

Prediction of Gestational Diabetes Mellitus in Overweight and Obese Caucasian Women using Machine Learning

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Abstract

Purpose: predict gestational diabetes mellitus (GDM) in overweight and obese Caucasian women

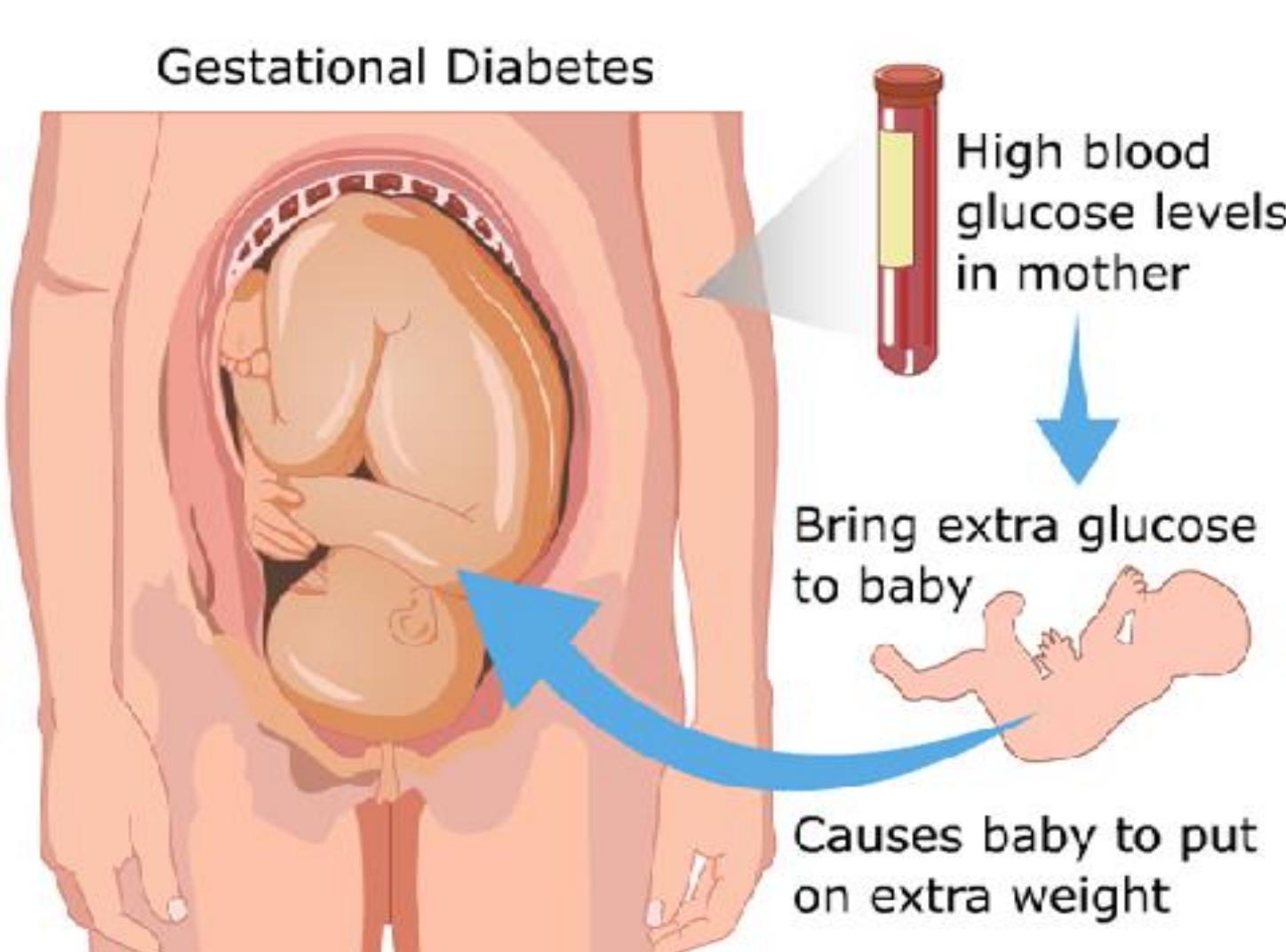
Method: apply machine learning on PEARS dataset

Results: a support vector machine with polynomial kernel that is able to identify 44% and 67% of GDM women in early second trimester at 5% and 10% false positive rate respectively

Introduction

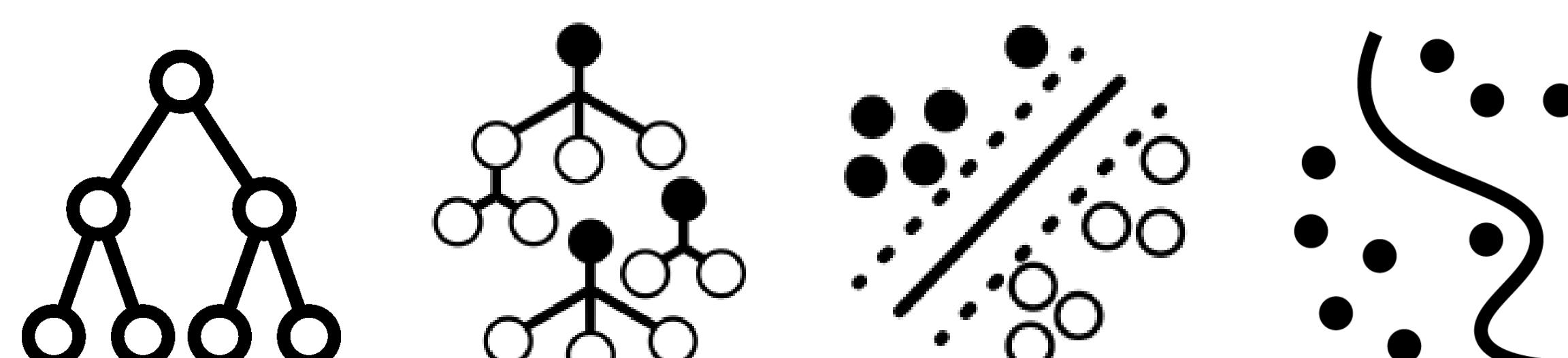
Gestational Diabetes Mellitus (GDM):

- Glucose intolerance of varying degrees of severity with onset or first recognition during pregnancy
- Affects 12.8% pregnant women in Ireland (2006-2009)
- Linked to gestational hypertension, polyhydramnios, Caesarean section, premature delivery, macrosomia, large for gestational age, neonatal intensive care unit admission...
- Increases in risk with overweight and obesity

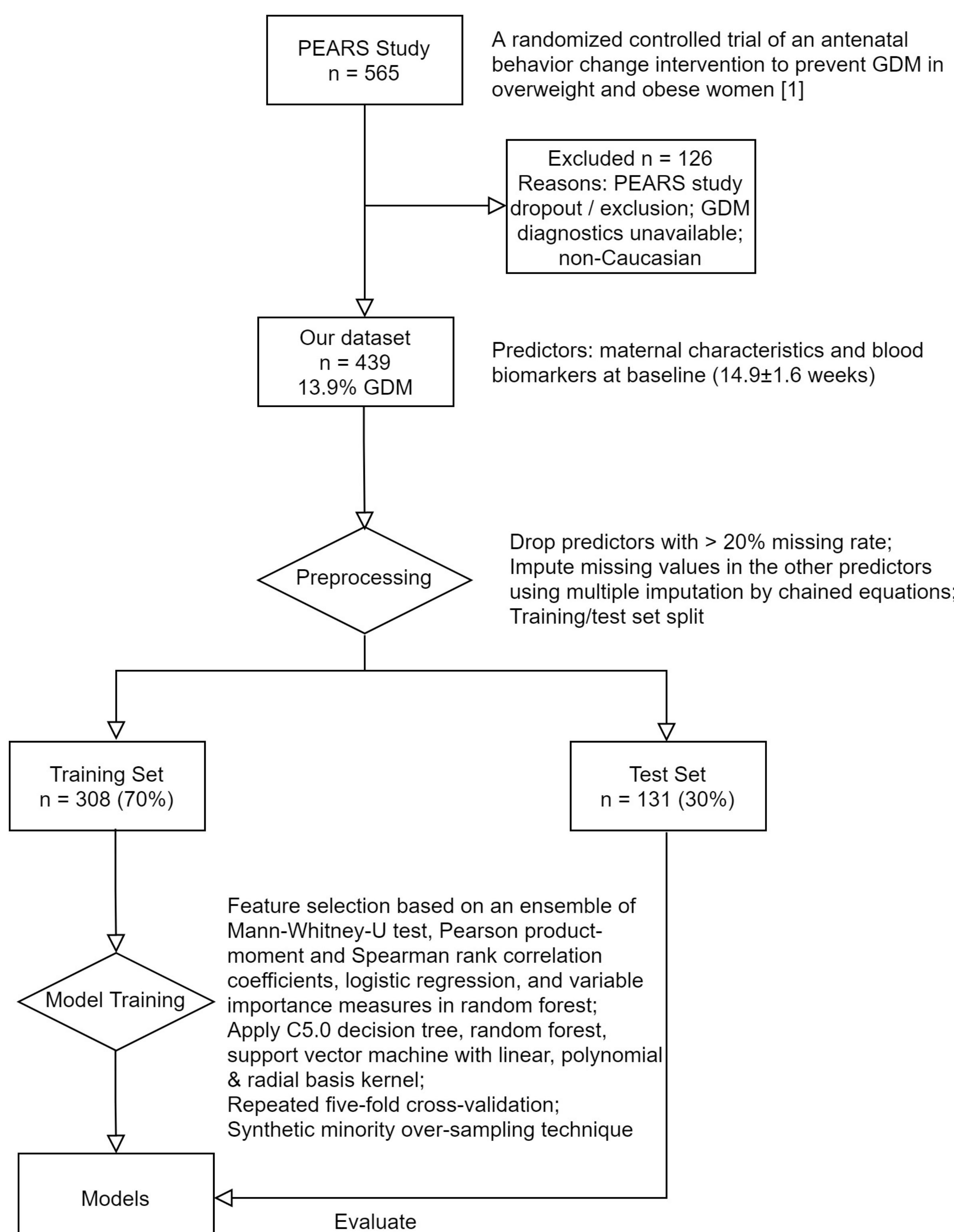


Machine Learning:

- Powerful data-driven approach
- Expected to improve prognosis dramatically

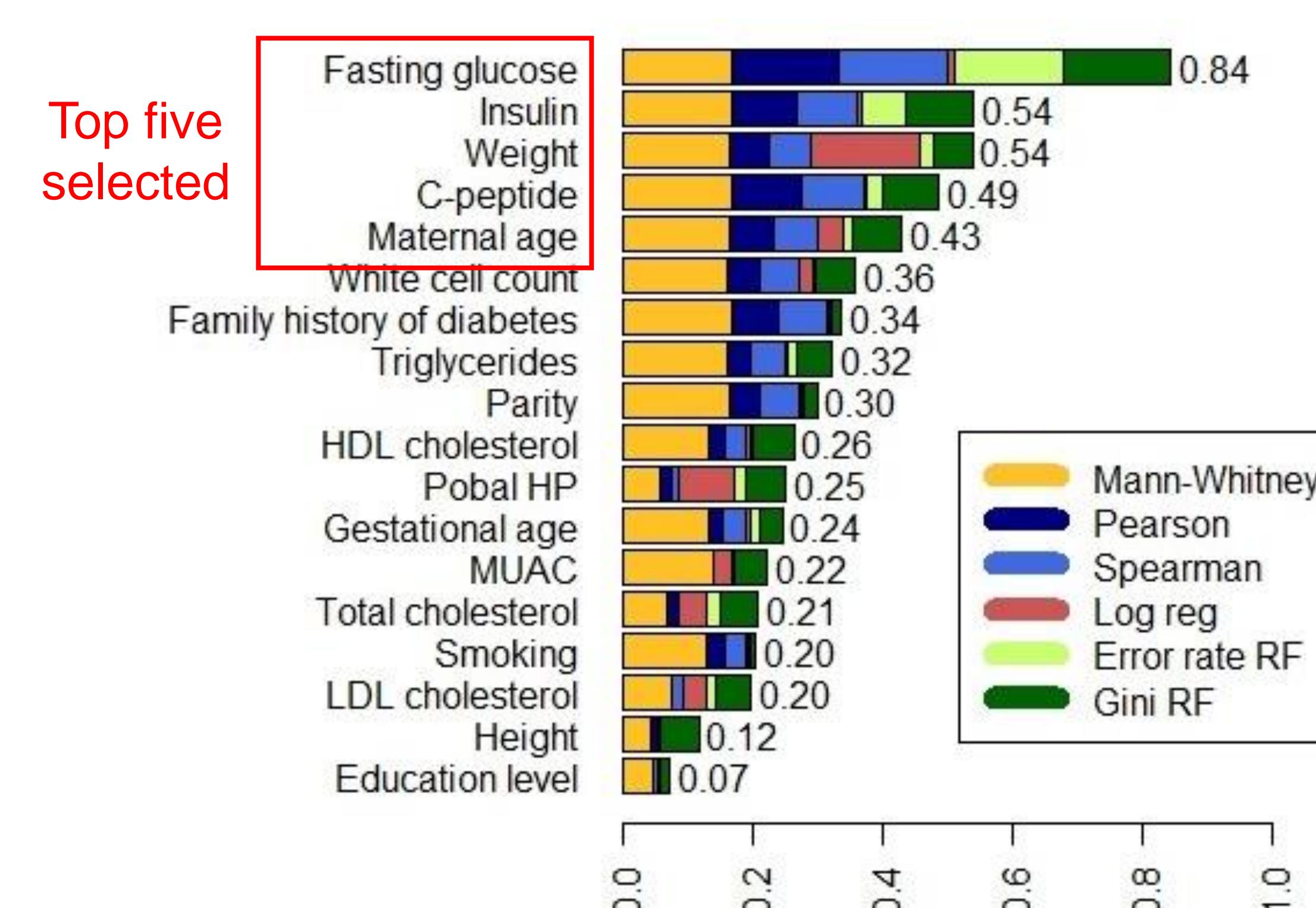


Method



Results

Feature importance plot



Results (cont.)

Performance of the models evaluated on the test set

	C5.0 Decision Tree	Random Forest	SVM Linear	SVM Polynomial	SVM Radial
AUC-PR	0.53	0.48	0.58	0.60	0.55
AUC-ROC	0.79	0.79	0.81	0.81	0.83

Performance of the SVM model with polynomial kernel

Setting	Evaluation Metric	Value
Cut-off of 0.5	Sensitivity	0.78
Cut-off of 0.5	Specificity	0.89
Cut-off of 0.5	Positive predictive value	0.54
Cut-off of 0.5	Negative predictive value	0.96
Cut-off of 0.5	Balanced accuracy	0.84
5% false positive rate	Sensitivity	0.44
10% false positive rate	Sensitivity	0.67

Discussion

This research explored the development of prediction models for GDM with a novel focus on the overweight and obese Caucasian group. The models achieved good performance, showing potential in assisting the early prediction of GDM in a clinical setting. Further research will be conducted on modelling remotely accessible maternal characteristics to reduce hospital visits during the COVID-19 pandemic.

Acknowledgements

The authors wish to express their appreciation to Dr Maria Kennelly and Dr Kate Ainscough for their contributions to the collection of the PEARS data. The authors gratefully thank Dr John Mehegan, Eileen C O'Brien, Ms Cara Yelverton, Ms Sarah Louise Killeen and Ms Shauna Callaghan for helpful discussions.

References

[1] Maria A Kennelly, Kate Ainscough, Karen L Lindsay, Elizabeth O'Sullivan, Eileen R Gibney, Mary McCarthy, Ricardo Segurado, Giuseppe DeVito, Orla Maguire, Thomas Smith, et al. 2018. Pregnancy exercise and nutrition with smartphone application support: a randomized controlled trial. *Obstetrics & Gynecology* 131, 5 (2018), 818-826.