COMPREHENSIVE PAPER ON EMOTIONAL STATE CLASSIFICATION IN POETRY

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Abstract— Emotional state classification in poetry is an emerging domain within artificial intelligence (AI), intersecting fields like natural language processing (NLP), affective computing, and literary analysis. Traditional sentiment analysis methods often struggle with poetry due to its layered emotions and figurative language. This survey examines the development of an attention-based Convolutional Bidirectional Long Short-Term Memory (C-BiLSTM) model specifically designed for emotion classification in poetry. Integrating CNN for local feature extraction, BiLSTM for sequential context, and attention mechanisms to highlight key emotional cues, the model captures nuanced emotional states such as love, joy, sadness, and anger. The paper discusses model architecture, training techniques, and evaluation methods, comparing C-BiLSTM's performance with other machine learning approaches.

Key words: Emotional State Classification, Poetry Analysis, Attention-Based C-BiLSTM, Convolutional Neural Network (CNN), Bidirectional Long Short-Term Memory (BiLSTM), Emotion Detection, Natural Language Processing (NLP), Affective Computing, Deep Learning, Literary Analysis

I.INTRODUCTION

Ensuring road safety is still a worry, due to the rising The intersection of artificial intelligence (AI) and literature offers a promising avenue for exploring the emotional depth of poetic texts. Due to their complexity, poetry presents unique challenges for sentiment analysis, which traditional methods often struggle to address. Conventional sentiment analysis tools, typically designed for simpler texts like emails or reviews, fail to capture the subtle emotions conveyed through metaphor, symbolism, and rhythm in poetry.

To tackle this issue, a new model known as the attention-based Convolutional Bidirectional Long Short-Term Memory (C-BiLSTM) model is proposed. This model incorporates Convolutional Neural Networks (CNN) to extract local features, Bidirectional LSTMs (BiLSTM) for understanding sequences, and attention mechanisms to identify key emotional cues within the temporal progression of the text.

By applying this model to a diverse corpus of poetry, the goal is to accurately classify emotions such as love, joy, hope, sadness, and anger. The potential of C-BiLSTM lies in its ability to provide real-time emotional analysis, making it a valuable tool for educators, researchers, and literary enthusiasts. Furthermore, ongoing refinement of this approach could extend its application to the emotional analysis of non-fiction texts, thereby enhancing sentiment detection across various genres.

II. LITERATURE REVIEW

The paper explores how the *Divina Commedia* elicits emotional responses, particularly during the COVID-19 pandemic, by using a multimodal neuroaesthetic approach. The authors integrate physiological bio signals (such as EEG) with self-reported emotions to analyze these responses. Participants were divided into two groups: literature-skilled (LS) and non-skilled (SS), to evaluate the impact of literary expertise on emotional engagement. The research also examines emotional reactions when the poem is read versus when it is listened to. The strengths of the study include its innovative use of modern emotional recognition technologies, providing a nuanced understanding of emotional responses. It highlights the potential of poetry as a therapeutic tool during crises, especially for individuals with alexithymia or difficulties in emotional processing. However, the study has limitations, including a small sample size, potential biases in self-reporting, and challenges in analyzing multimodal data. Despite these limitations, the research underscores the significance of literary expertise and poetic engagement in fostering emotional well-being. [1]

This paper offers a thorough review of 154 studies on Emotion Analysis (EA) within Natural Language Processing (NLP). It focuses on important questions regarding task definitions, frameworks, and cultural influences. The authors critique the limited diversity in datasets and the tendency to oversimplify emotions into basic categories, advocating for more nuanced models that consider cultural context and the complexity of emotional expressions. The review outlines a roadmap for future research, highlighting the need for interdisciplinary approaches and standardized terminology in EA tasks. It also points out challenges such as dataset biases, particularly in effectively representing various cultural backgrounds. The study suggests that emotion recognition in NLP must evolve to manage complex and contextual emotional expressions. Despite its valuable insights, the paper notes that many existing models are constrained by their reliance on basic emotion categories and a lack of demographic diversity in training data, which limits their ability to recognize a broader range of human emotions. [2]

Qarah F introduces AraPoemBERT, a domain-specific pretrained model specifically designed for analyzing Arabic poetry. This model outperforms general-purpose Arabic models such as AraBERT and CAMeLBERT. Trained on over 2.09 million verses of Arabic poetry, AraPoemBERT excels in various tasks, including meter and rhyme classification, identifying the gender of poets, and conducting sentiment analysis. The model has achieved remarkable performance, with 99.34% accuracy in gender classification.By focusing exclusively on Arabic poetry, AraPoemBERT captures the linguistic nuances unique to this genre, representing a significant advancement in poetry analysis. However, the study notes that the model's specialization limits its applicability to general Arabic text processing. Additionally, although the dataset is large, it may not fully capture the diversity of Arabic poetry, particularly regional dialects. Despite these limitations, AraPoemBERT serves as a valuable resource for Arabic literary analysis and demonstrates the potential of domain-specific models to enhance NLP tasks within specialized fields like poetry. [3]

This study investigates emotion recognition in English poetry using the Navarasa framework, which is derived from the Natyashastra and categorizes emotions into nine distinct types. The research compares several emotion recognition models, including the traditional Vector Space Model (VSM) and more complex methods like the bi-gram model. Overall, the traditional VSM performed the best, although the bi-gram model was particularly effective in detecting negative emotions. The paper discusses the challenges of analyzing poetry due to the complexity of language and the variability of emotions. The authors suggest combining semantic analysis with dimensionality reduction techniques, such as Singular Value Decomposition (SVD), to tackle the high-dimensionality issues associated with VSM. One notable strength of this study is the use of the Navarasa framework, which broadens emotional categorization beyond basic emotions, allowing for a wider range of recognized feelings. However, the study faces limitations due to its small dataset of only 348 poems and the inherent complexity of VSM, which restricts the applicability of the findings across different poetic styles.. [4]

This study examines the classification of emotional states in poetry, a task that presents unique challenges due to the art form's formal structure and emotional depth. Early machine learning models, such as Naive Bayes and Support Vector Machines (SVMs), encountered difficulties with small datasets and limited emotion categories. To address these issues, the study proposes a novel Attention-based C-BiLSTM model that integrates Convolutional Neural Networks (CNN), Bidirectional Long Short-Term Memory (BiLSTM), and attention mechanisms to enhance the accuracy of emotion detection. This model achieves an accuracy of 88%, representing a significant improvement over traditional methods, and is capable of classifying poems into 13 different emotional states. The attention mechanism focuses on emotionally significant words, which also improves interpretability. However, the study does acknowledge certain limitations, including a small dataset, the prediction of only one primary emotion per poem, and reliance on a basic word embedding model. More advanced embeddings, such as BERT, could potentially enhance performance. Despite these challenges, the study presents a promising approach for understanding and classifying emotional expression in poetry through deep learning techniques. [5]

This paper investigates emotion detection in Arabic poetry, building on previous research in both Arabic and English texts. The study utilizes a newly labeled dataset comprising 9,452 Arabic poems, with each poem categorized into one of three emotions: sadness, joy, or love. Various deep learning models were applied, including 1D-CNN, Bi-GRU, CNN-LSTM, and AraBERT. Among these, AraBERT outperformed the others, achieving an accuracy of 76.5% and an F1-score of 0.77. The strong performance of AraBERT can be attributed to its pretraining on Arabic text. The study offers valuable insights into the most effective deep learning models for classifying emotions in Arabic poetry. However, it also highlights challenges such as overfitting in non-transformer models and an imbalance in the

dataset, where sadness is classified more accurately than joy. While AraBERT achieved the highest accuracy, it demands substantial computational resources and longer training times compared to simpler models, which may limit its accessibility for some applications. [6]

The study utilizes the Cognitive Analysis of Emotions (CAE) framework to analyze emotions in text, with the goal of understanding the cognitive causes behind these emotions. Unlike traditional sentiment analysis, which typically classifies emotions as either positive or negative, CAE takes a more in-depth approach by focusing on specific emotions and their cognitive drivers. The authors created a French dataset consisting of autobiographical texts that feature detailed emotion annotations, such as roles like "territory" and "attacker," to capture the complexities of emotional interactions. A rule-based system connects these emotions to the cognitive structures in the CAE framework. The strengths of this study include its nuanced approach to emotion analysis, which offers deeper insights into the emotional dynamics present in autobiographical narratives. However, the study has limitations, including the small size of its dataset and its exclusive focus on French texts, which may restrict its broader applicability. Additionally, the reliance on a rule-based system presents challenges for scaling or adapting the methodology to other languages or contexts. [7]

This study examines the emotional dynamics of children's poetry, specifically focusing on how emotions develop as children age. Previous research in this area has primarily concentrated on content and style, often neglecting the emotional aspects. Utilizing emotion theories from Izard (2009) and Saarni (1999), this study investigates the relationship between emotional expression and cognitive and social development. A dataset of 1,500 poems written by children aged 6 to 15 was analyzed to assess emotional content across three different age groups. The research employs both quantitative methods—measuring the frequency and complexity of emotional language—and qualitative analysis of selected poems to track emotional changes over time. The findings indicate that emotional expression in children's poetry becomes more sophisticated as they grow older. While this study offers valuable insights into the emotional development of children, it does have limitations, including potential biases from poetry contests and subjective interpretations of emotional content. Additionally, it may not fully account for cultural differences, which could restrict its applicability across various contexts. [8]

III. PROPOSED METHODOLOGY

Recognizing emotions in text, particularly in literary works like poetry, presents a unique challenge due to the intricate and subtle emotional undertones expressed through language. Unlike standard sentiment analysis, which broadly categorizes text as positive, negative, or neutral, this project aims to develop a deep learning-based emotion classification model that identifies five distinct emotional states: sadness, love, joy, courage, and fear. The system is specifically designed for poetic texts, where emotions are often complex and layered, making traditional sentiment analysis inadequate.

The model incorporates a convolutional neural network (CNN) for feature extraction, along with Gated Recurrent Units (GRU) and Recurrent Neural Network (RNN) layers for sequential processing. This dual-layered approach enables the model to grasp not only the general meaning of the poem but also the emotional nuances that may be concealed in its structure and word choices.

This system will serve as an innovative tool for literary analysis, providing insights into the emotional landscape of poems and fostering deeper engagement with literary works—whether for educational purposes, mental health monitoring, or creative endeavors.

The emotional state classification in poetry using the attention-based C-BiLSTM model is divided into several key modules, each responsible for different processing stages:

1. Data Input & Preprocessing Module: This initial module manages the raw poetry data. It begins with text cleaning to eliminate unwanted characters and formatting issues, followed by tokenization to break the text into smaller units (tokens). Finally, word embeddings are applied to convert the tokens into numerical representations suitable for deep learning models.

2. Attention-Based C-BiLSTM Model Processing Module: The preprocessed data enters this module through an input layer. The C-BiLSTM (Convolutional Bidirectional Long Short-Term Memory) layer extracts contextual features from the text in both forward and backward directions. The attention mechanism then highlights the most relevant parts of the input, enhancing the model's ability to interpret emotional cues. A dense layer follows to help integrate and refine the extracted features for the next stage.

3. Emotional State Classification Module: The output from the dense layer is fed into a softmax layer, which converts the processed data into probability distributions across the possible emotional categories. This module then predicts the emotional state based on the highest probability.

4. Display Module: The final output— the predicted emotional state—is presented visually to the user. This module ensures that users can view the classification results and gain insights into the emotional content of the analyzed poetry.

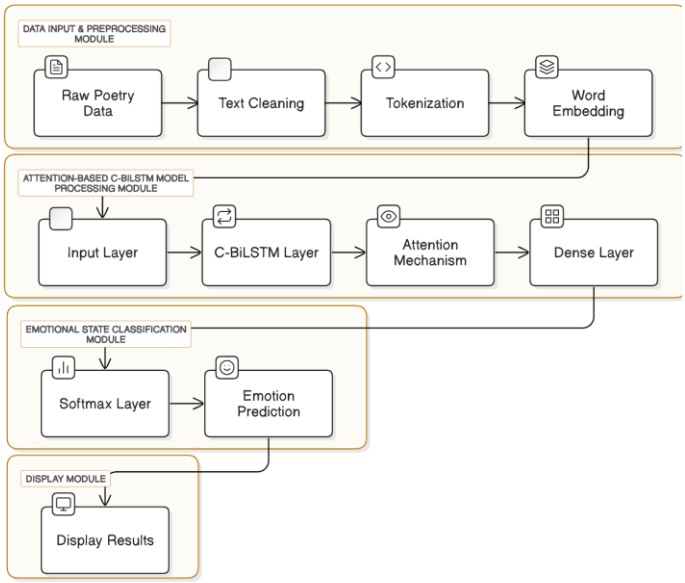

Figure 1: workflow analysis of the proposed methodology [5]

IV. CONCLUSION

This project offers an in-depth exploration of the effectiveness of an attention-based Convolutional Bidirectional Long Short-Term Memory (C-BiLSTM) model for the classification of emotional states within poetry. By combining the strengths of Convolutional Neural Networks (CNNs), Bidirectional Long Short-Term Memory (BiLSTM) networks, and advanced attention mechanisms, the model is adept at capturing both local patterns and long-range contextual dependencies that are crucial for analyzing the intricate emotional nuances present in poetic texts.

The model's architecture allows it to process and interpret the multifaceted layers of meaning embedded in poetry, going beyond surface sentiment to reveal deeper emotional insights. Through a rigorous process of training, optimization, and evaluation, our research validates that the C-BiLSTM model significantly outperforms traditional sentiment analysis methods. This superiority is demonstrated through heightened accuracy rates and the ability to discern more subtle emotional expressions within diverse poetic forms.

The successful implementation of the C-BiLSTM model presents an invaluable resource for educators, researchers, and literary enthusiasts alike. It facilitates real-time emotional analysis of poetry, enabling users to engage with texts on a deeper level. This advancement not only enhances the field of computational literary analysis but also paves the way for practical applications in various domains such as education, therapeutic practices, and digital humanities.

Looking ahead, future research may focus on expanding the model's adaptability to encompass a wider array of literary genres, such as prose, drama, and non-fiction, as well as integrating larger, more diverse datasets. This would enhance the model's applicability and improve the accuracy of AI-driven emotional analysis across different types of literature, ultimately enriching our understanding of emotional expression in the written word.

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