

DINOV3-Based Deep Learning Model for Automated Cervical Structure Segmentation in Transvaginal Ultrasound Images

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OBJECTIVE

Develop and validate a DINOv3-based network for four-region cervical segmentation in mid-trimester transvaginal ultrasound, supporting automated cervical length measurement and morphological assessment.

METHODS

592 transvaginal ultrasound images acquired at 16–28 weeks of gestation. Training n=520; validation n=72. Performance was evaluated with Intersection over Union and Dice coefficient.

MODEL

Pretrained DINOv3 encoder → multi-level feature extraction → resolution and channel alignment → lightweight MLP decoder → four anatomical masks.

AFFILIATIONS

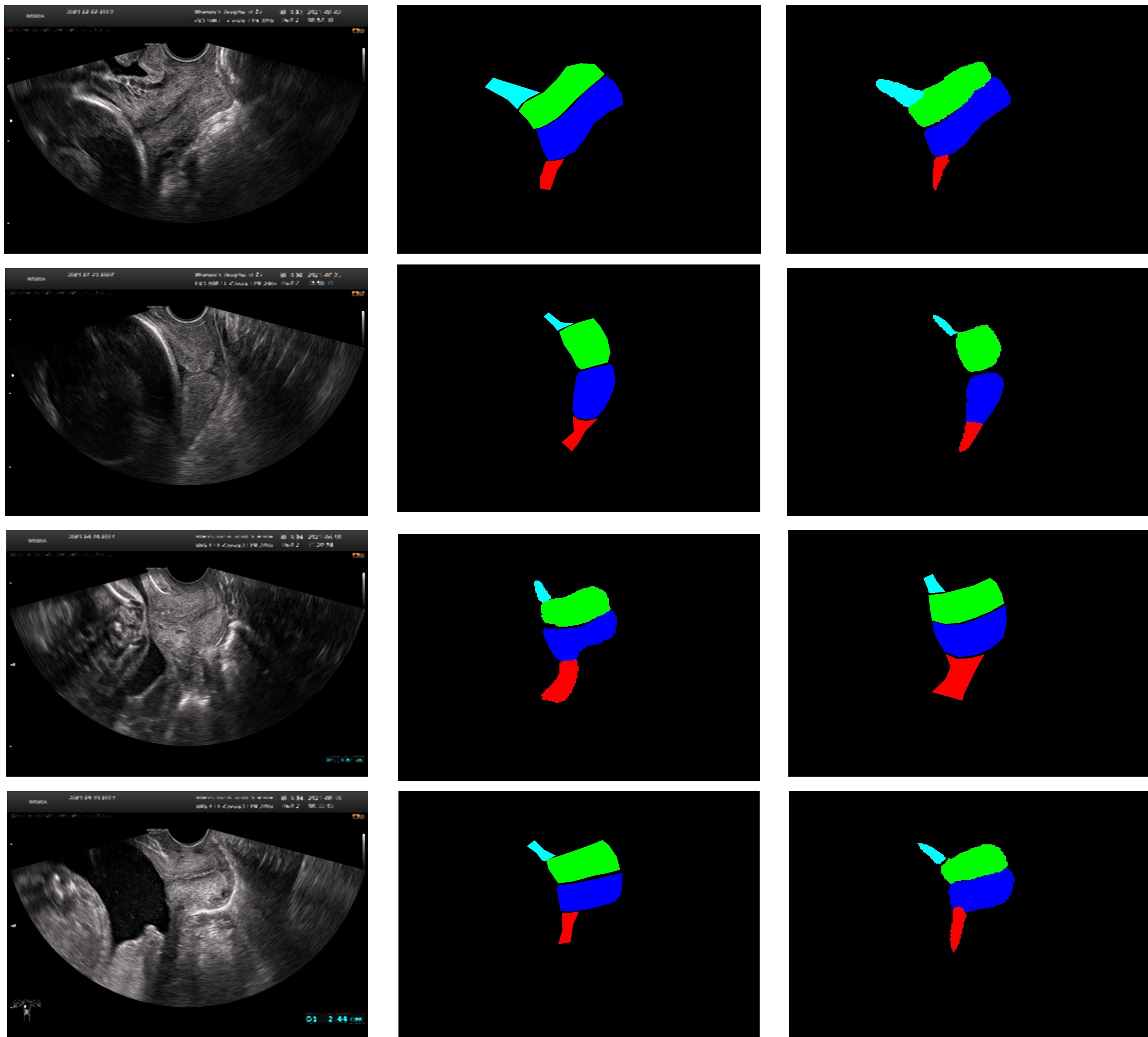
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ANATOMICAL LABELS

- Anterior cervical lip
- Posterior cervical lip
- Anterior LUS wall
- Posterior LUS wall
- Background

Figure 1. Representative cases. From left to right: ultrasound images, paired ground truth, segmentation masks.

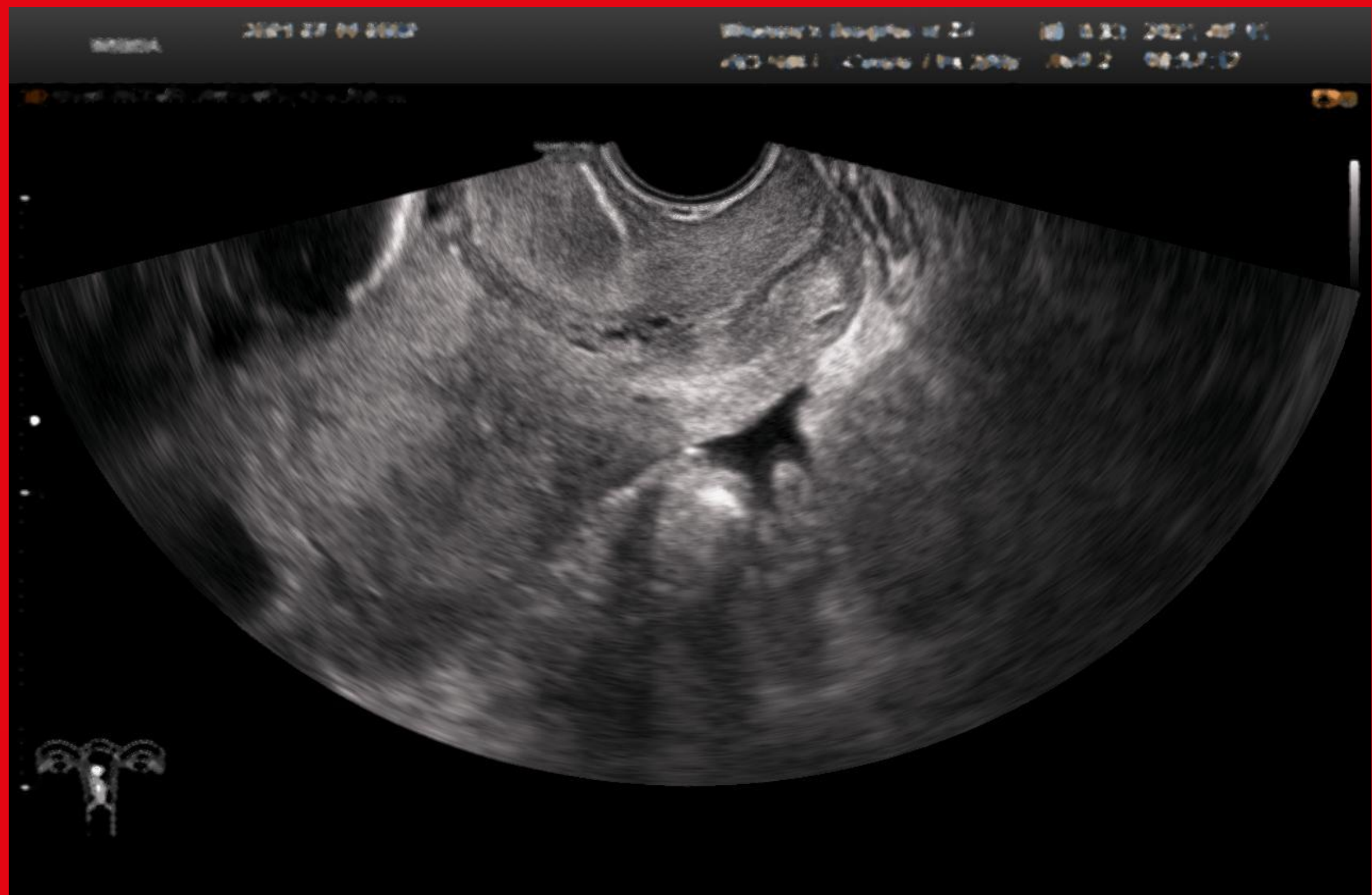


Figure 2. Representative mid-trimester transvaginal ultrasound.

RESULTS

Overall: mIoU 61.2%; mDice 71.4%.

Class-specific results (IoU / Dice) :

- anterior cervical lip (70.0% / 80.0%),
- posterior cervical lip (66.0% / 77.0%),
- anterior wall of lower uterine segment (35.0% / 49.0%),
- posterior wall of lower uterine segment (38.0% / 52.0%)

Anterior and posterior cervical lips showed higher segmentation efficiency

LUS walls remained more challenging.

CONCLUSION

Robust cervical lip segmentation provides a foundation for standardized cervical length measurement and morphology assessment. Lower uterine segment wall segmentation remains the priority for further optimization.