AI-POWERED MENTAL HEALTH CHATBOT

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PROJECT OVERVIEW – OBJECTIVE + DATASET

Project Objective:

- To develop an **Empathetic conversational chatbot** for mental health support that classifies user Intent and generates context-aware responses using a trained ML model and a local lightweight LLM..

Datasets Used:

We integrated Three cleaned and preprocessed datasets to create a Unified modeling dataset:

1. **Mental Health Counseling Conversations :** It provides real therapy-style conversations between users and professionals (*Source:* Hugging Face)

2. **Mental Health FAQ for Chatbot :** It contains frequently asked mental health questions and expert-provided answers. (*Source:* Kaggle)

3. **Sentiment Analysis for Mental Health :** This dataset includes User posts labeled with emotional states like anxiety, depression, etc. (*Source:* Kaggle)

UNIFIED DATASET OVERVIEW

- We integrated all the three datasets into one modeling-ready format with key columns: **Input, Intent, Label, Response**

- Relevant engineered features were aslso added for Modeling purposes like Word counts, therapy/FAQ keyword flags, and encoded emotion labels.

- We preproccesed i.e. cleaned and deduplicated the final dataset (49,228 rows) for downstream modeling tasks.

- Overview of Final Unified dataset is as follows :

Final enriched dataset shape: (49228, 12)

	Input	Intent	Label	Response	Statement_Word_Count	Has_Severe_Keyword	Question_Word_Count	Answer_Word_Count
19867	diagnosed early life always dealt gotten bit o...	emotional_support	1.0		51.0	1.0	NaN	NaN
41081	sleep face kinda swollen let allergic thing ge...	emotional_support	0.0		23.0	0.0	NaN	NaN
35900	effyobie stop speaking sophisticated way pleas...	emotional_support	0.0		3.0	0.0	NaN	NaN
45523	article really helpful anxiety disorder contro...	emotional_support	4.0		71.0	1.0	NaN	NaN
5832	twtan sinking ekw	emotional_support	0.0		3.0	0.0	NaN	NaN
21716	really regret iti chance finally end alnow ca...	emotional_support	2.0		16.0	1.0	NaN	NaN
39623	husband reading cpt depression tweet life newb...	emotional_support	1.0		63.0	1.0	NaN	NaN
2295	certain people government increasingly stupid ...	emotional_support	0.0		3.0	0.0	NaN	NaN
27904	going chat therapist next session need find so...	emotional_support	0.0		45.0	0.0	NaN	NaN
21254	wish grew healthier relationship hope least de...	emotional_support	1.0		255.0	1.0	NaN	NaN
28602	today really bad day energy cried thought suic...	emotional_support	4.0		27.0	0.0	NaN	NaN

KEY EDA RESULTS
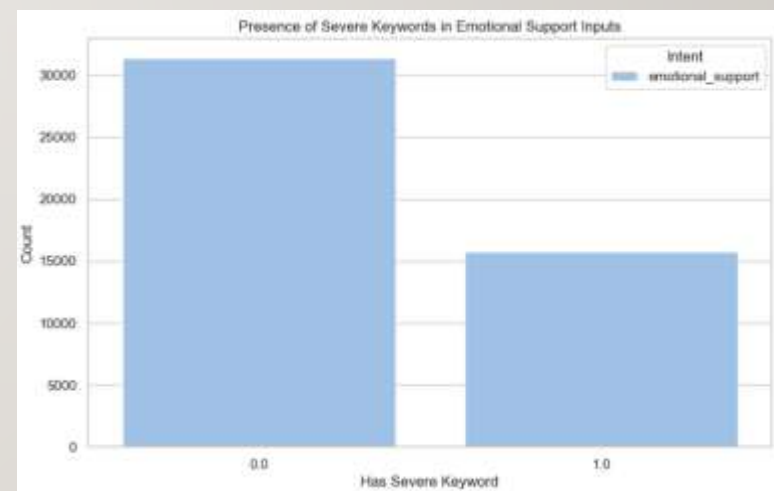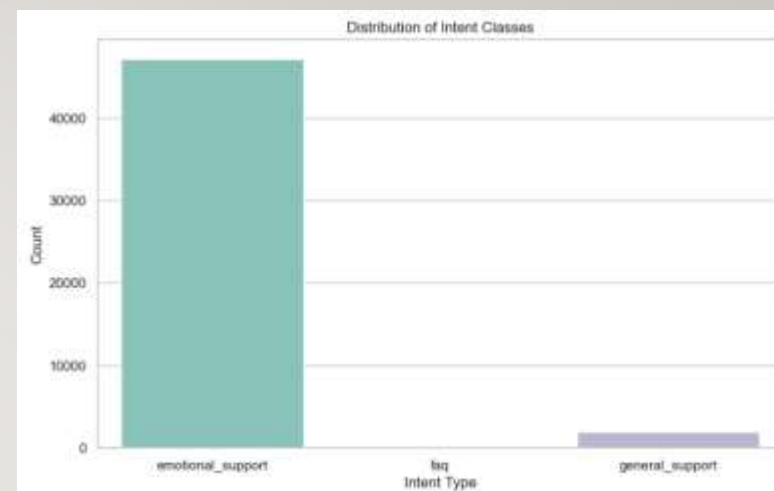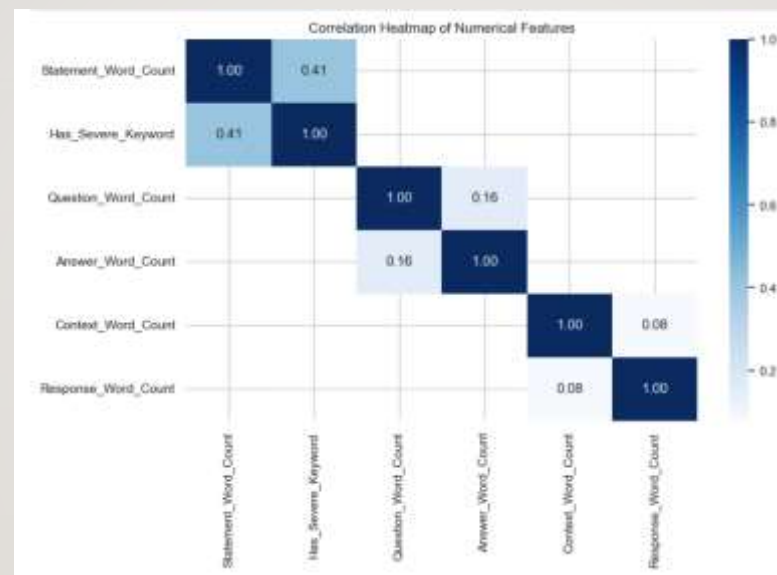
MODEL SELECTION & EVALUATION

Intent Classification Task (Input → Intent) :

- **Models Trained:** Logistic Regression, Random Forest, Multinomial Naive Bayes.

- **Best Model: Random Forest classifier** which achieved 98.5% accuracy and 0.73 macro F1-score which handled class imbalance better, especially for minority classes like faq and general_support

- Input features used in the Best model are TF-IDF Vectorized Input, Statement_Word_Count, Question_Word_Count.

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Logistic Regression Classification Report:

                    precision    recall  f1-score   support

emotional_support      0.99       0.95      0.97      9430
             faq       0.21       0.50      0.30        20
 general_support       0.47       0.90      0.62       396

        accuracy                            0.95      9846
       macro avg       0.56       0.79      0.63      9846
    weighted avg       0.97       0.95      0.96      9846

Multinomial Naive Bayes Classification Report:

                    precision    recall  f1-score   support

emotional_support      0.96       1.00      0.98      9430
             faq       0.00       0.00      0.00        20
 general_support       1.00       0.10      0.19       396

        accuracy                            0.96      9846
       macro avg       0.65       0.37      0.39      9846
    weighted avg       0.96       0.96      0.95      9846

Random Forest Classification Report:

                    precision    recall  f1-score   support

emotional_support      0.99       1.00      0.99      9430
             faq       0.83       0.25      0.38        20
 general_support       1.00       0.68      0.81       396

        accuracy                            0.99      9846
       macro avg       0.94       0.64      0.73      9846
    weighted avg       0.99       0.99      0.98      9846


Model Performance Summary:
                     Model  Accuracy  Macro F1 Score
0      Logistic Regression  0.950030        0.629205
1  Multinomial Naive Bayes  0.961913        0.389382
2            Random Forest  0.985578        0.729318
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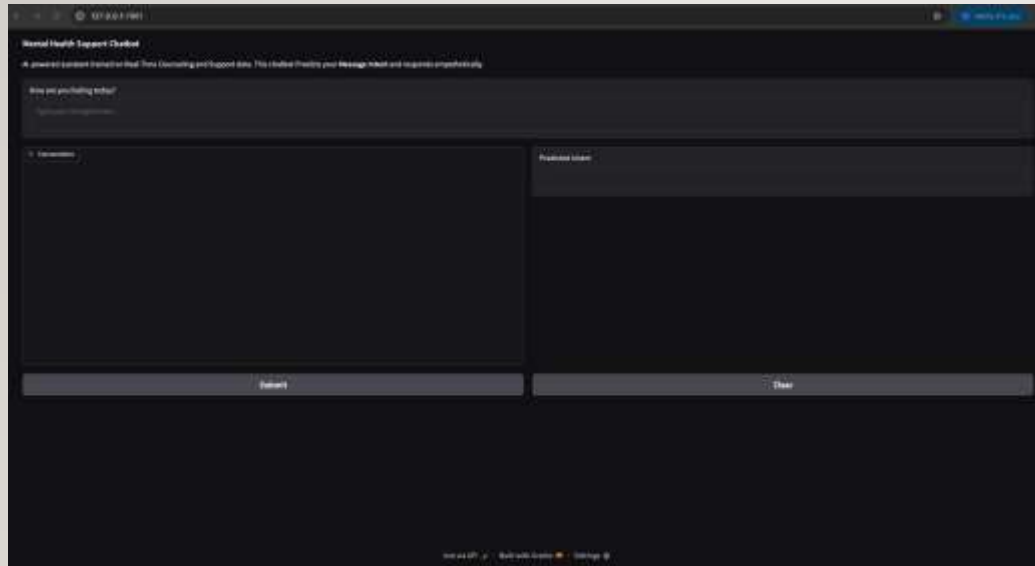
CHATBOT DEVELOPMENT (GRADIO UI)

- **Chatbot Components:**

  a. Intent Prediction: Using Trained **Random Forest** model

  b. Response Generation: Local **facebook/blenderbot-400M-distill** model

- **Why Blenderbot-400M? :** Lightweight and **locally deployable,** Avoids API limits or latency of cloud-based LLMs and Good at empathetic, safe multi-turn dialogue.

- **UI Features:**

  a. Intent display for transparency

  b. Multi-turn chat with memory

  c. Clear/Submit buttons

LIMITATIONS AND FUTURE WORK

Limitations:

- Cannot take long conversational instructions like ChatGPT/Gemini

- Response relevance depends on quality of training data

- FAQ class remains imbalanced in training

Future Work:

- Enhance chat history handling (multi-turn memory beyond 1 turn)

- Incorporate real-time emotion detection

- Add richer response generation with personalized support

THANK YOU