International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 03 | March - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Smart Health:Detecting Polycystic Ovary Syndrome with Machine Learning

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Abstract - Smart Health Detecting Polycystic Ovary Syndrome With Machine Learning is a system aimed to improve PCOS diagnosis through machine learning. PCOS is a hormonal condition that affects women, causing infertility and metabolic difficulties. This project analyzes patient data and ultrasound images using preprocessing techniques such as data cleansing and feature extraction. CNN, SVM, and KNN are machine learning algorithms that identify patients as PCOS-positive or normal. The technology automates diagnostics, resulting in higher accuracy and earlier detection. By incorporating deep learning, it ensures consistent outcomes and gives healthcare practitioners with an easily accessible interface. This approach is intended to promote quick intervention, reduce long-term health issues, and improve patient outcomes.

Key words: computer vision, image processing, guidance system, and object recognition.

1. INTRODUCTION

A prevalent endocrine condition that affects women of reproductive age, polycystic ovarian syndrome (PCOS) frequently results in infertility and metabolic issues. Hormonal abnormalities, obesity, irregular menstruation, and ovarian cysts are among the symptoms. Ultrasound imaging, which aids in ovarian follicle detection and abnormality assessment, is commonly used in diagnosis. This study analyzes patient data and ultrasound images using machine learning to improve PCOS identification. Through the use of segmentation and classification algorithms, the system seeks to enhance early diagnosis, lower human error, and enable prompt medical intervention.

Grade I:Every year, millions of women around the world suffer from PCOS, a serious health issue. It causes metabolic issues, infertility, and hormonal imbalances. The conventional techniques for identifying PCOS depend on subjective and time-consuming clinical assessments, blood testing, and ultrasound imaging. The use of machine learning in healthcare has made it possible to detect PCOS more quickly and accurately. These models can detect risk factors early through the analysis of massive datasets, guaranteeing that patients receive the right medical care before issues develop.

Grade II:The efficiency and accuracy of PCOS detection are improved by the application of machine learning and deep learning techniques. The suggested system classifies patients according to severity levels by analyzing ultrasound pictures using CNN, SVM, and KNN algorithms. These models Reducing human error and guaranteeing accurate diagnosis, the automated categorization system offers a quicker substitute for the traditional diagnostic techniques.

Grade III: Machine learning-driven PCOS detection systems are essential for healthcare decision-making, even beyond early diagnosis. Healthcare providers might suggest individualized therapies and lifestyle changes to effectively manage symptoms by spotting patterns in patient data. AI integration in medical imaging also helps with post-diagnostic monitoring, which enables physicians to follow the course of diseases and evaluate how well therapies are working.

Grade IV: The influence of machine learning-based PCOS identification on the economics and accessibility of healthcare is an additional benefit. Women can remotely evaluate their PCOS risk factors by integrating automated screening tools into mobile applications. Patients in remote places can now access healthcare more easily thanks to this invention, which lessens the need for specialist consultations. Additionally, insurance claims and legal paperwork are made easier by the digitization of medical data and diagnostic results, guaranteeing openness and equity in medical practices.

Machine learning must be incorporated into healthcare as medical technology advances in order to improve early diagnosis and treatment. With the use of AI models such as CNN, SVM, and KNN, this study enhances PCOS detection, guaranteeing precise and prompt outcomes. It facilitates improved patient care and medical decision-making by lowering human error and automating diagnosis. Through digital technologies, the system improves accessibility in addition to helping medical professionals. Future developments like telemedicine and smartphone apps will broaden its scope even more, improving the effectiveness and accessibility of PCOS detection.

2. LITERATURE REVIEW

A literature review is a crucial phase in the software development process since it offers insightful information and enhancements for improving current approaches. The main studies that have impacted the suggested work on machine learning-based PCOS detection are highlighted in this section. In order to predict PCOS risk, Singh et al. (2023) created a patient-centered smartphone application using machine learning techniques. Personalized risk estimates were made possible by the model's training on a varied sample of the PCOS cases. Given the intricacy of the disease and its wide variety of clinical manifestations, the study underlined the

urgent need for more precise and the prompt identification techniques.
A mobile-based period tracker with machine learning integrated for PCOS detection was presented in another study, BeRedy (2023). In order to forecast PCOS risk, the application examined user-provided data, such as menstrual cycle patterns and the few symptoms. By addressing the shortcomings of the conventional clinical diagnostic techniques, this strategy ensured the more individualized and easily accessible healthcare solutions.

A systematic review of machine learning-based ultrasound image-based ovarian cyst identification was carried out by Gupta and Fatima (2023). Their research showed how well numerical prediction models could differentiate between those who were impacted and those who weren't. Additionally, the study emphasized the value of parameter-based analysis in determining the severity of PCOS, offering insights into customized diagnostic strategies.

Chitra et al. (2023) proposed a hybrid deep learning model that combines CNN and traditional ML techniques for PCOS diagnosis. The model improved accuracy in detecting PCOS-related features from ultrasound images, emphasizing the potential of AI-driven diagnostics in women's healthcare.

Brindha and Rajalaxmi (2023) conducted a comparative study on CNN and transfer learning techniques for classifying PCOS ultrasound images. Their work synthesized numerical and image-based features, addressing gaps in current diagnostic tools. The study reinforced the importance of integrating AI-based methods to improve the efficiency and accessibility of PCOS diagnosis

3. SYSTEM DESIGN

Existing system:

Traditional techniques such as manual ultrasound analysis, hormone measurements, and clinical evaluations are still used in the current system for diagnosing Polycystic Ovary Syndrome (PCOS). Using ultrasound scans, doctors look at ovarian follicles while taking the patient's medical history and symptoms, such as hirsutism and irregular menstruation, into account. Nevertheless, this procedure is subjective, time-consuming, and reliant on the experience of the doctor, which might result in inconsistent results and a delayed diagnosis. Furthermore, the expense of many testing rises, making early detection challenging.

Accuracy is decreased by several contemporary methods that employ semi-automated ultrasonic analysis but lack sophisticated picture processing and feature extraction. Personalized risk assessment is further limited by the lack of machine learning-based predictive models in current diagnostic techniques. To improve accuracy, efficiency, and early PCOS detection, an AI-driven solution that combines deep learning, ultrasound segmentation, and clinical data analysis is therefore required.

Proposed system:

The proposed solution uses deep learning and machine learning to improve PCOS detection. Utilizing CNNs for image classification and segmentation, it integrates clinical data for thorough analysis and automates the diagnosis of ovarian cysts from ultrasound pictures. Preprocessing the data to eliminate noise and extract pertinent features is the first step in the system's organized methodology. By identifying intricate the patterns in images, CNNs, SVM, and KNN increase the accuracy of diagnoses. The system is made to be accessible in real time and has an easy-to-use interface that allows medical practitioners to enter data and get risk evaluations instantly. Future developments include remote diagnostics and telemedicine integration to provide PCOS screening to a larger population.

4. METHODOLOGY

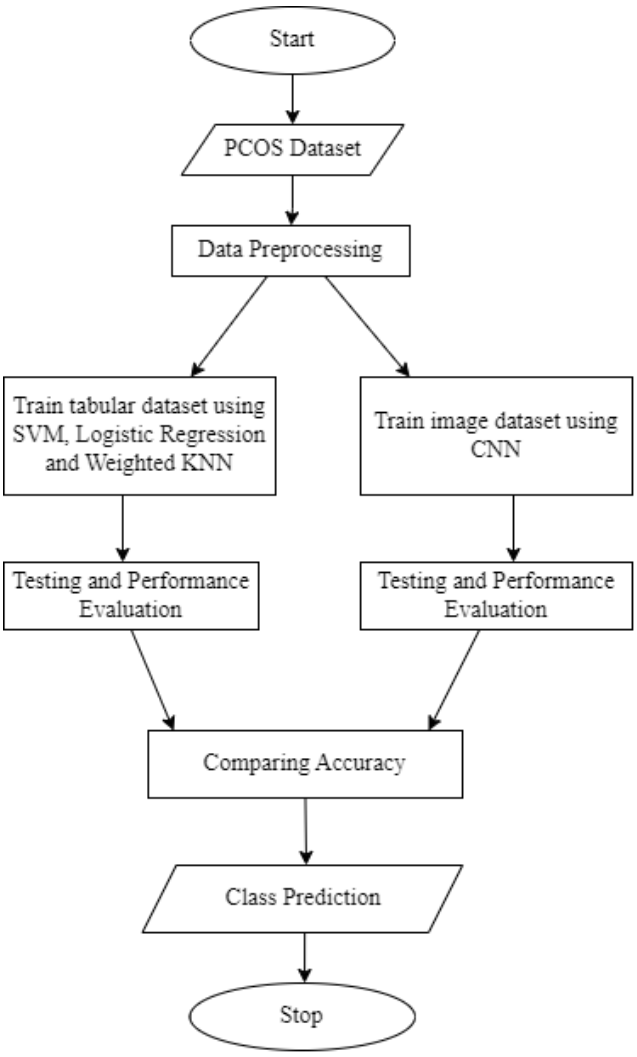

Figure 1: Dataflow Diagram

To guarantee precise and timely detection of Polycystic Ovary Syndrome (PCOS), the suggested PCOS detection system adheres to a systematic methodology. The PCOS dataset, which consists of clinical and ultrasound image data, is where the procedure begins. The dataset is cleaned, standardized, and made ready for analysis during the data preprocessing phase. The system then uses deep learning and machine learning models to classify the data. SVM, Logistic Regression, and Weighted KNN are used to train the tabular dataset, and a CNN-based model is used to process the ultrasound picture dataset in order to locate cysts. To determine their efficacy, both models are put through testing and performance reviews. Following an accuracy comparison, the system chooses the top-performing model for class prediction,

delivering accurate PCOS diagnosis findings to help medical practitioners make prompt and accurate decisions. This data driven approach enhances clinical efficiency, allowing for early intervention and personalized treatment strategies.

5. CONCLUSIONS

The PCOS Detection System is a cutting-edge tool that uses deep learning and machine learning methods to precisely identify Polycystic Ovary Syndrome. The system successfully classifies PCOS instances using classification techniques including Support Vector Machines (SVM) and Weighted K-Nearest Neighbors (KNN), with SVM obtaining an astounding accuracy of 95.73%. Furthermore, a Convolutional Neural Network (CNN) model is used to predict the severity of PCOS, with an accuracy of 97.59%. The system improves diagnosis accuracy by automating the detection process, allowing for prompt medical interventions and individualized treatment plans. The importance of AI-driven healthcare solutions in enhancing women's health is highlighted by this project. Real-time health monitoring, wearable device integration, and extending the model's capacity to identify associated reproductive health issues are possible future developments.

6. FUTURE DIRECTIONS

Future improvements to the PCOS Detection System could greatly increase its accessibility and accuracy. Creating mobile applications specifically for PCOS self-management, education, and detection can provide people with individualized health insights. By facilitating remote consultations, initial screenings, and follow-up care with medical professionals, telemedicine integration can improve accessibility. Additionally, putting in place community education and outreach initiatives can increase knowledge of PCOS risk factors, symptoms, and early detection techniques. Future developments might also incorporate AI-driven predictive analytics for proactive healthcare interventions and integration with wearable medical devices for the ongoing monitoring.

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