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Diagnosis of Polycystic ovarian syndrome using Deep learning

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Abstract: High levels of androgens in women produce polycystic ovarian syndrome (PCOS), a collection of symptoms. PCOS is caused by a combination of genetic and environmental variables that are frequent illnesses that are commonly associated with atherosclerosis, hirsutism, acne, and hyperandrogenism, as well as persistent infertility. According to recent studies, approximately 18% of Indian women suffer from this illness. Doctors manually examined ultrasound scans to determine which ovary was damaged, but they were unable to determine if it was a benign cyst, PCOS, or malignant cyst. In this research, DCNN-based algorithms are proposed, and coding for PCOS classification is produced in Python programming, and they are filled with blood or fluid using ultrasound pictures. To classify PCOS in the dataset, the study uses DCNN-based image processing feature extraction. That is, the research is conducted utilising a trained dataset of the same PCOS-related disorders. Finally, the test dataset is used to perform feature extraction and assess accuracy using performance parameters.

If not recognized and treated early, Polycystic Ovarian Syndrome (PCOS) can lead to infertility in women. The transvaginal ultrasound machine is a non-invasive means of examining the human ovary in order to show important aspects for PCOS diagnosis. The key characteristics that distinguish ovarian pictures are the number of follicles and their diameters. As a result, PCOS is diagnosed by manually counting follicles and measuring their diameters. This procedure is time consuming, labour intensive, and prone to errors. This research examines a variety of computer-assisted strategies for detecting follicles and PCOS diagnoses in ovarian ultrasound pictures. Some of the earlier works' performances are identified and compared. Finally, new research directions are suggested to address some of the identified constraints.

Keywords –PCOS Disease, Ultrasound Images, Deep Learning CNN (Convolution Neural Network)

I. INTRODUCTION

Deep Learning is a rapidly evolving technology that can help solve problems in a variety of fields. Deep learning is supporting healthcare practitioners and researchers in identifying hidden opportunities in data, allowing the medical sector to function more effectively. It also aids doctors in precisely analysing any type of ailment and better medicating patients, resulting in improved medical decisions. A medical condition like Polycystic Ovarian Syndrome (PCOS) lacks a reliable diagnosis and therapeutic alternatives. It's a common endocrine condition that causes ovarian cysts to form in child-bearing women, which can lead to infertility.

II. METHODOLOGY

This section provides a quick overview of the trials used to predict PCOS using machine learning classifiers. A dataset with 43 attributes of 541 women was obtained from the Kaggle repository for this purpose. 364 of the 541 incidences are for healthy people, while the remaining 177 are for PCOS sufferers. The Python programming language is employed as a machine learning tool in the research. Python is deployed using the Anaconda distribution package, Scikit-learn library, Jupiter notebook, Spyder, Orange, and other tools.

i. To develop an automated system for detection of cyst from the ultrasound images of ovary to avoid the manual mistakes and reduce the diagnosing time.

ii. To evaluate the performance of various filtering techniques and apply the most efficient technique to remove speckle noise.

iii. To enhance the contrast of the de-noised image, use suitable image enhancement technique.

iv. To segment the cyst exactly from the background of the ultrasound image, evaluate several segmentation techniques and apply the suitable segmentation techniques.

v. To optimize the features of segmented area required for classification of ovaries. vi. To classify the ovaries based on number of cyst and also fluid which is filled in follicles, compare the performance of various classifiers and use the most accurate classifier. vii. To validate the performance of the proposed system, compare the result with existing methods.

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III. SYSTEM ARCHITECTURE

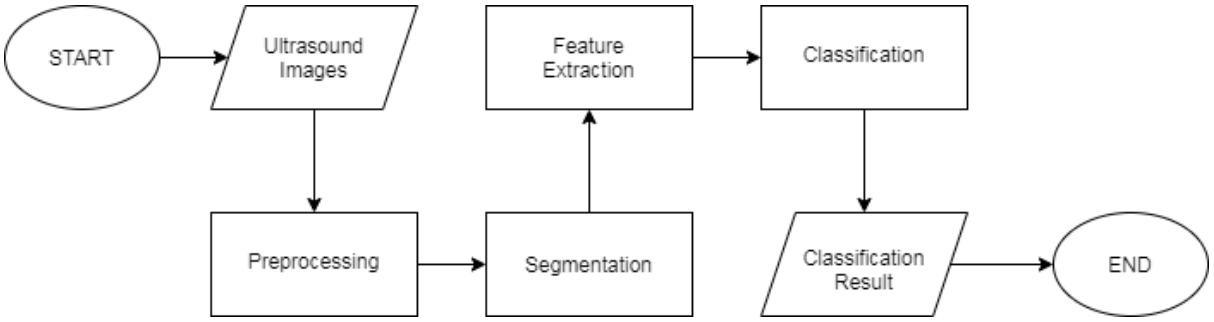

FIG. 1

The step by step process of the proposed methodology is as follows,

- Data collection. In this work, ovarian ultrasound images are collected.
- Next is preprocessing.
- As ultrasound images are mainly affected by speckle noise it is necessary to remove the speckle noise.
- After preprocessing, the region of interest i.e PCOS portion is segmented using a CNN algorithm.
- Once the PCOS is segmented, features are extracted which is necessary for the classification process.
- Using the extracted features, the CNN model is trained using training ultrasound images.
- To validate the model, the test images are applied to classify the PCOS.

IV. CONCLUSION

The proposed approach offers a basis for the automated quality evaluation of PCOS data using a Deep Convolutional Neural Network. Image processing advancements may aid medical practitioners in obtaining an early diagnosis of PCOS and, as a result, providing early therapy and treatment to patients. PCOS has a long-term impact on not just physical but also mental health disorders if detected late. This study demonstrates how several segmentation strategies can be combined to create a better follicle segmentation method. We want to utilise a machine learning technique by utilising a Logistic Regression classifier to classify all extracted follicular features. As a result, the system can automatically identify the follicles. To overcome the class imbalance problem in medical domain datasets, we proposed integrating an enhanced sampling technique that incorporates both oversampling and undersampling approaches to boost minority samples while removing outliers from our data. Following that, we chose statistically significant and discriminating features that best reflect the PCOS condition, and then fed them into an Extreme Gradient Boosting model. Our extensive testing on a benchmark dataset demonstrates the integrated solution's enormous potential. To improve our model in the future, we'd like to add CNN in an optimum version. Furthermore, for enhanced performance, we would like to do more comprehensive hyperparameter tweaking of machine learning algorithms as well as improved feature selection.

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