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Artificial Intelligence, Bhava, And Sadhana In Carnatic Classical Music

The role of Tradition in Carnatic Music beyond Artificial Intelligence

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Abstract: The amalgamation of Artificial Intelligence (AI) into music has transformed the processes of composition, analysis, and pedagogy within the guru-shishya Parampara globally. However, the application of AI within Carnatic classical music has unique challenges due to the tradition's emphasis on the bhava (emotional expression) and the sadhana (disciplined practice). This paper examines whether AI can meaningfully understand or replicate bhava in Carnatic music and also explores whether AI-driven tools reduce the necessity of a sustained sadhana. Based on Carnatic musicology, aesthetic theory and AI based researches, this study contends that although AI can identify and reproduce the structural patterns associated with the raga and tala, it lacks the experiential, cultural, and embodied dimensions of bhava. In addition, AI tools are better understood as augmenting rather than replacing sadhana, as they enhance technical training while leaving an emotional connection and artistic maturity depending on the human experience. This paper concludes that the essence of Carnatic music remains fundamentally human, despite any technological advancements.

Index Terms - Artificial Intelligence, Bhāva, Sādhana, Carnatic music, Gamaka, Rāga, Manodharma.

I. INTRODUCTION

Carnatic music, the South Indian system of art, is a highly evolved musical tradition that combines multiple domains such as melodic structure (raga), rhythmic structure (tāla), spontaneous creative improvisation (manodharma), and microtonal ornamentation (gamaka). An essential aspect of its aesthetic appeal is bhava, the emotive expressional dimension that enables performers to evoke emotional resonance in the listeners. Equally important is the guru shishya Parampara or the pedagogy and sādhana, the sustained disciplined practice through which musicians cultivate both technical mastery and the expressive depth.

With the rise of AI, learning music and creation have undergone a significant transformation. AI tools offer capabilities like pitch correction, raga identification, automated accompaniment. While such tools offer efficiency and accessibility, they also arise questions across the Carnatic music context.

This paper addresses two central questions: can AI understand or replicate bhava in Carnatic music? And do AI tools reduce the necessity of long-term sadhana? By examining these questions, the study aims to explore the evolving relationship between technology and tradition.

II. METHODOLOGY

This study adopts a qualitative and interdisciplinary approach. This paper is based on the critical analysis of existing literature in Carnatic music and recent developments of AI-driven technologies.

Primary sources include Carnatic musicological texts that discuss raga structure, gamaka and aesthetics, (Subbarao, 1964 and Bhagyalekshmi, 1990) alongside contemporary research on machine learning application in music, in particular with the rāga recognition and pattern analysis (Ranjani and Srinivas, 2017 and Hebbar and Jagtap, 2022) are examined to identify the extent to which computational models can represent musical nuance.

This study also uses a conceptual framework based on Indian aesthetic theory, especially the relationship between bhāva and rasa, to assess if the emotional expression can be modelled computationally. Additionally, philosophical perspectives on AI, such as Searle's (1980) argument on limits of machine understanding, are used to understand the distinction between simulation and experiential knowledge.

Through this integrative approach, this paper critically assesses both the capabilities and limitations of AI in the context of Carnatic music, with the emphasis on its implications for sādhana.

III. CARNATIC MUSIC: STRUCTURE AND AESTHETIC FOUNDATIONS

3.1 Rāga and lakshana.:- Carnatic music is structured around rāga systems, with each being distinct melodic identities, it embodies a dynamic melodic personality shaped by characteristic principles known as lakshana. While the ārohana and avarohana provide a skeletal outline, the distinctive feature of a rāga emerges through its characteristic phrases, context-sensitive note treatments when it has anya swara and the gamakas. As articulated by S. Bhagyalekshmy, rāga lakshana is not static but evolves through performance, practice, guided by tradition and aesthetic continuity.

3.2 Bhāva in Carnatic music: - the concept of bhāva originates from Indian aesthetic theory and is closely associated with the experience of rasa. In Carnatic music, bhava is not explicitly taught through notation but its cultivated through observation, applying, immersion and practice. Bhāva refers to the aesthetic and emotional essence conveyed through music. In compositions of the Carnatic music trinity- Saint Sri Tyagaraja, Sri Muttuswamy Dikshitar, Sri Shyamashastry- bhāva emerges through lyrical devotion, and the expertise of the composition through sādhana.

Its expression depends on several interconnected elements:

- 3.2.1** Gamaka: the microtonal oscillations and ornamental embellishments that define an identity of a rāga.
- 3.2.2** Manodharma: spontaneous creative improvisation in ālāpana, neraval and swara Kalpana.
- 3.2.3** Sāhitya: The lyrical meaning.
- 3.2.4** Emotional state of the performer.

For instance, in rāga Bhairavi, the nuanced use of dual dhaivatams and gamaka-rich phrases cannot be fully captured through a symbolic notation alone, which also requires the experience, involvement and deep understanding of a rāga.

Another example, A raga like Todi heavily relies on the gamakas that convey depth in the swaras. So, the identity of a rāga is not merely a scale but, beyond that, with the usage of gamakas. A plain rendering of its scale without these gamakas would fail to evoke its characteristic emotional intensity.

IV. AI IN CARNATIC MUSIC AND THEIR LIMITATIONS

AI systems have shown considerable success in identifying note patterns in music. In Carnatic music, this includes tasks such as rāga recognition, pitch tracking and automated accompaniment. However, such models often exclude gamakas, which are essential to rāga expression.

Hebbar and Jagtap show that deep learning algorithms can classify rāgas with utmost accuracy based on audio data.

The ragamAI system by Arunkumar Bagavathi et al. demonstrates how machine learning can assist in planning a concert by analyzing historical data of performances, optimising factors like variety, tonal range and engaging audience, highlighting AI's utility in structural organisation.

Ranjani and Srinivas illustrate that the rāga identification depends on recurring melodic patterns rather than static note sequences. Also, their work suggests that computational models can capture certain structural features of Carnatic music.

However, these approaches primarily focus on measurable features and do not account for emotional expressive nuances produced by gamaka, nor do they capture the spontaneous improvisations of performers in real time. Thus, AI remains limited to recognizing structure rather than the meaning or expression.

Recent datasets like Sanidha by Venkatakrishnan et al represents a significant advancement in Carnatic music informatics by providing clean, multi modal recordings tailored for AI research, yet it simultaneously highlights the limitations of automated systems in capturing the embodied and aesthetic dimensions of sādhana.

V. LIMITATIONS OF AI IN EXPRESSING THE BHAVA

While AI can replicate patterns associated with Carnatic music, its ability to come up with Bhāva is basically constrained. The expression of bhāva involves the involvement of the artist, intentionality, emotional depth and the contextual awareness that arise from human experience. For example, during a nerval in a composition Mamava pattabhirama by Muttuswami Dikshitar, the performer interprets a specific lyric, expanding it musically along with the rhythm in it while preserving its emotional core. This process

needs sensitivity to both lyrics, melody, lakshana of the raga and the tala along with the presentation context. As opined by Searle, AI systems, which operate on pre-existing data, fail to engage in such circumstance-sensitive exposition.

Sadhana:- Sādhana in Carnatic music involves a rigorous, long-term, disciplined practice under one single guru upon with musicians build their mastery over the art form. This includes voice culture, dynamics of the voice, rāga exploration, to learn the compositions along with the meaning and the situation when it was composed and manodharma training. This process is deeply rooted and is often continued for years. Through sādhanā, musicians gradually develop an intuitive understanding of music that cannot be acquired through shortcuts.

VI. AI TOOLS AND THEIR IMPACT ON LEARNING

AI tools have become increasingly common in Carnatic music. These include applications for pitch correction, rāga identification, and automated accompaniment. AI tools in music pedagogy introduce both pros and cons. The following table presents the advantages and pedagogical implications within a structured learning context.

Table 1: Advantages and pedagogical implications within a structured learning context

DIMENSION	ADVANTAGES OF AI TOOLS	PEDAGOGICAL IMPLICATIONS
Knowledge access	Learners can instantly retrieve compositions and reference material	Learning becomes resource driven rather than guided mentorship
Learning pace	Immediate feedback enables quicker correction and progression	Speed centered learning can restrict meaningful internalization
Practice structure	Supports repetition, consistency in practice and tracking.	Practice may become externally guided rather than cultivating internally
Evaluation methods	Enables data-oriented assessment of performance	Subjective dimensions like expression and aesthetic intent remain underrepresented
Technical development	Improves measurable aspects like pitch alignment and rhythmic precision	Greater focus on technical accuracy over integrated musical learning.
Learner's autonomy	Allows flexible, self-paced learning	Transforms teacher's role from core guide to an auxiliary support.

VII. DO AI TOOLS REDUCE THE NEED FOR SĀDHANA?

The AI tools availability may create an impression that learning can be progressive but it cannot eliminate the need for sādhanā.

- 7.1 Technical vs expressive learning:- AI tools help in improving accuracy but do not in any way cultivate expressive depth.
- 7.2 Embodied knowledge:- Carnatic music involves physical engagement like voice culture, voice modulation, practicing different gamakas, breath control and muscle memory which is developed only with the rigorous sādhanā.
- 7.3 Emotional and cultural context:- the expression of bhāva is achieved by lived experience in real time, and the cultural understanding behind what is presented which can not be replicated by AI tool.
- 7.4 Role of a guru:- the guidance and mentorship of a guru remains very much essential for developing interpretative insight and aesthetic sensitivity, which is passed on by the guru to the shishya.

VIII. AI TOWARDS A COLLABORATIVE FUTURE

AI tool rather than replacing musicians can serve as a collaborative tool assisting in pedagogy through visualization of rāga structures. Supporting archival and documentation efforts by enabling the systematic recording, indexing and retrieval of performances, thereby helping in preserving diverse bani's (a particular tradition/style passed on by a guru) for future study.

IX. CONCLUSION

AI has given valuable tools for learning and analyzing Carnatic music. However, its ability to engage with bhāva is inherently limited by the lack of lived experience. While AI can replicate structural features, it cannot express the emotional depth that defines the tradition.

Therefore, Sādhana remains indispensable, serving as a medium through which musicians develop both technical and expressive capability.

Ultimately, the essence of Carnatic music continues to reside in its human core, where true expression and creativity arise beyond the scope of any computational system.

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