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Female Self Hormone Analyzer using Decision Tree and Electronic Sensor

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***Abstract*—** Breast cancer and infertility are the universal problem, the recorded data from hospitals can be used to develop a decision tree to analyze the risk of breast cancer. Estrogens, Progesterone, FSH and LH are natural hormones that are important in sexual development and other body functions. Circumstances that raise your lifetime estrogen levels or lengthen the amount of time your body gets exposed to these hormones may increase your breast cancer risk. FSH and LH levels, on the other hand, seem to exert dual actions in premenopausal and postmenopausal breast cancer patients. An electronic sensor can detect low levels of estrogen (E2), the primary estrogen hormones, FSH and LH in liquids (BLOOD). The electronic sensor attached to the device senses the presence of these hormones and further tests these hormone levels in bodily fluids using decision tree concept in machine learning. This system senses the amount of these hormones secreted in the women's body fluid (BLOOD) using electronic sensor connected to the kit. Using decision tree it tests the range of secretion of hormones based on age. When the level of secretion of these hormones is abnormal (less or higher than normal range) it alerts the individual for early diagnosis by sending SMS to their registered mobile number.

***Keywords*—** Fuzzy logic, MATLAB, Seriousness, Decision supporting system, Tumor, Node, Metastasis, Estrogen

I. INTRODUCTION

Cancer is a global killer disease, taking 7.6 million lives across the world each year and infertility is also a major problem in day today's life. Cancer is a global epidemic disease, affecting all ages and all socio-economic groups. Breast cancer is the leading cancer among women. One in ten of all new cancer that are diagnosed worldwide each year is the cancer of the female breast and it is the most common cancer in women in both developing and developed countries. It is also the principal cause of death from cancer among women universally**.** Breast cancer in women is a major health issue worldwide. In India breast cancer leads cervical. Machine learning in medical diagnosis is increasing because of the improved effectiveness of classification and recognition systems to help medical experts to diagnosing breast cancer [14].

Geocomputation facilitated data collection and statistical report generation. However advanced autonomous techniques in exploratory analysis were not widely adopted [6]. For making a decision, enormous data are required from various sources. But it is a time consuming procedure for any data-base.

Nowadays, medical databases have accumulated large quantities of information about patients and their medical conditions. The existing techniques were unable to derive conclusions when the diagnosis of disease involves several levels of uncertainties. The computational intelligence techniques such as decision trees as well as neural networks are important tools for the rule extraction and data understanding [19]

The breast cancer and pcos seriousness has been predicted by extracting the knowledge from the data. Out of 940 data the complete history of the breast cancer patient has been obtained from 843 breast cancer cases. The parameters that are taken in account for the study of breast cancer data are location, age, sex, education, family grade, number of children, stage of diagnosis the level of Tumour [T], Number of Lymph Nodes [N] and Metastasis [M], treatment, heredity and the period of illness. This data was used for the analysis.

From the medical databases, the association between clinical, pathological and sociological factors and recurrence free survival in the breast cancer patients can be observed. The most applied intelligent techniques were Neural Networks, genetic algorithms, fuzzy techniques and knowledge based expert system.

II. METHODOLOGY

Many of the cells throughout our body both healthy and cancerous cells contain estrogen receptors. These receptors are a type of protein molecule that stimulates cell growth

when they come in contact with estrogen. Estrogen circulates through our bloodstream, and gets attached to the estrogen receptors in cancerous cells, causing them to divide and accumulate in your body. In the absence of estrogen, the cells stop growing and eventually die.

Circumstances that raise your lifetime estrogen levels or lengthen the amount of time your body gets exposed to these hormones may increase your breast cancer risk.

Estrogen is a tiny molecule. It has big effects on humans and animals. Estrogen is one of the main hormones that regulates the female reproductive system that would monitor and can track the human fertility.

TABLE I. ESTROGEN CHART

Average Estrogen Levels	
Age (yrs)	**Estrogen level (pg/ml)**
• 20 – 29	• 149
• 30 – 39	• 210
• 40 – 49	• 152
• 50 – 59	• 130

The table I give the normal hormone range for different ranges. The estrogen level varies depending on a person's age ranging from 20 to 29, the average estrogen level is 149 pg/ml and will increase to 210 pg/ml for females 30-39. For women over 40 has a range of 152 pg/ml that are not yet in menopause. The estrogen level for 10-20 pg/ml will produce a variety of symptoms including fatigue, night sweats, vaginal dryness, and memory impairment, irritability, mood swing, and feel exhausted. Estrogen levels more than 200 pg/ml causes obesity, exogenous intake (medications), stress, cardiovascular disease, mood swings, anxiety, depression and insomnia.

The figure 1 represents the Decision tree for the estrogen hormone secretion based on age. The figure 2 shows the necessary weka code to be runned on weka explorer. For this we have to write the attributes in Excel and save the file with the extension .csv and then open it in notepad. Then we should write two to three lines of code as.arff.

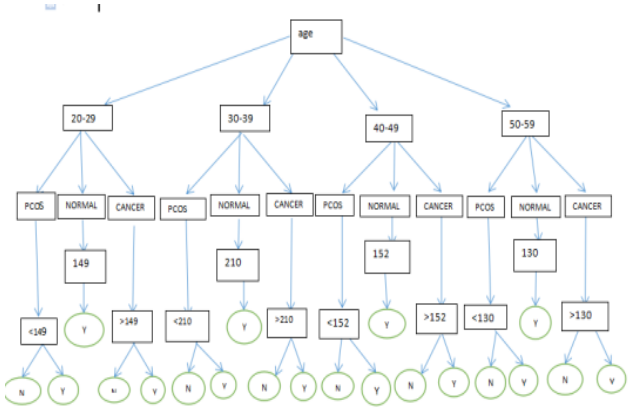

Figure 1 Decision tree

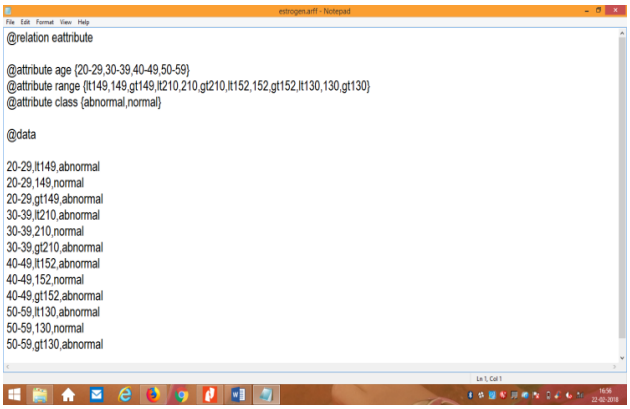

Figure 2. Weka Code

In the Figure 3 the program has been running in the weka explorer by choosing the j48 decision tree algorithm. For analysis we use j48 algorithm.

Decision tree J48 is the implementation of algorithm ID3 (Iterative Dichotomiser 3) developed by the WEKA project team. Behind the idea of a decision tree we will find what it is called information gain, a concept that measures the amount of information contained in a set of data. It gives the idea of importance of an attribute in a dataset. Information gain is the mathematical tool that algorithm J48 has used to decide, in each tree node, which variable fits better in terms of target variable prediction. Here we calculate the confusion matrix. This matrix tells us the attributes and the probability of the results and gives us the result values.

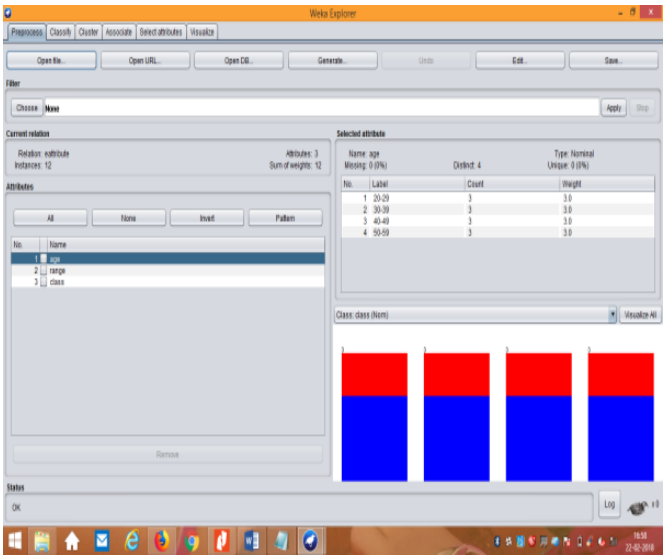

Figure 3. Weka Explorer

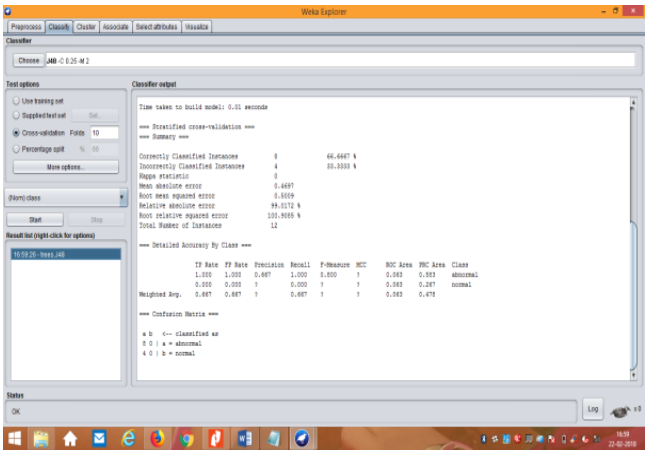

Figure 4. Result Analysis.

The figure 4 shows the result analysis based on j48 algorithm. It shows the number of correct and incorrect instances and calculates the gain and shows us the result. Average lifecycle progesterone reference for females:

- 5 to 9 years of age: 0.6 ng/mL
- 10 to 13 years of age: 10.2 ng/mL
- 14 to 17 years of age: 11.9 ng/mL
- Early follicular phase: 0.6 ng/mL
- Late follicular phase: 14.5 ng/mL
- Luteal phase: 31.4 ng/mL
- Mid-cycle: 16.1 ng/mL
- Postmenopausal: 0.2 ng/mL.

In the similar way we can predict the early occurrence of PCOS by referring to the hormone ranges given above.

III. ARCHITECTURE

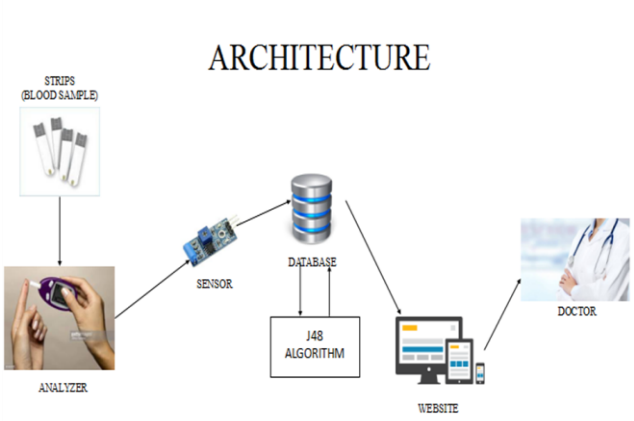

Figure 5. Architecture of Female Self Hormone Analyzer

The system architecture is shown in figure 5. This system senses the amount of estrogen, progesterone, FSH and LH hormones secreted in the women's body fluid (BLOOD) using electronic sensor connected to the kit. Using decision tree it tests the range of secretion of hormones in the given blood samples and diagnose based on age. When the level of secretion of these hormones is abnormal (less or higher than normal range) it alerts the individual for early diagnosis by sending SMS to their registered mobile number. If the abnormality persists for more than 5 months then the condition has to be seriously considered and the individual is advised to consult the doctor.

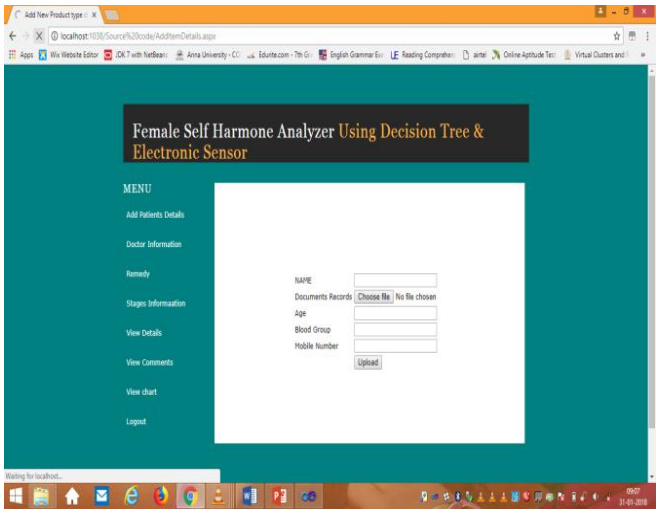

Figure 6. Registration Page

The figure 6 shows the registration page and we can view all the details of previous checkups using this webpage. An electronic sensor can detect low levels of estrogen (E2), the primary estrogen hormones, in liquids. The sensor sends an electronic signal is the presence of estrogen and, further

tests estrogen levels in bodily fluids or else test waterways for estrogen contamination that might pose a risk to humans and the environment. The devices use small snippets of DNA called aptamers to latch onto estrogen molecules. When it senses high level of estrogen using electronic sensor i.e., when the decision tree answer is yes then it transfers the secretion rate to raspberry pi which is connected to a Wi-Fi module and GSM. Then the data is stored in the database and sent an alert with the range of secretion to the victim mobile with the help of GSM and Wi-Fi module. The abnormal change in hormone secretion that helps them to go for a medical diagnosis.

IV. CONCLUSION AND FUTURE WORK

Computational methods for problem solving arrive at conclusion through a series of procedures and noise reductions. Using decision tree it tests the range of secretion of hormones in the given blood samples and diagnose based on age. When the level of secretion of these hormones is abnormal (less or higher than normal range) it alerts the individual for early diagnosis by sending SMS to their registered mobile number. If the abnormality persists for more than 5 months then the condition has to be seriously considered and the individual is advised to consult the doctor. In this system we just analyze the hormone range and monitor it every month and if any abnormality is found to persist for more than five months we predict that the individual might have PCOS or breast cancer(maybe Fibroadenosis also). Therefore in future we can evaluate them based on breast cancer stages also and we can even evaluate each hormones based on hormones range on normal days and hormone ranges during menstrual and pregnancy stages.

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