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Feature Extraction Computation and Automatic Raga Identification for Carnatic Ragas

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Sequence of *swaras* in a *raga* is one of the key features for determining the *raga* of the song in *CarnaticMusic*. This sequence of *swaras* can be represented as sequence of states in the Hidden Markov Model classifier which is the reason for choosing HMM to design the solution for the *raga* identification problem. Considering that shruthi of the song is unknown and without this *swaras* cannot be identified, the states (*swaras*) in HMM are hidden. We construct a feature *viz*; jump sequence which is computed using the sequence of pitch. Jump sequence is considered as the observation sequence for the HMM model. In this paper we illustrate the technique used for *raga* identification using HMM.

Keyword: Hidden Markov Model, Music Information Retrieval, Raga Identification.

1. INTRODUCTION

Music Information Retrieval (MIR) is a process of searching and indexing an audio clip from a large database collection based on the content of the audio clip. One of the approaches to solve MIR is by High-Level Music Content Description where musical concepts such as melody or harmony are used to describe the content of music. The design of MIR for Indian Music collections would require the intelligence of retrieving the piece of audio sample based on the underlying *raga* used to compose the musical piece. Also, managing the vast audio collections of classical music will require greater human intervention for classifying the songs into different categories based on the concept of *Raga*. *Raga* is the most fundamental concept of Indian classical music both in *Hindustani* and *Carnatic Musical* traditions.

We have addressed the two most important issues that are not yet dealt with *raga* identification problem. The kind of work done in this paper has been initiated in the previous work [1], where clusters have been defined manually which is a tedious job. But in this paper we discuss the methods where clusters are formed automatically by applying the K-means clustering algorithm. The organization of the paper is as follows. We present the previous works that are related to the *raga* identification problems. In the next section, we present the theoretical concepts of *raga* along with the techniques that are used for *raga* identification. We discuss the experimental analysis and results in the next section and conclude at the end with the highlight of the future works.

1.1. Previous Works

In Western music the research has been mainly focused on to the note transcription that is to convert the given musical audio into notational script. But in Indian music, the research works mainly have been done based on the identification of the *ragas* in the song. In paper

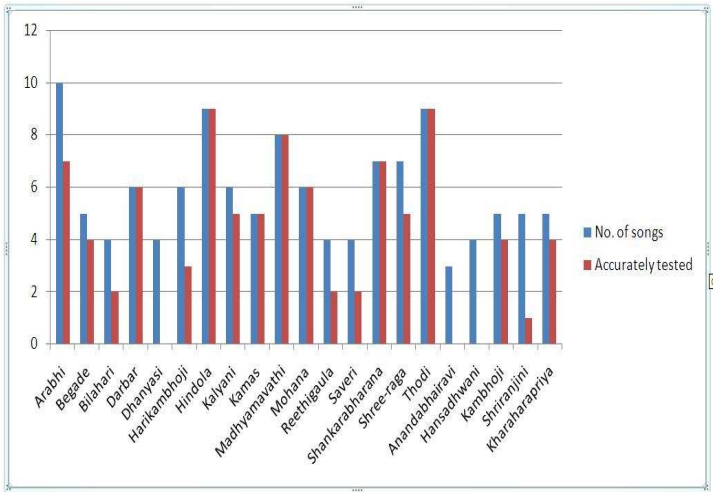

Figure 4. Cluster Identification Accuracy Result

pecially for musician and MIR systems. Even though many authors are researching in this field for realizing such a system; the task is proved to be very challenging. We have demonstrated a new way of problem solution in our paper which would help design a *raga* identification system for a vast number of *ragas*. But the success of such system highly depend accurate pitch calculation for the audio file. Since accurate pitch values corresponds to the sequence of *swaras* in the audio. To avoid the complexity of pitch calculation we have conducted the experiments on monophonic audio. In future we have planned to implement the robust polyphonic pitch detection described in the literature and combine it with the clustering approach.

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