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PCOS Disease Detection using Deep Learning

Samarth Sarode[1], Vinayak Borude[2], Mohit Lagad[3], Shubham Ghorpade[4], Prof. P.V Raut[5]
Student, Sinhgad Institute of Technology, Lonavala, Maharashtra, India [1]
Professor, Sinhgad Institute of Technology, Lonavala, Maharashtra, India [2,3,4,5]

Abstract: *The most common endocrinological condition and a major contributor to anovulatory infertility in women worldwide is polycystic ovarian syndrome (PCOS). One of the most reliable methods for diagnosing PCOS and developing an effective treatment plan for patients with this illness is the detection of numerous cysts using ovarian ultrasonography (USG) scans. An intelligent computer-aided cyst detection system may be an effective alternative to relying on labor-intensive manual identification. The Convolutional Neural Network (CNN) incorporating various state-of-the-art techniques and transfer learning has been employed for feature extraction from the images.High amounts of androgens in women result in a combination of symptoms known as polycystic ovarian syndrome (PCOS). A combination of genetic and environmental factors that are common illnesses are the root cause of PCOS. It is frequently accompanied with clinical symptoms such as atherosclerosis, hirsutism, acne, and hyperandrogenism as well as persistent infertility. According to recent studies, this illness affects roughly 18% of Indian women. The damaged ovary was identified by doctors manually reviewing ultrasound images, but they were unable to determine if it was a simple cyst, PCOS, or malignant cyst. For the purpose of classifying cysts that are filled with blood or fluid on the basis of ultrasound pictures, CNN-based methods are proposed in this study and Python programming code is produced. The work uses feature extraction from images processed using CNN.*

Keywords: Convolutional Neural Networks, Deep Learning, Polycystic Ovary Syndrome, Ultrasound Images, Machine Learning.

I. INTRODUCTION

One of the most prevalent conditions affecting women of reproductive age is polycystic ovarian syndrome (PCOS), which affects 6%–20% of premenopausal women globally [1]. Ovarian dysfunction and an excess of androgen are the two main signs of PCOS. Many factors are thought to cause this syndrome, including genetics, puberty, physiological changes, mental state, and environmental influences. Menstrual abnormalities, hirsutism, obesity, insulin resistance, and cardiovascular disease are all common among PCOS patients. In addition to reproductive and metabolic issues, a sizable portion of patients exhibit emotional symptoms like despair [2]. As a result, it is crucial for the accurate diagnosis and treatment of PCOS. That is, the investigation was conducted utilising a trained independent dataset of the same disorders associated with PCOS. Lastly, the feature is performed using the test dataset [3].

The typical methodologies used for detecting PCOS using computational approaches, however, rely on a number of image processing techniques for feature extraction and then conventional machine learning strategies for image classification, which is a time-consuming process with relatively poor performance. Once more, some scientists used deep learning strategies to identify PCOS from ultrasound scans using Convolutional Neural Networks (CNN)[4]. Although deep learning algorithms normally achieve a high level of accuracy in classifying images, they are limited by the fact that their execution requires a lot of processing complexity and time, which makes it difficult to use them in real-world applications9. In order to predict PCOS using image data, an integrated or extended ML-based strategy may improve prediction accuracy and lower computational complexity [5].

For feature extraction from the input ultrasound ovary images, a deep learning approach encompassing various cutting-edge approaches, such as transfer learning with numerous pre-trained models in a CNN architecture, has been used. Next, using that smaller feature set, a stacking ensemble machine learning model using five conventional models as base learners and one boosting or bagging ensemble model as meta-learner was used to classify the individuals into PCOS or non-PCOS criteria [6].

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Four different types of machine learning techniques, including the conventional machine learning technique, the conventional machine learning technique with feature reduction, the deep learning technique, and the proposed extended technique, have been trained and tested with the same dataset for PCOS detection in order to evaluate the performance of the proposed methodology [7].

II. LITERATURE SURVEY

[1] Automated Screening of Polycystic Ovary Syndrome using Machine Learning Technique.

Description:

PCOS affects more than five million women globally who are of reproductive age. Missed periods, irregular periods, or very light periods are some of the most typical symptoms of this condition. It can also cause ovaries to enlarge or to contain a lot of cysts, excess body hair on the chest, stomach, and hirsutism, weight gain, especially around the abdomen, acne, or oily skin. PCOS's precise pathogenesis is still unknown.

The ovaries are the key feature of this diverse illness. A polygenic and multifactorial disorder, PCOS. Through clinical experience, machine learning is able to "learn" features from very vast amounts of data to identify this condition. This research proposes a remedy for this issue that aids in early

[2] A Classification of Polycystic Ovary Syndrome Based on Follicle Detec-tion of Ultrasound Images

Description:

Today's women suffer from polycystic ovarian syndrome (PCOS), which is largely brought on by bad lifestyle decisions. It has been established that PCOS, an endocrine condition common in women of childbearing age, has become a significant contributing factor to infertility. Ovarian abnormalities brought on by PCOS carry a greater risk of abortion, infertility, heart issues, diabetes, uterine cancer, etc. Ovarian cysts, obesity, monthly irregularities, excessive levels of male hormones, acne, hair loss, and hirsutism are some of the symptoms of PCOS. Due to the diverse symptom combinations in different women and the numerous diagnostic criteria, PCOS cannot be diagnosed simply. The length of time required for numerous biochemical tests and ovarian scanning, in addition to the associated costs, have made things difficult for the patients.

[3] Detection and Prediction System for Polycystic Ovary Syndrome (PCOS) Using Machine Learning Techniques"

Description:

PCOS, also known as polycystic ovary syndrome, is an endocrine disorder that affects females of reproductive age. Once the disease has been identified, this is not required to reverse it, however medicine may aid with symptom relief. Although the precise aetiology of PCOS is unknown, several indicators show how likely it is to exist. The reasons of this illness include obesity, insulin addiction, blood pressure, depression, and infection. The symptoms include hirsutism, oligo-ovulation, acne, severe bruising, and skin discoloration. With the help of the causes and symptoms, a system is prepared to accept them as traits and results of the inclusion or exclusion of this condition. For supervised classification, machine learning methods K-Nearest Neighbor and Logistic Regression are utilised.

[4] Diagnosis of Polycystic Ovary Syndrome Using Machine Learning Algorithms

Description:

PCOS, also known as polycystic ovary syndrome, affects women of reproductive age and is an endocrine condition. Once identified, the illness cannot be cured, although treatment can lessen its effects. Although the precise aetiology of PCOS is still unknown, there are some variables that increase your risk of developing the condition. Obesity, insulin resistance, blood pressure, depression, and inflammation are the causes of this syndrome. While hirsutism, Oligo-ovulation, acne, excessive bleeding, and skin darkening are some of the symptoms. A model is created using the causes and symptoms to accept them as characteristics and outputs the existence or absence of the condition. The machine learning models used for supervised categorization are K-Nearest Neighbor and Logistic Regression.

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[5] Establishment and Analysis of a Combined Diagnostic Model of Polycystic Ovary Syndrome with Random Forest and Artificial Neural Network.

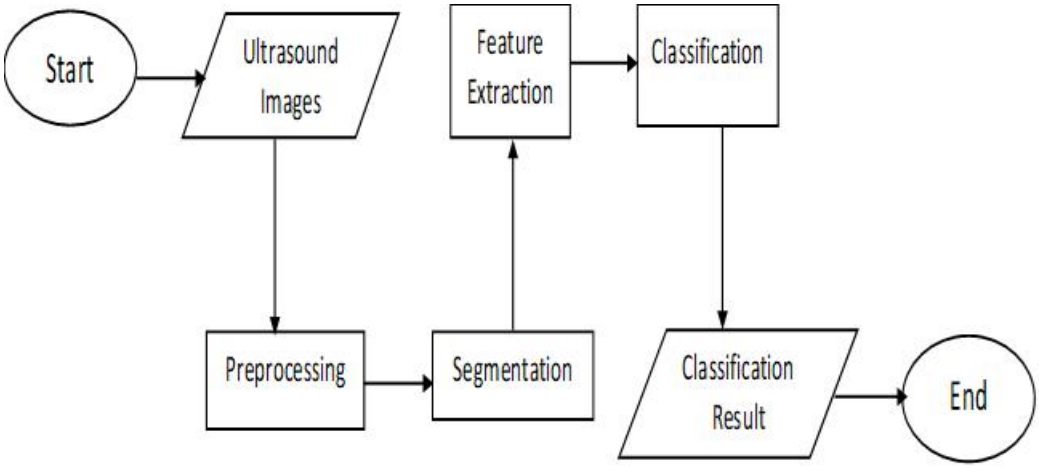
Description:

This study focuses on the data-driven diagnosis of Polycystic Ovary Syndrome (PCOS), a medical condition that impairs female fertility and affects women who are childbearing age or well past it. Complex long-term problems are possible as a result of this medical dispensation. boosting and begging algorithms' superior detection capabilities, particularly in the medical field. Extreme Boosting and Random Forest were mixed.(XGBRF). For the early detection of Polycystic Ovary Syndrome, we proposed a new approach using the XGBRF and CatBoost models. Data were re-sampled based on Synthetic Minority Over-sampling Techniques (SMOTE) to address outliers and data imbalance issues, in order to fully support this effective classification performance. Using an approach called univariate feature selection.

III. PROPOSED SYSTEM

Therefore, the objective of this research is to propose an extended machine learning classification technique for PCOS prediction using ovary USG images.

For feature extraction from the input ultrasound ovary images, a deep learning approach encompassing various cutting-edge approaches, such as transfer learning with numerous pre-trained models in a CNN architecture, has been used. Then, using that smaller feature set, a stacking ensemble machine learning model using five conventional models as base learners and one boosting or bagging ensemble model as meta-learner was used to classify the individuals into PCOS or non-PCOS criteria.



IV.METHODOLOGY (CNN)

The procedure was divided into two phases: training and testing. Testing phase is always preceded by the training phase. Convolution neural network does the feature extraction and classification. (CNN). The model is trained using training images, and the model is validated using testing data. The loss function is used to increase the model's accuracy. The prediction is made with greater accuracy the lower the loss function value.

Convolutional neural network (CNN, or ConvNet) is a form deep learning and most applied to analyzing visual imagery. CNNs use a variation of multilayer perceptron designed to require minimal pre-processing. They are also known as shift invariant or space invariant artificial neural networks (SIANN), based on their shared weights architecture and translation invariance characteristics. Convolutional networks were inspired by biological processes in that the connectivity pattern between neurons resembles the organisation of the animal visual cortex. Individual cortical neurons respond to stimuli only ina restricted region of the visual field known as the receptive field. The receptive fields of different neurons partially overlap such that they cover the entire visual field. CNNs use relatively little pre-processing compared to other image classification algorithms.[9]

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V. CONCLUSION

In this study, CNN is employed as an image classifier, and the dataset's cysts can be found using feature extraction and segmentation techniques. This procedure classifies test data from the dataset to determine whether the ovary is impacted and the parameters like area, solidity, extend, and perimeter where exactly affected using certain input ultrasound pictures as reference [10].

Much critical attention has been paid to PCOS screening. In order to address this problem, the current study was created to investigate a non-invasive way to aid in PCOS screening. Our research demonstrates that the suggested method achieves a meaningful classification performance, suggesting that deep learning may be an effective technique for PCOS detection. Additionally, research findings may suggest the exceptional potential of using scleral pictures to diagnose diseases. A fruitful study area may emerge from the integration of artificial intelligence and features taken from scleral pictures.

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