Abstract

This paper describes a system proposed by the NCUEE-NLP (National Central University, Dept. of Electrical Engineering, Natural Language Processing Lab) for the SMM4H 2022 Task 8 using transformer models including BERT (Devlin et al., 2019), RoBERTa (Liu et al., 2019), ALBERT (Lan et al., 2020), XLNet (Yang et al., 2019), and ELECTRA (Clark et al., 2020), followed by fine-tuning for the classification task. In addition, a majority voting ensemble mechanism is used to enhance system performance. The evaluation metric is F1-score for the positive class (i.e., tweets annotated as “1”). Our best F1-score is 0.73 over the positive class.

1 Introduction

The Social Media Mining for Health Application (SMM4H) shared tasks involve NLP challenges on social media data for health research. We participated in the SMM4H 2022 Task 8 (Weissenbacher et al., 2022), focusing on automatically differentiating tweets that exhibit self-reported chronic stress (annotated as “1”) from those that do not (annotated as “0”). Chronic stress is a kind of long-term physiological or psychological response which may damage mental health. Deep sparse neural networks were used to detect stress on social media data (Lin et al., 2014). Factor graph models were combined with convolutional neural networks to detect user stress (Lin et al., 2017). An emotion-infused language model was proposed to facilitate stress detection (Turcan et al., 2021). Emotion recognition was investigated as an auxiliary task to improve stress detection (Yao et al., 2021). Recently, novel transformer-based neural networks have achieved highly promising results in many NLP tasks. This trend motivates us to explore the use of pre-trained transformer models to detect chronic stress.
language model of each transformer thereby improving the embedding representation. Individual language models are then connected to the Multi-Layer Perceptron as a classifier.

The ensemble mechanism uses multiple learning models to obtain better classification performance. We use majority voting ensemble (Lee et al., 2021), in which each transformer model makes an independent classification (i.e., a vote 0 or 1) for each testing instance. The final system prediction output is the one that receives a majority of votes.

### 3 Evaluation

The experimental datasets were mainly provided by task organizers (Yang et al., 2022), with a total of 2,936 tweets in the training set, including 1,092 positive and 1,844 negative tweets. The validation set contains 534 tweets (156 positive/264 negative).

All tweets were pre-processed using the following steps: 1) Converting username into @USER; 2) Converting emojis into textual representation; 3) Removing all URLs; 4) Removing “#” from hashtags; 5) Segmenting hashtags which contained two or more words into their component words; and 6) Removing multi-lingual characters to retain English letters and numbers only.

The pre-trained transformer models were downloaded from HuggingFace (Wolf et al., 2019). We selected an odd number (i.e., three of five) of models for majority voting ensemble. A total of 12 groups was combined for the ensemble mechanism. The hyper-parameters used were as follows: training batch size 100, learning rate 1e-5, and maximum sequence length 256.

Table 1 shows the results on the SMM4H 2022 Task 8 validation set. Among individual transformer models, ALBERT clearly underperformed the other four models which had similar F1-score results. The five ensemble transformer models enhanced performance compared with the best standalone model, RoBERTa. Among all three ensemble models, those excluding ALBERT resulted in some performance improvements, with the best combination of BERT, XLNet and ELECTRA, achieving an F1-score of 0.7727.

We selected the top three ensemble models that performed well on the validation set as our final testing models. The combination of RoBERTa, XLNet and ELECTRA performed achieved the best F1-score of 0.73 on the test set.

### 4 Conclusions

This study describes the NCUEE-NLP system submission in SMM4H 2022 Task 8 for self-reported chronic stress, including system design, implementation and evaluation. Our submitted ensemble pre-trained transformer models achieved a high F1-score of 0.73.
Acknowledgments

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