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Improved Model for Menopause Management using Artificial Neural Network (ANN)

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ABSTRACT: A woman experiences a variety of physical and emotional symptoms during her menopause, which is a normal stage of life. One technological development that is revolutionizing women's health by offering efficient treatment options is the Artificial Neural Network (ANN). By providing doctors with promising answers to the complicated menopausal symptoms and revolutionizing treatment through individualized symptom tracking and management, artificial neural networks (ANN) also extend human intelligence to personalized management.With ANN-powered devices and applications, women can monitor and assess their symptoms in real time, learning about the frequency and intensity of their symptoms. This study used artificial neural networks to propose an improved model for managing menopause. The Model is a trained stand-alone system that displays data on menopause management after receiving pre-defined datasets as inputs. When the Model is put into practice and used, it will enhance menopause care for women in Nigeria's rural areas.

Keywords: ANN, Improved Model, Menopause, Women

I. BACKGROUND TO THE STUDY

A woman experiences a variety of physical and emotional symptoms during her menopause, which is a normal stage of life.

One technological innovation is the Artificial Neural Network (ANN) that is transforming women's health by providing effective treatment options. By providing doctors with promising answers to the complicated menopausal symptoms and revolutionizing treatment through individualized symptom tracking and management, artificial neural networks (ANN) also extend human intelligence to personalized management. ANN-powered devices and applications allow women to monitor and assess their symptoms in real time, obtaining data on the frequency and intensity of their symptoms. (Xiangyu et al. 2025)

The end of the reproductive stage for female humans is marked by the menopause, also referred to as the climacteric, when menstrual cycles permanently cease. Though the precise time can change, it usually happens between the ages of 45 and 55. Menopause is typically a normal transition associated with a drop in blood estrogen levels. It may manifest earlier in tobacco users (Ryu, 2021).

Additional causes include certain forms of chemotherapy, surgery that removes both ovaries, or anything that lowers hormone levels. Menopause is physiologically caused by a reduction in the ovaries' production of the hormones progesterone and estrogen. Hormone levels in the blood or urine can be measured to confirm a diagnosis, though they are usually not required. The opposite of menarche, which is when periods begin, is menopause.A woman's periods usually become irregular in the years preceding menopause, which can result in periods that are longer or shorter in duration or that flow more or less heavily. Hot flashes, which usually last 30 seconds to 10 minutes and can be accompanied by shivering, night sweats, and skin reddening, are common for women during this time. For four to five years, hot flashes may recur. Mood swings, difficulty sleeping, and dry vagina are possible additional symptoms. Symptom severity differs from woman to woman. "Early menopause" is defined as menopause before the age of 45, and "premature ovarian insufficiency" is defined as ovarian failure or surgical ovarian excision before the age of 40 (Ryu, 2021).

Reducing symptoms and preserving general health both during and after menopause are the main goals of menopause management.

Hormone therapy, non-hormonal drugs, and lifestyle changes are available forms of treatment. Diet, exercise, and stress reduction are examples of lifestyle modifications that can have a big impact on the severity of symptoms and general wellbeing. (Xiangyu and others, 2025)

1.1 Statement of the Problem

Managing menopause can be difficult for a number of reasons, such as lifestyle changes, emotional and mental health problems, and physical discomfort. A woman's relationships, career, and quality of life may all be impacted by these difficulties. Secondly, people frequently complain of sudden, intense heat that is frequently accompanied by discomfort and perspiration. Heart disease risk may rise as a result of menopause's effects on cardiovascular health. Hormonal changes can also cause abrupt mood swings, irritability, and even depression.

1.2 Aim and Objectives of the Study

The aim of this study is to develop an improved model for menopause management using Artificial Neural Network (ANN). The specific objectives of the study are to:

i) survey existing systems for menopause management.
ii) design a new model for improved management of menopause
iii) train the model on prediction and classification of menopause management.

II. LITERATURE REVIEW

This section discusses related literatures to the study. The following sub-headings were discussed in this section;

i) Overview of Menopause
ii) Artificial Neural Network as a Tool for Managing Menopause
iii) Review of Related Works

2.1 Overview of Menopause

The end of the reproductive stage for female humans is marked by the menopause, also referred to as the climacteric, when menstrual cycles permanently cease. Though the precise time can change, it usually happens between the ages of 45 and 55. Menopause is typically a normal transition associated with a drop in blood estrogen levels. It may manifest earlier in tobacco users (Victor, 2025).

Menstrual cycles continue to be regular during the early stages of menopause transition, but the time between cycles starts to increase. Hormone levels start to change. Every cycle may not result in ovulation.One year after the last menstrual cycle, a period of time known as the menopause occurs. Women may have a variety of symptoms both during and after the menopausal transition. The menopause, which is defined as the permanent loss of ovarian function, cannot be recognized by bleeding patterns in women who enter the transition without having regular menstrual cycles (due to previous surgery, other medical conditions, or ongoing hormonal contraception).

While longer cycles are still possible, menstrual patterns may exhibit shorter cycles (by 2–7 days) during the transition to menopause. Uneven bleeding (lighter, heavier, spotting) could occur. Because of the hormonal changes that come with the menopause transition, women who are getting close to menopause frequently experience dysfunctional uterine bleeding. Bleeding or spotting could be a functional endometrial response, a benign sore (polyp or lesion), or just vaginal atrophy. Guidelines for evaluating the endometrium, which is typically the primary cause of spotting or bleeding, have been published by the European Menopause and Andropause Society (Victor, 2025).

However, any unplanned vaginal bleeding in postmenopausal women is concerning and needs to be properly investigated to rule out the possibility of cancerous diseases. Urogenital symptoms, such as painful sex, dry vagina and atrophic vaginitis (thinning of the membranes of the vulva, vagina, cervix, and outer urinary tract), can start during menopause and persist after menopause. Additionally, all of the outer and inner genital areas may experience significant shrinkage and loss of elasticity. Additionally, some women may experience urinary urgency and incontinence (Mamun et al. 2023).

The menopause usually happens between the ages of 47 and 54. Over 95% of women experience their last menstrual cycle between the ages of 44 and 56 (median 49–50), according to a variety of data. The last bleeding occurs in 2% of women under 40, 5% of women between 40 and 45, and the same percentage of women between 55 and 58. The average age in the United States is 51 years old, compared to 50 years old in Russia, 49 years old in Greece, 47 years old in Turkey, 47 years old in Egypt, and 46 years old in India.These variations are caused by early-life environmental factors and linked to epigenetic effects in addition to genetic influences. It typically takes 3–4 years (sometimes up to 5–14 years) for the menopausal transition or perimenopause to precede menopause.

An early menopausal risk factor is undiagnosed and untreated celiac disease. In addition to gastrointestinal symptoms, celiac disease can present with a number of non-gastrointestinal symptoms. Most cases of the condition are not identified in time, which increases the risk of long-term complications. The risk is decreased by following a strict gluten-free diet. Women with celiac disease who receive early diagnosis and treatment have a normal lifespan. On average, women who have had a hysterectomy with ovary conservation experience menopause 1.5 years earlier than they should (Ryu, 2021).

Bilateral oophorectomy, or removal of the ovaries, can surgically induce menopause. This procedure is frequently, though not always, performed in conjunction with hysterectomy, which removes the uterus, and salpingo-oophorectomy, which removes the fallopian tubes. "Surgical menopause" is the term used to describe the cessation of menstruation following ovarian removal. Periods may completely stop as a result of surgical procedures like ovarian excision. Hot flashes and other severe withdrawal symptoms could result from the abrupt and total drop in hormone levels.Early menopause symptoms could be more severe (Chen et al., 2023). Although pelvic surgery of this kind frequently causes a somewhat earlier menopause, possibly due to a compromised blood supply to the ovaries, uterine removal without ovarian removal does not directly cause menopause. The ovaries' continued hormone production is the reason for the interval between surgery and a potential early menopause.

2.2 Artificial Neural Network as a Tool for Managing Menopause

A computational model known as an artificial neural network (ANN) is modelled after the composition and operation of biological neural networks, such as the human brain. To carry out tasks like pattern recognition, prediction, and classification, it is made up of interconnected nodes, also known as artificial neurons, that process information and sends it between layers. (Raymond & Pat, 2020).

An artificial neural network, or neural network, is a type of computer program that draws inspiration from biological neurons. Although each neuron in a biological brain is only in charge of solving a very small portion of the problem, biological brains are capable of solving complex problems. Although each individual cell in a neural network is only in charge of solving a small portion of the problem, the cells in the network cooperate to produce the desired outcome. This is one way to make programs that are artificially intelligent.

One type of machine learning is neural networks, in which a program can adapt as it gains problem-solving skills. Each example can be used to train and enhance a neural network, but the more examples a neural network requires to function well, the more it will require; in the case of deep learning, this often amounts to millions or billions of examples (Lakshimi&Lalli, 2021).

A neural network simulates a neuronal network, similar to those found in the human brain. Every neuron performs basic mathematical functions, such as receiving information from other neurons, modifying it, and then transmitting it to other neurons. Neurons are arranged in "layers"; a neuron in one layer receives information from neurons in other layers, processes it, and then transmits it to another layer's neurons. One or more layers make up a neural network.

The "input layer" is the first layer, which takes in information from the outside world (such as a text or image). The "output layer" is the final layer. The output layer reads the information from the neurons and uses it as the network's output. The "hidden layers" are the other layers. The neurons in a basic "feed-forward" network process numerical data. A weighted sum of the values of the neurons in the preceding layer is performed by each neuron. (Raymond & Pat, 2020)

Next, a constant value known as the "bias" is added to it. Lastly, a mathematical function known as the "activation function" is applied to this value. Typically, an activation function, such as tanh, returns a value between 0 and 1. The neurons in the following layer then receive the activation function's output. The network has a defined loss function. The neural network's performance on the given task is estimated by the loss function.Lastly, by altering the network's weights and biases, an optimization technique is used to reduce the cost function's output. We refer to this procedure as training. One tiny step at a time, training is carried out. The network usually performs its assigned task fairly well after thousands of steps (Ryu, 2021).

2.3 Review of Related Works

In order to detect significant subjective cognitive decline and associated factors in nurses going through the menopause transition, Xiangyu et al. (2025) suggested machine learning models. The study's objective was to create and validate a machine learning model for detecting nurses who are undergoing menopause-related severe subjective cognitive decline (SCD) and the factors that are linked to this condition. Cross-sectional

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data from 1,264 nurses going through the menopause transition were used for a secondary analysis.The Bortua algorithm was used for feature selection, and the data set was randomly divided into training (75%) and validation (25%). A total of seven machine learning models were developed and refined. Accuracy, sensitivity, specificity, F1 score, and the area under the receiver operating characteristic curve were used to evaluate the model's performance.

The weights and features of several factors linked to severe SCD were clarified using Shapley Additive Explanations analysis. Among nurses going through the menopause transition, the average SCD score was 5.38 ± 2.43. Thirteen important feature factors were found by the Bortua algorithm. With an area under the receiver operating characteristic curve of 0.846, accuracy of 0.789, sensitivity of 0.753, specificity of 0.802, and an F1 score of 0.658, the support vector machine model outperformed the other seven models in terms of overall performance. Menopausal symptoms and menopausal stage were the two factors most closely linked to SCD.

Victor (2025) examined the use of AI in managing menopause. According to the author, menopause is a normal stage of a woman's life that is marked by a number of emotional and physical symptoms. Artificial intelligence (AI) is one example of a technological advancement that is transforming women's health by providing effective treatment options. AI also extends human intelligence to personalized management, giving doctors promising solutions to the complex menopausal symptoms and transforming treatment through personalized symptom tracking and management.Women can track and evaluate their symptoms in real time with AI-powered apps and gadgets, gathering information on the frequency and severity of their symptoms. Their algorithms offer tailored suggestions for dietary modifications, lifestyle modifications, and suitable therapeutic approaches. AI can help women who are going through this menopausal transition by offering easily accessible support.

Using data from general hospitals, Ryu (2021) examined machine learning techniques to find factors linked to women's vasomotor symptoms. The study's objective was to use machine learning to analyze the variables linked to women's vasomotor symptoms (VMS). Data from Korea University Anam Hospital in Seoul, Korea, on 3,298 women between the ages of 40 and 80 who had general health examinations between January 2010 and December 2012 were acquired. The Menopause Rating Scale was used to measure the prediction of VMS, and five machine learning techniques were used and compared. The primary factors linked to VMS were identified using variable importance, which measures a variable's impact on model performance.

The random forest (0.9326) outperformed artificial neural networks with one, two, and three hidden layers (1.5576, 1.5184, and 1.5833, respectively) and linear regression (12.4856) in terms of mean squared error. Age, menopause age, thyroid-stimulating hormone, and the levels of monocytes, triglycerides, gamma glutamyltransferase, blood urea nitrogen, cancer antigen 19-9, C-reactive protein, and low-density lipoprotein cholesterol were the most significant factors linked to VMS, according to the random forest's variable importance. In fact, total cholesterol, insulin, free thyroxine, forced vital capacity, alanine aminotransferase, height, homeostatic model assessment for insulin resistance, carcinoembryonic antigen, and cancer antigen 125 were all ranked in the top 20 variables in terms of variable importance.

The creation and performance evaluation of machine learning techniques for menopausal women's depression prediction was suggested by Mamun et al. (2023). The authors used supervised machine-learning to create a system that was remarkably accurate. By analyzing several parameters, such as accuracy, sensitivity, specificity, precision, recall, F-Measure, Receiver Operating Characteristic (ROC), Precision–Recall Curve (PRC), and Area Under the Curve (AUC), different classification algorithms are used to identify the best-performing classifier. With an accuracy of 91.04%, we discovered that the Random Forest and XGBoost classifiers perform best.

Using ensemble learning techniques, Lakshmi &Lalli (2021) proposed a hybrid intelligent framework to predict health risks among women during menopause. A novel framework that employs an ensemble technique to predict women's risk levels during menopause. To predict the level of risk among women during menopause, it consists of four phases, primarily a feature selection method, a feature importance method, and a new classifier with fuzzy rule-based decision making. While the Random Forest Classifier finds the most dominant features among all those pertinent for classification, the Recursive Feature Elimination (RFE) method identifies the most important features. By combining several classification algorithms, an ensemble classifier is a method for integrating different classifiers that improves accuracy.For an ensemble classification

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algorithm, the study recommends a stratified sampling technique and a multilayer stacking technique. The original dataset is divided into multiple samples using the stratified sampling technique. The ensemble model is constructed using the base learners, which are popular classifiers like Decision Tree, Naive Bayes, and K-Nearest Neighbor.

III. MATERIALS AND METHODS

This section discusses the analysis of the existing and proposed systems for menopause management. The following sub-headings were discussed in this section;

i) Methodology of the Study
ii) Analysis of the Existing System
iii) Analysis of the Proposed System

3.1 Methodology of the Study

In this study, Object Oriented Analysis and Design Method (OOADM) was utilized. The OOADM was used to analyse the component parts and build them into programming components in the design for easy coding using an object-oriented programming language. The object-oriented paradigm and concepts, such as classes and object, polymorphism, encapsulation and visual modelling, are applied in the analysis and design of the system using the OOADM methodology. This is used all the way through the application or system's development life cycle, improving the quality of the final product and even promoting stakeholder involvement and usability.

3.1.1 Justification of the Methodology

The employed methodology sought to understand and represent the system in Object Oriented form to create a seamless implementation procedure for the system. The construction of the system is designed as a group of interdependent classes and objects which OOADM is better at due to its quicker, more reusable, dependable, efficient, and more effective method of system development. Given these two main reasons, it was expedient for the two methodologies to be used in analysing and designing the system.

3.2 Analysis of the Existing System

This study considered the work of Victor (2025). The author developed a menopause management system using artificial intelligence. The model functions as an information retrieval system via a chatbot for women who are in their menopause. The system consists of an interface, a database and an output. Figure 3.1 shows the architecture of the Existing System.

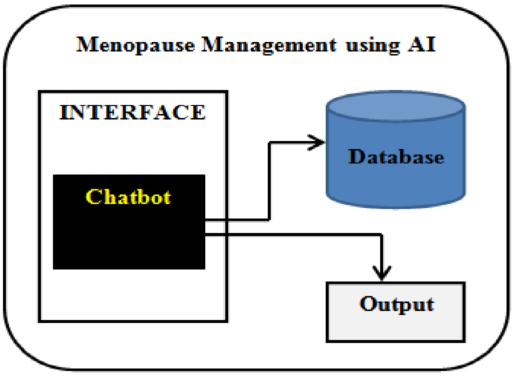

Fig. 3.1: Architecture of the Existing System (Source: Victor, 2025)

3.2.1 Components of the Existing System

The following are components of the Existing System;

i) The Interface

The interface of the existing system enables human computer interaction in which the user communicates with the system via a Chatbot. A Chatbot is an AI tool used for human computer interaction.

ii) The Database

The database component is the storage section of the existing system. It stores the details about menopause management.

iii) The Output

The output component displays requested information on menopause management.

3.2.2 Algorithm of the Existing System

The following is the existing system algorithm;

Algorithm 1: Menopause Management
Procedure: Information Retrieval using Chatbot
Input: User Data Request
Output: Information on Menopause Management

1. Start
2. Initialize Model
3. Commence System Interaction
4. Request for Info. on Menopause
5. Verify Information
6. Stop

3.2.3 Disadvantages of the Existing System

The following are disadvantages of the Existing System;

i) Poor language comprehension: The existing system struggles with understanding slang, sarcasm, complex queries, or regional dialects.

ii) Context limitation: The existing system cannot maintain long conversations or understand context across multiple messages.
iii) The existing cannot empathize or offer genuine emotional support, which is essential in healthcare and counselling.

3.3 Analysis of the Proposed System

This study considered an improved model for menopause management using Artificial Neural Network (ANN). The model is a trained standalone system which offers a flexible framework for healthcare guidance and management. The model consists of an interface, internal mechanism and system output. The interface enables the user to register, login and commence interaction with the system. The internal mechanism consists of the ANN model for training and prediction. The system output displays results of the system. Figure 3.2 shows the proposed system architecture.

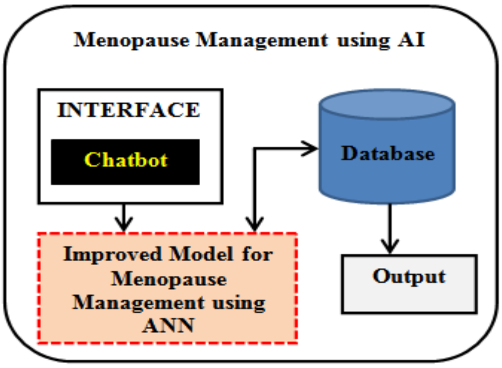

Fig. 3.2: Architecture of the Proposed System

3.3.1 Architecture Breakdown of the Proposed System

The architecture breakdown of the Proposed System is shown in Figure 3.3

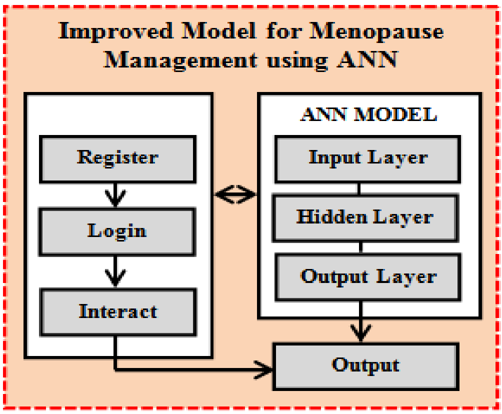

Fig. 3.3: Architecture Breakdown of the Proposed System

3.3.2 Components of the Proposed System

The following are components of the Proposed System;

i) The Interface

The interface serves as frontend of the system which enables the user to register, login and commence interaction.

ii) The ANN Model

The ANN model trains the system to be learned, updated and classifieshealthcare information on menopause management. It also enables a framework for unauthorized access validation. Secondly, the ANN model consists of layers such as input, hidden and output.

The input layer receives data which the neural network needs to analyse or learn about

Then this data passes through one or multiple hidden layers that transform the input into data that is valuable for the output layer. Finally, the output layer provides an output in the form of a response of the Artificial Neural Networks to input data provided.

Once the weighted inputs for menopause management, the neurons calculates the sum (s) of the product of the weights and inputs as illustrated in equation 3.1.

$$s = (x_1 w_1 + x_1 w_2 + \ldots, x_n w_n) \qquad (3.1)$$

The unit step function of the ANN model for the proposed menopause management is a non-linear transformation that is activated over the input before sending it to the next layer of neurons or finalizing it as output. Let's consider an ANN with one hidden layer, where the input layer has 3 neurons, the hidden layer has 2 neurons, and the output layer has 1 neuron. We'll use ReLU as the activation function in the hidden layer and apply Sigmoid in the output layer of our ANN for binary classification. The output assumes value 0 for negative argument and 1 for positive argument. The function is as follows:

$$f(x) = 0 \text{ when } x < 0, \; 1 \text{ when } x > 0 \quad (3.2)$$

The range is between (0,1) and the output is binary in nature. These types of activation functions are useful for binary schemes. When we want to classify an input model in one of two groups, we can use a binary compiler with a unit step activation function.

iii) The Output
The output component displays the results on menopause management.

3.3.2 Algorithm of the Proposed System
The following is the proposed system algorithm;

Algorithm 2: Improved Model for Menopause Management
Procedure: Training, Learning and Prediction
Input: Python Data
Output: Updated Info on Menopause Management
Step 1: Start
Step 2: Initialize ANN forward propagation
Step 3: Take the inputs, multiply by the weights (just use random numbers as weights)
i) Let $Y = W_iI_i = W_1I_1+W_2I_2+W_3I_3$
ii) Pass the result through a ReLu formula to calculate the neuron's output.
Step 4: Stop

3.3.3 Advantages of the Proposed System
The following are benefits of the proposed system;
i) The proposed system can learn from datasets on menopause experience and generalize from training data to new, unseen data. This makes it excellent for tasks like classification, prediction, and pattern recognition.
ii) The proposed system can model and solve complex, non-linear problems that traditional algorithms struggle with, thanks to their layered architecture and activation functions.
iii) The proposed system can adapt to changes in data patterns over time, making them useful in dynamic environments like healthcare prediction or real-time analytics.

IV. CONCLUSION
A woman experiences a variety of physical and emotional symptoms during her menopause, which is a normal stage of life. Managing menopause can be difficult for a number of reasons, such as lifestyle changes, emotional and mental health problems, and physical discomfort. A woman's relationships, career, and quality of life may all be impacted by these difficulties. Second, people frequently complain of sudden, intense heat that is frequently accompanied by discomfort and perspiration. This study used artificial neural networks to propose an improved model for managing menopause. The Model is a trained stand-alone system that displays data on menopause management after receiving pre-defined datasets as inputs.

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