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Feasibility of fetal lung maturation diagnosis using radiomics features of ultrasound images

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Introduction

Assessment of fetal lung maturity is of great importance in prenatal management to prevent adverse outcomes for the fetus or mother. Since it is not yet possible to assess fetal lung development with non-invasive methods, this study evaluates the feasibility of using radiomics features from ultrasound images to predict fetal lung maturity.

Methods

A dataset of 467 ultrasound images (four-chamber view, single pregnancy, 25 and 40 weeks) were collected and categorized into low, medium, and high-quality groups. Low-quality images were excluded due to their negative impact on prediction accuracy, leaving 190 right and 178 left lung images. The images were labeled into two classes based on gestational age (less or more than 34 weeks). Lung regions were manually segmented, and radiomics features were extracted using PyRadiomics v3.1.0. Preprocessing included intensity normalization, discretization, and mask correction. Features were derived from original images, wavelet decompositions, Laplacian of Gaussian (LoG) filtering, and intensity transformations, resulting in 1127 features per lung.

result

A K-Best feature selection algorithm identified 15 informative features from each lung, with p-values < 0.05 . A grid search SVM classifier with 10-fold cross-validation achieved 73% accuracy using 30 selected features, primarily texture-based, highlighting their importance for prediction. Separate experiments using only right or left lung images yielded accuracies of 72% and 70%, respectively, suggesting right lung data may be more informative. The accuracy for the <34 weeks class was slightly higher, potentially due to class imbalance.

Conclusion

Diagnosing of fetal lung maturation can be feasible by using radiomics characteristics of ultrasound images. Future work will focus on balancing class samples and exploring deep learning-based features for improved prediction.

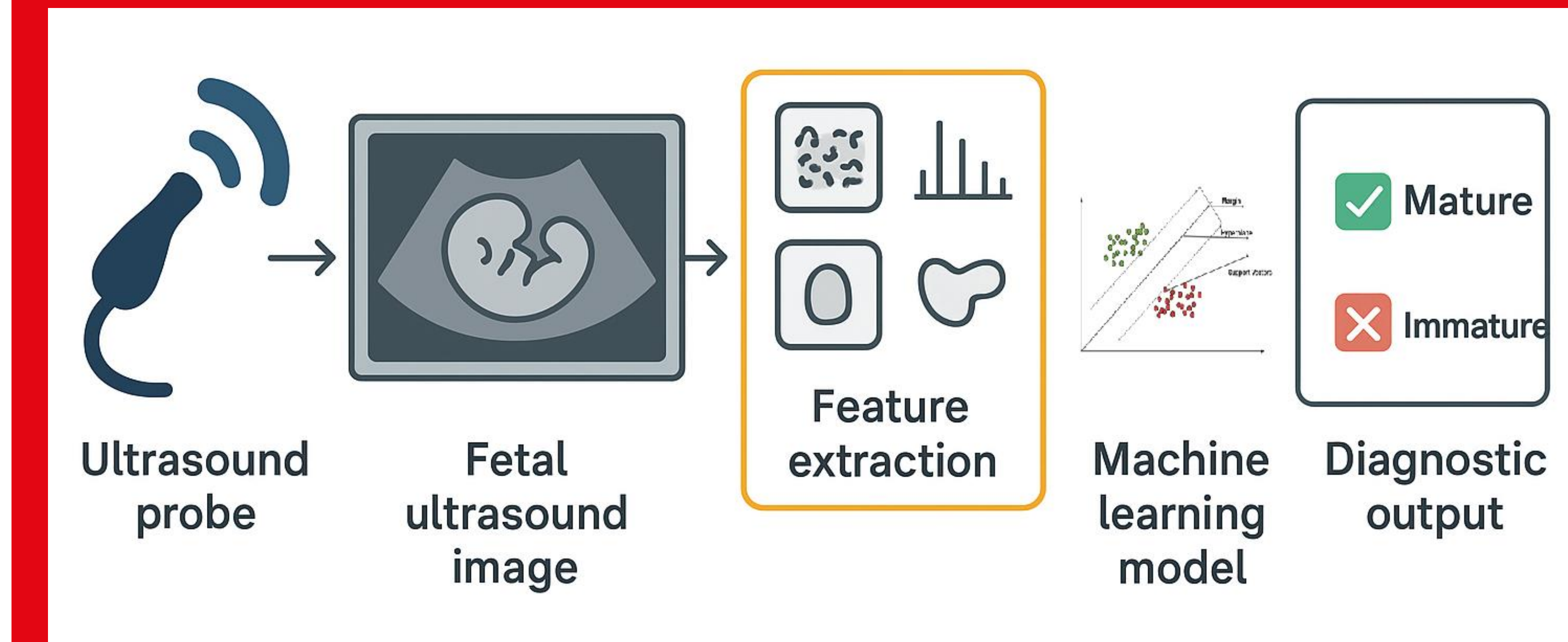


Figure 1. General Steps of the Proposed Approach

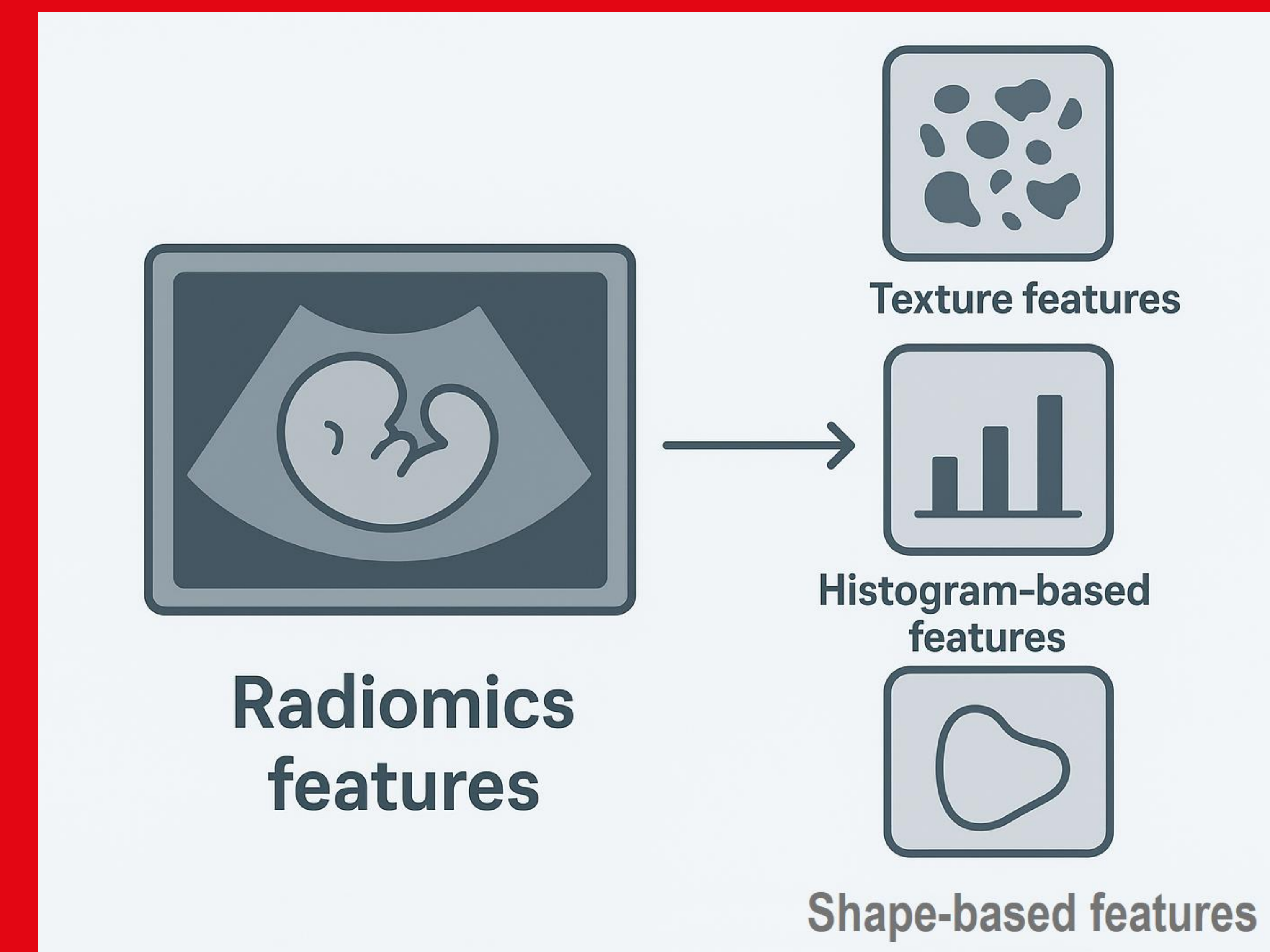


Figure 2. Different kinds of Radiomics features