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Exploring Personalization and Contextual Understanding in NLP-Based Mental Health Chatbots for Student Support

A Project Proposal by

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Abstract

Problem: In the last ten years, there has been a gradual rise in the incidence of mental health concerns, especially stress, anxiety, and depression, among students. Traditional counseling services have often remained unreachable for many owing to stigma, a shortage of mental health professionals, and lengthy wait times. This very shortage gave birth to the development of mental health chatbots, presenting a scalable and accessible alternative. However, most of these chatbots are not able to provide the personalized emotional support and contextual relevance that students need. They often rely on generalized responses that do not take into consideration the specific emotional and situational contexts of each user. Consequently, students very often feel these solutions are inadequate, thereby reducing engagement and limiting the overall effectiveness of the chatbot in improving student mental health. The challenge lies in creating a chatbot that can understand and respond to users' unique emotional states and provide more relevant and personalized support related to their mental health.

Methodology: The proposal aims to enhance mental health chatbots by utilizing advanced Natural Language Processing (NLP) methods, specifically BERT, to provide personalized, context-sensitive emotional support to students. The chatbot is trained on student mental health datasets, identifying emotions like stress, anxiety, or sadness, and using machine learning algorithms to provide tailored responses. Continuous testing will improve precision, error reduction, and overall user experience.

Initial Results: Early simulations and studies indicate that state-of-the-art NLP models, such as BERT, applied to personalized mental health chatbots, can significantly increase the capabilities of emotional detection and responses with more context. Indeed, according to preliminary testing in related studies, one may expect 90-92% accuracy rates in the test detection, while models like BERT achieve an AUC-ROC of about 0.88. Confusion matrix analysis coming from the mentioned models will give a common false-positive rate of about 4-5%. This would suggest that it performs well in classifying the state of emotion, though further testing with real student data is needed. In other similar research, early prototypes have won average user feedback satisfaction rates of about 80%, thereby proving that this tailored mental health support can substantially improve student engagement.

Subject Descriptors:

- Computing methodologies −> Machine learning −> Natural language processing −> Sentiment analysis
- Information systems −> Information retrieval −> Question answering
- Applied computing −> Health care information systems −> Health informatics

Keywords: Mental health chatbot, NLP, emotion detection, personalized responses