

I. INTRODUCTION

Depression has become a critical global mental health issue, affecting millions of people across various age groups. This disorder is characterized by prolonged feelings of sadness, loss of interest, and different physical and emotional symptoms that can significantly interfere with daily functioning [1][2]. In some cases, this condition can trigger suicidal thoughts [3]. The World Health Organization (WHO) estimates that approximately 300 million people worldwide suffer from depression [4]. In 2021, the Indonesia National Adolescent Mental Health Survey (I-NAMHS) reported that 5.5% of adolescents aged 10–17 years met the diagnostic criteria for a mental disorder in the past 12 months [5].

The social stigma surrounding mental illness often perceived as an incurable condition remains a major barrier for many individuals to seek timely professional help [6]. As a result, most of them choose to express their emotions through social media platforms, such as X, for support. Many users openly share feelings of despair, worthlessness, emotional exhaustion, and persistent sadness by posting tweets, making X a relevant platform for depression detection [7] to classify psychological symptoms from actual text using advanced machine learning and hybrid deep learning approaches.

Among various approaches, a hybrid method combining Convolutional Neural Networks (CNN) and Recurrent Neural Networks (RNN) has shown promising results in emotional text classification. A previous research [8] reported that a hybrid model of Convolutional Neural Network and Recurrent Neural Network using TF-IDF for feature extraction and GloVe for feature expansion achieved an accuracy of 95.42% in fake news detection, indicating its potential for other classification tasks such as depression detection. Informal syntax, spelling variations, and heavy use of slang in Indonesian social media pose significant challenges for natural language processing. To address this, FastText is utilized as a feature expansion technique, enabling the model to handle out-of-vocabulary (OOV) words through subword-level representations [9]. Moreover, research [10] has demonstrated that Genetic Algorithm (GA) optimization can further enhance model accuracy and robustness across various configurations.

Although both FastText and GA have individually proven effective in NLP, their combined use within a CNN-RNN framework for depression detection, particularly on informal Indonesian social media data, remains underexplored. This study is among the first to present such a combined framework and apply it to a large-scale dataset of real-world tweets in the Indonesian language. Through this approach, the study seeks to improve semantic understanding and model classification performance. The findings are expected to contribute to early mental health intervention efforts, support healthcare professionals, and inform policy, ultimately helping reduce the stigma surrounding mental illness in Indonesia [6].