AI-Assisted Diagnosis of Endometriosis Using Medical Imaging

Introduction

Endometriosis is a chronic gynecological condition in which tissue similar to the uterine lining grows outside the uterus, often causing severe pain and infertility.
It affects approximately 10% of reproductive-age women worldwide (Becker et al., 2022). Despite its prevalence, diagnosis is often delayed by 7–10 years due to nonspecific
symptoms and limitations in current diagnostic methods (Chapron et al., 2019). Artificial Intelligence (AI), particularly deep learning, offers new opportunities to improve
detection and reduce diagnostic delays by analyzing ultrasound and MRI imaging, as well as combining clinical data and patient history.

Innovation in AI for Endometriosis

1. AI-powered ultrasound analysis: Deep learning models can be trained to detect endometriotic cysts (endometriomas) and deep endometriosis lesions in transvaginal ultrasound images.
Tellum et al. (2022) demonstrated that convolutional neural networks can classify ovarian endometriomas with performance comparable to human experts.

2. MRI-based AI models: Machine learning techniques have been used to analyze MRI scans for preoperative mapping of endometriosis lesions. This helps clinicians plan surgery
and improves diagnostic accuracy compared with traditional imaging review.

3. Predictive models using patient data: AI systems that integrate symptoms, biomarkers, and imaging results have been developed to predict endometriosis risk,
potentially reducing diagnostic delays.

4. AI in surgery: Early research explores AI algorithms that can highlight lesions during laparoscopy in real time, guiding surgeons in detecting smaller or atypical lesions.

Project Demo Application

For this project, we developed a Streamlit-based demo app that simulates an AI-assisted endometriosis screening tool:
- Input: Pelvic MRI or ultrasound image
- Processing: Image is resized, normalized, and passed through a model (or stub predictor if no trained model is available)
- Output: Classification into Possible Endometriosis or Unlikely Endometriosis with a probability score
- Explainability: Saliency heatmaps overlay suspicious regions on the original image

This demo illustrates how AI can be integrated into a clinician’s workflow to provide decision support, but emphasizes that clinical-grade systems require rigorous validation and regulatory approval.

Limitations

- Dataset availability: Unlike diabetic retinopathy (with large open datasets), public datasets for endometriosis imaging are limited. This restricts model training and reproducibility.
- Generalizability: AI models may perform differently across populations, scanners, and imaging protocols.
- Ethical considerations: Patient privacy, informed consent, and bias in training datasets must be carefully addressed before deployment.

Conclusion

AI-assisted tools for endometriosis detection show great promise in reducing diagnostic delays, improving accuracy, and supporting both radiologists and gynecologists.
While research has shown encouraging results in ultrasound and MRI applications, clinical adoption requires larger datasets, external validation, and regulatory oversight.
Our demo project demonstrates the concept of an AI pipeline for endometriosis detection and highlights the potential of such innovations in the future of women's health.

References

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- Tellum, T., et al. "Deep learning for ultrasound detection of endometriosis." Ultrasound in Obstetrics & Gynecology, 2022.