Introduction to Identification of Raga in Carnatic Music and its Corresponding Hindustani Music

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Introduction to Identification of Raga in Carnatic Music and its Corresponding Hindustani Music

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Abstract— Music Information Retrieval (MIR) is a science of retrieving information about music both statically and dynamically. Music Information Retrieval is a high learning curve and is beyond the knowledge of text Information Retrieval (IR). The two main approaches in which MIR is dealt with is meta-data based and content based. The classification of music based on compositions, artists and other static information is called text-based retrieval. The content based MIR actually focuses on musical content retrieval such as pitch, melody, rhythm etc. which can be used for extracting audio features for identification and classification of ragas dynamically.

Keywords—MIR, ICM, HPS, Pattern recognition

I. INTRODUCTION

The origin of music is not known to any of us but it is there since the existence of life. When talking about music, Indian music is that music which comes from Indian origin. Indian music can be broadly classified into five categories. The first category of music is the Tribal or Primitive music which is usually heard in tribal rituals, the second category being called the folk music which usually inhibits a village traditional gathering like harvest song etc. The third category is called the Religious music. This music is usually heard in temples, pujas etc. The fourth category is the popular music which is usually film songs, album songs etc. And the fifth category of music was regarded as the Art-music which is also known as classical music. Indian classical music is of two types, the Carnatic music and the Hindustani music [1].

Indian classical music has its own historic importance. Both the branches of Indian classical music or shastriya sangeet have originated from a common base called the "Samveda" which is one of the four Vedas of the Aryans. In northern India, with the influence of Persian and Arabic invaders gave rise to Hindustani Sangeet whereas the south India which was un-influenced by intruders, continued the same tradition and was called Carnatic sangeet. Indian classical music is based on raga or melody, which is the backbone of Indian classical music.

Carnatic music (CM) is also referred as South Indian Classical music as its popularity was more in Southern India, meanwhile the Hindustani music (HM) also called as Hindu music, came into the category of Indian classical music of North India because it became popular in northern part of India. Indian classical music is based on sapta swara ie. "Sa Ri Ga Ma Pa Dha Ni". Every note has an individual frequency range. When these seven notes are put together in different combinations both in ascending and descending order called the (arohana and avrohana) forms a Raga.

Raga is the backbone of ICM. A Raga consists of a set of five or more musical notes combined upon which a melody is constructed. The Indian Classical Music is set in a particular Raga. There are two distinct classes of Carnatic Music Ragas. They are the 72 Janak Ragas or Parent Ragas also called complete Ragas and the Janya Ragas or Child Ragas [2]. A raga consists of a minimum of five or more musical swaras upon which a melody is constructed. The swaras are approached and rendered in musical phrases so that they convey moods for a particular time or season of the year. Each raga will have a set of swaras for ascending called arohana and a set for descending called avarohana.
Section I contains the introduction of raga in Indian Classical Music , Section II contains the related work done in the field of identification of raga , Section III contains the proposed methodology for identifying raga of a given input signal. Section IV contains the system architecture of the proposed work at last in section V we discuss about the expected outcome of the proposed work.

II. RELATED WORK

V. Krishnan [3] in one of his books, proposed how to rank order the scales of these ragas in such a manner that an algorithm can be constructed so that the scale can be obtained directly from the rank order. The first level of 1-36 ragas are based on the scales containing the Shuddha

Madhyama (M1) and the next level of 37-72 ragas are based on the scales containing the Prati Madhyama (M2) where Shuddha Madhyama and Prati Madhyama are the scales based on which the raga can be classified in Carnatic Music.

R. Sridhar et al. in 2009 proposed an architecture consisting of modules for signal separation, segmentation, feature extraction, frequency mapping based on singer identification and frequency mapping. This work is based on low level signal features for Raga identification. They tested for three Ragas belonging to two Talams sung by three singers. The system has to be tested for different singers, all melakarta Ragas and ten most frequently occurring talams [4]. Similarly P. Dighe et al. in 2013 proposed methods to perform scale-independent raga identification using a random forest classifier on swara histograms and achieved state-of-the-art results for the same. The approach is robust as it directly works on partly noisy raga recordings from Youtube videos without knowledge of the scale used [5].

According to M. Kamble et al. in 2015, surveyed the different raga identification techniques such as scale matching, arohanaa varohana pattern, statistical approach and Pakad matching, Pitch class distribution (PCD) and pitch class dyad distribution (PCDD) and an unsupervised statistical approach: LDA model, swara intonation [6]. Further in 2017 R. Joseph et al. proposed a raga recognition approach that uses pitch determination, segmentation and a key note mapping technique to identify ragas in a song. Compositions of different ragas are analyzed and features were extracted to arrive at a rule for classification [7].

In 2011 P. Reddy et al. introduced the use of Hidden Markove Model (HMM) which is based on the standard speech recognition technology by using Hidden continuous Markov Model. Data is collected from the existing data base for training and testing of the method with due design process relating to Melakarta Raagas [8]. Later in 2012 K. Srimanip et al. proposed a unique Neural network approach has been used in the present investigations and a comparative study of the raga systems of Carnatic (CCM) and Hindustani classical music (HCM) was done. The paper concerns a detailed study of the melakartha-janya raga system of CCM, Thaat-raaga system of HCM and cognitive studies of the same based on Artificial Neural networks (ANN). For CCM, studies were confined to the 72 melakartha ragas [9].

In 2012 itself Preeti Rao, et al. signal processing methods can be used to extract specific musical knowledge from audio signals such as descriptors related to the melody or rhythm. Audio signal processing methods and data representations are discussed for specific retrieval tasks within the musicological basis of the tradition [10]. Ms. P. Kirthika, et al. in 2014, in their research paper introduced the Audio Feature Extraction for classifying the music based on Raga which plays a major role in Music Information Retrieval (MIR) systems they proposed how the frequency can be used to determine a raga by using Linear Predictive Coding(LPC). They also propose a method to identify the Raga of the input audio clip using Latent Semantic Indexing(LSI) [11].

A novel approach in 2015 for matching, called Longest Common Segment Set (LCSS), was introduced by Shrey Dutta, et al. The LCSS scores for a raga is normalized. The resulting systems and a baseline system are compared with two partitions of a dataset [12]. The novel method was usedfor the identification of swaras and ragas in an Indian classical harmonium recital. They dealt with the segmentation of the audio signal by using two different methods for onset detection viz. use of spectral flux and by fundamental frequency estimation.

In 2013 P. Krithika proposed swara identification by using the pitch frequency of the swaras as a distinguishing feature. For this the 5 frequencies associated with each swara were first identified and the exact mapping of the frequencies in the given signal was done by using devised database. In case of raga identification, an extensive database of commonly used swara permutations was structured and dynamic programming was used for template [13]. N. Liu, et al. in 2014 in their study, used the information from user’s search history, as well as the properties of genres common to users with similar backgrounds, to estimate the genre or style the current user may be interested in, based on a probability calculation [14].

In 2009 S. Shetty, et al. proposed the technique of data mining named “raga mining” and depicted a system which takes an audio file as an input and converts it into sequence of notes, identifies the raga by extracting its Arohana avarohana pattern [15]. In 2013 S. Chakraborty analyzed the structure of raga Bhairavi through a simple exponential model [16].

In..J. Serra et al. (2011) in their paper studied the tuning of several Indian music recordings. In order to do so, it makes sense to focus on the singing voice, since it was not constrained to pitch control, it was the reference to be followed by all the other instruments. It also had many solo sections, easy to analyze, in all performances. Using standard techniques, they estimated the fundamental frequencies of song recordings and, based on a pool of these, they built an interval histogram. Interval histograms for different data sources were then used to assess the plausibility of just intonation and equal temperament tunings, both in Carnatic and Hindustani music. They compared the interval histograms obtained from these sources against the ones obtained from both synthetic and real signals [17].

In 2012, S. Shetty, et al. used clustering techniques based on jump sequence to handle a large number of raga classes in Carnatic music [18]. In the same year, G. K. Koduri, et al. proposed that automatic raga recognition is an important step in computational musicology as far as Indian music is considered. It has several applications like indexing Indian music, automatic note transcription, comparing, classifying and recommending tunes, and also teaching [19]. They identified the main drawbacks and proposed minor, but multiple improvements to the state-of-the-art raga recognition technique.

In 2017, T. Rao et al. discussed how to recognize and classify the raga emotions from singers Database. Here the classification is mainly based on extracting several key features like Mel Frequency Cepstral Coefficients (MFCCs) from the speech signals of those persons by using the process of feature extraction [20]. In a similar study, B. Tiple et al. in 2017 found that Music can be mapped to mood by extracting its features that contribute to generation of specific emotions and mapping them with emotional model. Therefore, analysis of features of North Indian Classical Music that contribute to emotions becomes the basic step of mood detection in North Indian Classical Music [21].

K. M. Shiva Prasad, G. N. Kodanda Ramaiah and M. B. Manjunatha in 2017 discussed on various speech features and speech extraction methods using digital speech processing. Speech analysis is the foremost step in speech processing. Generally the output of front end tools is a set of parameters that represents the acoustic cues (features) results from the input speech signal for further analysis. [22].

III. PROPOSED METHODOLOGY

The Indian classical music is based on raga and raga consists of collection of swaras bound in a specific order to produce melody. Each raga has a set of swaras arranged in ascending and descending order of frequencies called Arohana and Avrohana.

A raga that has all the seven swaras of the octave in its ascend (arohana) and descend (avrohana) is called as 'Janak' raga in Carnatic music. It is also called as a complete raga. There are 72 such 'Janak' ragas in Carnatic music called the Melakartha ragas.

The seven swaras present in arohana and avrohana of a 'Janak' raga consists of two constant (achala) swaras and five variant (chala) swaras. Each swara has a specific range of frequency, therefore these frequencies can be used for identifying the frequently repeating swara sequence (raga chaya) present in the audio signal taken as input.

Once these swara sequence is been identified, we move further towards identification of raga of the given piece of input signal of Carnatic music.

We want to do a cognitive study of raga identification of Carnatic sangeet and recognize its corresponding raga in Hindustani sangeet. For this we will prepare Training and Testing Database and use Praat tool for speech recording and analysis.

Praat is a speech analysis tool that we will be using in analysis of sound signals. It provides easy feature extraction and also analysis based on features like formant analysis, spectral analysis, pitch, intensity etc. extraction and its analysis.

IV. SYSTEM ARCHITECTURE OF THE PROPOSED WORK

The proposed system architecture consists of following databases:

a. The training dataset,

b. The testing dataset

c. The standard frequencies of the 12 swaras.

The following figure, Fig-1, describes the proposed system architecture.

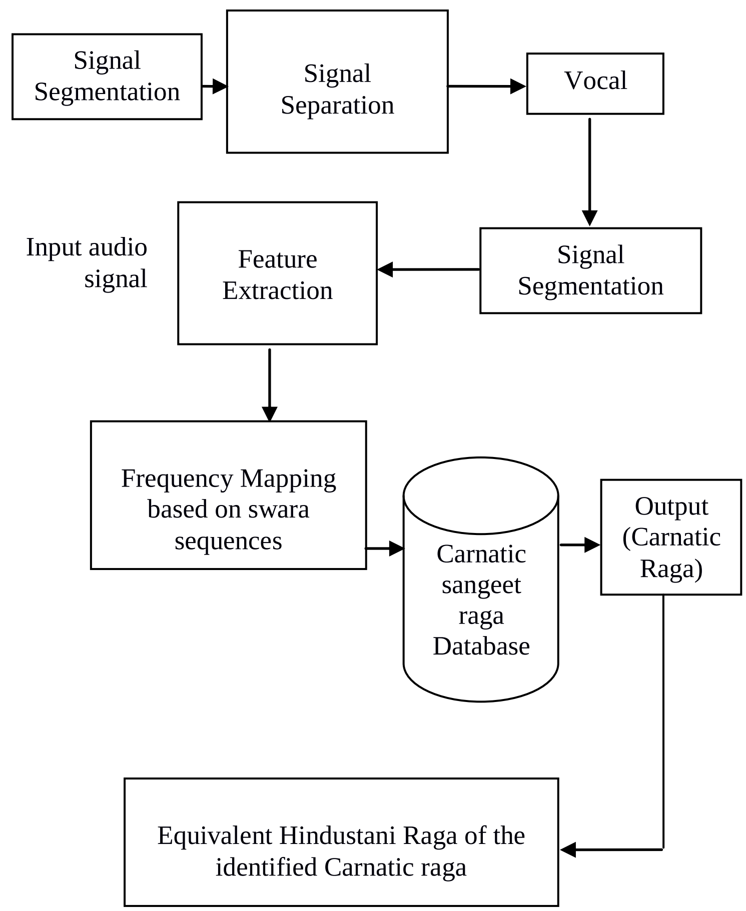

Fig 1

V. EXPECTED OUTCOME

In the proposed work, we will work on self-created database consisting of all 72 Janak ragas (complete raga/ parent raga) of Carnatic sangeet and Thaat ragas of Hindustani sangeet then we will identify the carnatic sangeet (Audio signal) in one of the carnatic Janak ragas using a relevant MIR tool (Praat) and recognize its corresponding raga in Hindustani sangeet. At last we will calculate the accuracy of identification of carnatic raga by using different classifiers.

The proposed system is expected to give the desired output in a better and easier way.

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