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# USING DEEP LEARNING TO DETECT POLYCYSTIC OVARRIAN SYNDROME

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## ABSTRACT

A cluster of symptoms experienced by women due to elevated testosterone levels is known as polycystic ovarian syndrome (PCOS). Recurrent infertility, hyperandrogenism, acne, hirsutism, atherosclerosis, and hirsutism are all symptoms of polycystic ovary syndrome (PCOS), which has both genetic and environmental components. Nearly 18% of Indian women suffer from this condition, according to recent research. Cysts might be benign, connected to polycystic ovarian syndrome (PCOS), or malignant; however, doctors were unable to determine which ovary was impacted due to manual examination of ultrasound images. In this paper, we provide DCNN-based techniques, write code to classify polycystic ovary syndrome (PCOS) using Python, and then use ultrasound pictures to fill them with blood or fluid. The dataset is used to classify PCOS in this study using DCNN-based image classification.

This research makes use of a pre-trained dataset of PCOS-related diseases. Lastly, feature extraction is executed and accuracy is measured using the test dataset and performance parameters. Many reproductive-aged women suffer from Polycystic Ovary Syndrome (PCOS), a hormonal illness linked to diabetes, heart disease, and infertility. The majority of imaging characteristics are used for the purpose of making a diagnosis. A key diagnostic method for polycystic ovary syndrome (PCOS) is ultrasound imaging. The diagnostic process is laborious because to overlapping follicles, equipment noise, and the lack of operator understanding (the operation is mostly dependent on experience), all of which make it harder to get a normal-looking picture. As a result of the aforementioned situations, cyst detection accuracy is affected. Preventing infertility requires prompt and precise detection of female reproductive system abnormalities before therapy begins. This study discusses many approaches that have been suggested for quickly and accurately diagnosing cysts, including methods for decreasing speckle noise, extracting regions of interest via segmentation, and image classification.

Disease of Polycystic Ovarian Syndrome (PCOS), Ultrasound Pictures, Convolution Neural Network (CNN) for Deep Learning. Classification, Enhancement, Poly Cystic Ovary, Syndrome, Segmentation, Speckle Noise, Ultrasound Images.

## INTRODUCTION

The fast evolving field of deep learning has the potential to solve issues in many different sectors. Academics and healthcare professionals are working together using deep learning to find previously unknown data possibilities, which is improving medical sector efficiency. Additionally, it aids physicians in making more accurate diagnoses and more effective medication recommendations for individuals suffering from any illness. There is currently no cure or conclusive diagnosis for Polycystic Ovarian Syndrome (PCOS). A frequent endocrine issue that might cause infertility is the cause of ovarian cysts in women who are able to have children. There are few organs as important as a woman's reproductive system. Two main parts of a woman's reproductive system are the ovaries, which generate egg cells, and the uterus, which contains the growing fetus and the uterine fluids as well as the vaginal tube that carries sperm from a man to the fallopian tubes. Molecular signals sent out by the egg help the sperm find their way to the egg, which in turn helps the egg to attach to the sperm, which in turn allows the egg to absorb the sperm, and the process of fertilization to start. Although the uterus is an alternate location for fertilization, the oviducts are the most common site.

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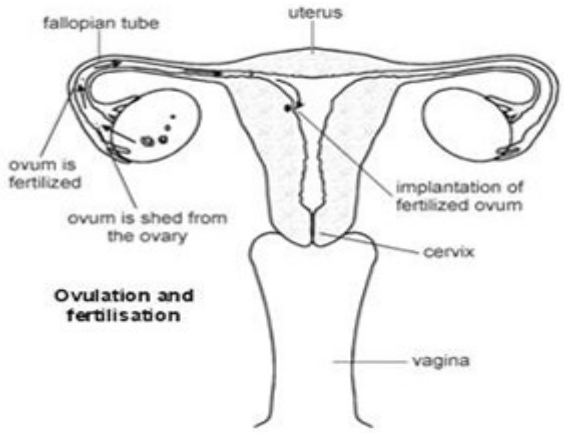
Vol19, Issue 1,2025

A major concern in the field of medicine is polycystic ovary syndrome (PCOS). Polycystic ovaries are defined by an abundance of small, noncancerous cysts, each no larger than one centimeter in diameter. Eight millimeter women are affected with polycystic ovary syndrome. The inability to conceive is the only symptom for many women. period-related health concerns The symptoms of polycystic ovary syndrome are many. Among a woman's most vital organs is her reproductive system. There are two primary parts of a woman's reproductive system: the uterus, which contains the fluids necessary for pregnancy and the growing fetus, and the ovaries, which are responsible for producing the egg cells. In order for fertilization to take place, the egg releases a small number of molecules that direct the sperm, which causes the egg's surface to adhere to the sperm's surface. Although fertilization may happen in the uterus, it happens more often in the oviducts. A significant area of medical research is polycystic ovary syndrome (PCOS).




Symptoms include menstrual irregularities, infertility, and an overabundance of hair on the scalp, face, and chest as well as sudden weight gain, hair thinning, and hair loss. The goal is: When it comes to diagnosing polycystic ovary syndrome (PCOS), deep learning technologies like Convolutional Neural Networks (CNNs) might be very helpful.

## RELATED WORKS LITERATURE SURVEY

A significant area of medical research is polycystic ovary syndrome (PCOS). Women who suffer from polycystic ovary syndrome often have several small, benign cysts in their ovaries, which can't be more than 8 mm in diameter. Many women have infertility or irregular periods as their only symptoms. Infertility, irregular periods, excessive facial and chest hair, excess weight gain, hair thinning, and hair loss on the head are all indications of polycystic ovary syndrome (PCOS). One of the leading causes of female infertility is polycystic ovarian syndrome. Polycystic ovary syndrome (PCOS) affects a large percentage of infertile women. The ovaries deposit an egg into the uterus at the beginning of each menstrual cycle. The process, scientifically known as ovulation, typically occurs once every thirty days. Infertility is a common symptom of polycystic ovary syndrome (PCOS), which affects women and makes it difficult for them to conceive. Uterine lining cancer is more common in women who have had menstruation irregularities or non-occurrence for an extended length of time compared to the overall population. However, the risk of endometrial cancer and its symptoms may be reduced with the use of period-controlling medications, such as the pill. The number of follicles may be manually counted using ultrasound imaging to identify an ovarian cyst. [1] "Segmenting PCOs in ultrasound images using Otsu thresholding and the Chan-Vese method" The authors of this work are Asma Amirah Nazarudi, Noraishikin Zulkarnain, Siti Salasiah Mokri1, Wan Mimi Dayana Wan Zaki, and Aini Hussain. Combining Otsu's threshold approach with the Chan-Vese method is suggested in this paper. [2] in A "Machine Learning Algorithm for the Diagnosis of Polycystic Ovary Syndrome" Working with M. Rubaiyat Hossain Mondal and Prajoy Podder, Subrato Bharati authored the work. The dataset is subjected to a slew of classifiers, including logistic regression, gradient boosting, random forest, and a hybrid of the two, RFLR.

the third Polycystic ovary syndrome (PCOS) detection and prediction system using machine learning techniques: i-HOPE Thanks to Anita Raj, Ashi Ashok, Amsy Denny, and C. Ram Maneesh and George Remya In this study, we provide a machine learning-based approach for early PCOS identification and prediction utilizing basic, but promising, clinical and metabolic characteristics.

The studies used to predict polycystic ovary syndrome (PCOS) using machine learning classifiers are summarized in this section. To achieve this goal, we used the Kaggle repository to acquire a dataset consisting of 43 characteristics belonging to 541 women. Of the 541 occurrences, 364 were in healthy individuals and 177 were in those with polycystic ovary syndrome. Python is used as a machine learning tool in this investigation. You may install

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www.ijasem.org

Vol19, Issue 1,2025

Python with the help of the Anaconda distribution package, Scikit-learn, Jupiter notebook, Spyder, and Orange, among other tools. The goal of this project is to automate the process of detecting cysts in ovarian ultrasound pictures in order to cut down on diagnostic time and human error. In order to determine which filtering method is most effective in removing speckle noise, we must first assess its performance. Apply an appropriate image enhancement method to boost the de-noised picture's contrast. • Choose the best segmentation method after evaluating multiple options in order to isolate the cyst in the ultrasound picture. As a means to enhance the segmented region traits necessary for ovarian categorization. Use the most accurate classifier after comparing their performance to categorize the ovaries according to the amount of cysts and the fluid contained in the follicles. By comparing the outcome with current approaches, you may confirm that the proposed system is performing as expected.

## MATHEMATICAL MODELING

Set Theory

1) Let S be as system which input image

S = {In, P, Op, Φ}

2) Identify Input In as

In = {Q}

Where,

Q = User entered input image(dataset)

3) Identify Process P as

P = {CB, C, PR}

Where,

CB = Pre-process

C = apply deep learning algorithm

PR = Pre-process request evaluation

4) Identify Output Op as

Op = {UB}

Where,

UB = Predict outcome

Φ=Failures and Success conditions.

Where,

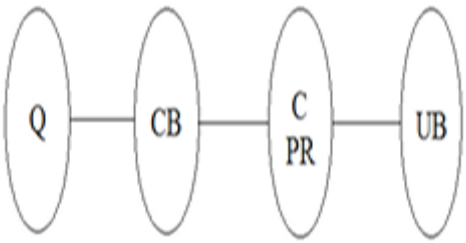
Q = read the dataset

CB = preprocess

C = apply DCNN algorithm

PR = preprocess request evaluation

UB = predict outcome




## Failures:

It may take longer time to retrieve the information from a large database.

2. Computer system crash.

3. Crash in the program.

To achieve success, you must first search the datasets for the necessary information. The user receives results quickly that are tailored to their requirements. Complexity of Space: The complexity of space is influenced by how patterns are presented and seen. The space complexity increases as the data storage capacity increases. Time Complexity: Verify if there are n patterns in the datasets. The time it takes to get information may increase if (n>1). This algorithm has a time complexity of O(). The mathematical model mentioned above is NP-Complete. PROS

This study presents a data-driven integrated approach for early PCOS disease prediction using a deep learning algorithm. We provide the outcomes of our testing and implementation of a machine learning algorithm into the current system. This method used SVM and ML models for PCOS prediction. The

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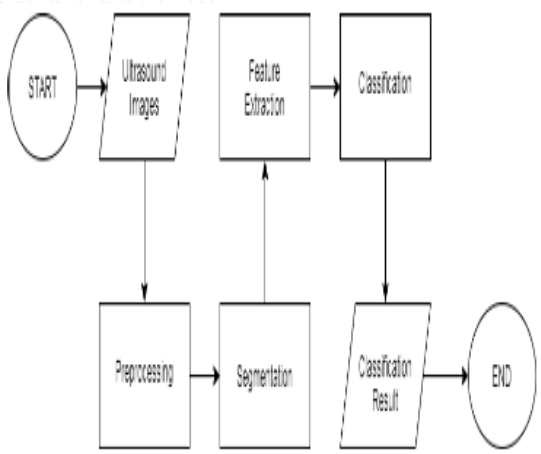
Vol19, Issue 1,2025

technique aids in forecasting details of previous PCOS data and evaluating PCOS characteristics based on fundamental factors.

## PROPOSED SYSTEM AND ADVANTAGES

The ovarian ultrasound photos included in this investigation are collected using the specified manner. The next stage is pre-processing. Ultrasound pictures may be affected by speckle noise, thus it's crucial to eliminate this kind of noise. This is the pre-processed area of interest. A convolutional neural network (CNN) approach is used to separate the PCOS component. The segmentation stage is necessary for the classification step, which involves retrieving features from the PCOS. The collected features and training ultrasound images are used to train the convolutional neural network (CNN) model. In order to verify the model, the test photographs are utilized for PCOS classification.




## Image Preprocessing:

Prior to using the clustering method, it is crucial to do image preprocessing on the PCO ultrasound pictures. The preprocessing stage in this work included cropping, denoising, and contrast enhancement. Cropping The PCO ultrasound photos used for this study should be divided into left and right ovaries as they include two ovaries that could have been taken at different probe depths. You may also use cropping to reduce the size of irrelevant parts of a picture. • Cleaning up Ultrasound photos include a unique kind of noise termed speckle noise, which is different from the more common Gaussian, Poisson, Salt, and Pepper noises that impact digital images. Speckle noise is particularly challenging to eliminate since it is a multiplicative noise. The speckle noise makes the image's edges seem much worse. In order to denoise speckle noise, this research employs the wavelet thresholding approach. • Enhancement of Contrast Dark regions in images are made more visible and distinct by contrast enhancement, which raises the contrast in low-contrast regions. This study makes use of histogram equalisation, which improves contrast by making the histograms more evenly distributed. Ultrasound for Medical Diagnosis: Tissue boundaries and other characteristics are revealed when this wave travels through tissue, hits the target, and is reflected in part. The signal is transformed into a radio frequency signal when the receiver picks up on the reflected signal. The attenuation of the acoustic pulse wave as it passes through tissue, which is proportional to the depth and the amount of time it takes for the signal to return, causes the apparent signal to be magnified. Following the modification of the temporal gain, the RF signal is sampled at a high rate by the analogue to digital converter. A Selection of Features: In this part, we will discuss how to choose features. Feature selection is the act of narrowing down a large set of potential features to a manageable number of relevant and helpful ones. Because of this, a lot of classes might need better pattern characterization. Classification models' accuracy could be compromised when superfluous data characteristics are used. You may improve accuracy and decrease overfitting by using feature selection. A univariate feature selection approach based on filtering looks at each feature separately in relation to the dependent variable; this is one kind of feature selection technique. After a set of criteria is applied to each feature, the features with the highest scores or rankings are selected. The research used a univariate feature selection technique to identify the important characteristics and compute the score.

## Advantages:

1) System that is both safe and effective.

2) We can acquire a very accurate diagnosis and provide therapy at the right moment with the help of ultrasound pictures.

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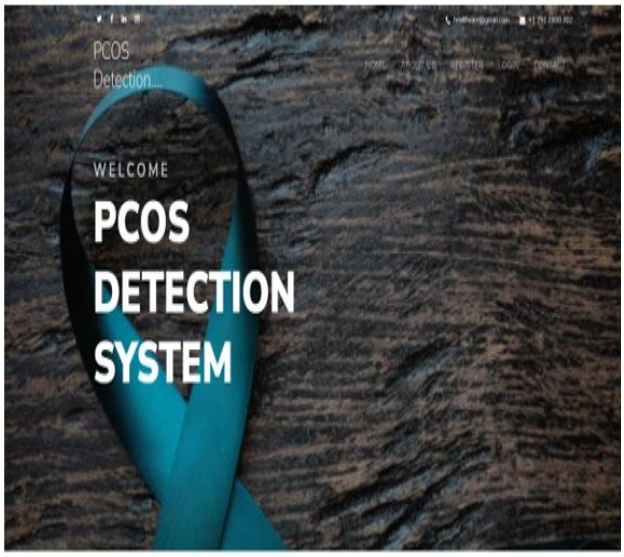
Vol19, Issue 1,2025

# RESULT

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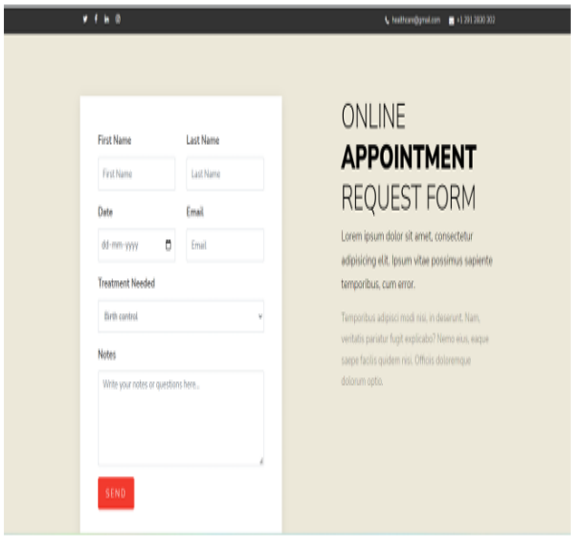
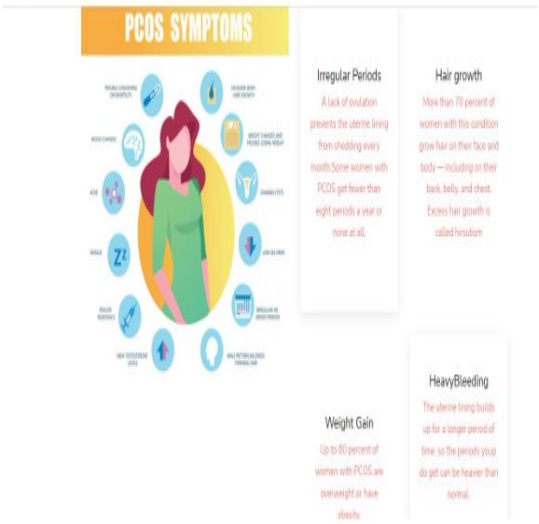
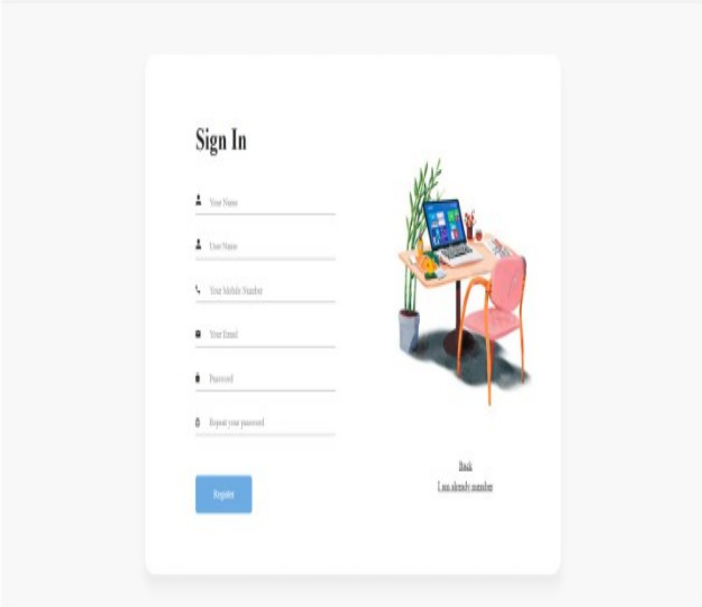



Signup




# OUTCOMES

INTERNATIONAL JOURNAL OF APPLIED SCIENCE ENGINEERING AND MANAGEMENT

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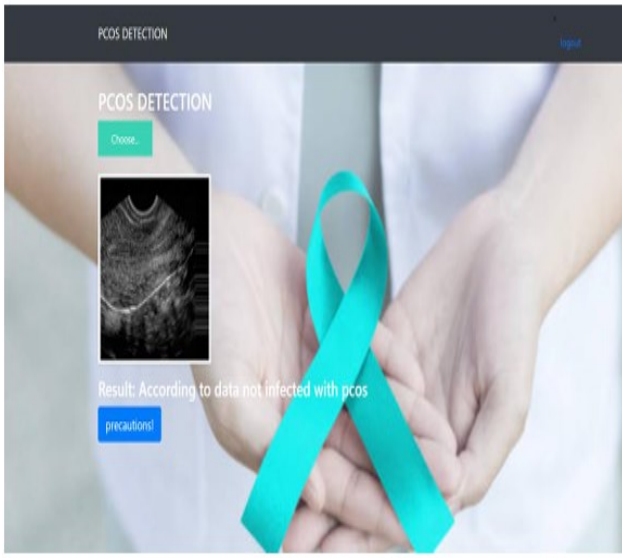
Vol19, Issue 1,2025


NOT AFFECTED WITH PCOS




## CONCLUSION

Using a Deep Convolutional Neural Network, the suggested approach provides a foundation for the automatic quality evaluation of PCOS data. Image processing advances may benefit medical practitioners in making an early diagnosis of PCOS and, as a result, giving patients with early therapy and treatment. If PCOS is identified late, it can have a long-term influence on not only physical but also mental health concerns. This research shows how different segmentation strategies can be coupled to improve follicle segmentation. We wish to use a machine learning technique to identify all extracted follicular features using a Logistic Regression classifier. As a result, the system can detect follicles automatically. We proposed incorporating an upgraded sampling technique that involves both oversampling and undersampling approaches to boost minority samples while removing outliers from our data to tackle the class imbalance problem in medical domain datasets. Then, using an Extreme Gradient Boosting model, we selected statistically significant and discriminating features that best characterise the PCOS condition. The integrated solution's huge potential is demonstrated by our rigorous testing on a benchmark dataset. We'd like to use CNN in an optimal version of our model in the future to improve it. We'd also like to do more detailed hyperparameter tweaking of machine learning algorithms, as well as better feature selection, to boost performance.

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