Fetal Health Classification from CTG Signals with Explainable Machine Learning

Goal:

- Classify fetal health as Normal, Suspect, or Pathological using CTG data

Motivation:

- Support clinicians with interpretable AI

Methods:

- XGBoost, Neural Network, SHAP Explainability, SMOTE

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AI In Healthcare

High Risk Project

Data Overview and Preparation

2,126 samples, 21 CTG features

3-class target: Normal (0), Suspect (1), Pathological (2)

Issues: severe class imbalance

SMOTE used for balanced training set

Machine Learning Models

XGBoost Classifier: Fast, robust, well-suited for tabular data

Neural Network: 2 hidden layers, dropout for regularization

Trained on SMOTE-balanced data, tested on original test set

Model Performance & Explainability

XGBoost Accuracy: 93.9% | **Neural Net Accuracy**: 89.9%

Best F1-scores on Pathological class from XGBoost

SHAP revealed top 5 features driving predictions:

Abnormal Short-Term Variability, Accelerations, Uterine Contractions, etc.

Conclusion & Next Steps

- **XGBoost + SHAP + SMOTE** = effective & interpretable pipeline
- **Limitations**: small dataset, no external validation
- **Future**: dashboard interface, ensemble models, real-time CTG analysis