

SELF APPLIED REMOTE NON-INVASIVE FETAL ECG USE TO ASSESS FETAL VIABILITY isuog2025.0680030

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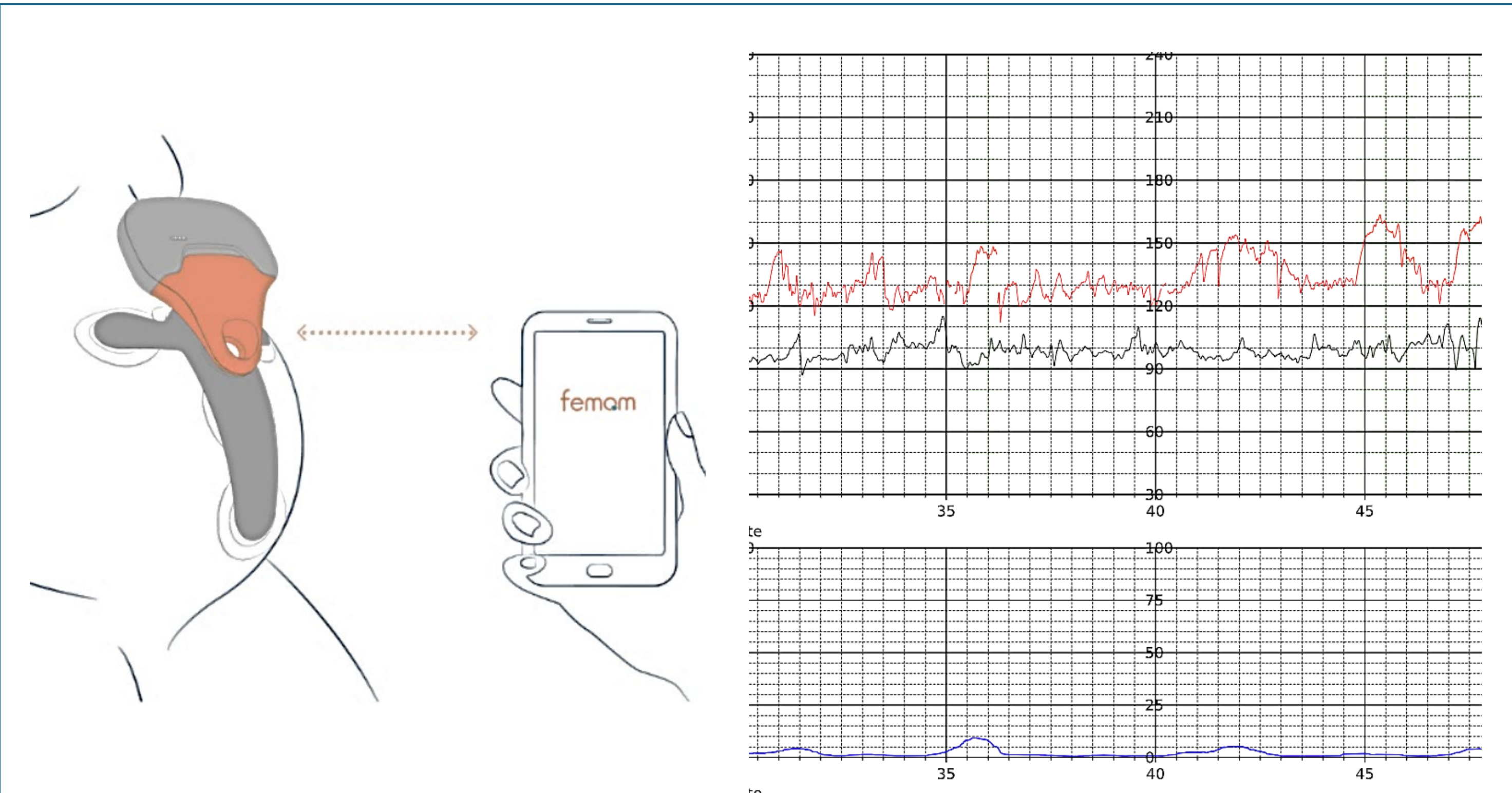
Disclosure Statement: CP is studying an MD(Res) which is funded by Biorithm Pte. CL is Signal Processing Engineer at Biorithm Pte. AN is the CEO of Biorithm Pte. BT is Medical Director of Biorithm Pte. AB holds a research grant from Biorithm Pte.



Background:

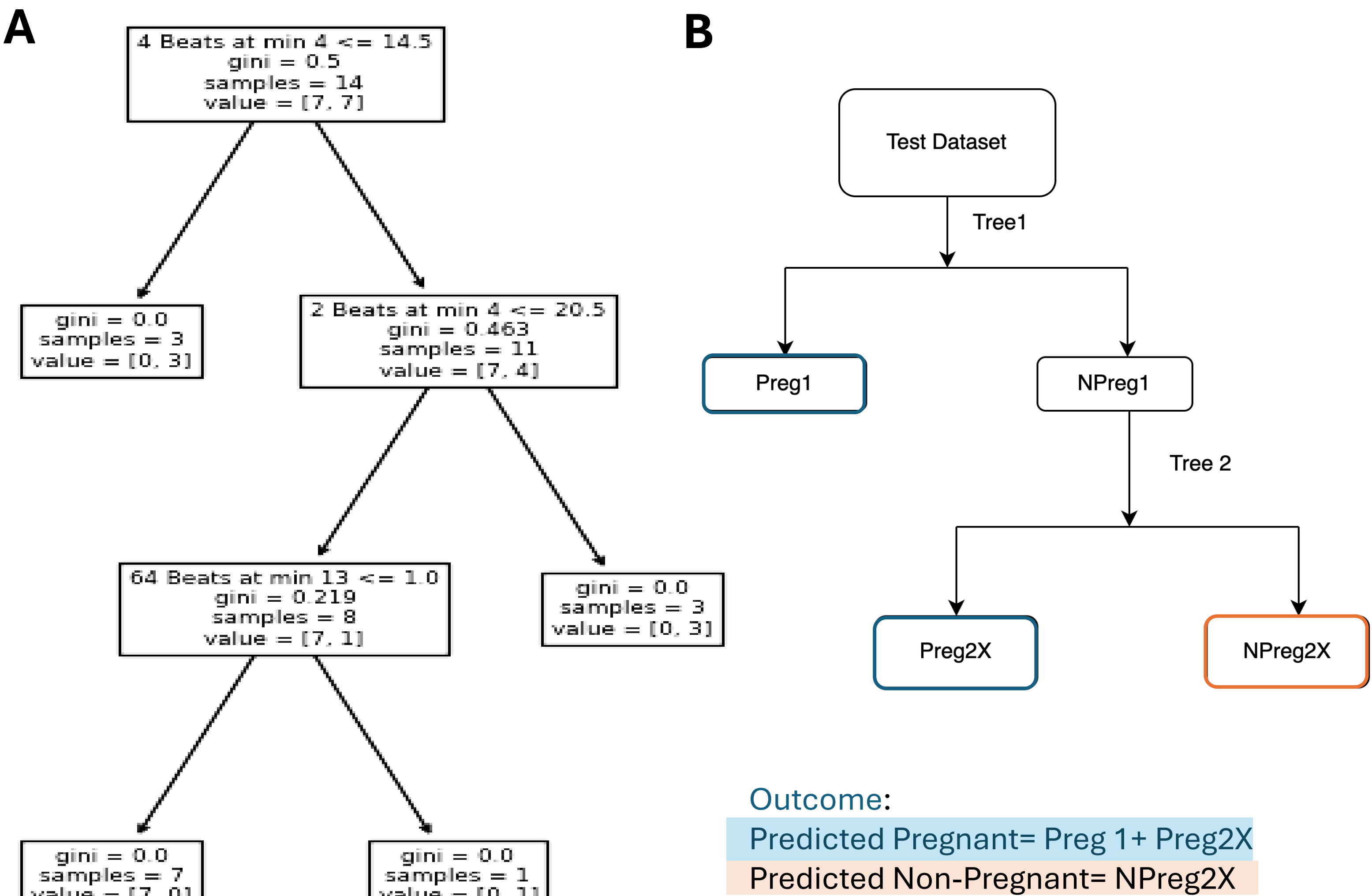
- Fetal viability requires a healthcare professional to use a hand-held Doppler or CTG device and interpret the results.
- **Non-invasive fetal ECG (NIFEKG)** technology offers a promising remote and self-applied alternative for fetal monitoring¹.
- NIFEKG is known to be prone to signal loss².
- Self applied FHR monitors have not been shown to reliably assess fetal viability

The aim of this study was to develop and test decision trees which would correctly identify viable pregnancy in a remote setting in the presence of signal loss.



The femom[®] device consists of a pod and spreader which stick to the mother’s abdomen with electrodes - developed for self application by mothers without healthcare worker intervention. It connects to the mobile phone via Bluetooth and monitoring sessions are started using the mobile application. The app transfers the data to the Clinician’s web portal via Wifi which is transformed by the server translates into a femom trace.

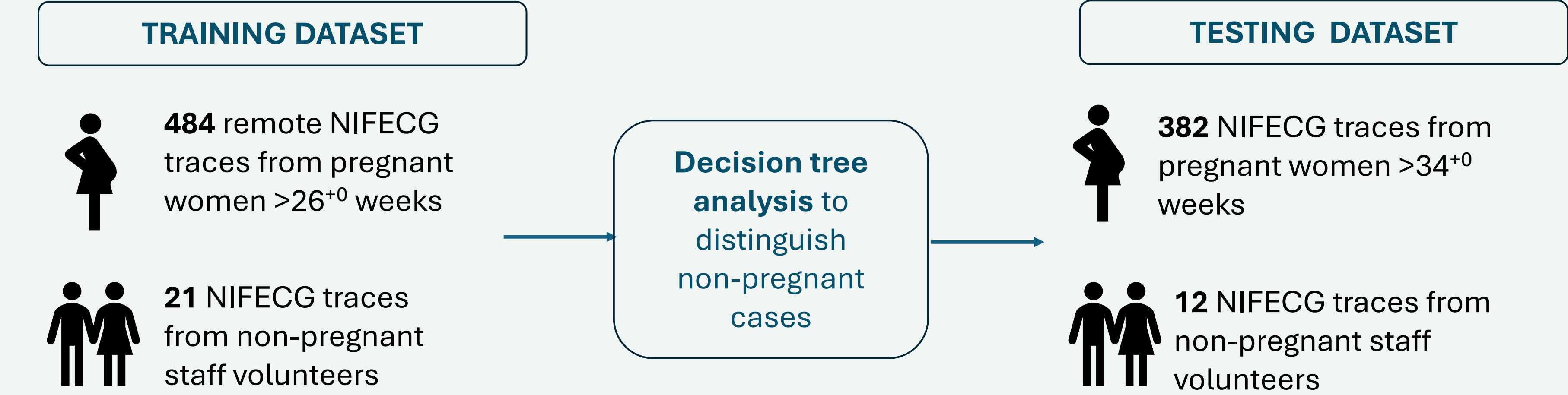
Methods: **A.** Example of part of a decision tree to assess if an NIFEKG trace has a viable FHR. A decision tree consists of a series of decisions and their possible outcomes. Each node in the tree represents a decision, while each branch signifies the result of that decision. Every node contains a potential threshold for non-missing data, a splitting criterion, a sample size, and a value [Pregnant, Non pregnant]. **B.** Example of structure used when combining decision trees to increase sensitivity of finding a FHR even in the presence of signal loss. In this case, the second tree is only applied to the traces predicted as non pregnant after the first refining those cases predicted as pregnant.



Methods

Pregnant women with singleton pregnancies >26 weeks gestation were asked to use the Femom to monitor the fetal heart rate (FHR) for a minimum of 45 minutes daily for 7 days. Non-pregnant staff volunteers were asked to do an abdominal ECG monitoring session for 60 minutes at home using Femom. The raw abdominal ECG data was analysed to provide the frequency of valid fetal RR intervals between 100 and 200 bpm. The frequency and timing of consecutive RR intervals was compared with non-pregnant traces. Combinations of frequency and timing were used to create decision trees to identify non-pregnant and pregnant traces. These were then tested using a separate cohort of pregnant FHR traces.

Results



Combination name	Number of trees	Max time (min)	False Negative	False Positive	Accuracy	Sensitivity	Positive Predictive value
A	2	16	1	5	98.5	99.7	98.7
B	2	16	1	5	98.5	99.7	98.7
C	2	16	1	5	98.5	99.7	98.7
D	2	16	1	5	98.5	99.7	98.7
E	2	10	4	4	98.0	98.9	99.0
F	2	10	4	4	98.0	98.9	99.0
G	2	16	0	5	98.7	100	98.7
H	2	16	0	5	98.7	100	98.7
I	3	16	0	5	98.7	100	98.7
J	3	18	0	5	98.7	100	98.7

Table representing the performance of different combinations of algorithms to predict fetal viability. The False negative are for the patients who are pregnant but are predicted by the algorithm to be non-pregnant and the False positives represent the non pregnant volunteers who are predicted by the decision tree to be pregnant.

Conclusion

Self-applied femom[®] in a remote setting can confirm fetal viability with a sensitivity of 100% within the first 18 minutes of application.

References:

- Liu, B., Ridder, A., Smith, V., Thilaganathan, B. & Bhide, A. Feasibility of antenatal ambulatory fetal electrocardiography: a systematic review. *The Journal of Maternal-Fetal & Neonatal Medicine* **36**, (2204).
- Liu, B., Thilaganathan, B. & Bhide, A. Correlation of short-term variation derived from novel ambulatory fetal electrocardiography monitor with computerized cardiotocography. *Ultrasound in Obstetrics & Gynecology* (2023) doi:10.1002/uog.26191.