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AI-based gestational age estimation using an obstetric sweep protocol with handheld ultrasound

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Introduction

- Accurate gestational age estimation is essential for obstetric care but often requires trained sonographers.
- This study evaluates an AI-based gestational age (GA) algorithm using blind ultrasound sweeps.
- Blind sweeps are predefined freehand scans acquired without targeting fetal anatomy or obtaining conventional biometric measurements.

Methods

Design: Retrospective evaluation of a deep-learning algorithm using blind 2D B-mode sweeps.

Scanning Protocol: Each examination comprised either 6 blind sweeps (3 craniocaudal and 3 lateral) or 10 blind sweeps (5 craniocaudal and 5 lateral), selected based on fundal height.

Data split: Training and test datasets separated at the patient level.

Reference: Same-day BPD, HC, AC and FL using applicable Hadlock equations.

Device: Philips Lumify C5-2 transducer.

Sites: Clinical sites in India, Kenya, Zambia and the United States.

Methods

Dataset Split

1,232
singleton training
examinations at ≥14 weeks

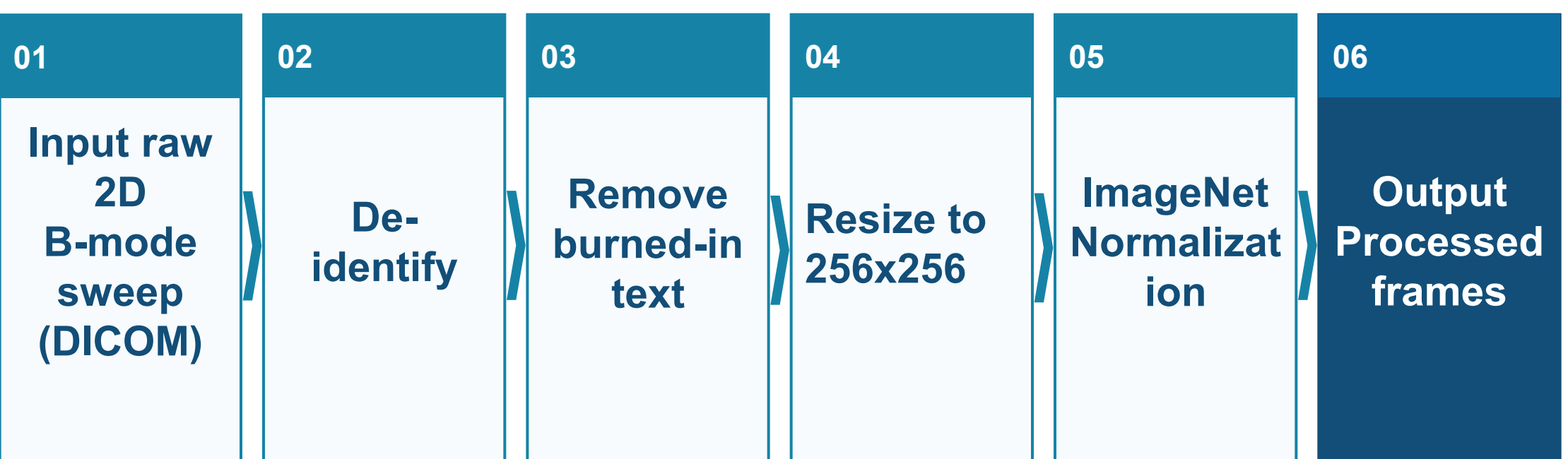
815
independent test examinations

Test Cohort Split

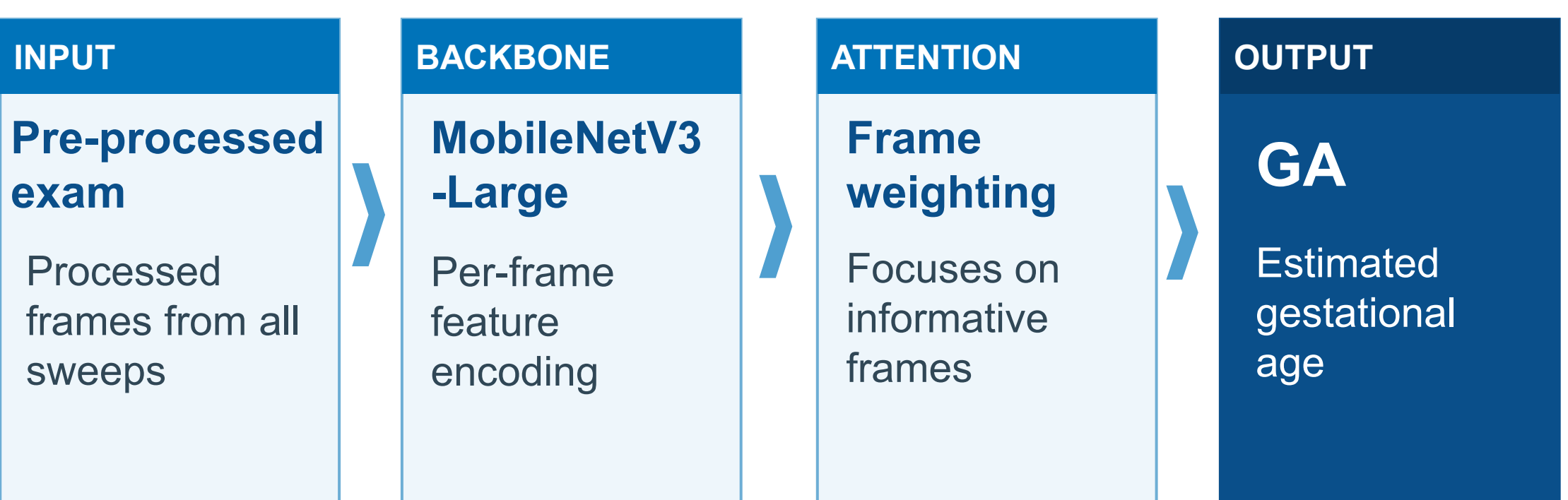
506
exams in the second
trimester, 14–28 weeks

309
exams in the third trimester, 28–40 weeks

Data Pre-processing



Model Architecture



Results

Agreement by trimester

TRIMESTER 2
14–28 weeks

MEAN ABSOLUTE ERROR
3.59 ± 0.20
MAE ± SE (days) · n=506

87.75%
within 7 days

99.21%
within 14 days

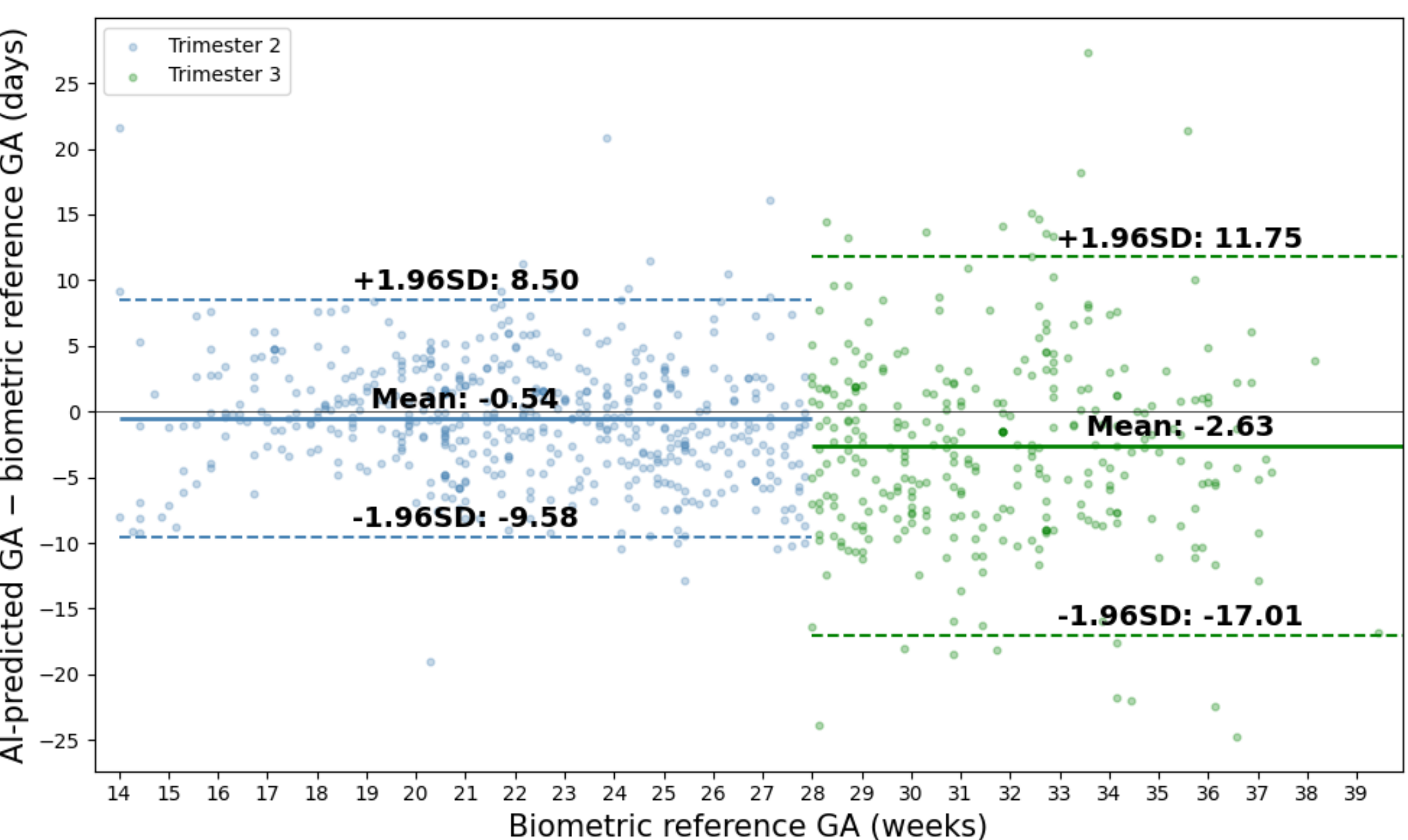
TRIMESTER 3
28–40 weeks

MEAN ABSOLUTE ERROR
6.06 ± 0.42
MAE ± SE (days) · n=309

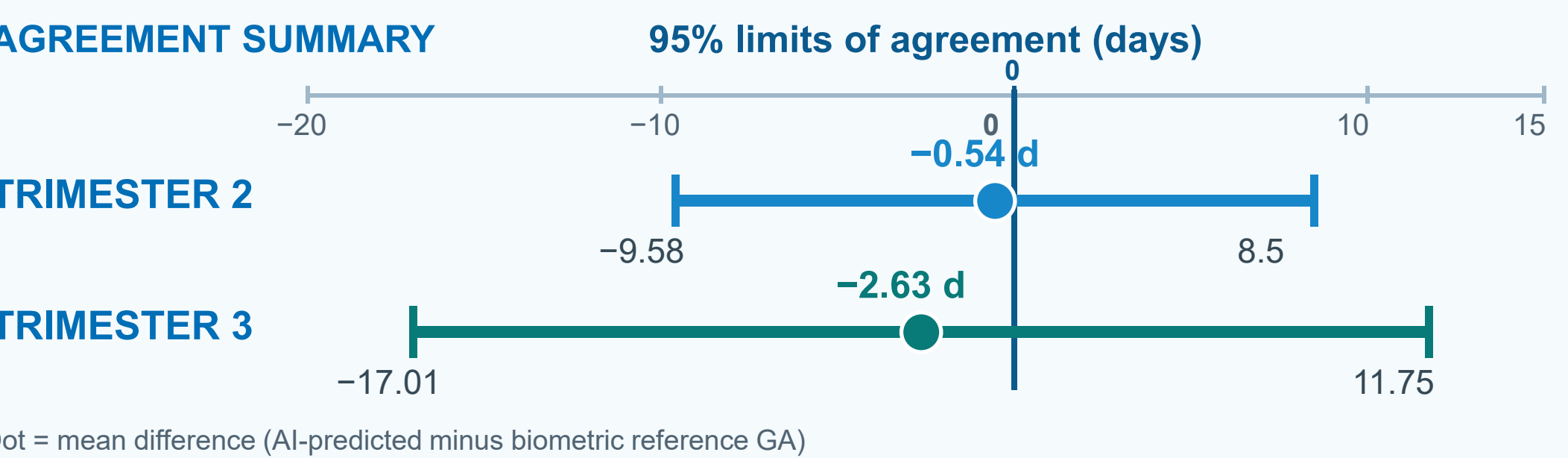
62.14%
within 7 days

93.20%
within 14 days

Agreement between AI-predicted & biometric reference GA



AGREEMENT SUMMARY



Conclusions

The AI algorithm showed agreement with same-day Hadlock biometric GA using blind sweeps acquired with handheld ultrasound.

Agreement was stronger in the second trimester, with greater error and underestimation in the third trimester.

Because biometric GA reflects fetal size and becomes a less reliable proxy for true gestational age later in pregnancy, third-trimester agreement should be interpreted accordingly.

AI-assisted blind sweeps may support gestational-age estimation where trained sonographers are unavailable, but validation against independently established pregnancy dating is required.

Acknowledgements

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