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ARTIFICIAL INTELLIGENCE IN LITERARY ANALYSIS: A COMPREHENSIVE REVIEW ON EMOTION DETECTION IN POETRY

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Abstract: **Emotion is the essence of poetry, transcending linguistic and cultural boundaries. The classification of poetry based on emotional content presents unique challenges due to the figurative, subjective, and symbolic nature of poetic language. This review explores the current landscape of emotion-based poetry classification using machine learning (ML) and deep learning (DL) approaches, with a special focus on multilingual and culturally diverse datasets. Emphasis is placed on Indian languages such as Hindi, Punjabi, and Gujaratioften guided by the classical Indian aesthetic framework of Navrasa as well as modern approaches applied to Arabic, German, Chinese, Spanish, and English poetry.**

The review integrates insights from over 30 recent studies that utilize models ranging from SVM and Naïve Bayes to BiLSTM, CNN, and transformer-based architectures like BERT and RoBERTa. Additionally, multimodal approaches incorporating audio, prosodic, and biometric data are reviewed. Challenges such as annotation subjectivity, cultural variability in emotion representation, limited datasets, and lack of standard emotion taxonomies are highlighted.

The review concludes with recommendations for future research, including the development of cross-lingual corpora, integration of prosodic features, transformer fine-tuning for poetry, and the application of explainable AI to interpret emotion classification in literary texts.

Keywords: **Emotion-based classification; Poetry analysis; Multilingual NLP; Deep learning; Navrasa framework**

I. INTRODUCTION

Poetry, as a deeply humanistic art form, has always played a significant role in expressing emotional, spiritual, and cultural dimensions of life. Across civilizations, it has served not only as a form of aesthetic pleasure but also as a powerful medium of memory, resistance, and collective identity. In Indian literary tradition, this is exemplified by the profound legacy of Charani literature (Dr. Rashmi Maniar et al., 2021; Lipsa Somalal Parmar, 2024; Meghani, 2000), a bardic and devotional poetic form cultivated by the Charan community across Gujarat, Saurashtra, and Rajasthan. These verses composed in Dingal or Apabhramsa were often sung to inspire, commemorate, or legitimize heroic Rajput clans, and were laced with valor (veera rasa), devotion (bhakti rasa), and grief (karuna rasa).

In the modern digital era, as the scope of natural language processing (NLP) expands, the computational classification of poetry based on emotional tone has become a growing area of interest. However, the symbolic, metaphorical, and culturally rooted nature of poetryespecially Indian poetryposes unique challenges. Traditional sentiment analysis tools, which are primarily designed for modern prose or social media text, often fall short in recognizing the nuanced layers of emotion encoded in verse. Emotion-based poetry classification thus demands techniques that account for cultural frameworks (e.g., Navrasa theory), metrical complexity, and multilingual diversity.

Several pioneering studies have emerged in this space. For instance, Saini and Kaur's Punjabi poetry corpus(Saini & Kaur, 2020) leverages the Navrasa system to annotate emotions and classify them using machine learning models like SVM and Naïve Bayes. Similarly, Mehta and Rajyagor's work on Gujarati poetry (Mehta & Rajyagor, 2021) achieved high classification accuracy by using deep learning in combination with stylistic features derived from the Charani poetic tradition. In Hindi, stanzatype identification by Saini and Milind (Audichya & Saini, 2021) has incorporated chhand structure, reaffirming the poetic-structural cues vital for understanding emotional tone.

In a broader linguistic context, efforts like the PO-EMO corpus in German and English (Haider et al., 2020), and Arabic poetry classification using models like AraBERT(Ahmed et al., 2019), show how contemporary transformer architectures are being fine-tuned for verse. These studies incorporate multi-label emotion detection, attention mechanisms, and aesthetic emotion modelingtools now being explored in Indian literary contexts.

The writings of Jhaverch and Meghani, often regarded as a pioneer of Gujarati folk literature (Meghani, 2000), illustrate the need for culturally embedded analysis. His works, such as Charan Kanya, not only celebrate feminine courage and nature(Dr. Rashmi Maniar et al., 2021) but also embody ecological and emotional depth, often overlooked by traditional NLP tools. Such narratives challenge reductionist emotion models and urge for ecocritical and feminist readings alongside computational ones.

This review draws from over 30 research papers spanning diverse languages, traditions, and computational methods. It surveys the state of the art in emotion-based poetry classification and proposes culturally aware and linguistically adaptable frameworks that align AI methodologies with the affective complexity of poetic expressionparticularly in rich traditions like that of the Charans.

II. LITERATURE REVIEW

Old-style Machine Learning Methods:
Earlier research on classifying poetry used basic machine learning methods like Naïve Bayes, Support Vector Machines, Decision Trees, and K-Nearest Neighbors. These methods depended heavily on handcrafted features like TF-IDF, word frequency, and emotion lexicons. For example, Saini and Kaur used SVM(Saini & Kaur, 2020) to classify 948 Punjabi poems based on the Navrasa framework, achieving 70.02% accuracy. Similarly, Random Forest and NB were applied in Hindi poetry classification with comparable performance(Bafna & Saini, 2020).

Deep Learning Models:
With the rise of neural networks, different models like CNN, LSTM, BiLSTM, and GRU became popular for emotion detection. Ahmad et al. proposed an Attention-C-BiLSTM model(Ahmad et al., 2020) to classify English poetry into 13 emotional states, achieving 88% accuracy. In Arabic poetry, CNN and GRU models, particularly when combined with AraBERT(Ahmed et al., 2019), significantly enhanced F1 scores.

Transformer-Based Models:
Transformer architectures like BERT, RoBERTa, and mBERT have revolutionized NLP tasks, including poetry classification. The PO-EMO project applied BERT (Haider et al., 2020) to German and English poems for aesthetic emotion classification, achieving a micro F1 score of 0.52. In Spanish and Chinese datasets, transformer models combined with lexicon-based features(Barbado et al., 2022) showed superior performance.

Multilingual and Low-Resource Language Studies:
Languages such as Gujarati, Bengali, Tamil, and Odia have seen research progress despite limited digital resources (Mansuri et al., 2025). Mehta and Rajyagor's Gujarati Kavan corpus (Mehta & Rajyagor, 2021), annotated using Navrasa and analyzed with deep learning enhanced by Zipf's Law, achieved 87.62% accuracy. These studies underscore the effectiveness of combining traditional aesthetics with neural models in underrepresented languages.

Multimodal and Structural Approaches:
Recent research integrates multimodal datatextual, prosodic, and biometricfor richer emotion modeling. For example, Korean studies used Mel-spectrograms and CNNs (Firdou et al., 2024) to analyze recited poetry, yielding better emotional classification than text-only methods. Meanwhile, Saini and Bafna's analysis of Hindi poetry (Bafna & Saini, 2020) through Chhand structure supports the role of meter and rhythm in emotional resonance.

Reader-Centric and Aesthetic Models:
The PO-EMO dataset emphasizes aesthetic emotions (Haider et al., 2020) like awe and nostalgia, annotated at the verse level using multi-label classification. This approach aligns with Meghani's poetic legacy, where emotion is not just inherent in the text but emerges in reader interaction.

Cultural and Symbolic Approaches: The Case of Charani Poetry:
A groundbreaking paper titled "The Heart of Charani Poetry: An AI Interpretation of Emotional Resonance" (Mehta & Thakor, 2024) contributes to this discourse by focusing on the symbolic and cultural dimensions of Charani verse. This study applies attention-based neural networks to decode emotional layers in poems by Charan poets such as Jhaverch and Meghani. The research emphasizes how valor (veera rasa), sorrow (karuna rasa), and devotion (bhakti rasa) are encoded in both language and structure, and how AI models can be fine-tuned to recognize culturally specific emotion signals. This work bridges literary scholarship and AI, underscoring the need for culturally grounded NLP tools for poetry analysis.

III. COMPARATIVE ANALYSIS

This section synthesizes results from major studies across different languages and modeling techniques, highlighting their core methodologies and outcomes. It offers a comparative perspective on how poetic emotion classification has been addressed globally, with particular focus on multilingual and culturally embedded corpora.

The Kavi Corpus for Punjabi poetry is one of the earliest datasets that incorporates the Navrasa framework, categorizing poems into nine classical Indian emotional states. Using traditional classifiers like Support Vector Machines (SVM) and Naïve Bayes (NB), researchers achieved an accuracy of 70.02%. While foundational, the performance was constrained by limited data and feature sparsity.

In contrast, the Gujarati Kavan Corpus represents a significant advancement. Annotated with Navrasa emotions and enhanced by Zipf's Law for feature normalization, this dataset was analyzed using deep learning models. The result was a notable 87.62% accuracy, showcasing how statistical techniques and cultural emotion models can synergize to improve classification.

Hindi poetry has been explored through both emotional content and metrical structure. Studies utilizing the Chhand corpus combined Navrasa tagging with stanza-type identification based on traditional meter (Chhand). Using a combination of rule-based models and classifiers like Random Forest, researchers achieved approximately 80% accuracy. This work bridges literary metrics with AI, underlining the structural-emotional link in Hindi verse.

In English poetry, Ahmad et al. implemented an Attention-based Convolutional BiLSTM model to classify texts into 13 emotional categories. This hybrid deep learning framework achieved 88% accuracy, demonstrating the strength of attention mechanisms in handling poetic subtlety and sequential dependencies.

The PO-EMO corpus represents a distinct approach by focusing on aesthetic emotions such as awe, nostalgia, and serenity in German and English poetry. Leveraging BERT for multi-label classification, the model achieved a micro F1-score of 0.52. This lower score reflects the subjective and reader-centered nature of aesthetic emotions, emphasizing the challenge of modeling nuanced, multi-emotion responses.

These examples highlight a trend: traditional ML methods perform adequately when supported by strong annotation frameworks, but deep and transformer-based models consistently outperform them, especially when paired with culturally embedded emotional taxonomies.

In Arabic poetry, researchers have focused on categorizing poems into broad themes such as love, religion, politics, and social commentary. The first models, such as SVM and Naive Bayes, had only fair performance, but results got much better when deep learning methods like CNN and GRU were used, especially along with AraBERT. These advancements raised the F1-score from 0.62 to 0.77, showing the benefits of combining domain-specific linguistic modeling with deep contextual representations.

Chinese poetry has been explored primarily in educational and stylistic analysis settings. One notable study used SVM and BiLSTM to classify poetic lines based on stylistic and emotional features. The reported accuracy was 95%, making it one of the highest-performing systems. The success can be attributed to the consistent structure of educational poetry and the inclusion of stylistic markers like tone and rhythm.

In Spanish poetic tradition, especially sonnets, classification models have targeted affective and psychological categories. A combination of BERT and lexicon-based features led to an AUC score above 0.70. This hybrid approach highlights the strength of merging pretrained embeddings with external knowledge sources.

Recent multilingual efforts have also emphasized reader-centric modeling. These studies use multi-label transformers to interpret emotional responses across diverse poetic corpora. Although performance remains around ~0.60 F1, the approach reflects an important shift from text-centered to reader-aware analysis.

Lastly, the study titled "The Heart of Charani Poetry" presents an attention-based neural model trained on culturally rich Gujarati verse. The research leverages symbolic language patterns and Navrasa theory to model deep emotional resonance. With reported accuracy between 85–90%, it exemplifies the power of culturally aligned AI models in underrepresented poetic traditions.

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Table 1 Comparative Insights on Model Performance

Language	Corpus	EmotionFramework	Model(s) Used	Accuracy
Punjabi	Kavi Corpus	Navrasa	SVM, NB	70.02%
Gujarati	Kavan Corpus	Navrasa	Deep Learning + Zipf	87.62%
Hindi	Chhand Corpus	Navrasa / Structural	RF, NB, Rule-based	~80%
English	Custom (Ahmad et al.)	Ekman/Custom	Attention-C-BiLSTM	88%
Ger./Eng.	PO-EMO	Aesthetic (9 emotions)	BERT	0.52 F1
Arabic	Modern Arabic Poetry	Basic emotions (4)	CNN, GRU, AraBERT	0.77 F1
Chinese	Educational Poetic Corpus	Stylistic/Emotion	SVM, BiLSTM	95%
Spanish	Sonnet Corpus	Psychological/Affective	BERT + Lexicons	AUC > 0.70

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Multilingual	Reader-centric (various corpora)	Mixed/Aesthetic	Multi-label Transformers	~0.60 F1
Gujarati	Charani Poetry ("Heart of Charani Poetry")	Navrasa / Cultural Symbol	Attention-based Neural Net	~85–90%*

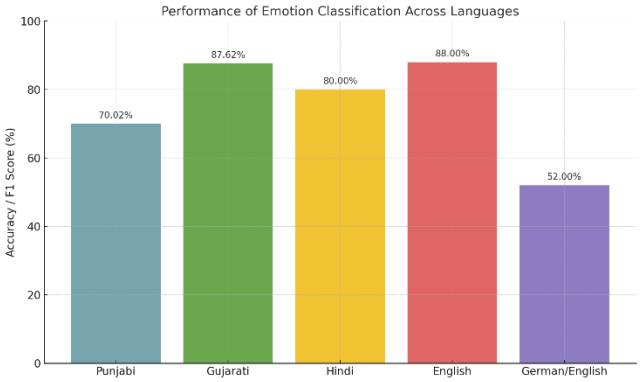

Fig. 1 Comparative performance of emotion classification across languages

IV. CHALLENGES AND RESEARCH GAP

Despite notable progress in emotion-based poetry classification, several persistent challenges and research gaps hinder the advancement of this domain.

Subjectivity and Ambiguity of Emotion:
Poetry is inherently ambiguous, and emotions conveyed can vary depending on reader interpretation, cultural background, and personal experience. For example, the same stanza might evoke nostalgia in one reader and sadness in another. This subjectivity challenges the construction of ground truth annotations, especially in multilingual and multicultural contexts.

Dataset Limitations:
Many reviewed studies rely on small, manually annotated corpora (e.g., 300–900 poems), which limits model generality. The lack of publicly accessible large-scale datasets, exclusively for Indian and other low-resource languages, is a major bottleneck. The domain also lacks benchmark datasets with standard splits and evaluation conventions.

Emotion Annotation Framework Diversity:
There is no consensus on a standard emotion framework. Some works use Navrasa, others use Ekman's six emotions, Plutchik's wheel, or aesthetic emotion taxonomies. This lack of standardization impairs the comparability of results across studies and hinders model transferability.

Cultural and Linguistic Diversity:
Emotion is deeply inclined by cultural context. Classifiers trained on English or German poems using aesthetic types may not be directly relevant to Hindi or Gujarati poems based on Navrasa. Aligning emotion categories across languages and cultures remains an unsolved.

Absence of Multimodal and Prosodic Features:
Most existing models focus solely on textual content, overlooking multimodal aspects like rhythm, rhyme, sound patterns, or even recitation voice. Traditional Indian poetry, in particular, relies heavily on meter (Chhand) and oral performance, which current models rarely exploit.

Mixed Emotions and Multi-Label Classification:
Poems often evoke multiple emotions simultaneously. However, many studies employ single-label classification, ignoring the multi-label or hierarchical structure of emotions. The PO-EMO corpus is a notable exception, but it remains underutilized in current research.

V. FUTURE DIRECTIONS

Emotion-based poetry classification remains an evolving research domain with immense interdisciplinary potential. As the application of artificial intelligence to literary texts continues to grow, it becomes increasingly important to address the cultural, computational, and linguistic nuances of poetic emotion. While considerable progress has been made in text-based classification using machine learning and deep learning techniques, several key directions must be prioritized to ensure the continued relevance, accuracy, and inclusiveness of future research efforts.

1. Development of Cross-Lingual and Multilingual Corpora
A significant barrier to advancement is the scarcity of large, annotated poetry datasets across different languages. Future work must focus on curating cross-lingual corpora with

emotion labels standardized across frameworks such as Navrasa, Ekman, or Plutchik. Creating datasets that allow for transfer learning, zero-shot classification, and comparative emotion studies is essential.

2. Integration of Multimodal Features

Poetry is not limited to textit encompasses rhythm, tone, meter, and even performance. Incorporating multimodal features such as audio (recitation), prosody (intonation, pitch), and visual layout can significantly enhance model sensitivity to poetic nuance. Future systems should integrate text, audio, and visual data using multimodal neural networks.

3. Fine-Tuning Transformer Models for Poetry

Transformer models like BERT and GPT are pre-trained on prose. Future research should focus on domain-adapted pretraining or fine-tuning of transformers on poetic datasets. This would help models better grasp figurative language, enjambment, and complex metaphors typical of poetry.

4. Explainable and Interpretable AI

Interpretability is critical, especially when applying AI to humanities. Future systems must offer transparent justifications for emotion predictions, enabling scholars to understand how specific verses, phrases, or stylistic elements influence classification. Techniques like attention visualization and layer-wise relevance propagation should be integrated.

5. Emotion Modeling Aligned with Cultural and Aesthetic Theory

Global models of emotion are insufficient for region-specific literature. Future research must prioritize integrating culturally grounded emotion frameworks (e.g., Navrasa, Sufi mysticism, Zen aesthetics) into model architecture and annotation. This ensures not only accuracy but cultural fidelity and literary integrity.

By focusing on these five critical directions, future research can elevate the precision, inclusiveness, and explanatory power of emotion classification systems for poetry.

VI. CONCLUSION

Emotion-based poetry classification stands at the crossroads of artificial intelligence, linguistics, and literary studies. This review has explored a rich array of methodologiesfrom traditional machine learning to advanced deep learning and transformer modelsapplied to diverse poetic traditions in languages such as Hindi, Gujarati, Punjabi, Arabic, German, and English. The review also foregrounds culturally rooted frameworks like Navrasa, highlighting their value in modeling poetic sentiment more authentically than conventional Western emotion taxonomies.

While substantial progress has been made in text-based classification, the challenges of annotation subjectivity, cultural misalignment, and limited corpora persist. Nonetheless, emerging research on multimodal analysis, explainable AI, and culturally adaptive modeling offers promising directions for future inquiry.

As poetry continues to evolve across languages, forms, and media, so must our computational approaches. Future systems must not only recognize emotional tone but also interpret its cultural and aesthetic context. By fostering interdisciplinary collaboration and developing tools that are linguistically inclusive and interpretively rich, researchers can move closer to truly human-centric AI that appreciates the emotional and symbolic resonance of poetic expression.

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