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Diagnosis of breast cancer tumor type

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Abstract
The most common types of cancer are breast, lung, colorectal, and prostate cancer, while colon and liver cancer are the leading causes of cancer deaths. Cancer poses a significant risk to public health due to premature mortality, reduced productivity, high treatment costs, and long-term impacts on quality of life. Early diagnosis and effective treatment can lead to successful outcomes for many cancer patients. In cancer research, early detection of breast cancer affects the prognosis and longevity of the patient. Artificial methods and data pre-mining are among the ways to assist in this case. The purpose of this article is to design and evaluate a new automatic computer diagnosis system for predicting the type of breast mass by using a fuzzy combination of regression methods.

Keywords: Breast Cancer, SAM AI , Artificial Intelligence, Regression, Diagnosis, Tumor, Chemotherapy

Introduction

Breast cancer is the most common cancer in women[1][2]. Every year, one million new cases of this disease are diagnosed. Due to some significant advances in treatment, about 25% of breast cancer patients die each year due to this disease[3].The perception and mortality rate of breast cancer is different in races and geographical locations, and various environmental mechanisms, somatic changes such as mutations in oncogenes, tumor suppressor genes and genetic polymorphisms are among the factors that exist in it.Currently, American women have a 1 in 1 chance of developing breast cancer and it causes about 100 deaths each year. In up to out of people, this disease is the most common cause 44,000 women are affected. Although mortality from cancer in Iranian women. The prevalence of this disease before the age of 25 to 30 is rare, but the occurrence of this cancer at younger ages has also been reported.Breast tumors are Breast tumors are divided into benign and malignant. tumors are divided into benign and malignant. Benign tumors are rarely fatal .But a number of benign breast tumors can also Increase the risk of breast cancer. Tumors Malignant is more serious and is considered cancer. Researcher, The death of women due to breast cancer is caused by the high death rate and late diagnosis of this disease.With early detection of breast cancer and progress in treatment The survival rate of patients with this disease is increasing. Timely diagnosis of breast cancer (up to 5 years after the first cancerous cell division) increases the chance of survival of a cancer patient from 56% to 86%[9]. Therefore, the existence of an accurate and sure system for early detection of benign or malignant cancerous mass seems necessary. Although the most common and The most definitive method for diagnosing breast cancer is breast biopsy and diagnosis of the lesion with the usual histopathology methods, but since 70 to 80% of surgical biopsies are related to benign breast masses, doing this type of surgery is not only a waste of money, but also causes will be It causes anxiety, stress and anxiety in the patient[10]. Needle aspiration test (FNA)[1] is a low-cost, easy, fast, high-precision method with almost no side effects and can be performed on an outpatient basis[11]. In the FNA method, the fluid extracted from the b reast tissue is tested for cytological characteristics. After extracting the patient's cytological characteristics, it should be possible to distinguish whether the mass is benign or malignant. In cases where it cannot be determined whether it is benign or malignant. With the diagnosis of this disease, the use of computer algorithms and machine learning techniques is a good guide for doctors. By using the properties extracted from the needle aspiration test and with the help of machine learning techniques, an efficient system can be designed to detect breast cancer with high accuracy.

2.Sample Selection

This is a descriptive, retrospective study recording needle aspiration data from breast cancer patient records at a Wisconsin hospital[12]. The database dataset contains 569 samples with 32 features. The basis of the first step in creating any software model of data mining and machine learning techniques is the pre-processing[2] stage. There is no sample in this database, even though in the pre-processing stage by removing the sample. column, we continued with 569 samples and 31 columns. In this database, it was shown that there are 357 benign samples (62.741%) and 212 malignant samples (37.259).

[1] Fine needle aspiration
[2] Preprocessing

3.Parametric methods such as selection of effective features in breast cancer diagnosis

To investigate the effect of each feature in breast cancer diagnosis using quadratic classification, linear classification and closest mean classification parametric models, from The method of selecting the feature ahead is used and it is the best We select the features that play a role in breast cancer diagnosis in each of the models. For this purpose, first in each of the models, we check the results with only one feature and select the it shows the feature with the highest accuracy, then we add the rest of the features to the feature selected in the previous step and measure the accuracy of the model using binary features. From the set of binary features, choose the set with the highest accuracy and we add the rest of the features to it and measure the accuracy of the model. It shows the feature with the highest accuracy, then we add the rest of the features to the feature selected in the previous step and measure the accuracy of the model using binary features. Among the set of binary features, choose the set with the highest accuracy and we add the rest of the features to it and measure the accuracy of the model. which in this sample shows the accuracy of Train (98.74), Test (98.24).

4. Chemotherapy

Triple negative breast cancer is a highly aggressive subtype that does not express PgR, ER, and ERBB2 receptors. It accounts for 10-15% of cases and has a poor prognosis. Chemotherapy, particularly with taxanes, is the main treatment option, but the average survival for metastatic patients is only 18 months. Chemotherapy's limited effectiveness is due to factors like the tumor microenvironment and drug resistance development. Suboptimal dosages are used to minimize side effects, contributing to treatment failure[13].

5.Immunotherapy

The tyrosine kinase receptor human epidermal growth factor receptor 2 (Her2) acts as a molecular switch for breast tumors. In 25% of breast tumors, it is upregulated due to aberrant gene ampli□cation. Dimerization of Her2 is crucial for signaling cascade activation promoting the survival of the cells via the Ras–Raf–mitogen-activated protein kinase, ERK kinase (MEK)/ ERK pathway. Consequently, this discovery aided in the discovery of trastuzumab, which is the □rst
targeted anti-kinase therapy based on genomic research. The Food and Drug Administration (FDA) approved trastuzumab for invasive breast cancer therapy involving the overexpression of Her2[14].

6.Engineering AuNPs with antibodies

Antigens present in cancer cells are able to assist in treating cancer via immunotherapy. Speci□c cancer cells produce their own signi□cant antigens i.e. tumor-associated antigens (TAAs) by cellular gene mutation of aberrantly expressed normal genes. In BC, mutated as well as genes those are over-expressed in breast tissues produce different antigens. The antigens found in BC include human epidermal growth factor receptor 2 (HER2), carcinoembryonic antigen (CEA), mucin-1 (MUC-1), carbohydrate antigens (CA-15, Tn, TF, and STn) which are overexpressed and produced by abnormal or immature glycosylation of different amino acids i.e. serine and threonine, human telomerase reverse transcriptase (hTERT), and p53 – the most common tumor suppressor gene found mutated in cancers[15].

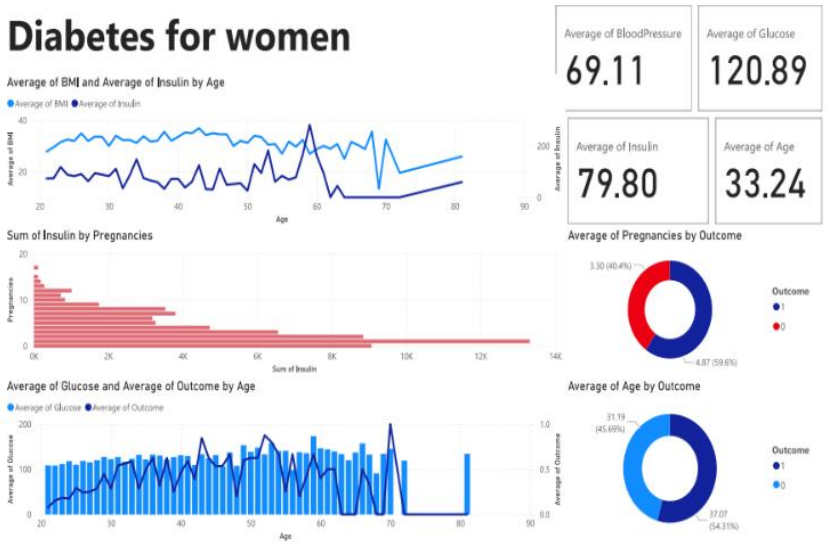
2- Methodology

And today, based on breast cancer research, the SAM AI team has specifically developed a predictive cancer and diabetes detection system for women and men. This system considers various medical parameters and features to accurately predict the probability of infection. Some of the characteristics considered are: number of pregnancies, glucose level, blood pressure, skin thickness, insulin level, body mass index, DPF, age and other characteristics that cause disease. By collecting user information and By analyzing these medical parameters, this system can accurately predict the type of breast cancer tumor, diabetes, etc. in women and men. Some of the important questions that are asked to the user are:

1. Smoking habits
1.2. Duration and type of smoking
2. Alcohol consumption
3. Marital status
4. Blood group
5. Number of pregnancies
6. Family history of diabetesر
7. Weight
8. Medical history
9. Drug use, and Moore

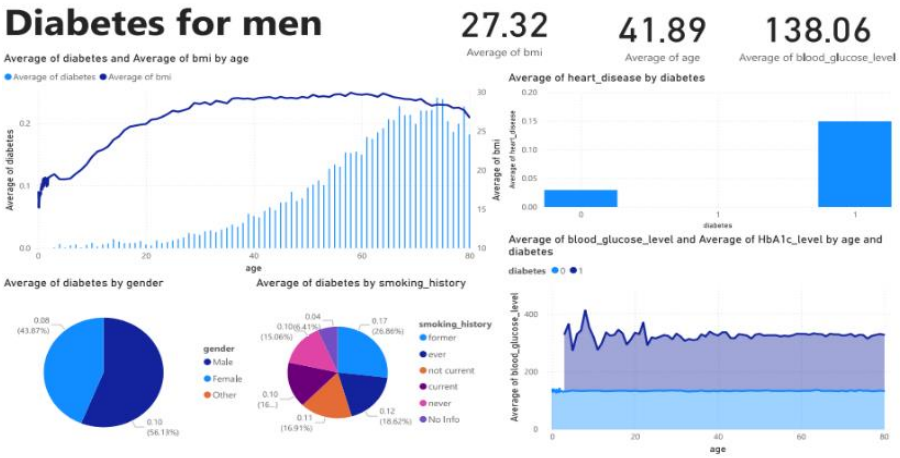
According to the chart "Tab.1" created by SAM AI as a powerful data analysis tool, Analysis and visualization of diabetes data in men and women. In this analysis, linear regression equation was used to achieve the highest possible level of detection accuracy, that is 97%, and detailed relationships and accuracy were brought to them. And as you can see in the chart "Tab.2" like "Tab.1" includes information about diabetic patients such as blood pressure, insulin level, glucose level, Age, BMI and treatment outcomes. SAM AI separates the disease section for men and women from visual reports to show important patterns and relationships using line maps, scatterplots, and more.

(1)



1.The clustered bar chart displays insulin levels in pregnancy.
2.The line chart shows the relationship between insulin, age, and BMI.
3.In the donut chart, the average age relationship with the result shows that 54% of 37-year-olds are diabetic.
4.In the second donut chart, the average by pregnancy shows that 59% of pregnant women are diabetic.
5.The line and stacked column chart show age and average glucose levels based on the individual's positive and negative test results.

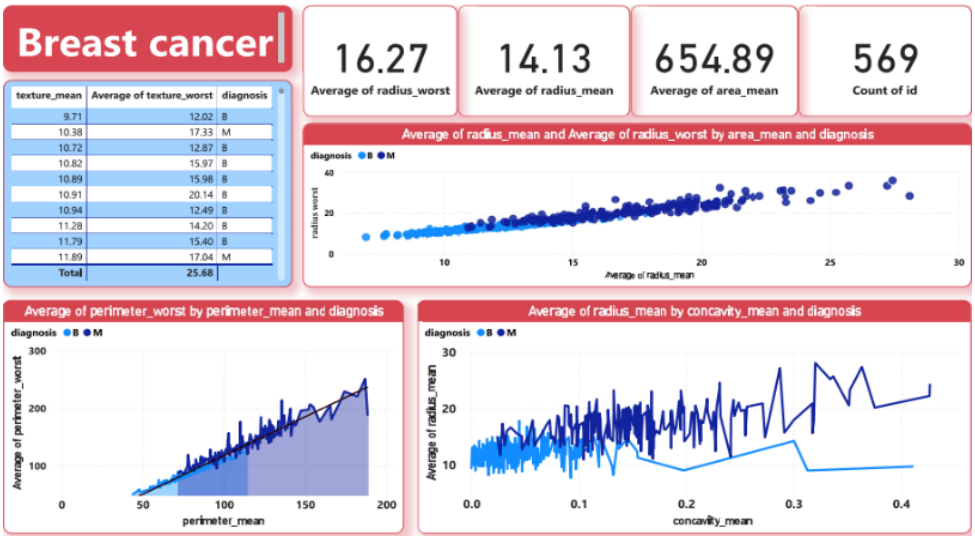
(2)



2 .Tumor type of breast cancer

The second and most important part of this artificial intelligence is breast cancer tumor diagnosis. According to the diagrams "Tab.3" in this section, the system can detect the type of breast tumor in the patient based on the information provided. Doctors can use this section to determine the amount

(3)



type of tumor in the patient in the shortest possible time and speed up the patient's recovery process. Features used in the diagnosis of breast cancer tumor type include: average radius, texture, perimeter, area, smoothness, compactness, concavity, concave points, symmetry, fractal dimension, worst texture, perimeter, and other features. This system sends a PDF containing plots and line graphs predicting the individual's disease based on the information received about the patient's tumor type. This artificial intelligence has a recommendation and consultation system that provides all the information and diseaseanalysis to the doctor and user. This system can provide powerful predictions in various environments and wide-ranging diseases using medical and psychological parameters.

3- Results

First, precision, accuracy, sensitivity and specificity indices In the simulation of each of the regression methods, it is clear in the graphs. As shown in the graphs, the data set used in this paper is calculated, regression methods alone can compete with other methods designed to detect and predict the type of breast masses. As mentioned earlier, the decision-making system A proposed group has been carefully investigated by combining regression methods[17] With the forward feature selection method and machine learning line techniques, in addition to achieving high accuracy in disease diagnosis, the main factors and characteristics in breast cancer diagnosis were also identified. It seems that this feature is one of the most important factors to help in the early detection of breast cancer.

4- Conclusions

Investigating the performance of the proposed group decision-making system In this article, with the indicators of accuracy, precision, review and The specificity of this system was shown in predicting the type of mass Breast and its classification into benign and malignant It has been successful. This shows that the composition Fuzzy regression methods, competition with other methods Designed to predict the type of breast cancer and the software designed based on it can be as A decision support system to assist the physician and education Useful for medical students.

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