Survey Paper on Raga Recommendation Based on Emotion Identification

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Abstract — **Music is believed to be the language of emotions, and listening to music is an activity that is part of everyday living. These emotions are referred to as rasa (aesthetics) in ancient Sanskrit literature. Raga which is an important aspect of Indian Classical Music (ICM) has a close relationship with rasa or aesthetics. Lyrics or words in any language are a medium of expressing an emotion or rasa through it. Indian Classical Music has a rich history that captivates listeners and invokes emotions. The ability of music to elicit emotions has been integral to the aesthetics and reception of India's elite raga-based traditions. This model proposes an automated method to analyze and identify the emotion or the sentiment through the lyrics of a poem or song. This method will assist the music composer in composing melodies with the support of the raga framework to enhance the emotion or rasa of the song. This can also assist the music enthusiast to recognize the emotion of the song/poem by reading the lyrics. With the inherent ambiguity of Indian Classical Music, defining the emotions it evokes becomes far more challenging. Due to the nature of Creative interpretations, a single musical performance can elicit a wide range of emotional responses in the audience. One of the most challenging test cases is the categorization of emotions caused by ICM; yet, with significant advances in deep learning, this music emotion detection task is becoming more relevant and robust. Develop classifiers that use textual properties to automatically determine the presence of one or more emotions.**

Index Terms — **Emotions Detection, Raga Recommendation, NLP, NLTK, CNN, Collaborative Filtering, Raga, Rasa, Hindustani Classical Music.**

I. INTRODUCTION

Indian Classical Music (ICM) is based on aesthetics and the effect of music on a person's emotions [7]. These aesthetics were defined in the text Natyashastra before 200 BC. Since then, there has been a link between raga music and art rasa/aesthetics. Music is frequently referred to be an expressive language. Raga and Rasa (essence) are essential components of ICM [2][4]. Indian Classical Music (ICM), often known as Hindustani music, is an ancient Indian musical genre that evolved from a cultural fusion of the Vedic chant tradition.

Emotions have an important role in human communication [1]. Regardless of different cultures and languages, emotions are communicated in unique ways [3]. Emotions have an essential role in conveying feelings through language, facial expressions, music, and dance. Emotion analysis has piqued the interest of researchers in both computational linguistics and psychology. In computational linguistics, emotion analysis is a burgeoning study subject. Many applications exist, such as emotional analysis in text, emotional analysis in music, mood categorization in blogs, emotional analysis in social networks, and so on.

Emotions aware recommendation system would be able to better understand people's requirements and feelings and select appropriate music pieces according to the emotional context. Music-related emotions are classically considered from two main perspectives: emotions that can be observed in music (cognitivist perspective) and emotions that are perceived from music (emotivism perspective). We trained neural networks for both perspectives with music features as inputs, outputs of these models were arousal and valence-based emotions which were observed by music analyses and by psychological feedback received from research participants. Music recommendation can be applied in different areas such as support of intellectual and physical work, studying, sports, relaxing, stress and tiredness destruction, music therapy, and many others.

In this work, we present the design of the personalized emotion-driven raga recommendation system. The principal purposes of the recommender are: addressing the choice problem, exploring new music pieces, supporting mental and physical well-being, and support in improving working processes. The design involves a combination of artificial intelligence techniques and generalized, music recommendation and therapy approaches.

Hasya	Adbhut	Bibhatsa
Shringar	Shant	Bhayanak
Veer	Raudra	Karun

Fig 1.1 Rasa Matrix

Fig 1.1 gives us a fair idea of the positioning of the rasa concerning each other. This states the emotion quotient of each rasa and their sentiment relation in terms of their behavior. This is an attempt to map the rasas in the form of a matrix to simplify the classification of the aesthetic/rasa classification process.

When any of these emotions is represented via any form of art, the matching rasa or "feeling par excellence" might occur in both the performer's and the connoisseur's minds. Rasa experience is formed by the interaction of these innate, permanent inclinations or predispositions of the mind (*sthayibhava*) existent in both the performer and the perceiver or contemplator. Rasa is formed by combining *vibhava, anubhava,* and *bhava. Bhava* is an emotion or mood imitation. *Bhava* uses movements and facial expressions to convey message. Bhava is made up of two parts: *vibhava* and *anubhava. Anubhava* is the embodiment and enactment of *bhava,* whereas *vibhava* is a stimulant.

The sthayibhava are the primary emotions exhibited by the performer as well as projected through the text's wordings and meanings. *Sancharibhava*-s and *vyabhicharibhava*-s are the ephemeral, transitory, and less prominent emotions that arise and fade out during and between performances. This has been demonstrated in the below table (Table 1.1).

Bhava	Rasa
Rati (Love)	*Shringar* (Erotic)
Hasa (Laughter)	*Hasya* (Laughter)
Krodh (Angry)	*Raudra* (Furious)
Nirveda (Detachment)	*Shant* (Peace)
Shoka (Grief)	*Karuna* (Compassionate)
Utsaha (Enthused)	*Veer* (Valorous)
Bhaya (Afraid)	*Bhayanak* (Fear)
Jugupsa (Dislike)	*Vibhatsa* (Odious)
Vismay (Wonder)	*Adbhut* (Wondorous)

II. LITERATURE REVIEW

Several research has attempted to capture the emotional emotions of music listeners through emotional modeling and conceptualization. Hevner classified emotions into eight categories to demonstrate how music is perceived by listeners. Many of the approaches proposed in the literature either involve classifying emotions or using the valence arousal dimensional method. The approaches used to identify emotions are time-consuming and have various disadvantages. Given that the goal is to elicit emotions, no design is perfect. Because how we feel emotions differ from person to person, complete agreement among listeners is unusual. The most common way to determine ground truth is to average the participants' opinions.

Music is a fascinating subject; virtually everyone loves listening to it and many aspire to make it. In general, Music Information Retrieval (MIR) study is one of the emerging academic interests, including the extraction of relevant characteristics from music and indexing of music utilizing these features. [17] Raga identification refers to approaches that recognize qualities in music and classify it into the right raga. The piece is set to a melodic pattern known as a raga. Raga is distinguished by distinct climb (*Arohana*) and fall (*Avarohana)* patterns. Other traits include prominent (*Vadi)* and second prominent (*Samavadi)* notes, as well as unique phrases (*Pakad*). Each raga has its own set of natural register (*Ambit)* and glissando (*Meend)* regulations.

Meera Patil et al. [15] suggested an effective approach for identifying Marathi text documents using the Nave Bayes (NB), Centroid, K-Nearest Neighbor (KNN), and Modified KNN (MKNN) classifiers. The accuracy and classification time efficiency of these four classifiers are then compared. The findings demonstrate that NB is more efficient in terms of accuracy and classification time for Marathi documents, whereas KNN is the least accurate of the four algorithms.

In an information retrieval system, automatic text categorization is crucial. It facilitates data organizing and retrieval. There hasn't been much study done on Indian regional languages like Marathi.[16] As a result, a system based on supervised learning methods and ontology-based classification approaches offers text categorization of Marathi language documents can be designed. The suggested Marathi categorization system may be evaluated with a larger corpus size in the future, and new domains can be added.

The lyrics/*Sahitya* are vital in bringing out the rasa of the music. The lyrics of a song express feelings in a literary sense.[20] The words are written in such a way that the desired emotion is conveyed, and a corresponding raga is tuned to it. Only when proper lyrics are paired with the raga can the desired emotion be effectively created. The raga is a *swara* combo arrangement (Seven basic notes in Indian Music). Our ancient literature, written many centuries ago, emphasized the link between the *Swaras* and our bodies. Ragas in music have the

ability to impact listeners both physically and emotionally. This unique association between Ragas and emotions (Rasas) has been extensively regarded as a technique in medical therapy sessions and has also been utilized to improve quality of life. This article will shed further light on this relationship by examining the consequences of the emotions elicited by ragas.

Carlo Strapparava and Rada Mihalcea reported research on emotion identification that included emotion analysis and identification using corpus-based and knowledge-based learning methodologies [5]. Ekman classifies the emotions under consideration as anger, disgust, fear, pleasure, sorrow, and surprise [6]. This research underlines the importance of ten emotions in a variety of fields, including psychology, behavioral sciences, and computational linguistics. Among the suitable situations discussed are sentiment analysis, computer-assisted creativity, and language expressivity in human-computer interaction.

According to ancient books on "aesthetics" or the "philosophy of beautiful arts" by Bharat Muni [8] and Abhinavagupta [9]. Rasa is defined as a superposition of emotional states rather than a single emotional state. The concept of emotional evaluation based on *'NavaRasa'* is an emotional classification proposed by Bharata that is considered critical when performing behavioral studies on Indian art forms. The key Rasa or feelings that Bharat Muni and Abhinavagupta may transmit are *Shringar*-love/erotic, *Hasya*- joy/laughter, *Vira*-heroism, *Raudra*-wrath, *Bibhatsa*-disgust, *Adbhuta*-wonder, *Bhayanaka*-fear, *Shant*- peace, and *Karun*- sorrowful.

Other researchers have studied the impact of musical elements like loudness and tone on perceived emotional expression. They analyzed these factors by examining the psychological link between each musical ingredient and the feeling it evokes. Juslin and Sloboda explored the use of acoustic elements in the communication of music emotions by performers and listeners [10]. They assessed the link between emotional expressions (such as anger, grief, and happiness) and acoustic cues (including pace, spectrum, and articulation).

Speech is a complex signal including information about the message, the speaker, the language, and the emotions. Emotion improves communication expressiveness and effectiveness [12]. Humans express their emotions in many ways, such as laughing, yelling, mocking, weeping, and so on. As computers become more embedded into our daily lives, the requirement for cognitive connection between humans and technology grows. While speech recognition is a well-established topic of study, technology lacks the "human touch" essential to respond appropriately to another person's mood.

Raga identification is a very cognitive process that occurs only after a certain level of exposure. Certain raga qualities must be transformed into relevant attributes for automated recognition. This is especially difficult for Indian music because of the following factors that must be considered while converting a piece of music to *swara* strings.[18] (i) During a performance, a music composition may be constructed using various instruments. (ii) Unlike Western music, Hindu music uses a relative scale rather than an absolute scale. (iii) A raga has no defined starting *swara*. (iv) In Indian music, notes have a range of frequencies (oscillations) surrounding them rather than a constant frequency. (v)The order of the *swaras* in the ragas is not defined, and numerous improvisations are permitted [19] while referencing a raga as long as the raga's features are preserved. This is explained in the table below (Table 2.1)

To overcome this constraint, computers should be able to recognize, comprehend, and respond to various emotional situations in the same way that people do. This audio-emotion recognition (AER) is a relatively recent area of research that is becoming more relevant in the field of human-machine interactions (HMIs) [11]. Emotion has been shown in studies to impact our decision-making process. It improves communication by allowing us to express our feelings and give feedback to one another. As a result, emotion detection is becoming an increasingly important aspect of HMI model design. AER is particularly useful in human-robot interaction and phone-based customer service applications.

Swar	Western Scale	Rasa
Shadja (Sa)	C	Veer Rasa, Raudra
Rishabh (Re)	D♭, D	Komal Rishabh – Karun Rishabh – Veer, Raudra
Gandhar (Ga)	E♭, E	Komal Gandhar – Karun
Madhyam (Ma)	F, F♯	Tivra Madhyam – Shringar Madhyam – Shringar
Pancham (Pa)	G	*Pancham - Hasya, Shringar*
Dhaivat (Dha)	A♭, A	*Dhaivat - Bibhatsa*
Nishad (Ni)	B♭, B	*Karun Rasa*

Music has developed expressly for the expression of emotions, and it is natural for humans to categorize music based on its emotional connotations. The uncertainty of the ground truth contributes significantly to the difficulties of constructing emotion-based characteristics. [21] Emotion recognition is a cutting-edge scientific trend. Indian classical music is a centuries-old tradition with a very efficient mathematical framework. The majority of study in the subject of emotion identification has been done on Western music, with relatively little on Indian Classical Music.

III. PROPOSED METHODOLOGY

Exploring the research, we figured out that an emotionally aware system would work better with Raga's recommendations. After conducting the literature survey, we discovered that there are many ways for detecting the mood of the user by using chatbots, images, and live video. Sentiment analysis (or opinion mining) is a natural language processing (NLP) technique used to determine whether data is positive, negative, or neutral. We propose a real-time, emotion-based system for suggesting raga. Real-time text extraction will be used to identify the user's emotions, and depending on the results, the user will be given raga recommendations. The ultimate goal of this project is to predict the sentiment of a given text using python where we use NLTK Natural Language Processing Toolkit, a package in python made especially for text-based analysis. So with a few lines of code, we can easily predict whether a sentence or a review is a positive or a negative review.

IV. SYSTEM ARCHITECTURE

Fig. 2 shows the complete architecture of an emotion-based raga recommendation system. Lyrics analysis, emotion detection, and raga recommendation are the three key steps of the system. The initial step is to give text input to the raga recommendation system. Based on the given input, text analysis will be performed with the help of the NLTK algorithm, which basically performs the

Tokenization of the given input text. NLTK helps with the analysis, classification, stemming, processing, and understanding of the written text. The second step is to determine the emotions from the given input text and analysis of the text. Based on that detection, emotion split into 6 different moods – happy, sad, fear, anger, neutral and surprise. The final step after getting all the data like emotion, lyrics, etc, a raga will be recommended to the user.
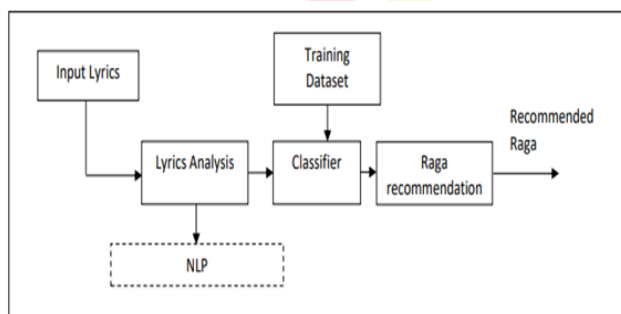

Fig. 3.1 Architecture Diagram

A database will include a few songs that are broken down by the 'NavaRasa' and raga in which they are written. Using this dataset, the computer will be taught to analyze emotions. The trained model will run text analysis on each poem or input text it receives and generate an emotion. [13] The algorithm will then assign the feeling of a raga and create music in line with that raga. Compared to a basic CNN model, this method

provides results for emotion detection that are more accurate. The final step involves recommending raga to the user for this a recommendation system is built using the NLP technique.

V. CONCLUSION AND FUTURE SCOPE

A. Conclusion

An emotionally intelligent recommendation system would be able to understand people's wants and feelings. The goal of this project is to incorporate a little real-time user emotion recognition into the current raga recommend- dating system. As of right now, we are building an ML model for classification that can identify the emotion and be trained using the NLP Classifier. The detection and classification of emotions into nine categories will be done using natural language processing. The collaborative filtering method based on matrix factorization will model its raga recommendation system using the emotions found. With the survey that has been conducted there are various approaches to analyze the sentiment of a given lyrics. Through this project an idea of mapping the rasa and the raga has been explored.

B. Future Scope

Concurrent physiological reactions can frequently reveal the type and intensity of emotions. The design of these trials makes it possible to also produce music that is intended to induce a certain physiological reaction. Future research will examine how diverse musical selections alter physiological responses such as skin conductance, muscle tension, and heart rate. Using this knowledge, training corpora of musical compositions that are expected to elicit desired physiological reactions might be developed. These might then be applied to produce songs with related characteristics.

VI. ACKNOWLEDGMENT

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