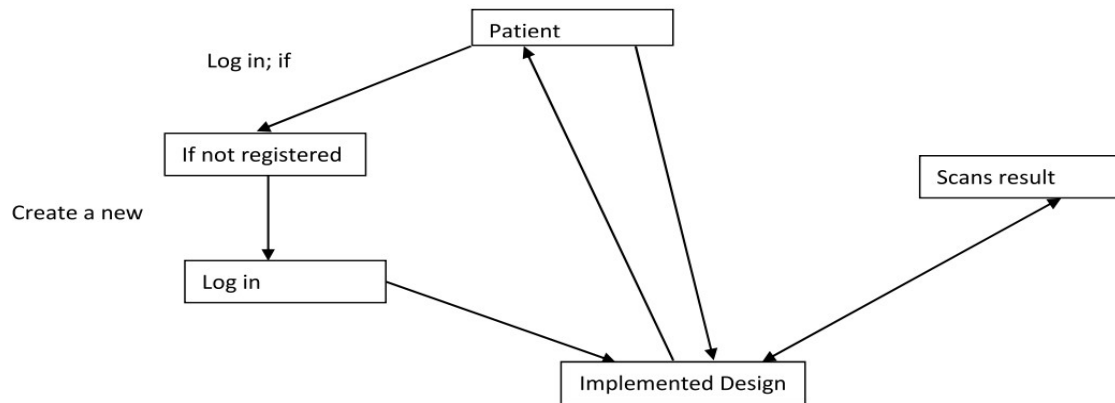


Fig. 2: Information Flow Diagram

4. System Implementation and Maintenance

The New System consists of different modules working together to achieve the goal of the system. The new system consist of the user interface and database.

User Interface



Homepage

Register page

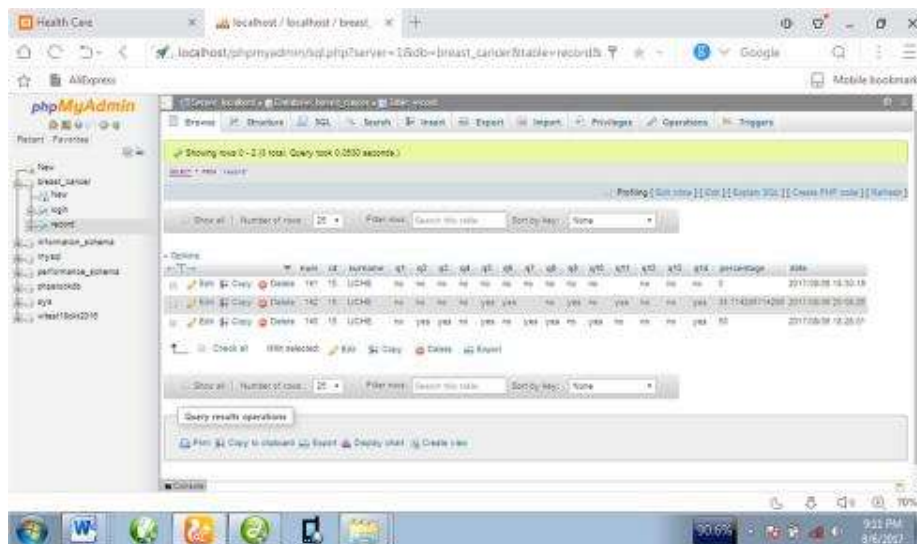
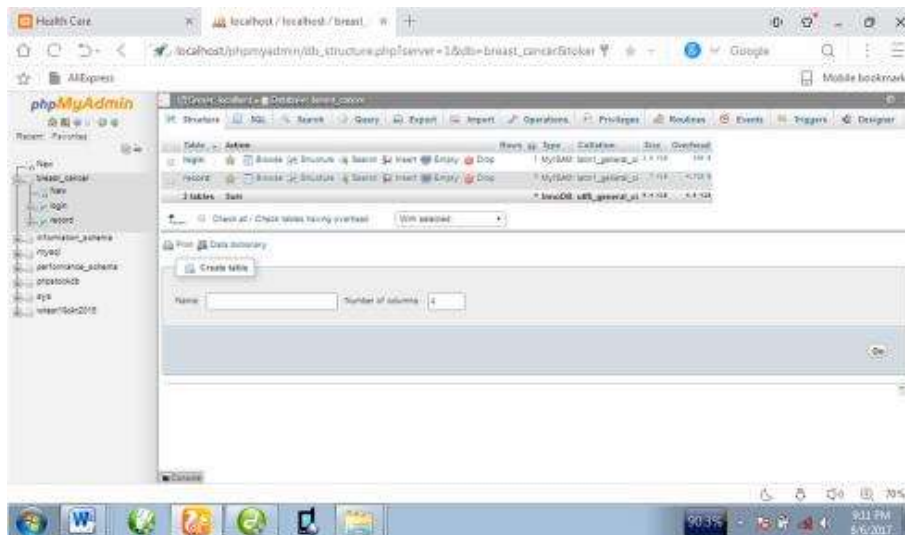


Diagnosis Page



Result Page

Database Interface:





5. CONCLUSIONS

This paper aims to promote breast health through breast cancer awareness, education, and research, providing diagnostic breast care service, and to support to women in all social and economic strata. However, the developed system provides an online diagnosis tool for breast cancer anywhere and anytime for each patient from its knowledge-base. The limitation of this work is the inability to test the system in real time with breast cancer patients.

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