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Machine Learning-Based Classification Of Medical Images

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Abstract
For an accurate diagnosis, it is necessary to track both follicular development and follicle development brought on by hormonal stimuli. Infertility therapies also need the detection of ovarian cysts and polycysts in the ovaries in addition to the identification of follicular development. In any event, the diagnosis of a follicle or cyst is determined based on its size, shape, and number, which is crucial when treating infertility. It is time-consuming and unreliable to manually analyze and interpret ovarian ultrasound pictures. Furthermore, the skill of the physician doing the scan has a significant impact on both quality and interpretation. However, only multispecialty hospitals have this kind of knowledge. To get professional advice, people from rural areas must travel to urban areas. Inaccurate opinions and misinterpretations are more likely to result from inter-observer variation and the likelihood of a false diagnosis. Therefore, automatic ovarian follicle and follicular cyst recognition helps the radiologist make a good judgment about the follicle's appearance based on visual examination of ultrasound pictures. In addition to detection, ovarian image categorization is an essential component of infertility therapy. The medical professional's ability to classify the ovary as normal, polycystic, or cystic is essential for diagnosis and treatment. The distinction between an ovarian cyst and a normal ovarian follicle is always unclear when interpreting images. If an ovarian cyst is not identified in a timely manner, it may result in ovarian cancer. Likewise, women with polycystic ovaries may experience severe infertility.
Keywords: *machine learning, recurrent neural networks, opportunities*

1. INTRODUCTION

"A state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" is how the World Health Organization (WHO) defines health. A woman's health directly affects her children, family, and the communities in which she lives. Our contemporary world's health and well-being are influenced by the health of women and girls [1]. Women's health is a branch of medicine that focuses on identifying and treating illnesses and ailments that affect a woman's physical and mental health. Protecting and preventing infections, injuries, and long-term health problems is crucial for women's reproductive health. Hormonal imbalance, infertility, breast cancer, irregular menstruation, ovarian cysts, and polycystic ovarian syndrome (PCOS) are among the prevalent medical conditions that women encounter [2]. To identify these health problems in women, a variety of medical diagnostic techniques are available [9]. While pelvic ultrasonography is frequently used to diagnose issues related to women's reproductive health, mammography is frequently used to diagnose breast cancer. Three techniques, including transabdominal, transvaginal, and transrectal, are used to do pelvic ultrasonography. The female reproductive organs can be imaged using both transvaginal and transabdominal methods. Because transabdominal ultrasonography must pass through the abdominal wall and subcutaneous tissues, the quality of the resulting image is reduced, making it less desirable. As a result, it doesn't offer additional diagnostic details about the scanned anatomical structure [3]. However, compared to transabdominal ultrasound, transvaginal ultrasound provides more precise diagnostic information, which is why it is highly recommended. This study investigates the potential, difficulties, and suggestions for additional research in the healthcare industry as it looks at the importance of AI-related technologies, specifically ML and/or DL approaches, in the processing of biological or medical pictures. The emphasis will be on machine learning techniques that can be used for medical picture classification [3]. The development of machine learning in medical imaging not only demonstrates its potential but also emphasizes how vital it is to accomplishing the more general objectives established by

the pioneers of artificial intelligence in a number of medical domains [4]. Because of the combination of clinical methodology, technological breakthroughs, and the comprehensive vision of artificial intelligence, the use of machine learning techniques is positioned as a transformative factor for gaining unsurpassed diagnostic accuracy and efficiency in healthcare. [13].

2. REVIEW OF LITERATURE

In addition to its high cost, CT and MRI each have significant drawbacks, such as radiation emission and contrast injection, respectively. The literature mentioned above makes it clear that CT and MRI are only recommended when the advantages outweigh the hazards. Additionally, they are only recommended for tumor localization and differentiation; they are not recommended for initial assessment [14]. The first and most important diagnostic option for ovarian follicle/cyst detection is transvaginal ultrasonography. CT or MRI is preferred only in cases where the ultrasound results are unclear or where lesion differential identification and tumor staging are necessary [5]. It follows that ultrasound is always the best and most primary imaging modality for evaluating the female pelvis, including imaging of the ovaries, fallopian tubes, uterus, and bladder. The diagnosis of ovulatory diseases using ovarian ultrasound imaging is the main goal of the current investigation. In order to guarantee that the ultrasonic images are fully denoised and hence preserve the image information, speckle reduction employing the wavelet transform was carried out [11]. In order to reduce the speckle noise in medical ultrasound images, contourlet transform was used. The contourlet transform assisted in shielding the wavefronts and eliminating speckle noise. Performance metrics such as geometric, speckle reducing anisotropic diffusion, median, hybrid median, and non-local means filters were compared between root filters. In terms of speckle reduction, anisotropic diffusion filters and non-local means filters performed better than the others. The modified total variation approach reduces speckle noise in ultrasound imaging of polycystic ovaries. Here, the image's intensity variation is decreased, smoothing out similar areas while keeping the edges intact. Furthermore, it is believed that medical photographs are the primary source of vital information needed to identify illnesses [6].

3. MATERIALS AND METHODS

It is necessary to create a predictive modeling technique that can recognize the unique characteristics of ovarian pictures and aid in image analysis. This makes it difficult to find the pattern or extract particular features for image analysis, which emphasizes pattern recognition and image analysis. Machine learning techniques are commonly utilized in image processing for undersea, medical, and satellite images. Significant progress has been made in identifying significant features in medical photographs, particularly in the identification and categorization of anomalies, thanks to machine learning and pattern recognition. When creating machine learning algorithms, choosing features, designing the network or model, and adjusting the network's parameters are difficult jobs. They are essential in producing the right choice for a certain set of characteristics, enhancing the system's precision and resilience. [7].

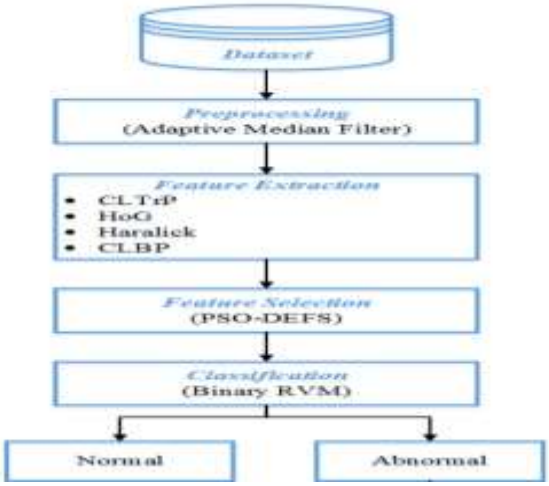

Figure 1: Proposed flow

Machine learning techniques used in computer-aided diagnosis (CAD) will undoubtedly aid in automated early detection and categorization, preventing hallucination [12]. It assists the doctor in improving his diagnostic judgment about image interpretation and moving forward with the proper course of treatment [15]. Therefore, the creation of an intelligent automated algorithm that can detect and classify ovarian follicles and cysts and act as a decision support system is desperately needed [8].

4. RESULT AND DISCUSSION

Another ovulatory condition that contributes to female infertility is ovarian cysts. They are generally benign and more prevalent throughout the reproductive years. Postmenopausal women and women approaching menopause may have an increase in the malignancy of ovarian cysts in the reproductive age range.

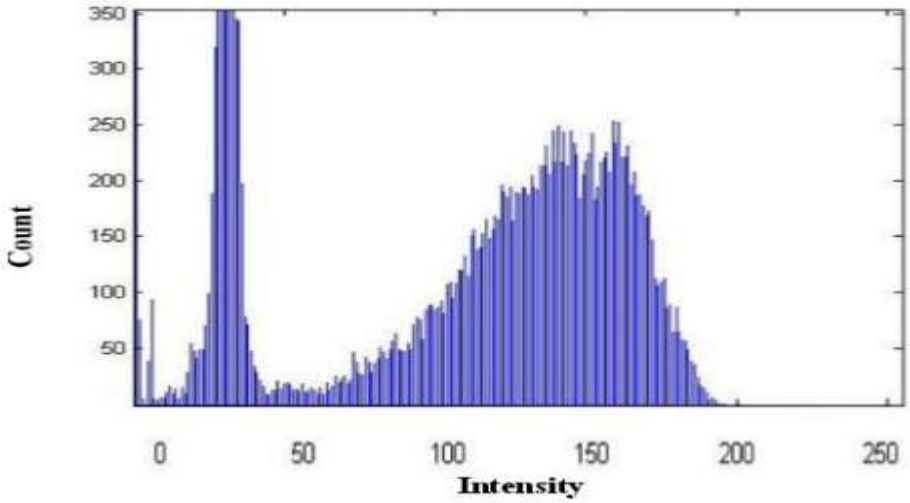

Figure 2: Histogram of an Image

However, it is mostly preferred for women in the reproductive age range to avoid needless surgery to address the cysts in order to prevent subsequent fertility complications (Alka et al., 2004). It is also thought that inclusion cysts, which are thought to be invasions of the ovarian surface, are the source of epithelial ovarian cancer. When ovarian cancer is limited to the ovaries, early identification can cure up to 90% of patients.

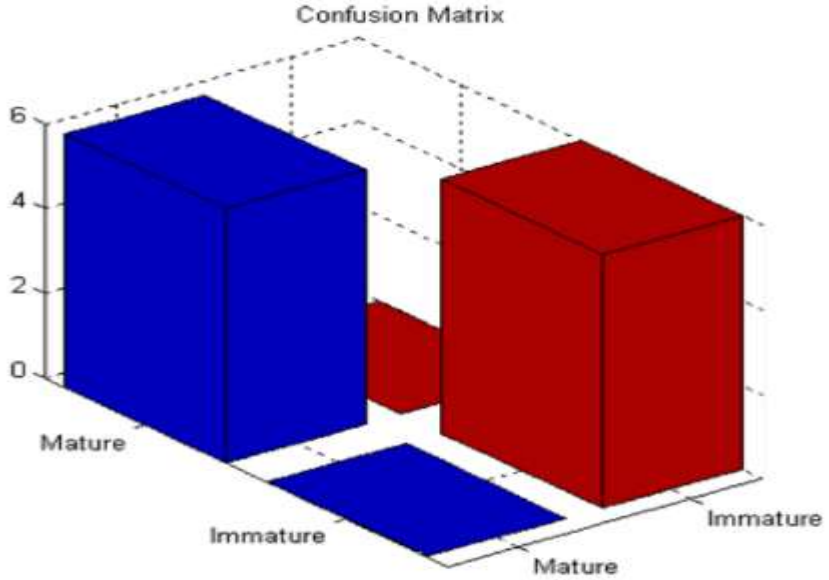

Figure 3: Confusion matrix

In addition to identifying polycysts and ovarian cysts, classifying ovaries as polycystic, cystic, and normal will improve medical interpretation by the doctor and aid in the diagnosis and management of infertility.

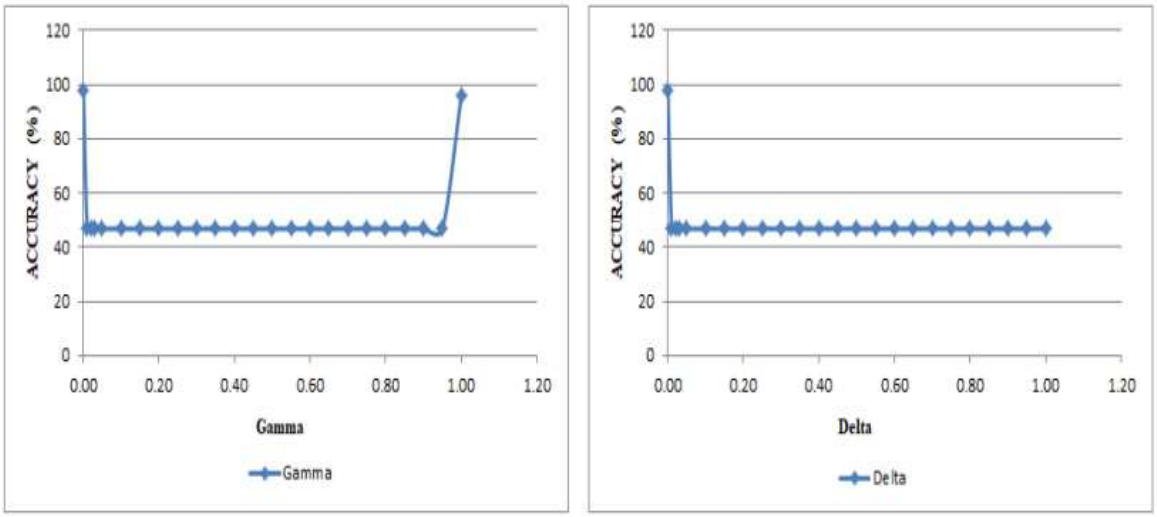

Figure 4: Accuracy using gamma and delta in LDA

The process of determining which group a given observation or piece of data belongs to is called classification. A training set that consists of observations with a labeled or known group is used to achieve this. In classification difficulties, machine learning techniques are frequently employed. Machine learning is used in medical image analysis to detect and categorize anomalies. Typically, different aspects of the patient's image, diagnostic data related to his or her health status, or a combination of both serve as the input features in medical image classification.

5. CONCLUSION

Classification, segmentation, and point-of-interest detection and identification processes for medical images are now considerably simpler. Advances in CV have the potential to accelerate the development and integration of numerous medical applications. However, there are currently very few real-world deployments in busy clinics and hospitals. The present status of CV in the healthcare industry is examined in this article. We examine the main obstacles that CV and intelligent data-driven medical applications face and provide solutions for the future in order to promote the development, advancement, and use of CV technology in healthcare operations. First, we conduct a comprehensive literature review in the CV area, focusing on research that categorizes medical images, recognizes objects and structures in images, and segments images for medical applications. Next, we provide a thorough examination of the numerous obstacles impeding the advancement of intelligent CV approach research, development, and implementation in actual hospitals and medical settings.

REFERENCES

1. Neelapu, Ramesh, Golagani Lavanya Devi, and Kurapati Srinivasa Rao. "Deep learning based conventional neural network architecture for medical image classification." Traitement du signal 35, no. 2 (2018): 169.

2. Akshyaa Raaja Shri, I. T., Dheenadhayalan, S., Rahul, B., Vishnu, B., & Suganya, S. (2023). Face Recognition Using LSTM in Image Processing. International Journal of Advances in Engineering and Emerging Technology, 14(1), 124–129.

3. Guo, Zhe, Xiang Li, Heng Huang, Ning Guo, and Quanzheng Li. "Deep learning-based image segmentation on multimodal medical imaging." IEEE Transactions on Radiation and Plasma Medical Sciences 3, no. 2 (2019): 162-169.

4. Hussain, I., & Qureshi, A. (2024). Gender-Inclusive Energy Transitions: Empowering Women in Renewable Energy Sectors. International Journal of SDG's Prospects and Breakthroughs, 2(2), 7-9.

5. Shihadeh, Juliana, Anaam Ansari, and Tokunbo Ozunfunmi. "Deep learning based image classification for remote medical diagnosis." In 2018 IEEE Global Humanitarian Technology Conference (GHTC), pp. 1-8. IEEE, 2018.

6. Sharma, A., & Desai, P. (2024). AI-Driven Fault Detection in Electrical Networks: Applications Explored in the Periodic Series of Technological Studies. In Smart Grid Integration (pp. 1-5). Periodic Series in Multidisciplinary Studies.

7. Murtaza, Ghulam, Liyana Shuib, Ainuddin Wahid Abdul Wahab, Ghulam Mujtaba, Ghulam Mujtaba, Henry Friday Nweke, Mohammed Ali Al-garadi, Fariha Zulfiqar, Ghulam Raza, and Nor Aniza Azmi. "Deep learning-based breast cancer classification through medical imaging modalities: state of the art and research challenges." Artificial Intelligence Review 53 (2020): 1655-1720.

8. Etuk, H. S., Ebong, G. A., Ekot, A. E., Ekpo, B. O., & Ayi, A. A. (2024). Mineral and elemental compositions of suspended particulate matter (SPM) and sediments from major rivers in the Southeastern Nigeria. International Journal of Aquatic Research and Environmental Studies, 4(1), 71-89. http://doi.org/10.70102/IJARES/V4I1/7

9. Liu, Xiangbin, Liping Song, Shuai Liu, and Yudong Zhang. "A review of deep-learning-based medical image segmentation methods." Sustainability 13, no. 3 (2021): 1224.

10. Branitskiy, A., Levshun, D., Krasilnikova, N., Doynikova, E., Kotenko, I., Tishkov, A., Vanchakova, N., & Chechulin, A. (2019). Determination of Young Generation's Sensitivity to the Destructive Stimuli based on the Information in Social Networks. Journal of Internet Services and Information Security, 9(3), 1-20.

11. Jiang, Huiyan, Zhaoshuo Diao, Tianyu Shi, Yang Zhou, Feiyu Wang, Wenrui Hu, Xiaolin Zhu, Shijie Luo, Guoyu Tong, and Yu-Dong Yao. "A review of deep learning-based multiple-lesion recognition from medical images: classification, detection and segmentation." Computers in Biology and Medicine 157 (2023): 106726.

12. Baggyalakshmi, N., Kanishka, J., & Revathi, R. (2024). Stationery Management System. International Academic Journal of Innovative Research, 11(1), 39–50. https://doi.org/10.9756/IAJIR/V11I1/IAJIR1105

13. Noothout, Julia MH, Bob D. De Vos, Jelmer M. Wolterink, Elbrich M. Postma, Paul AM Smeets, Richard AP Takx, Tim Leiner, Max A. Viergever, and Ivana Išgum. "Deep learning-based regression and classification for automatic landmark localization in medical images." IEEE transactions on medical imaging 39, no. 12 (2020): 4011-4022.

14. Baggyalakshmi, N., Janani Shree Priya, M., & Revathi, R. (2024). Online Shopping System. International Academic Journal of Science and Engineering, 11(1), 71–80. https://doi.org/10.9756/IAJSE/V11I1/IAJSE1110

15. Tang, Hai, and Zhihui Hu. "Research on medical image classification based on machine learning." IEEE access 8 (2020): 93145-93154.