Nurture Joy – AI-Enabled Emotional & Pregnancy Support Platform

INFO8665-26W-Sec1-Projects in Machine Learning

Assignment 1: Project Description and Use Case Justification

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Problem Statement

Pregnant women often lack timely emotional support, personalized health insights, and safe community spaces, while healthcare providers face challenges in efficiently identifying emotional distress, emerging risks, and engagement trends from patient-generated data.

To address these gaps, the Nurture Joy project proposes three machine learning–enabled solution use cases grounded in academic research and aligned with maternal healthcare needs.

Strategy, Purpose, Vision, Mission, and Tactics

Aspect	Definition	Time	Focus	Nurture Joy
Vision	The long-term future state the product aims to create	Long-term	Inspiration & Direction	Throughout pregnancy, every mother receives individualized, knowledgeable, and caring support anytime, anywhere.
Mission	What the application does, how it does it, and for whom	Medium - long-term	Purpose & Identity	To create and deliver a safe digital platform that uses machine learning to offer: Primary User: Expectant mothers seeking accessible, supportive, non-diagnostic pregnancy insights.

				Secondary Users: Healthcare professionals using aggregated, explainable insights to support not replace care.
Strategy	The high-level plan to achieve the mission	Medium-term	Plan & Approach	Create an emotional well-being chatbot for pregnant users, leveraging NLP to categorize free-text reflections into emotional sentiments and provide supportive, non-clinical feedback. It will also use user-reported data to create a lightweight, non-diagnostic pregnancy risk scoring model for general awareness.
Tactics	Concrete, short-term actions that implement the strategy	Short-term	Execution & Operations	Key tactics include defining pregnancy-related emotional sentiment categories, preprocessing emotion-labeled text datasets, training supervised ML models (Naive Bayes and Logistic Regression), evaluating model performance, designing sentiment-aware chatbot responses, deploying models via REST APIs, integrating them into a user interface, and embedding safety disclaimers with escalation messaging for high-distress cases.

Use Cases

Use Case 1: NLP-Based Emotional Well-Being Chatbot
Provides real-time emotional support by classifying user reflections into sentiment categories and generating supportive, non-clinical responses. This addresses emotional well-being and improves access to care.

Use Case 2: Non-Diagnostic Pregnancy Risk Prediction
Uses user-reported health data to identify potential pregnancy risk patterns, increasing awareness and encouraging early clinical consultation without providing diagnoses.

Use Case 3: Moderated Community Forum with ML Assistance
Applies sentiment analysis to support moderation, enhance safety, and prioritize posts in online pregnancy support communities.

These use cases address societal well-being, support the digital health industry, reduce healthcare system strain, and promote culturally safe spaces for maternal support.

Literature Review Support

Each use case is supported by academic literature demonstrating feasibility and relevance:

Emotional Well-Being Chatbot:

Research on AI-driven sentiment-aware chatbots shows effectiveness in providing scalable mental health support where professional access is limited.

Title: Prediction of High-Risk Pregnancy Based on Machine Learning Algorithms

PDF / Source Link:https://www.nature.com/articles/s41598-025-00450-3.pdf

Summary of the paper:

The study explored how an AI-powered chatbot can analyze users' text to recognize emotional states like stress, anxiety, and sadness and then deliver suitable support. It used natural language processing and machine-learning–based sentiment analysis to classify messages into emotion categories and link them to predefined empathetic responses. Findings showed that these models can reliably detect emotional distress and provide timely, relevant replies, highlighting the chatbot's ability to offer scalable support. The researchers built a real-time, sentiment-aware chatbot to assist people who may lack immediate access to mental health care, and this work directly reinforces Nurture Joy's concept of classifying user reflections by sentiment and responding with supportive feedback.

Pregnancy Risk Prediction:

Studies confirm that machine learning models can identify high-risk pregnancy patterns using health-related data.

Title: Prediction of High-Risk Pregnancy Based on Machine Learning Algorithms

PDF / Source Link:https://www.nature.com/articles/s41598-025-00450-3.pdf

Summary of the paper:

The study investigated the use of machine learning to predict high-risk pregnancies early by analyzing maternal clinical and demographic data. Using a maternal health risk dataset with variables like blood pressure, glucose level, body temperature, heart rate, and age, the researchers compared several algorithms Logistic Regression, Decision Trees, Random Forest, SVM, XGBoost, and Multilayer Perceptron—evaluating them with accuracy and ROC metrics. The Multilayer Perceptron performed best, achieving over 90% accuracy, and the findings emphasized that early pregnancy indicators are valuable for risk detection and that ML models can surpass traditional rule-based methods. The study ultimately proposed a non-diagnostic ML decision-support tool to help clinicians identify and prioritize high-risk cases, demonstrating the practicality of ML-based pregnancy risk prediction and supporting the feasibility of Nurture Joy's personalized risk awareness feature.

Community Forum Moderation:

Prior work demonstrates that text classification improves safety and moderation efficiency in online health communities.

Title: Text Classification for Assisting Moderators in Online Health Communities

PDF / Source Link: https://pmc.ncbi.nlm.nih.gov/articles/PMC3874858/

Summary of the paper:

The study investigated how machine learning can automate the detection of online health forum posts that require moderator intervention, addressing the challenge of rapidly growing message volumes that overwhelm human moderators. Researchers built a binary text classifier using word unigrams, sentiment features, and thread length, applying χ^2-based feature selection and under sampling to manage class imbalance, and evaluated it on real WebMD diabetes forum data. Results showed that sentiment features and feature selection improved performance (AUC around 0.75 and F1 around 0.54), indicating that emotional tone helps identify posts needing expert attention, while also highlighting social, legal, and ethical considerations in such systems. Overall, the work demonstrated a practical ML solution for prioritizing moderation, supporting Nurture Joy's goal of an intelligently moderated, supportive community forum.

Justification of Use Cases

The selected use cases are justified by their strong alignment with real-world maternal health challenges, ethical AI principles, and technical feasibility within a semester timeframe. NLP-based emotional support offers immediate, low-risk impact, making it an ideal foundational implementation. Risk prediction and community moderation extend the platform's value while maintaining a non-diagnostic scope, ensuring safety, scalability, and societal relevance.

References

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