

EP04.08. Improving ovary segmentation robustness with simulated menstrual-phase ultrasound data

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Introduction

Ovarian appearance varies across menstrual phases, which can cause AI segmentation models to over-rely on follicular patterns when training data are imbalanced. Our goal was to simulate the less-represented menstrual phases from the follicular phase and evaluate whether adding these synthetic images improves segmentation robustness.

Methods

We curated a dataset of 86 transvaginal ultrasound images showing the ovary in the follicular phase. We synthesized each of the other phases (luteal, ovulation, postmenopausal) from these 86 images. For the simulation, two latent diffusion models were trained and used for inpainting ovaries and follicles. Using the ovarian masks from the follicular-phase images, we inpainted the corresponding region to resemble the other phases.

To evaluate the usefulness of the generated images, a segmentation model was trained with and without synthetic data. Evaluation was performed on an external test set of 64 images containing all menstrual phases, using the Dice score.

Results

Synthetic menstrual-phase images consistently improved ovary segmentation across all 10 random seeds.

+0.049

Mean Dice uplift (0.761 → 0.810)

-17%

Lower variability (std 0.162 → 0.135)

p < 0.001

Paired Wilcoxon, 10 seeds

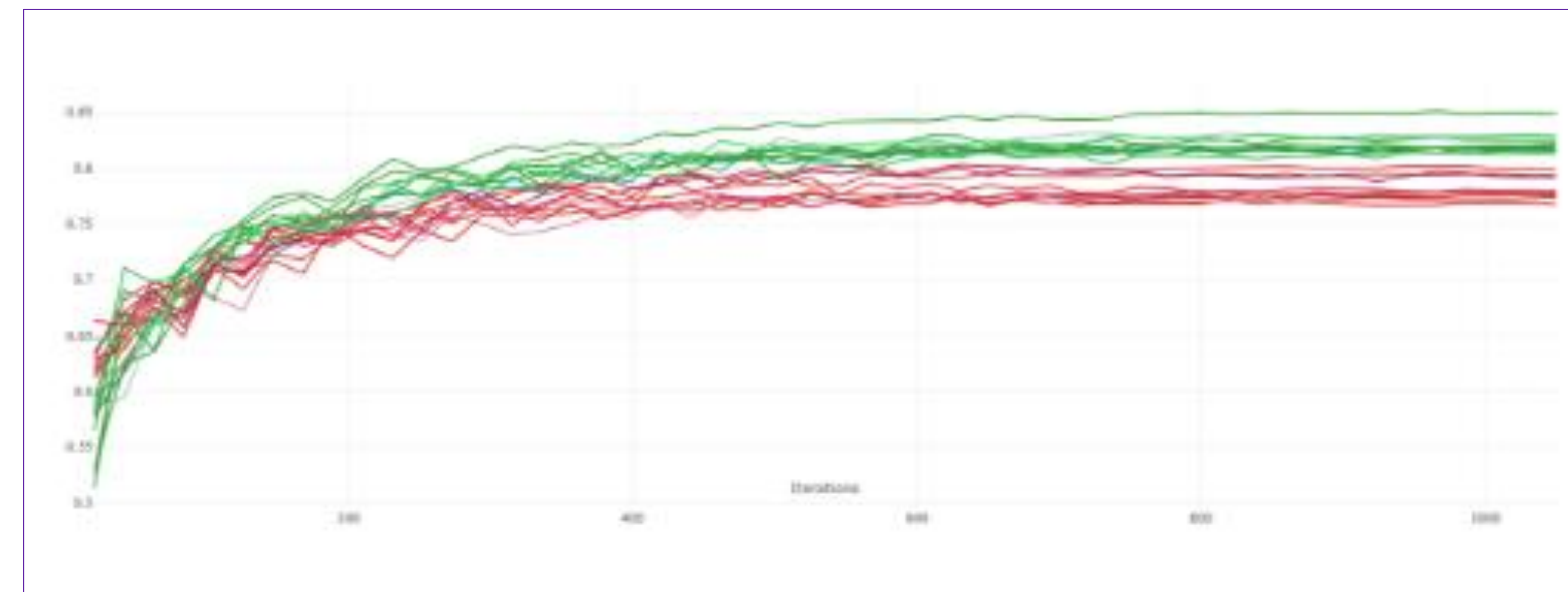


Figure 1. Validation Dice across 10 seeds. Runs trained on real + synthetic phases (green) consistently beat real-only (red).

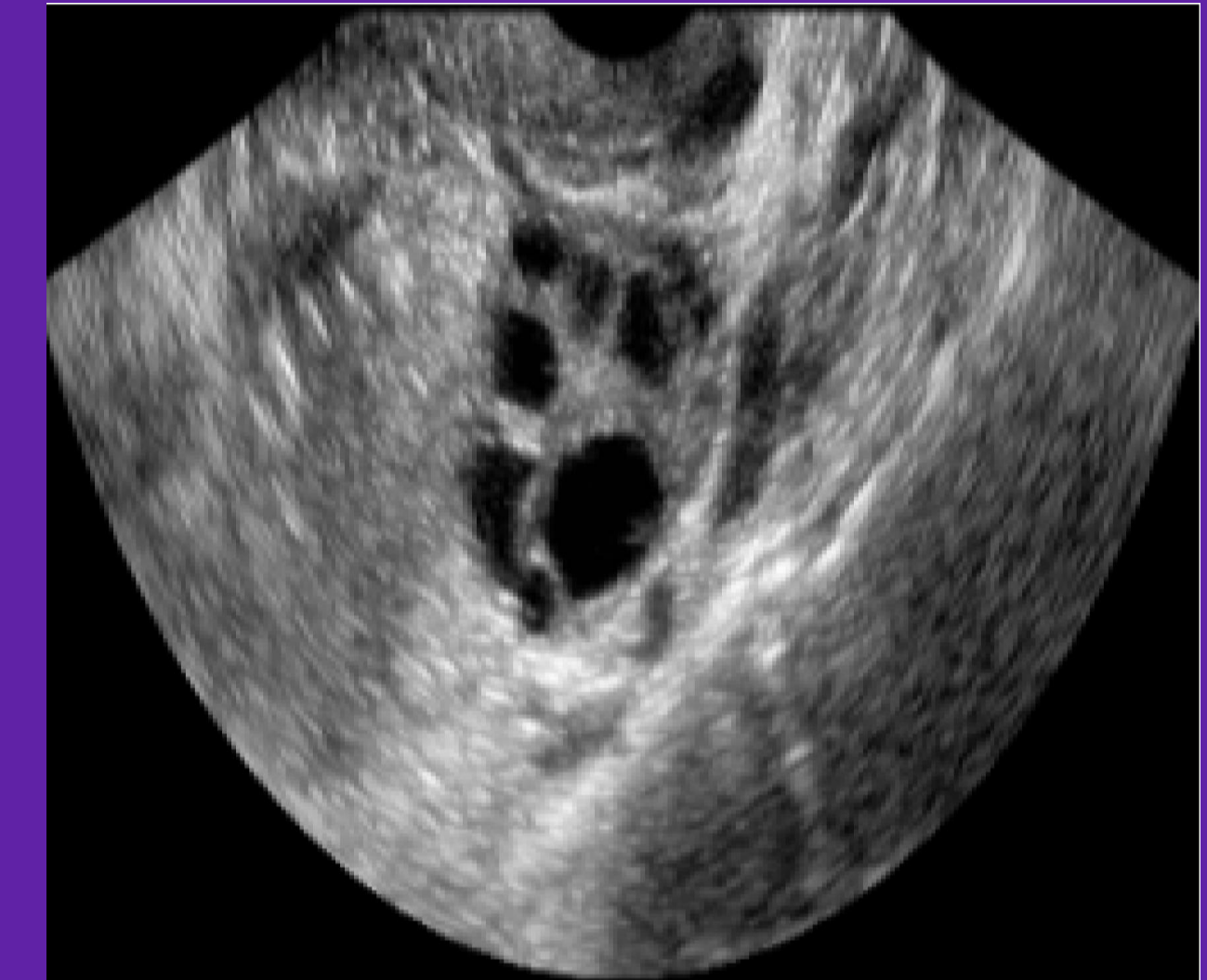
Conclusion

Our experiment shows that simulated data can help improve deep-learning-based segmentation performance and robustness when the training dataset is imbalanced.

Acknowledgements

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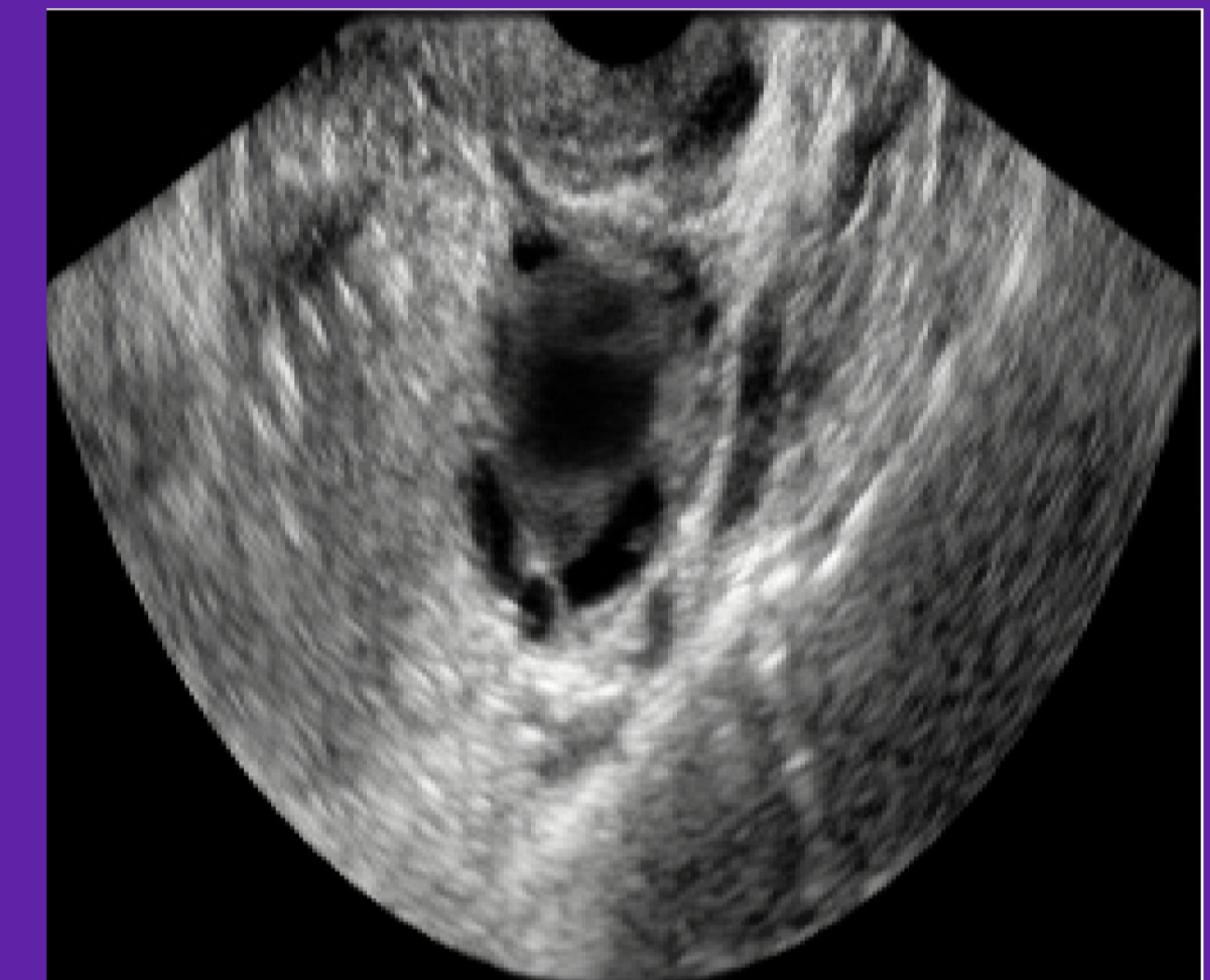
Original (follicular phase)



Generated postmenopausal phase



Generated luteal phase



Generated ovulation phase

