



StillSafe

empowering safe pregnancies for every family





The Devastating Reality of Stillbirth

"Stillbirth is the loss of a baby at or after 20 weeks of pregnancy." (CDC)

- **Global Impact:** 2 million stillbirths annually (1 every 16 seconds) (CDC)
- **US Impact:** Over 21,000 stillbirths annually (1 every 175 births) (CDC)
- **Emotional Cost:** Increased risk of depression, anxiety, and PTSD (Westby et al., 2021)
- **Financial Burden:** \$7,000-\$9,000 per stillbirth (Veettil et al., 2023)



A Preventable ~~Tragedy~~

- Most stillbirths occur in pregnancies that appear healthy (NHS)
- Early detection of risk factors could prevent many stillbirths (You et al., 2020)
- If trends persist, 20 million additional stillbirths are projected in the next decade (You et al. 2020)

“Many stillbirths could be prevented with early detection, timely interventions, and access to high-quality healthcare.” (You et al., 2020)



8 out of 10



Meet Our Team



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StillSafe

empowering safe pregnancies for every family

Our Solution

Empowering families through data-driven insights to predict and prevent stillbirth.

Mission: Provide early, personalized risk assessments using machine learning

Vision: Make healthcare equitable, reduce stillbirth rates, and improve maternal-fetal outcomes



StillSafe

empowering safe pregnancies for every family

Target User Overview



Early-On/Soon-To-Be Pregnant
Patients



Patients With Limited Access To
Healthcare Services



*Market Research

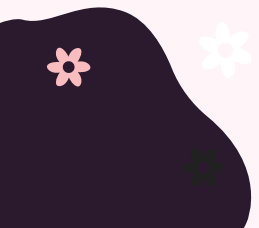
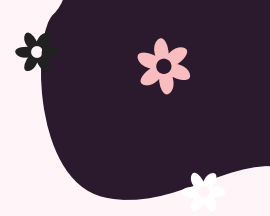
Missed Opportunity: Maternal health market projected to grow to **\$22.6 billion** by 2025

Tommy App	AI-powered tool focused on early assessment and monitoring for pregnant people
Hera MED	Smart home fetal monitor for remote maternity care
Nuvo MED	Remote monitoring system for fetal non-stress tests

None of these address the need for comprehensive, risk-based stillbirth prevention



MVP



Demo: Home Page



Demo: Risk Assessment Tool



How many months has it been since your last pregnancy? (You'll get help and feel any previous pregnancies)

Risk Assessment: We calculated to inform you that your pregnancy-related indicators are within the range of 0-20000 based on the information you provided. Please see the accompanying, ongoing assessment results provided for ensuring a healthy pregnancy.

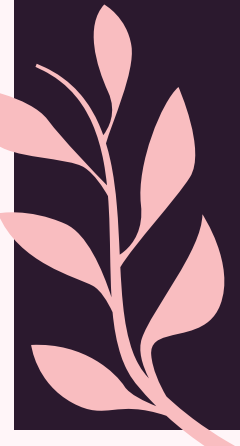
Recommendations for Continued Care:

- 1. Attend Regular Check-ups: Keep all scheduled appointments to monitor your pregnancy.
- 2. Monitor Signs and Symptoms: Stay attentive to your body, including baby's movements, and report any concerns to your healthcare provider.
- 3. Maintain a Healthy Lifestyle: Follow medical advice on nutrition, exercise, and stress management.

For additional information, please 'Tap for help' on the bottom of our website. It provides valuable insights to help you monitor pregnancy progress.

Thank you for your commitment to your health and your baby's well-being. If you have any concerns, please contact your healthcare provider during your next prenatal appointment.

Disclaimer



Demo: Meet Our Team Page



Demo: StillSafe Tips for Success Page



Navigation

- Home
- Risk Assessment
- Need Our Team
- StillSafe Tips for Success
- Feedback

Pregnancy

Schedule Regular Prenatal Checkups

Work closely with your healthcare provider to monitor everything in on track and to address any questions or concerns along the way. They're your biggest partners in this journey, so make sure to share how you're feeling - they're here to support both you and your baby!

Nourish Your Body with a Balanced Diet

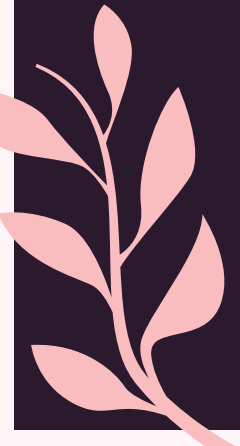
Eating well during pregnancy can do little but gifts you can give yourself and potentially future generations. Focus on nutrient-rich foods, including fresh fruits, vegetables, whole grains, lean proteins, and dairy. These provide the substances, including protein - it's essential with a high-protein diet you and your future baby need.

Engage in Safe Physical Activity

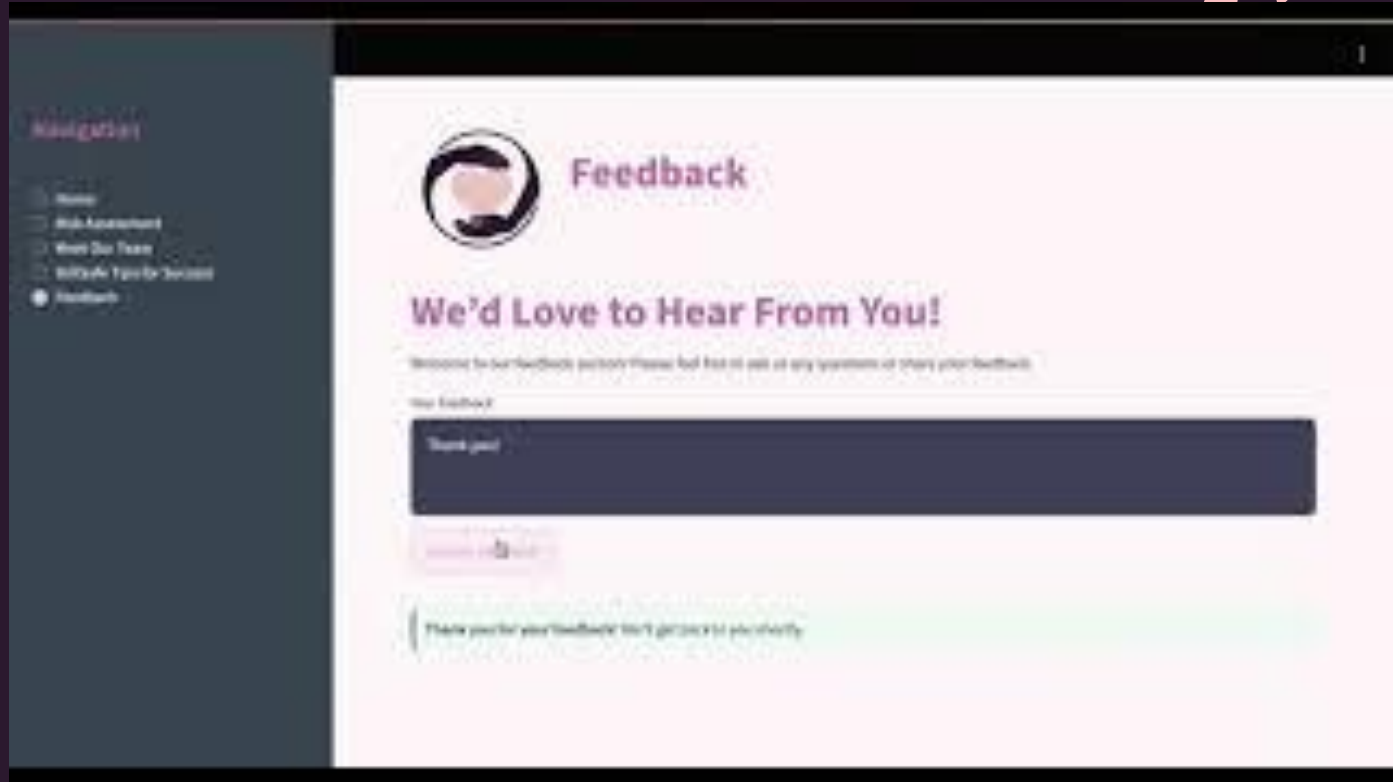
Staying active during pregnancy can boost your energy, improve your mood, and promote better sleep. Try gentle exercise like walking, prenatal yoga, swimming, or low-impact aerobics - just make sure to get clearance first from your healthcare provider. There is a lot of great support about physical health, but also help us stay mentally healthy and prepared for the journey ahead!

Avoid Harmful Substances

Keeping your baby's development safe and sound starts with making healthy choices for yourself. Try to minimize caffeine and be sure to give up all alcohol, tobacco, and recreational drugs to give your little one the best possible start. Remember, every small step you take toward a healthier lifestyle is a big step for your baby's well-being!



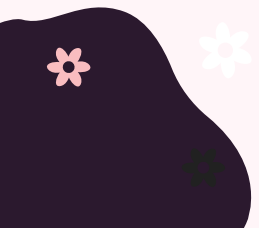
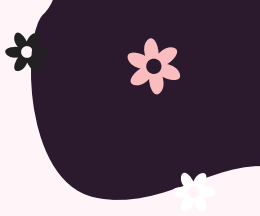
Demo: Feedback Page



The screenshot shows a web application interface. On the left is a dark sidebar with a 'Navigation' section containing links for Home, Risk Assessment, What Our Team, and Feedback Type for Services. The 'Feedback' link is selected. The main content area has a white background and features a circular logo with two hands holding a heart, followed by the word 'Feedback' in a bold, purple font. Below this is the heading 'We'd Love to Hear From You!' and a sub-heading 'Welcome to our feedback section! Please feel free to ask us any questions or share your feedback.' A form with a text input field and a 'Submit Feedback' button is present. A green banner at the bottom of the form area reads 'Thank you for your feedback! We'll get back to you shortly.'



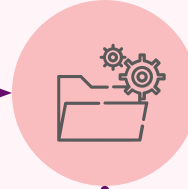
Technical Overview



Pipeline

Data Wrangling

Pull, clean and explore the data

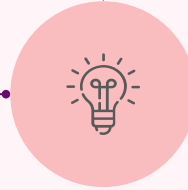
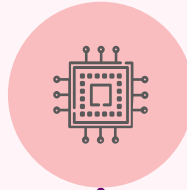


S3

Data is stored in Amazon S3 bucket

SageMaker Inference

Create a SageMaker Serverless Inference Endpoint



SageMaker Model Training

Train and deploy ML models

AWS Lambda

Acts as a bridge to connect the Streamlit web app with the inference endpoint



Streamlit Web App

Streamlit Web App allows users to interact





Summary of Data



Source

- Pull data from CDC website
- Merged “Fetal Death” and “Live Birth” data from 2014 to 2022
- Over 1 million rows and 100+ features

Assumptions

- **Target Variable:** Created using “Obstetric Estimation Tabulation Flag”
- **Definition:** Any death occurring at or after 20 week of pregnancy

01

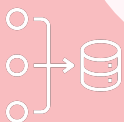


03

Features

- Guided by experts to retain key stillbirth-related features
- Removed unnecessary/redundant features and feature engineered new ones

02



04

Clean

- Converted “Unknowns” to null values
- Removed rows with excessive nulls
- Balanced live births and fetal deaths by year

Final Data

136,216 Rows
25 Features



Evaluation Metrics Selection and Initial Approach

Accuracy | Precision | Recall | F1 Score

01

ACCURACY

Labels in the data are approximately balanced, so they serve as a good indicator of our models' performance

02

RECALL

One of the most important metrics in healthcare because it is crucial to minimize misdiagnosing a stillbirth

Baseline Models	Accuracy	Recall
Logistic Regression	0.6274	0.6806
Bernoulli Naive Bayes	0.6077	0.6899
KNN	0.6206	0.7379

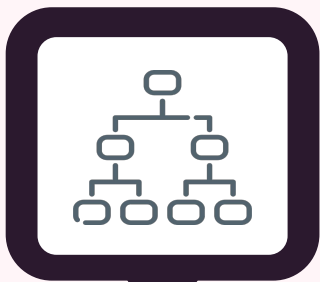


Modelling Approach



Traditional Machine Learning

- Logistic Regression
- Bernoulli Naive Bayes
- KNN
- Random Forest
- Decision Trees

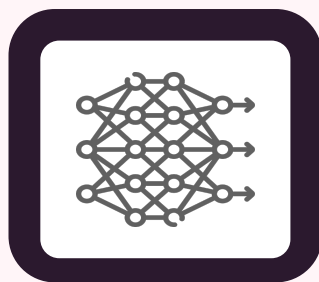


Gradient Boosting

- LightGBM
- XGBoost
- CatBoost

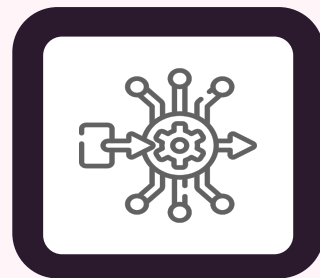


Grid Search + Random Search



Neural Networks

- Convolutional Neural Networks



Ensemble Methods

- LightGBM + XGBoost + CatBoost w/ Meta Learner

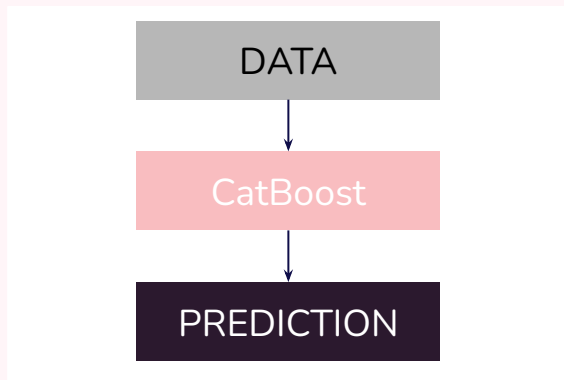


Accuracy: 0.7728
Recall: 0.7647



*Best Performing Models

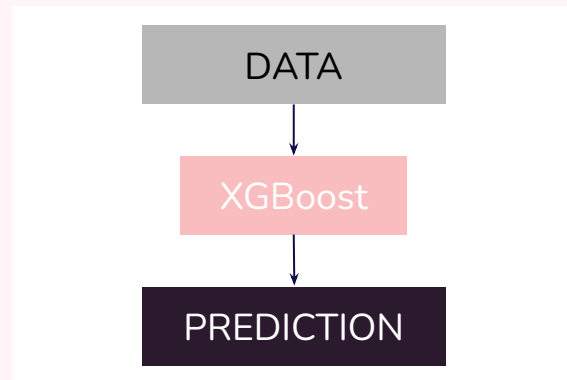
CatBoost



Accuracy: 0.7717

Recall: 0.8133

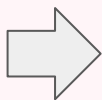
Fine-Tuned XG Boost



Accuracy: 0.7970

Recall: 0.8586

Accuracy: 0.7728
Recall: 0.7647



Feature Importance

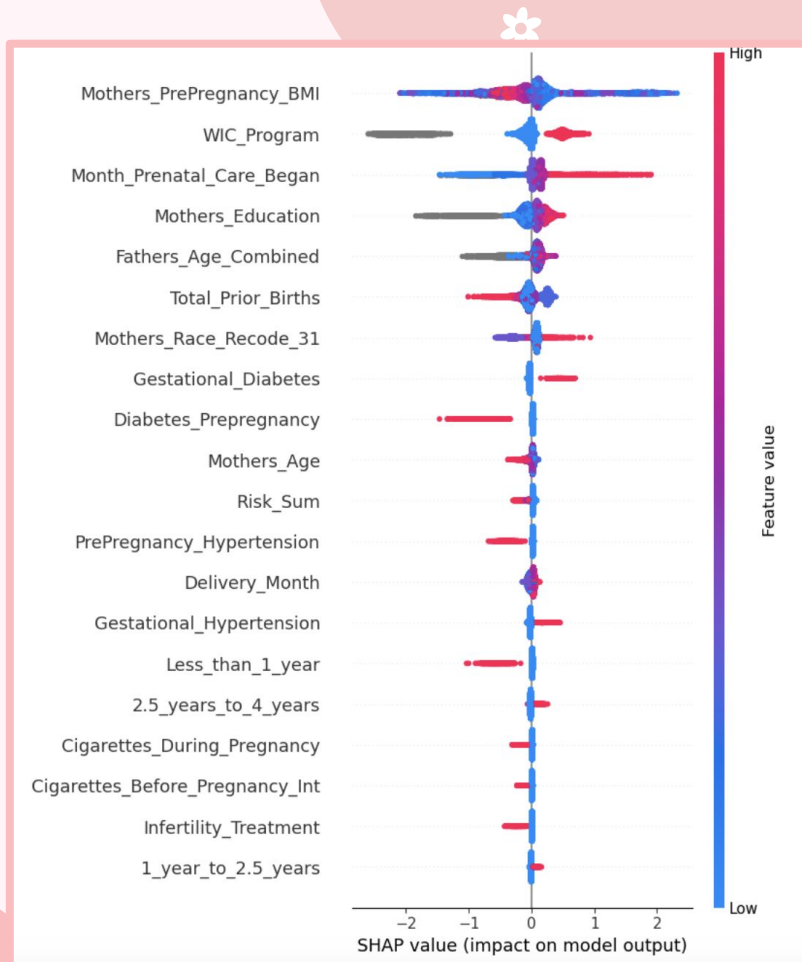


- Top Predictors
 - *Mothers_PrePregnancy_BMI*
 - *WIC_Program*
 - *Month_Prenatal_Care_Began*
- Feature Impact
 - High BMI
 - Early prenatal care
- Global Importance

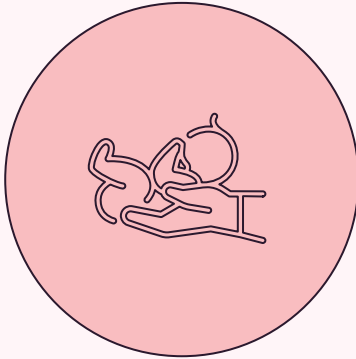
*BMI: body mass index

*WIC: federal program that assists Women, Infants, and Children

*Prenatal Care: medical care during pregnancy to monitor and support the health of the mother and baby

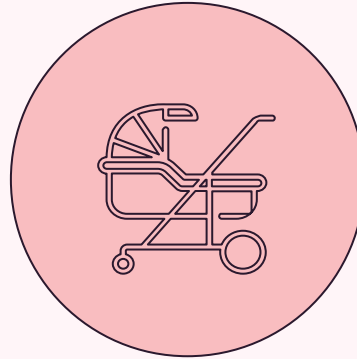


Technical Challenges



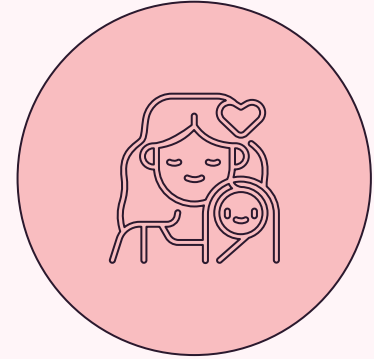
Data Collection

- Lack of available data (mainly features of interest)
- Pulling and parsing data from the CDC



Dealing with Health Data

- Health data is sparse
- Several missing data
- Understanding the features with no medical background



Feedback Loop

- Cannot add new data from users to further train our model



* Ethical Considerations

Lack of Standardization in Data Collection

“ Oftentimes the ones getting the least care have the most missing variables ”

Monica Wojcik
Director of the Neonatal Genomics Program at
Boston Children's Hospital

“ Fetal Death data is challenging to collect due to lack of resources and difficulty asking mothers questions after their stillbirth. ”

Elizabeth Gregory
Health scientist at the CDC's National Center
for Health Statistics

“ There is a disparity by states of how well data is collected. This could be because some states don't give mothers the worksheet to fill out the self-reported data. ”

Elizabeth Gregory
Health scientist at the CDC's National Center
for Health Statistics





Future Work



- Interview and run demo with pregnant women
- Implement chatbot to replace “Tips” section
- Broaden target user to include doctors

Design 2.0



Accessing data that contains more features that are believed to be related to stillbirth risk

Access More Data



Ensuring that the data entered in the website is completely secure and not accessible by others

Data Security



Final Remarks





“Our mission is to empower pregnant individuals and their families with a groundbreaking, data-driven tool that predicts the risk of stillbirth early, offering hope, action, and equity when it matters most.”



Acknowledgements

We would like to especially thank:



- **Dr. Glenn Grossman (OBGYN)**
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- **Megan Aucutt** (Healthy Birth Day / Count the Kicks)
- **Natasha Williams** (NICHD Subject Matter Expert)
- **Elizabeth Gregory** (CDC National Center for Health Statistics)
- **Sarah Lopez, Susannah Leisher, and Nathan Blue** (University of Utah Health, Stillbirth Center of Excellence)





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Thank you!

