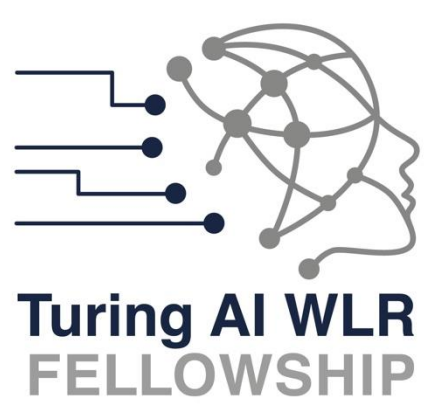
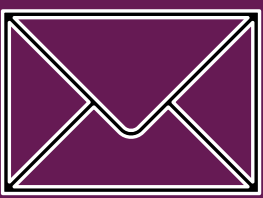


Can Machine Learning Models Outperform the Hadlock Formula in Predicting Fetal Weight?



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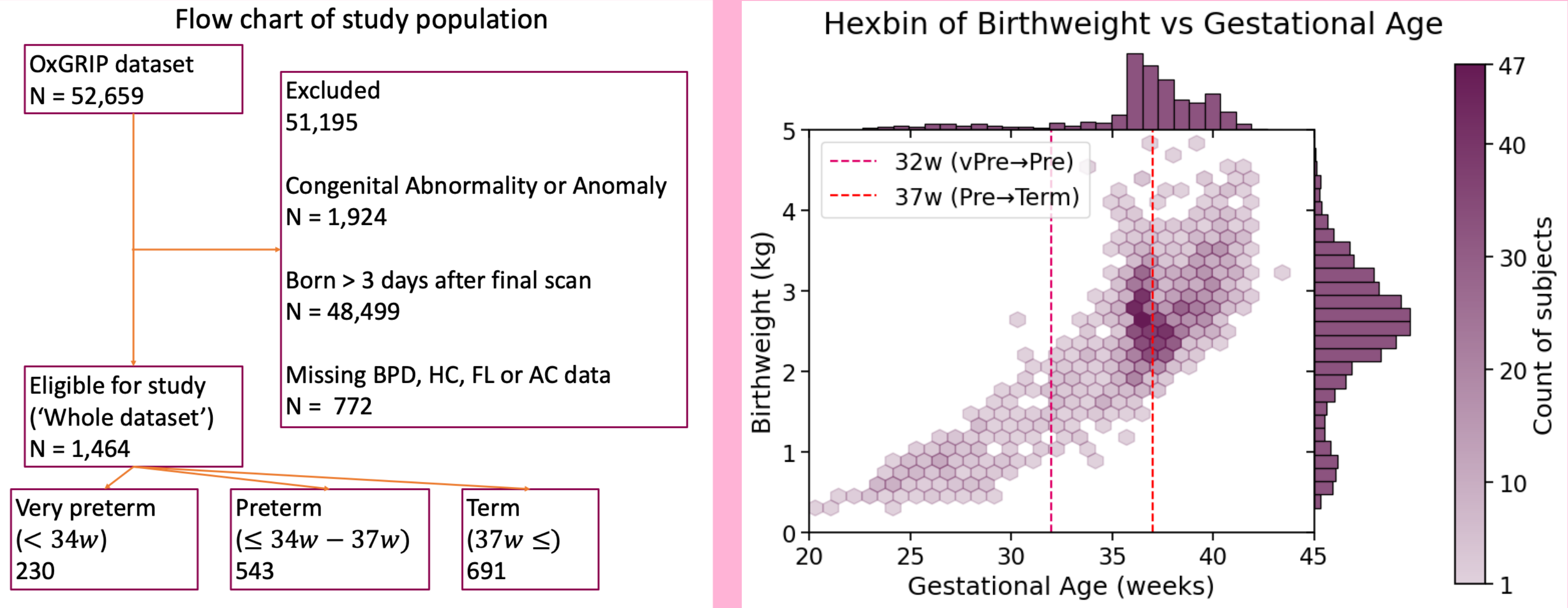
Key Learnings

Machine learning models that use only fetal biometry can achieve **significantly improved birthweight predictions** compared to the Hadlock equation, particularly in **preterm** cohorts.

However, accuracy gains were modest, perhaps due to ultrasound quality.

OxGRIP Dataset

1,464 singleton pregnancies **born ≤ three days after their final ultrasound assessment** between 2016–2023 in Oxford, UK.



References

Hadlock, F. P., Harrist, R. B., Sharman, R. S., Deter, R. L., and Park, S. K. Estimation of fetal weight with the use of head, body, and femur measurements—A prospective study. *American Journal of Obstetrics & Gynecology*, 151(3):333–337, 1985.

Dudley, N. J. A systematic review of the ultrasound estimation of fetal weight. *Ultrasound in Obstetrics & Gynecology*, 25(1):80–89, 2005.

Scioscia, M., Vimercati, A., Ceci, O., Vicino, M., and Selvaggi, L. E. Estimation of Birth Weight by Two-Dimensional Ultrasonography: A Critical Appraisal of its Accuracy. *Obstetrics & Gynecology*, 111(1):57, 2008.

Results

Cohort	Mean birthweight (g)	% of cohort	Best performing ML Model or Hadlock	AC	BPD	FL	HC	MAE ±SD (g)	MPE±SD (%)	R ²	p-value	Significance
Whole dataset	2,524 ±825g	100%	Random Forest	Y	Y	Y	Y	150±63g	6.3±2.8%	0.94	0.02	Yes
			Hadlock	Y	-	Y	Y	156±137g	6.3±5%			
Term (37–42 weeks)	2,916 ±534g	47%	Ensemble of lasso, ridge and linear regression	Y	Y	Y	-	172±5g	6±0.2%	0.82	0.37	No
			Hadlock	Y	-	Y	Y	176±149g	6±5%			
Preterm (34–37 weeks)	2,616 ±568g	37%	Ridge regressor	Y	-	Y	Y	147±81g	5.9±3.2%	0.86	<0.001	Yes
			Hadlock	Y	-	Y	Y	162±127g	6.2±4.7%			
Very preterm (<34 weeks)	1,126 ±528g	16%	KNN regressor	Y	Y	Y	-	79±35g	6.9±3.2%	0.96	0.00407	Yes
			Hadlock	Y	-	Y	Y	77±75g	7±5.4%			

Method

Ten machine learning (ML) regression algorithms were applied to combinations of 1-4 biometric ultrasound measurements (abdominal circumference, head circumference, femur length, biparietal diameter).

- Linear Regression
- Decision Tree
- Random Forest
- KNN
- MLP
- AdaBoost
- XGB
- LGBM
- Ridge
- Lasso

Additionally, ensembles of ML models outperforming Hadlock were created and assessed.

Background

