

Depression Detection on Social Media X by Text Analysis with Attention-based CNN-BiLSTM using FastText

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Abstract—The exponential growth of the digital domain has rendered contemporary society reliant on social media. Consequently, the manner in which many individuals engage with social media can manifest indications of distress, such as depression. Social media X is a popular platform that can contain all the outpourings of its users called tweets. With the increasing cases of depression, it is important to be able to detect depression early. This research contributes to combining a hybrid deep learning method to detect depression on social media X with TF-IDF as a feature extraction that plays a role in measuring the importance of words in each user's tweet, FastText as feature expansion to improve word representation and finding semantic similarities, and attention mechanisms as optimization in adding weights. With a total of 50,523 tweet data, a similarity corpus of 100,594 was constructed. Based on the result, using the attention mechanism the BiLSTM model achieved 84.25% accuracy, a 2.03% increase from the baseline, and the CNN-BiLSTM hybrid model achieved 83.43% with an accuracy increase of 0.99% from the baseline.

Keywords: *attention mechanism, depression, FastText, hybrid deep learning, TF-IDF.*

I. INTRODUCTION

In contemporary society, social media has become a ubiquitous aspect of daily life, with a notable impact on stress and depression levels [1]. People use a variety of social media platforms, such as Facebook, X, TikTok, and Instagram, to disseminate their perspectives, concepts, experiences, and emotions. Currently, X is among the most prevalent social media platforms, providing users with a platform to publish original written content [2]. However, a considerable number of users have also reported feelings of unease and distress associated with the content, including symptoms of depression. Depression is a global mental health concern that in its most severe form results in self-mutilation or self-harm [3]. A 2022 survey, the Indonesia National Adolescent Mental Health Survey (I-NAMHS), revealed that 17.95 million adolescents in Indonesia had a diagnosed mental disorder. Among them, 1.0% had major depressive disorder. One of the most common mental health conditions experienced by Indonesian adolescents [4].

The publicly created user data on social media is of significant importance to the field of health technology, as the patterns that can be discerned from such data will prove to be highly useful. One such application is the automatic detection of an individual's mental health status, including conditions such as depression [2]. The presence of feelings of worthlessness, hopelessness, disinterest in pleasant things, and persistent sadness are indicative of depression, which can potentially result in suicidal ideation [5]. The number of cases of depression-induced suicide has increased in recent years [6]. However, depression is also a challenging condition to diagnose, with current approaches relying on scales that do not permit the direct and rapid measurement of its severity [7]. Depression is regarded as a dangerous illness, as it can have adverse effects on both mental and physical health [8]. In light of recent developments in artificial intelligence applications, the affective computing community has witnessed a surge in interest surrounding the creation of automated systems capable of detecting depression [9]. Automated depression detection systems offer a valuable tool for diagnosing depression and facilitating early intervention [10].

The attention mechanism in the Convolutional Neural Network-Bidirectional Long Short-Term Memory (CNN-BiLSTM) hybrid deep learning model is investigated in this study. The attention mechanism allows the deep learning model to concentrate on the most important parts of the input sentence, making it easier to identify depression levels from social media text data [11]. Furthermore, FastText embedding as word embedding facilitates the rapid and effective learning of words, thereby enhancing the capacity for text learning, which is a crucial aspect [19]. Additionally, the author employs word weighting through Term Frequency-Inverse Document Frequency (TF-IDF) as feature extraction, a technique not utilized in some of the referenced studies.

This research was developed by referencing a number of literature sources from previous studies that exhibited similarities in terms of the methods and research objects employed. In the research conducted by Joel Philip et al. [11], linguistic characteristics like the use of pronouns that refer to oneself