SCHOOL OF COMPUTING
Faculty of Engineering

Project Proposal Form MCST1043
Sem: 2 Session: 2024/25

SECTION A: Project Information.

Program Name: **Masters of Science (Data Science)**

Subject Name: **Project 1 (MCST1043)**

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Project Title: Leveraging Natural Language Processing Models for Depression Detection in X(Twitter) Posts.

Supervisor 1:

Supervisor 2 / Industry Advisor(if any):

SECTION B: Project Proposal

Introduction:

In recent years, the prevalence of depression has become a significant public health concern, with social media platforms like X (formerly Twitter) serving as a valuable source of real-time data for understanding mental health trends. This project, "Leveraging Natural Language Processing Models for Depression Detection in X (formerly Twitter) Posts," seeks to utilize advanced Natural Language Processing (NLP) techniques to improve the identification of depressive symptoms in textual content shared on social media. By analyzing social media posts, this research aims to enhance early detection of depression, enabling timely intervention and support for individuals at risk.

NLP models, particularly transformer-based architectures such as BERT (Bidirectional Encoder Representations from Transformers), have revolutionized text analysis by capturing the contextual relationships between words in a sentence. Unlike traditional models, BERT understands the meaning of words in context, which enables a more nuanced understanding of language. These models are pre-trained on vast amounts of data and can be fine-tuned for specific tasks, such as depression detection, improving the model's ability to identify subtle linguistic cues associated with mental health conditions. By leveraging BERT-based models, this research aims to overcome challenges such as imbalanced datasets and suboptimal model performance, ultimately enhancing classification accuracy and providing a more reliable tool for early detection and proactive mental health management.

Problem Background:

Depression has become a global mental health crisis, affecting over 280 million individuals worldwide, with its prevalence continuing to rise alongside the rapid evolution of digital communication platforms. Social media platforms, particularly X (formerly Twitter), have become a prominent space where individuals frequently share their emotions, mental states, and personal experiences. These platforms provide a valuable resource for understanding and detecting signs of depression, as users often post in real-time about their emotional well-being. Traditional methods of identifying depression, such as clinical interviews and surveys, are time-consuming, costly, and may not be accessible to many individuals, highlighting the need for more efficient and widespread detection methods.

The rise of Natural Language Processing (NLP) and deep learning models, such as BERT (Bidirectional Encoder Representations from Transformers), has introduced new opportunities for automating depression detection from text data. BERT-based models have demonstrated superior performance compared to traditional machine learning

approaches in understanding context and sentiment in short, informal texts like tweets. X (formerly Twitter) was chosen as the primary platform for this research due to its real-time, high-volume nature, making it particularly useful for capturing immediate emotional states and mental health signals. In contrast, other platforms like Reddit, while valuable, often feature longer posts that might not capture the same level of spontaneous, immediate emotional expression seen on X. Despite advancements, challenges remain in accurately identifying nuanced mental health signals, such as sarcasm, ambiguity, and slang, often present in social media posts. This underscores the need for more robust and context-aware models capable of effectively detecting depression through Twitter data.

Problem Statement:

The growing need for early depression detection is increasingly recognized, but identifying symptoms in Twitter posts remains a significant challenge due to the complexities and nuances of human language. While previous research utilizing BERT-based models has shown promise in sentiment analysis and emotion detection, these models often struggle with the subtleties of informal and context-dependent language, such as sarcasm, ambiguity, and slang, that are prevalent in social media posts. Moreover, previous studies have not fully addressed the limitations of BERT and its variants, such as the inability to effectively capture long-term context or handle highly imbalanced datasets that often skew results. This project aims to address these weaknesses by enhancing BERT-based models to better detect subtle emotional cues in Twitter posts, improving the accuracy and reliability of automated depression detection systems and providing a more robust solution for early intervention.

Aim of the Project:

The purpose of this project is to develop an enhanced and reliable automated system for detecting signs of depression in Twitter posts using BERT-based Natural Language Processing (NLP) models. By leveraging BERT's advanced contextual understanding, this project aims to overcome the limitations of traditional models in capturing subtle emotional cues within short, informal, and complex text data. Ultimately, the system will contribute to early identification of depression, supporting timely mental health intervention and awareness.

Objectives of the Project:

- To develop and fine-tune BERT-based NLP models for detecting depressive symptoms in tweets.
- To develop and trained machine learning model that is capable of classifying Twitter post into Normal and Depression.
- To develop a dashboard that summarizes the analysis.

Scopes of the Project:

- This project focuses on developing an enhanced automated system for detecting signs of depression in Twitter text posts using BERT-based Natural Language Processing (NLP) models.
- The study will be limited to textual posts from Twitter users (excluding images, videos, or other media).
- Python will be used as the core programming language for implementing the model and visualizing the analysis results.

Expected Contribution of the Project:

- Improved accuracy in depression detection by leveraging BERT's contextual understanding.
- Development of a fine-tuned BERT-based NLP model that can identify depressive content from Twitter post.
- Support tool for mental health awareness.

Project Requirements:

Software:
- Python
- PyCharm
- Hugging Face Transformers
- Scikit-learn

Hardware: Personal Laptop with minimum 8 GB RAM.

Technology/Technique/ Methodology/Algorithm:
- Natural Language Processing (NLP)
- Binary Classification
- Transformer-Based Models (BERT)
- Fine-Tuning Pretrained Language Models
- Text Preprocessing
- Model Evaluation

Type of Project (Focusing on Data Science):

[ ] Data Preparation and Modeling

[ ] Data Analysis and Visualization

[ ] Business Intelligence and Analytics

[X] Machine Learning and Prediction

[ ] Data Science Application in Business Domain

Status of Project:

[X] New

[ ] Continued

If continued, what is the previous title?

SECTION C: Declaration

I declare that this project is proposed by:

[X] Myself

[ ] Supervisor/Industry Advisor ( )

Student Name:

Signature **Date**

SECTION D: Supervisor Acknowledgement

The Supervisor(s) shall complete this section.

I/We agree to become the supervisor(s) for this student under aforesaid proposed title.

Name of Supervisor 1:

Signature **Date**

Name of Supervisor 2 (if any):

Signature **Date**

SECTION E: Evaluation Panel Approval

The Evaluator(s) shall complete this section.

Result:

[ ] FULL APPROVAL
[ ] CONDITIONAL APPROVAL (Minor)
[ ] CONDITIONAL APPROVAL (Major)*
[ ] FAIL*

***** Student has to submit new proposal form considering the evaluators' comments.

Comments:

Name of Evaluator 1:

Signature **Date**

Name of Evaluator 2:

Signature **Date**