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A Proposed Rule Based System for Breasts Cancer Diagnosis

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Abstract

Breasts cancer is an important issue in all women's life, not just in current life but also was in the past and is in the future. It is a threat for many people females and males. But it affect females more frequency than male.

It is well Known that female breast cancer incidence is the largest in proportion among other type of cancers in general; where the annual breast cancer achieves the largest proportion among cancers.

In this paper the design of the proposed Rule Based System will be presented and the symptoms of the breast cancer disease and possible ways to prevent it will be outlined. The proposed Rule Based System was produced to help people to Prevent and early detection breast cancer, because it is known that this disease does not have medication or cure yet. SL5 Object language was used in the designing of the proposed ruled based system.

Keywords: Expert Systems, Rule Based System, SL5 Object, Beast Cancer

Introduction

The breast is the bandanna overlying the chest muscles. Women's breasts are prepared of dedicated bandanna that generates milk (glandular bandanna) in addition to fatty bandanna. The quantity of fat verify the size of the breast[1].

The milk- generating element of the breast is arranged into 15 to 20 segments, identified as lobes. Inside every lobe is smaller configurations, named lobules, where milk is generated. The milk moves through a network of small tubes named ducts. The ducts join and arrive together into bigger ducts, which ultimately depart the skin in the nipple. The dim region of skin neighboring the nipple is identified as the areola.

Connective bandanna and ligaments offer help to the breast and provide it its form. Nerves offers sensation to the breast. The breast in addition have blood vessels, lymph vessels, and lymph nodes(as shown in figure 1)[1].
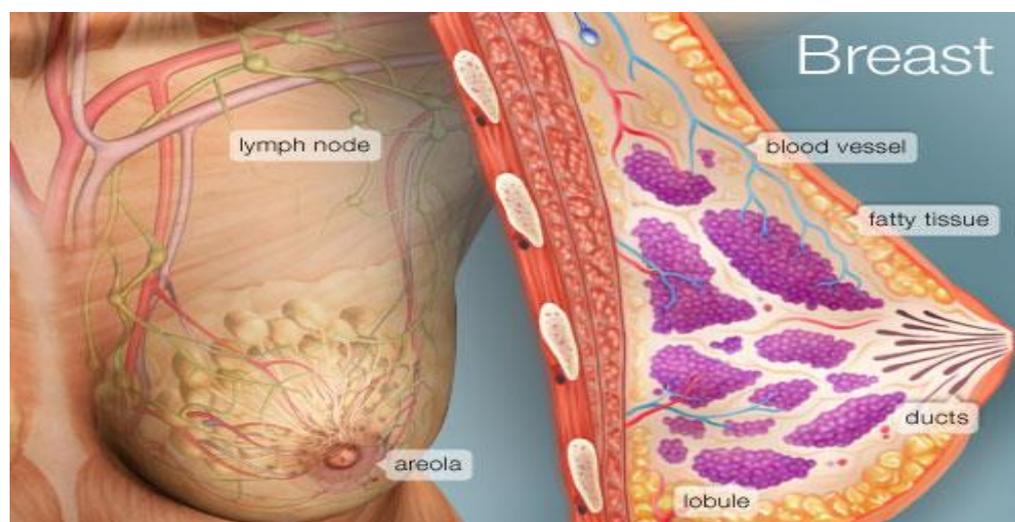

Fig 1: The structure of the breast.

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Breasts cancer is very widespread these days, some people may discover it early on, can be cured and others is in an advanced cases undiscovered and here the situation becomes extra dangerous as the disease grows. Consequently, people must be educated about the seriousness of this disease and its causes, symptoms, prevention techniques and early discovery of the disease[13,14,15].

Expert Systems
An Expert System is a computer application of Artificial Intelligence (AI)[7-11]; which contains a knowledge base and an inference engine; see figure 2 for details.
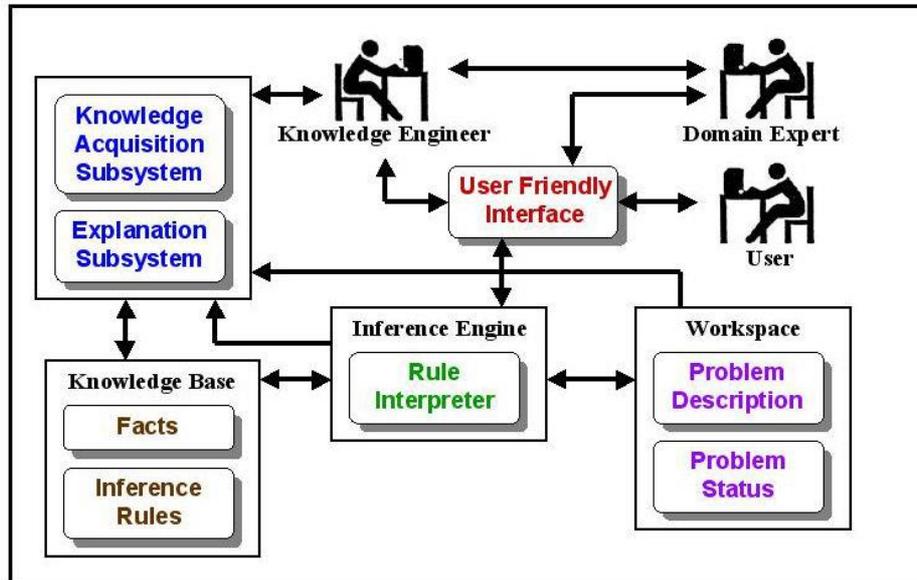

Fig 2: Main Components of an Expert System.

The proposed rule based system for breast cancer diagnosis was implemented using, SL5 Object language, which stands for "Simpler Level Five" Object Language integrated production system"[12]. It is a forward reasoning expert system language that can make inferences. The advantages of SL5 Object expert system language, are implemented in Delphi RAD XE6 Embarcadero for efficiency and portability, developed by Prof. Dr. Samy Abu Naser, and Rule-Based Language[12].

Knowledge Representation
The main source of the knowledge for this Rule based system are cancer diseases specialist and specialized websites for breast cancer diseases. The captured knowledge have been converted into SL5 Object Knowledge base syntax (facts, rules, and objects)[12]. Currently the expert system have 10 questions which cover symptoms that the expert system can help the user with.

Background/ Literature Review
Many expert system were developed in diagnosing problems such as ear, eye, foot, endocrine, neck, low back problems, Urination Problems [6,12,16,-27-31].
Kahn, Charles E., et al. worked on the construction of a Bayesian network for mammographic diagnosis of breast cancer[2], Karabatak, and Cevdet have an expert system that is based on association rules and neural network for detection of breast cancer[3], Cardoso and Cardoso worked towards an intelligent medical system for the aesthetic evaluation of breast cancer conservative treatment[4], Chou, Shieu-Ming, et al. have some work on Mining the breast cancer pattern using artificial neural networks[5]. There are no expert system that directly diagnosis breast cancer. Our system is a rule based system which is designed using SL5 Object to be easy to use and have friendly user interface.

Symptoms of Breasts Cancer
Symptoms of breast cancer in women, may differ from one patient to another; it is likely that a few patients do not show any type of signs or symptoms. Someone can realize that she or he has breast cancer by the regular Mammography.
Some of the signs (Signs are the clinical alteration perceived by the examining doctor whilst symptoms are the changes that the patient himself/herself communicates to the doctor as protests concerning own health's seen changes) which calls the consideration to suppose breast cancer are[13,14,15]:

- Swelling of all or element of the breast, the form of a lump or accumulation in the breast or beneath the axila.
- solidifing or swelling of one element of the breasts.
- Skin annoyance or dimpling of the breast skin.
- Nipple hurting or the nipple turning inward .The patient notices the

Nipple hurt or the nipple turning inward, or the inversion of the nipple backward inside the breast, this is an alarming sign.

- Redness, scaliness of the breasts nipple.
- Nipple release other than breast milk, in addition could be bloody discharge.
- Any alteration in the size or form of the breasts. People should frequently look at their breasts changes in the mirror when they use bathroom from time to time as a routine.

- Pain in any element of the breast.
- A lump in the beneath arm area (Axila).

It may be possible to find some of the above mentioned signs could present in other diseases not related to cancer.

In order to educate the society on helping for an early diagnosis of breast cancer the health society should offer seminars to make people conscious on the regard in the type of lectures, videos and teaching/learning to the public.

Mammography

Mammography is a very important in screening tests for early detection and diagnoses, followed by Echography, Magnetic Resonance (MRI) or biopsy of the affected breast area or lumps.

Fig 3: shows normal and abnormal

As a basic information regarding the procedures to be taken by the doctor in the follow up health care provided by the health care department, the doctor must inform the patients on the followings:

- The meaning of the nipple changes which appears in life and considered not cancer named as benign changes.
- Other diseases not considered under the category of cancer like cysts, Fibroadenomas and Adenosis.
- Diseases that are not cancers but could increase the risk of producing breast cancer, like the Atypical Lobulillar Hyperplasia, Atypical Ductal Hyperplasia, and Carcinoma lobulillar in situ.
- Diseases that are not cancer, but could convert into cancer if not treated properly, like the Ductal Carcinoma in situ.

To the women information, it is wise to tell that if you received an abnormal result in your mammography or if you noticed a change in your breast as a lump or mass or abnormal secretion from your nipple or a change in the skin of your breast. Should read the health care department guide, which explain the significance of breast changes that expected to deliver from the health care social team.

The majority of the founded breast changes through mammography are not considered cancer. However, it is important to consult the health medical provider after you receive the abnormal results of your mammography or after you have noticed a change in your breast.

In the habitual checkup with the Gynecologist, or when the patient visit the doctor because of any symptom, the doctor will realize the clinical history and a physical examination based on the physical exploration of the breasts focusing on the detection of any changes in the consistency, presence of nodes, lymph nodes in the axila or in the supraclavicular fosse, evaluation of the state condition of the skin, and of the nipples. Also he will do you a general physical exploration.

With the obtained information, the doctor will value the need of complementing a series of diagnostic tests.

Diagnostic tests

- Blood and urine test; blood markers CEA and CA 15-3
- Imaging tests: Mammography: It is the most efficient exploration for an early diagnosis of malignant tumors of the breast. Consists of the realization of a special radiography of the breasts with an X-ray apparatus designs for this object. With very low dose of radiation (0.1 to 0.2 cGy per 1 radiography) enabling us to detect a multiple findings, fundamentally the breast cancer including in its very early stages in progress. It is a simple painless test, uncomfortable in some occasions, due to the fact that we must pressure over the breast in order to get a better imaging quality of the breast. Realizing it in projections for each breast. If the breast injury (Lump or mass) is benign then we recommend the repeating of the mammography after 4-6 months.

If we obtain a suspicious malignant image, the doctor will order more advanced imaging tests to identify the nature of the lesion (injury) like echography, MRI nuclear magnetic resonance imaging and or Biopsy.

Mammography has its limitations, especially in young women due to having a thick glandular tissue density. In this case, we complement the tests with an echography.

It is very important to compare the newly taken mammography images with old ones taken before in previous years.

What we can be seen with Mammography

With mammography, we can appreciate a series of signs, which shows with enough precision, if the lesion is suspicious of malignity or not. Within other non-malignant lesions such as;

- Calcifications that could correspond to benign tumors. Also to malignancies but less frequently.
- Masses could correspond to benign lesions like in the case of Fibroma, or malignancy. They could contain calcifications or not.
- Cysts, a cyst is a collection of fluid in an interior of a small lobulle inside the breast. The diagnostic

exploration must be completed with a breast echography. Evacuation of the fluid could be done to be analyzed and studied histologically. It is rare the cyst to be malignant.

What to do if the mammography is not normal

-Echography (Ultrasonography) it is a painless simple test that could be done in few minutes. It is a complimentary test to mammography. Helps to differentiate between the fluid content of a cyst (which is frequently benign) from the solid masses that could be malignant.

It is useful in the case of dense breasts where mammography has less capacity to define the nature of the tested lesion.

Ductogram or Galactogram

- Consists in the injection of a contrast in one duct of a mammary gland through the nipple and observe the image with X-ray in order to detect small intraductal masses. This technique is used in those cases with bloody nipple discharge.
- Ductoscopy, it is a minimally invasive technique consisting in the introduction of a small endoscope through the galacoforos ducts. It is useful in the early diagnosis while under investigation.
- (MRI) Nuclear Magnetic resonance; an imaging technique based on the emission of Radio waves whose energy is absorbed by the different tissues.

Modification aspects to reduce the risk of suffering breast cancer

The breast cancer could not be avoided but recent studies seems to demonstrate that the risk of getting breast cancer could be reduced realizing physical exercises in regular form for at least 4 hours/week. Avoiding overweight and obesity after menopause[ ].

Also through epidemiological studies, it has been demonstrated that the use of hormonal substituent therapy during menopause is associated with increased risk of getting breast cancer. So you may avoid the substitutive hormonal therapy after menopause.

If there are some familiar cases within your family of breast cancer then it is advisable and convenient to seek genetic advice to determine whether you have a genetically mutation BRACI, BRAC2.

Women who has high risk of getting breast cancer must discuss with their doctor the variety of therapeutically options. The patient together with the doctor must evaluate the advantages and the inconveniencies of each type of treatment and decide which is the most adequate one.

The therapeutically possibilities are the frequent revisions, prophylactic mastectomy and Chemoprevention.

What is the genetically advice?

It is the genetic patron study of the patient with tumor cancer of the breast.

In first place, a family history study is realized to identify the number of affected next family members, at which age they were diagnosed of the malignant tumor and the degree of relatives staging, mothers, sisters, cousins, etc.

Practical Advices

The medical Oncology is interested to give an impulse and promoting the formation and functionality of Units of Genetical advice together with the services of information to patients and families affected with a genetical mutation of the gen BRCA, delivering the pepper advices of anti-conceptive treatment or regarding pregnancy, together with how to realize and identify an early breast injury(Tumor) and assist supporting in taking decisions for preventive surgeries like Mastectomy or oophorectomy (extirpation of the ovaries in females) or medical therapy like Tamoxifen.

Conclusion

In this paper, I presented some treats of breasts cancer and some of symptoms. That can help the reader to know about breasts cancer and its symptoms and how they can discover it. A proposed expert system was presented for help Tumors in diagnosing patients. Tumors and breast cancer diagnosis can get the information about what they can do and some advantage. This expert system can deal with it easily and simply. It was developed using CLIPS Shell.

Future Work

this expert system must to be important in our life, more information planned to be added and to make it more available and flexible by the users anytime and anywhere.

Expert System Source Code

```
! Breast Problems in Women Expert System
! Written By Bashar Bastami
!
ATTRIBUTE One Do you have swelling and tenderness in
one or both breasts COMPOUND        Yes, No
ATTRIBUTE Two Have you given birth recently
COMPOUND   Yes, No
ATTRIBUTE Three Did the tenderness start recently and
do your breasts feel fuller and heavier COMPOUND  Yes,
No
ATTRIBUTE Four  Do the swelling and tenderness seem
to occur at about the same time during every menstrual
cycle COMPOUND Yes, No
ATTRIBUTE Five Do you feel thickened bumpy areas
throughout your breast COMPOUND Yes, No
ATTRIBUTE Six Do you feel a tender lump smaller than a
penny that wasnt there last month COMPOUND Yes, No
ATTRIBUTE Seven Do you feel a painless lump that is
deep in your breast possibly attached to your ribs
COMPOUND  Yes, No
ATTRIBUTE Eight Are you breastfeeding and having pain
and cracking of the nipple COMPOUND
Yes, No
ATTRIBUTE Nine Have you noticed any breast changes
such as skin dimpling or puckering COMPOUND Yes, No
ATTRIBUTE Ten Do you have a sore on your breast that
wont heal COMPOUND
Yes, No
ATTRIBUTE start SIMPLE

INSTANCE the domain ISA domain
   WITH start := TRUE

INSTANCE the application ISA application
 WITH title display := introduction
 WITH conclusion display :=  Conc
 WITH numeric precision := 8
 WITH simple query text := "
  *?
```

is
*"
 WITH numeric query text := "What is the value of :
*
of
*"
 WITH string query text := "What is(are):
*
of
*"
 WITH time query text := "What is(are):
*
of
*"
 WITH interval query text := "What is(are):
*
of
*"
 WITH compound query text := "
*?
of
*"
 WITH multicompound query text := "What is(are):
*
of
*"

INSTANCE introduction ISA display
 WITH wait := TRUE
 WITH delay changes := FALSE
 WITH items [1] := textbox 1

INSTANCE textbox 1 ISA textbox
 WITH location := 10,10,800,350
 WITH pen color := 0,0,0
 WITH fill color := 100,200,100
 WITH justify IS left
 WITH font := "Arial"
 WITH font style IS bold
 WITH font size := 14
 WITH text :="
Breast Problems in Women Expert System

Written By Bashar Bastami

This Expert system is an example of Simpler Level 5 Object (SL5 Object) that
Demonstrate the use of some of the System classes, Instances, Rules, etc.

This Expert System diagnoses Breast Problems in Women through a dialogue between the
System and the End User.

The Conclusion of the finding is displayed and a recommend is given for the End User
to diagnoses the Diseases."

INSTANCE Conc ISA display
 WITH wait := TRUE
 WITH delay changes := FALSE
 WITH items [1] := title textbox
 WITH items [2] := diagnosis textbox
 WITH items [3] := recommend textbox

INSTANCE title textbox ISA textbox
 WITH location := 20,10,800,70
 WITH pen color := 0,0,0
 WITH fill color := 200,200,100
 WITH justify IS center
 WITH font := "Arial"
 WITH font style IS bold
 WITH font size := 14
 WITH text := " The Conclusion of the Breast Problems in Women Expert System"

INSTANCE diagnosis textbox ISA textbox
 WITH location := 20,110,800,130
 WITH pen color := 0,0,0
 WITH fill color := 170,170,170
 WITH justify IS left
 WITH font := "Arial"
 WITH font size := 12
 WITH text :=" --===--"

INSTANCE recommend textbox ISA textbox
 WITH location := 20,280,800,130
 WITH pen color := 0,0,0
 WITH fill color := 170,170,170
 WITH justify IS left
 WITH font := "Arial"
 WITH font size := 12
 WITH text :=" --===--"

RULE R0
IF start
THEN ASK One Do you have swelling and tenderness in one or both breasts

RULE R1
IF One Do you have swelling and tenderness in one or both breasts IS Yes
THEN ASK Two Have you given birth recently
ELSE ASK Six Do you feel a tender lump smaller than a penny that wasnt there last month

RULE R2
IF Two Have you given birth recently IS Yes
THEN text OF diagnosis textbox := " Soon after giving birth, your breasts could become engorged with milk, causing swelling and tenderness."
AND text OF recommend textbox := " If your breasts are engorged, applying warm compresses to the breast and gently expressing some milk may help. "
ELSE ASK Three Did the tenderness start recently and do your breasts feel fuller and heavier

RULE R3
IF Three Did the tenderness start recently and do your breasts feel fuller and heavier IS No
THEN ASK Four Do the swelling and tenderness seem to occur at about the same time during every menstrual cycle
ELSE text OF diagnosis textbox := " You may be PREGNANT. Changes in the way your breasts feel, fatigue, nausea and frequent urination are some of the early signs of pregnancy."
AND text OF recommend textbox := " Take an at-home pregnancy test. If it's positive, see your octor."

RULE R4

IF Four Do the swelling and tenderness seem to occur at about the same time during every menstrual cycle No

THEN ASK Six Do you feel a tender lump smaller than a penny that wasnt there last month

ELSE ASK Five Do you feel thickened bumpy areas throughout your breast

RULE R5

IF Five Do you feel thickened bumpy areas throughout your breast IS No

THEN text OF diagnosis textbox := " Your symptoms may be a result of HORMONAL CHANGES during your menstrual cycle. If you also have irritability, trouble sleeping and mood changes, you may have "

AND

text OF recommend textbox := " Over-the-counter medicines may help relieve bloating and tenderness. Ibuprofen or naproxen may be helpful for painful periods"

ELSE text OF diagnosis textbox := " Your symptoms may be caused by FIBROCYSTIC DISEASE."

AND text OF recommend textbox := " Carefully check this lump for a month. If it doesn't go away or it changes, see your doctor."

RULE R6

IF Six Do you feel a tender lump smaller than a penny that wasnt there last month IS Yes

THEN text OF diagnosis textbox := " This lump may be a noncancerous GROWTH or CYST."

AND text OF recommend textbox := " Carefully check this lump for a month.

 If it doesn't go away or it changes, see your doctor."

ELSE ASK Seven Do you feel a painless lump that is deep in your breast possibly attached to your ribs

RULE R7

IF Seven Do you feel a painless lump that is deep in your breast possibly attached to your ribs IS Yes

THEN text OF diagnosis textbox := " A painless, firm lump may be a

 sign of a more serious problem, such as BREAST CANCER."

AND text OF recommend textbox := " See your doctor as soon as possible."

ELSE ASK Eight Are you breastfeeding and having pain and cracking of the nipple

RULE R8

IF Eight Are you breastfeeding and having pain and cracking of the nipple IS No

THEN ASK Nine Have you noticed any breast changes such as skin dimpling or puckering

ELSE text OF diagnosis textbox := "Persistent pain and cracking in the nipple with breastfeeding could mean INFECTION, or it could mean that your baby is not latching properly."

AND text OF recommend textbox := " Try a lanolin ointment on your nipple. If it doesn't help, see your doctor or a lactation consultant."

RULE R9

IF Nine Have you noticed any breast changes such as skin dimpling or puckering IS No

THEN ASK Ten Do you have a sore on your breast that wont heal

ELSE text OF diagnosis textbox := " These changes may be a sign of a serious problem, such as BREAST CANCER."

AND text OF recommend textbox := " See your doctor as soon as possible."

RULE R10

IF Ten Do you have a sore on your breast that wont heal IS No

THEN text OF diagnosis textbox := " ------ "

AND   text OF recommend textbox := " For more information, please talk to your doctor. If you think your problem is serious, call right away. "

ELSE text OF diagnosis textbox := " A nonhealing sore on the breast could be a sign of a serious problem."

AND text OF recommend textbox := " See your doctor."

END

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