Machine-learning prediction of early postpartum prediabetes in women with gestational diabetes mellitus

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Background

Gestational Diabetes Mellitus is "Glucose Intolerance first diagnosed during pregnancy".

Pre-eclampsia
Hypertension
Type 2 Diabetes

Hypoglycaemia
Macrosomia
Obesity
Type 2 Diabetes
CVD

GDM

- ~90% GDM found in LMICs
- GDM women have 10-12 times higher risk of T2D
- Follow-up rates very low (~60% even in high-income countries)

Background

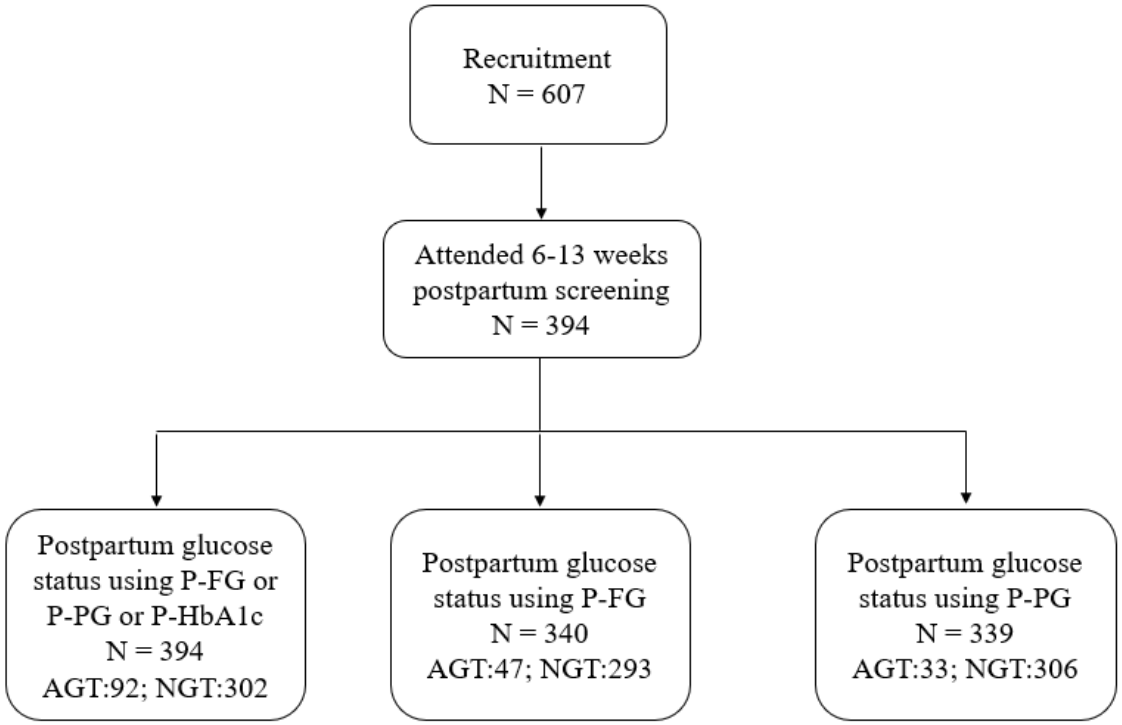
Vision

To improve quality of life of two individuals – the mother and her baby – in one go, & work towards prevention of inter-generational propagation of diabetes

Objective

Antenatal prediction of postpartum prediabetes in GDM women using advanced ML Machine Learning

Methods



Part A. Prediction model development

- 394 samples for 21 features
- Algorithm: Logistic Regression and compare with tree-based algorithms
- Model evaluation metric: area under the ROC curve

Part B. Optimal cut-off selection to prioritize high-risk women depending upon resource availability

- Kullback-Leibler Divergence theory and Information graphs

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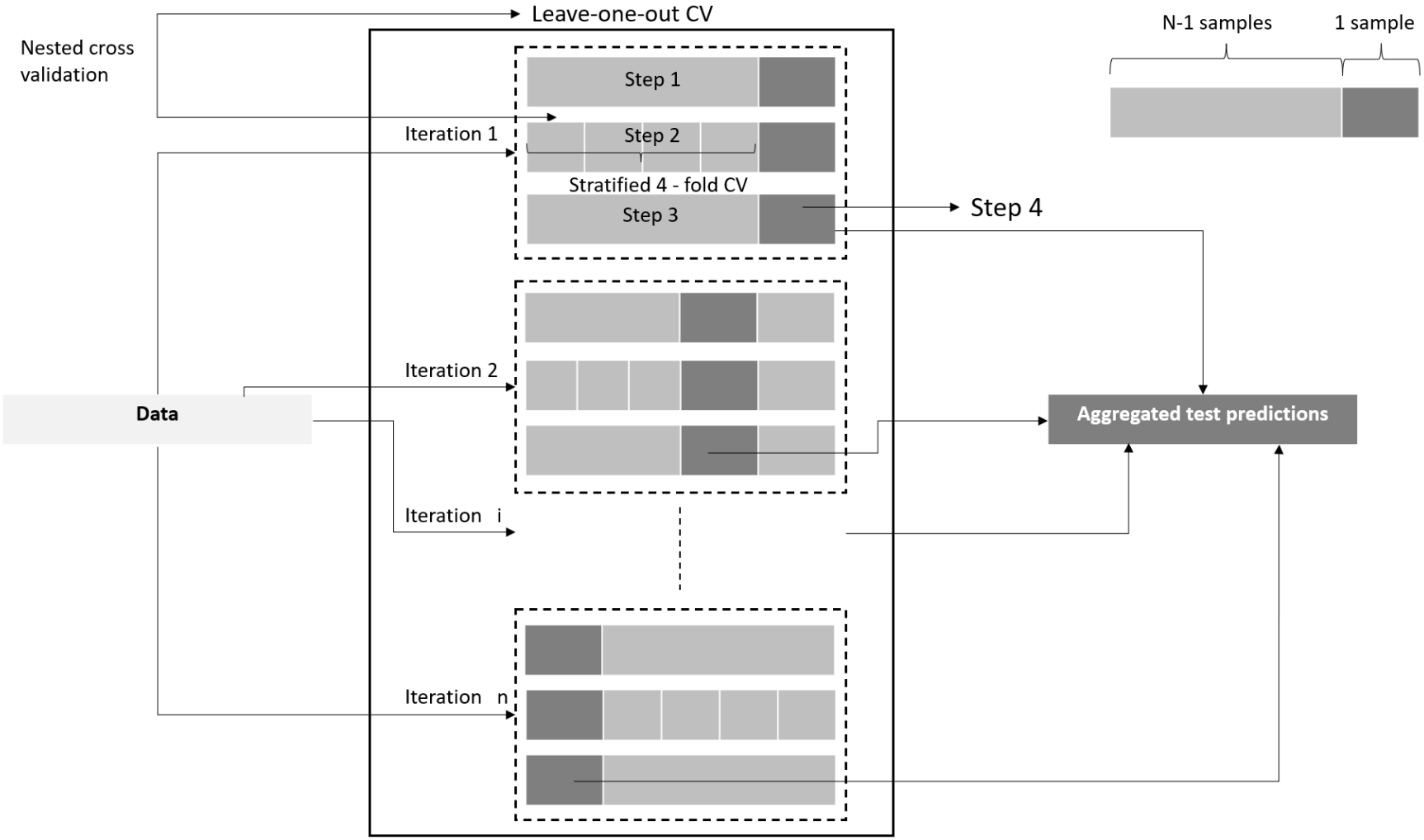
Methods



Step1: Divide full data into n-1 training and 1 testing
Step2: Feature selection using Lasso shrinkage hyperparameter optimization
Step3: Model training using Logistic regression
Step4: Model evaluation (aggregated test predictions)

Methods

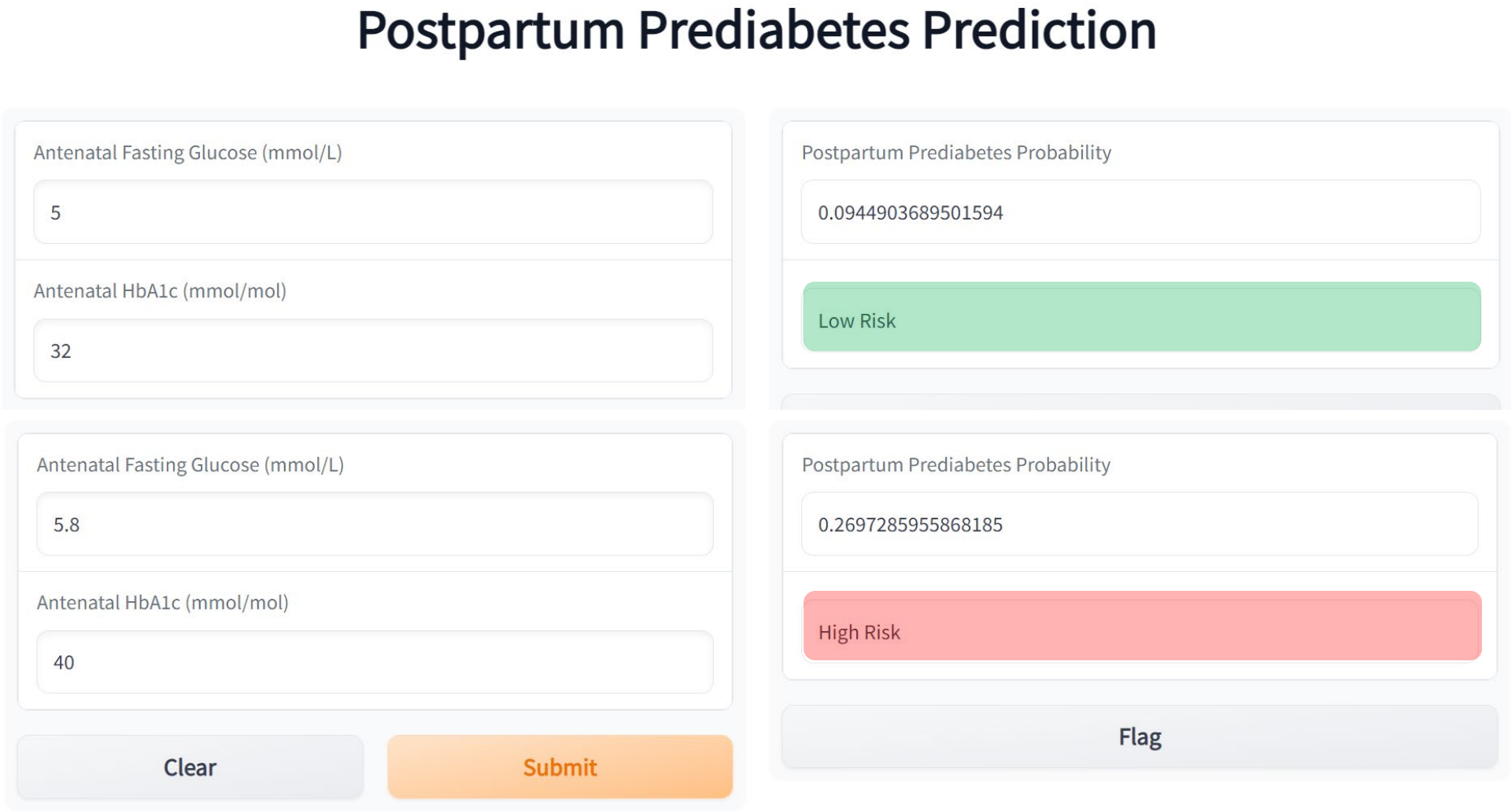
The key ideas are:

1. Identify features with the potential of prediction of GDM out of a pool of all possible collected features
2. Create new predictive features from existing ones
3. Use selected predictors to build a prediction model using ML algorithms and a well-designed model architecture
4. Represent the model mathematically in the form of a CRS
5. Study the optimal thresholds for classifying women based on their individual risk
6. Convert all this into a simple software tool for practical use

Process and Challenges

1. Small Data size - Only 394 (64.91%) out of 607 had postpartum GTT data available
   - Data augmentation using synthetically generated data
2. Ethics - Data privacy
   - Data replacement using synthetically generated data
3. Data Incompleteness - Failure to achieve 100% follow-up & Missing data
   - Targeted follow-up
4. Data Imbalance - Only 92 (23.35%) out of 394 women had prediabetes

Results and Conclusions



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