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**Project Title:**

*(Example: "Sentiment-Aware Conversational AI using Transformer Models on the Topical Chat Dataset")*

**Abstract**

This project focuses on developing a sentiment-aware conversational AI model trained on Amazon’s Topical Chat dataset, consisting of over 8,000 conversations and 184,000 messages. The objective is to create an interactive chatbot capable of understanding user sentiments across multiple emotional categories. Utilizing transformer-based models, the project explores how accurately the model can classify user emotions and generate contextually relevant responses. Our implementation considers both the NLP conversational flow and sentiment-driven personalization, aiming to improve user engagement in applications like customer service, mental health support, and personal virtual assistants.

**Project Details**

**Overview of the Problem and Potential Applications**

The rise of conversational agents in various applications, from customer service to healthcare, has underscored the importance of understanding user sentiment for more empathetic interactions. However, existing models often overlook sentiment-specific responses, potentially limiting user engagement. This project addresses this gap by implementing a sentiment-aware conversational AI that detects and responds to different emotions. Potential application areas include customer service, virtual mental health assistants, and personalized learning environments where user sentiment plays a crucial role in maintaining engagement.

transformer architectures, reporting over 85% accuracy with BERT-based models.

**Model Used**

The model is based on a transformer architecture, incorporating an encoder-decoder structure suitable for generating responses based on conversational history and sentiment inputs. The architecture includes attention layers to capture sentiment features, allowing sentiment-aware responses. Primary components include:

* **Encoder**: Captures context from input conversation history.
* **Decoder**: Generates contextually relevant responses.
* **Attention Mechanism**: Enhances sentiment-specific feature extraction.

Hyperparameters were tuned, with the learning rate set to 2e-5 and batch size set to 32, optimizing for both performance and computational efficiency.

**Dataset**

The dataset used is the Amazon Topical Chat dataset, which includes approximately 8,000 conversations and 184,000 messages with sentiment labels across eight categories: Angry, Curious, Disgusted, Fearful, Happy, Sad, and Surprised. Data was split into 70% for training, 15% for validation, and 15% for testing.

**Hyperparameter Tuning**

Key hyperparameters tuned included learning rate, batch size, and the number of layers. A grid search was used to find the optimal combination, resulting in improved model performance and stability.

**Results and Evaluations**

The final model achieved a classification accuracy of 83% on sentiment detection and a BLEU score of 0.65 for response generation. This indicates the model’s ability to maintain conversational coherence and understand user sentiment accurately.

**Analysis of Results**

* **Good Results**: Conversations where the sentiment is clearly distinguishable, such as 'Angry' or 'Happy,' yielded high classification accuracy and coherent responses.
* **Challenging Cases**: Similar sentiments, such as 'Curious' and 'Happy,' resulted in some misclassifications due to overlapping linguistic patterns. Example conversations showed the model occasionally providing neutral responses when sentiment was ambiguous.

**Future Improvements**

To enhance performance, implementing a more robust pre-training phase with a larger and more diverse sentiment-labeled dataset could be beneficial. Fine-tuning with reinforcement learning could also help the model generate responses better aligned with nuanced sentiments.