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Predicting & Identifying Risk of Polycystic Ovary Syndrome (Pcos)

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Abstract ***Polycystic Ovary syndrome is a disorder that many women faces during their reproductive age, due to this they suffer from diabetes, infertility and high blood pressure. Diagnosis of this disorder is mainly done through various types of screenings like ultrasound images. Imaging is the most important factor in the diagnosis, through ultrasound images the follicles generated and cysts formed are easily affected. Although, this is the best method for diagnosis, the main concern is the symptoms shown by this disorder are many times ignored because symptoms like acne, hair loss, and weight gain can also be the causes of some other problem and this leads to the PCOS getting more severe. This paper can be said as a prevention measure or as an alert that one needs to visit hospital for screening. It will help female to recognize the symptoms at early age so that they can take required steps toward the cure. The proposed work is based on the images obtained after ultrasound and how the noises that occur in them can be removed by various methods like data mining, machine learning algorithms. This paper will provide the overview of predicting the disorder using symptoms as parameters through genetic algorithm and back propagation algorithm in neural network. Since, genetic algorithm and back propagation algorithm is known for their accuracy can produce better results.***

Keywords : Poly cystic Ovary Syndrome, Ultrasound images, Genetic algorithm, Back propagation algorithm

I. INTRODUCTION

PCOS (Poly cystic ovary syndrome) is one of the most common hormonal disorders which most of the women suffer once in a lifetime during their reproductive age. [1] This paper considers the issues when it affects more than 70% of the population of female, it is not that known among the people. Many time's females ignore the symptoms and only recognize it when it gets very serious when one has to take drastic measures against it. PCOS is a hormonal disorder where women develop some follicle in their ovaries called cysts and these follicles causes ovaries to fail in releasing eggs. Women suffering from PCOS can release excessive androgen (male hormone) and can suffer from extended or infrequent menstrual periods [2].

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This paper focus on the female population to make them aware about this disorder so that they can take the symptoms into consideration as not everyone go to screenings as this disorder can be diagnosed through it, considering the symptoms can be seen as a cause to go for screenings.
Up until
2019, all that has been done regarding PCOS are always based on ultrasound images and image recognition techniques to diagnose the disorder using particle swarm optimization, automated detection using follicle recognition, segmentation using poly cystic ovary using ultrasound images, data mining techniques or speed gradient method [3].
Out of all the methods one of the problem is they are considering the symptoms but focusing on the ultrasound images or recognizing follicles through any other screening method and then giving the result that whether person is suffering from PCOS or not.
The researcher is predicting the percentage of chances that PCOS can occur in a female only through the symptoms using back propagation algorithm in neural network and genetic algorithm as they are known to provide a good result. These two methods can also help us recognize the disorder in early reproductive age of a female (9-15 years) to warn them about their future. The technique and the problem are described below.

II. LITERATURE SURVEY

A. Neural Network and Back Propagation Algorithm

A set of algorithms which are designed to recognize patterns and are constructed in such a way that they work similar to the human brain. This helps us to cluster and classify the raw data in such a way that they start showing some patterns accordingly.

They can aggregate unlabelled data also according to their similarities [4]. Neural networks can also recognize numerical, vector containing data, images, sound, contents based. The significance of learning in Artificial Neural Network will increment because of the secured dynamic activity likewise in light of the fact that the info/yield vector, when a specific system is built. Back propagation algorithm is one of the best pattern recognition algorithms in neural network. It is a method which tells the network during prediction whether or not to make mistakes and also reduce the mistakes made. It uses weights and the parameters attached to it shows on how the error can be occurred in the final layer [5]. It has three layers through which data flows one is input layer second is hidden layer and next is final layer where we get the output according to the data inputted. Process that back propagation algorithm follows can be described as [6].

- **Forward propagation of operating signal**

The input signal is provided to the input layer and it moves forward via hidden layer to the output layer to produce the output. During this step weight and offset value is provided to the input layer which remains constant throughout the process to have only the expected effect to the neurons to give only the required output [6]. This process expected output is not achieved it has to be switched to the process of back propagation of error signal.

- **Back propagation of error signal**

Error signal is said to be the difference between the expected output and the real output. The error signal is moved from output layer to input layer in layer by layer manner. In back propagation, there is error feedback through which weight value of the network is regulated. Weight value and offset value is continuously modified to get the value nearer to the required final value it will reduce the error value. The parameters of the neural system have an association with the blunder the internet produces, and once the parameters correct, the mistake will, as well. Change of parameters exploitation improvement calculations an extremely standard improvement procedure is named inclination plummet that is useful for finding the base of a work [7]. General square measure looking to weaken the blunder that is also all to as the misfortune work or the objective work.

B. Genetic Algorithm

One of the most famous algorithm used for the concept of natural selection and genetics for generation of search based algorithms are genetic algorithm. Genetic Algorithms was created by John the Netherlands and his understudies and partners at the University of Michigan, most remarkably David E. Goldberg and has since been taken a stab at various advancement issues with a high level of success [8]. In Genetic Algorithms, we've a pool or a populace of potential answers for the given downside. These arrangements at that point bear recombination and change like in normal hereditary science, producing new youths, and furthermore the technique is perpetual over various ages. Every individual or competitor answer is distributed a wellness cost bolstered its goal perform cost and furthermore the fitter individuals region unit given a superior probability to mate and yield progressively "fitter" people [8, 9]. This is in accordance with the Darwinian Theory of "Natural selection". As such, we tend to continue "advancing" higher individuals or arrangements over ages, until we tend to arrive at a halting standard [8, 9, and 10].

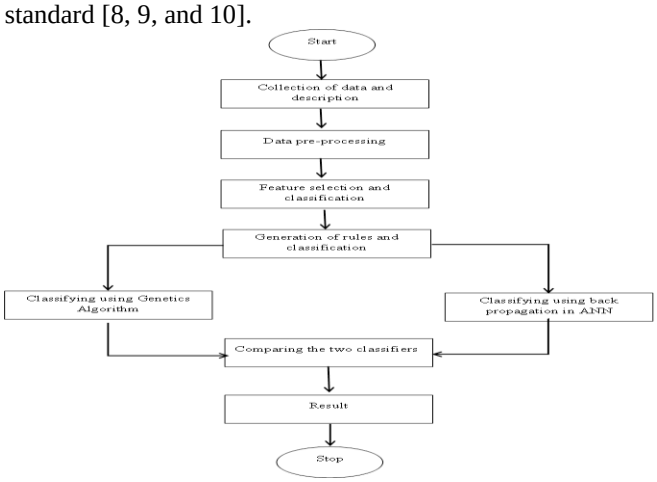

Fig: General Architecture of the system [11]

Hereditary Algorithms region unit adequately sporadic in nature, however they perform much better than arbitrary local hunt during which we tend to just endeavor various irregular solutions, keeping track of the best so far, as they misuse chronicled data too.

C. PCOS

Nowadays PCOS is the most common disorder among woman. It is one of the major causes that cause infertility in woman. It leads to the growth of fluids, follicles or multiple sacs and cysts in ovaries. In the recent study it was found that 18% of women in India are suffering from it [12]. The most common symptoms faced by the patients suffering from PCOS are acne, hair falling, oily skin, irregular menstrual cycles, hypertension, weight gain and metabolic dysfunctions. Hypertension, hyperinsulinemia, abdominal obesity is some of the metabolic features that can later cause serious problems like diabetes, coronary disease, endometrial hyperplasia. Recent studies have also suggested that it can also led to breast cancer and uterine cancer in early reproductive age [12,13,14].

- **Hormonal Changes [13]**
  1. Cardiac arrests
  2. Anxiety
  3. Depression
  4. Increase in weight
  5. Miscarriage

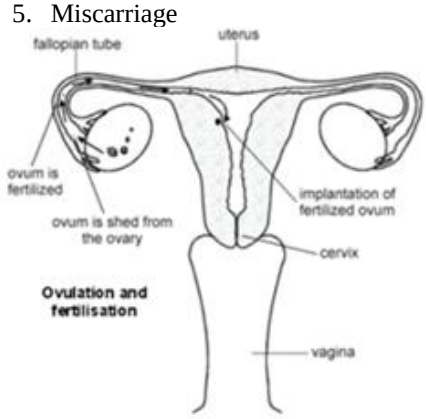

Fig 2: Women Reproductive System [15]

- **Symptoms**

  Although symptoms may vary from person to person [13, 14], but if a person possesses any of the two symptoms there is a high chance of them suffering from PCOS-

  1. Irregular menstrual cycles
  2. Infertility
  3. Unwanted hair growth
  4. Acne
  5. Absence of menstrual periods
  6. Periods occurring in every 20-35 days
  7. Hair loss on the scalp
  8. Weight increasing only around the waist
  9. Blackened skin which may include skin tags
  10. Swollen breasts before period
  11. Sleep apnea
  12. Itchy vagina or vulva
  13. Hysteria
  14. Neuralgic pain

- **Therapeutic Measures**

Generally, there is no proper cure for the women suffering from PCOS but in most of the patients adapting healthy lifestyle and losing weight can help. But there are always chances of the symptoms to bounce back. [13]

III. RESEARCH ANALYSIS

Large amount of data of female patients is needed to follow the predictive analysis steps .Some of the parameters that are considered for the feature extraction and classification of patients are weight, symptoms of acne, age, duration of menstrual periods, sugar level, hair growth and hair loss at scalp, swelling at breasts[11].The system thus proposed will classify the patients accordingly into their groups using the back propagation in neural network and genetics algorithm and then perform the analysis.

Table 1.1 Comparison Analysis of different research article

S. No.	PAPER TITLE	SUMMARY
1	Automated Detection of Poly cystic Ovarian Syndrome Using Follicle Recognition[3]	In this paper, authors have tried to recognize PCOS based on the follicle recognition through image pre-processing to increase the quality of image. Multiscale morphological approach and top-hat transform is used to classify the image of follicle so that they can be separated according to size. Used for automated results after the screening.
2	An Implementation of Convolutional Neural Network on PCO Classification based on Ultrasound Images[1]	Classifies patients into PCO and NON-PCO class by using convolutional neural network algorithm over ultrasound images. Suggests that optimizing neural network is hard. Shows the percentage of accuracy attained by the author.
3	CLINICAL REVIEW: Identifying Children at risk For Poly cystic Ovary Syndrome[14]	Provides a prospect that PCOS can be prevented at an early age. There are many risk factors that can be monitored at early get like birth age, insulin obesity in early childhood, assessment of hyperandrogenism can show the chances of PCOS.
4	i-HOPE: Detection and Prediction System For Poly cystic Ovary Syndrome(PCOS) Using Machine Learning Techniques[16]	Various machine algorithms are applied over the data obtained among which RF algorithm is found superior.
5	Obese and Non-Obese Poly cystic Ovarian Syndrome: Comparison of Clinical, Metabolic, Hormonal parameters and their differential response to clomiphene[17]	Patients suffering from obese PCOS are more prone to get hypertension, IR, Metabolic syndrome. Controlling obesity in patients make them more responsive towards clomiphene.
6	Study and Theoretical Investigations on PCOS[13]	Shows how cysts get developed in the ovary and what the symptoms are and how these cysts causes hypertension, diabetes etc. Ultrasound images are one of the best methods which can be used to recognise PCOS.
7	Segmentation of Poly cystic Ovary in Ultrasound Images[18]	ICV algorithm is developed that can give us right result in less computational time and iterations.
8	Exploration On Poly cystic Ovarian Syndrome and Data Mining Techniques.[19]	Various data mining techniques are discussed and how they can be useful in getting right results
9	Computational Characterization and Identification of Human Poly cystic Syndrome Genes[20]	Developed an algorithm to predict new PCOS genes. Shows out of a certain number of genes how they can be positive or negative.
10	Poly cystic Ovary Syndrome: definition, aetiology, Diagnosis and treatment[21]	This paper suggests that although PCOS has no set of particular causes of why it happens, the process of treatment is also not that complicated, a few clear advices over diet plan and lifestyle changes with some proper clinical treatment with the help of proper diagnosis it can be easily managed.

A. Procedure Of Predictive Analysis

- *Data Collection*

The data used in our procedure will include patients database containing parameters as their weight, age, symptoms like acne, weight gain, irregularity in their periods, diabetes etc.

- *Data Pre-processing*

After, data is collected it should be scaled and abstracted accordingly according to the requirements.

- *Feature Selection and classification*

Here, features are selected and classified again so that they can be sending to the algorithms used i.e back propagation and genetics algorithm.

- *Results*

Both of the results that are obtained will then compared to get the good result.

IV. CONCLUSION

This paper briefly gives us the review of what PCOS is how it is caused and what are the symptoms how it affects the health of a woman and causes infertility, diabetes and heart disease. Although it is mainly recognised through ultra sounds it also adds to the disadvantage due to the noise that occurs in the image. But here we are trying to predict the disorder using the symptoms that occur in female but mainly neglected and for that prediction we are using back propagation algorithm and genetics algorithm. And according to these algorithms we can construct architecture to carry out the whole analysis process, which is shown above. And using this architecture we will try to get better results.

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