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Notice for the PhD Viva Voce Examination

Ms Renju K, Registration Number: 1942056, PhD Scholar at the Department of Computer Science, School of Sciences, CHRIST (Deemed to be University), will defend her PhD thesis at the public viva-voce examination on Saturday, 05 September 2026 at 09.00 am in Room No. 044, Ground Floor, R&D Block, CHRIST (Deemed to be University), Bengaluru - 560029, Karnataka, India.

Title of the Thesis	:	**Swaranet: A Hybrid Deep Learning Architecture for Analyzing Indian Carnatic Music**
Discipline	:	**Computer Science**
External Examiner - I	:	**Dr Durai Raj Vincent P M** Professor School of Computer Science Engineering and Information Systems Vellore Institute of Technology Vellore - 632014 Tamil Nadu
External Examiner - II	:	**Dr Arnab Maji** Associate Professor Department of Information Technology North-Eastern Hill University Shillong - 793022 Meghalaya
Supervisor	:	**Dr Ashok Immanuel V** Professor Department of Computer Science School of Sciences CHRIST (Deemed to be University) Bengaluru - 560029 Karnataka

The members of the Research Advisory Committee of the Scholar, the faculty members of the Department and the School, interested experts and research scholars of all the branches of research are cordially invited to attend this open viva–voce examination.

Registrar (Academics)

Place: Bengaluru
Date: 28 August 2026

ABSTRACT

One of the oldest and most popular music traditions in South India namely Carnatic music is based on a set of fundamental components such as Raga, Thaala and Shruthi. This music tradition is famous for its well defined structure of swaras or notes pertaining to each raga of the composition. Singers have the freedom to improvise the singing within the raga structure that makes Carnatic music unique. Our proposed SwaraNet architecture is a comprehensive deep learning architecture that combines classifying raga, pitch analysis and instrument detection in Carnatic music and employs state-of-the-art machine learning methodology. The developed models RC Model for Raga Classification, DI Model for Instrument Detection and PA Model for Pitch Analysis within the SwaraNet architecture are adapted to one aspect of computational musicology. The melodic heart of SwaraNet architecture which is RC model is designed to classify the complexity of twenty-two different ragas within Carnatic music. The RC model has successfully captured the uniqueness of each raga by combining Convolutional Neural Networks with the powerful architecture of InceptionV3 and the temporal modeling ability of the Bidirectional GRU. The DI Model of the SwaraNet architecture is developed for the accurate identification of instruments such as violin and flute accompanied in Carnatic music. Using deep learning techniques and training using spectrogram representations of isolated instrumental stems, the model was further enhanced using image augmentation techniques to make it generalizable across a range of sound environments. The developed DI model was able to understand timbral characteristics and nuances which are unique to each instrument and achieved high accuracy in classifying the instruments such as violin and flute. The PA Model of the SwaraNet architecture was developed to learn the pitch characteristics which played an important role in understanding the swaras or notes in Carnatic music. The model systematically computed the sixteen music notes based on the frequency ratios after extracting the fundamental frequency, the tonic 'Sa'. Hence, the developed PA model have created an accurate tonal consistency within the raga system of Carnatic music Once vocals are isolated from instruments, the model assesses the harmony, how they match compared to the pitch trajectories of the instruments, gave a visualization of the structural appealing harmony of a song. The PA model also incorporates SRT model, a Transformer-based deep learning model that analyzed pitch values extracted from the vocal track of different compositions by the same singer, identified the singer, estimated their range and hence could determine the upper and lower bounds of their vocal capability.

Keywords: *Carnatic Music, Mel Frequency Cepstral Coefficients, Machine Learning, Deep Learning*

Publications:

1. **Renju K**, Ashok Immanuel V, Vinay M, Sagaya Aurelia P. Classification of Raga in Carnatic Music Compositions UsingTransfer Learning.Indian Journal of Natural Sciences, ISSN.0976-0997, Vol.13, Issue 76, February 2023, 53534-53542(WoS Indexed-Zoological Record).
2. **Renju K**, Ashok Immanuel V. Comparing the Accuracy of CNN Model with Inception V3 for Music Instrument Recognition. International Journal of Intelligent Systems and Applications in Engineering, ISSN:2147- 6799214, Vol 12(17s), February 2024, 276–282.
3. **Renju K**, Ashok Immanuel V. A Novel Approach for Singer Identification and Vocal Rage Estimation Using Hybrid Deep Learning Model. International Journal of Applied Mathematics, November 2025, https://doi.org/10.12732/ijam.v38i5.925
4. **Renju K**, Ashok Immanuel V. A Deep Learning Based Pitch Analysis Model to Identify Pitch Anomalies and Assessing the Harmony of Instrument and Vocal Components. International Journal of Computer Information Systems and Industrial Management Applications (IJCISIM), E-ISSN: 2150-7988, ISSN 2150-7988 Volume 18(2s) 2026, pp. 704-715, DOI: 10.70917/ijcisim-2026-2108