RESEARCH REVIEW JOURNALS
Volume-04
Issue-04
April-2019

ISSN: 2455-3085 (Online)
RESEARCH REVIEW International Journal of Multidisciplinary
www.rrjournals.com[Peer Reviewed Journal]

A Case Study of Musical Arrangement and Recognition of Syllable Based Percussion in India

[1]Uttam Chakraborty & [2]Dr. Kiran Hooda

[1]Research Scholar, OPJS University, Churu, Rajasthan (India)
[2]Assistant Professor, OPJS University, Churu, Rajasthan (India)

ARTICLE DETAILS

Article History
Published Online: 15 April 2019

Keywords
percussion music
syllables
HMM.

ABSTRACT

In numerous societies of the India, customary percussion music utilizes mental aide syllables that are illustrative of the timbres of instruments. These syllables are orally transmitted and frequently give a language to percussion in those music societies. Percussion designs in these societies subsequently have a very much characterized portrayal as these syllables, which can be used in a few computational percussion design examination undertakings. We investigate an associated word discourse acknowledgment based system that can viably use the syllabic portrayal for programmed interpretation and acknowledgment of sound percussion designs. Specifically, we consider the instance of India and present a syllable level hidden markov model (HMM) based framework for translation and grouping of percussion designs. The empowering order results on an agent dataset of India percussion examples bolsters our methodology and gives further bits of knowledge on the utility of these syllables for computational depiction of percussion designs.

1. Introduction

One normal highlight in conventional musics is the advancement of sets of predefined, recognizable melodic and cadenced examples. These examples structure a store of basic components for the sythesis or execution of the conventional collection. Certain elements of conventional music hypothesis, as melodic modes, cadenced cycles or melodic structures, are launched by methods for these examples. The examples work as key components for the coordination of various melodic components, as instrumental and vocal segments, and the association with other fine arts, similar to move, dramatic acting, narrating, and so on. For the transmission of such examples in these for the most part oral customs, specific frameworks of oral memory aides have been created. These frameworks regularly share basic highlights crosswise over various societies, so broad standards can be set up. Computational investigation of these examples is a significant viewpoint in Music Information Research (MIR) for such music societies. Further, their very own conventional frameworks of transmission can offer a strong reason for their modeling.

1.1 Syllable based Percussion

Numerous music conventions around the globe have created specific frameworks of oral memory aides for transmission of the collection and the procedure. David Hughes begat the term acoustic-notable memory helper frameworks for these wonders, and depicted their utilization in various kinds of customary Indian music. As he calls attention to, the center part of these frameworks is that the syllables are picked for the similitude of their phonetic highlights with the acoustic properties of the sounds they are speaking to, setting up a notorious association with them. Consequently, these frameworks are basically unique in relation to those of solmization, as for example the syllables of solfège, of the Indian svaras documentation, which are strange in connection to the acoustic wonders they speak to. In this paper, we center around the oral syllabic frameworks of mental helpers created for percussion customs.

The utilization of the previously mentioned frameworks for the transmission of percussion is wide reached out among conventional musics. In the Indian subcontinent, the two Hindustani and Carnatic music societies have grown such oral syllabic frameworks of mental helpers for the percussion instruments, individually the bōlsin the Hindustani custom, utilized chiefly by tabla players, and the solkaṭṭu in the Carnatic convention, where the primary percussion instrument is the mridangam. The level of complexity that these frameworks have come to in India is with the end goal that the cadenced recitation of the syllables, which requires high abilities, are usually embedded in shows for melodic appreciation. In Carnatic music, this training has even been united into a particular music structure, called konnakōl. In this paper, we investigate the utilization of oral syllabic framework created in the Indian convention for the computational examination of its percussion designs.

The advantages of utilizing oral syllabic frameworks from a MIR point of view are both the social particularity of the methodology and the exactness of the portrayal of timbre, explanation and elements. The portrayal of these percussion customs need to consider components that are fundamental to them, for example, the extravagance of their palettes of timbres, nuances of verbalization, and the various degrees and advances of elements, which is all precisely transmitted by the oral syllables. We investigate the utilization of oral syllables as a methods for portrayal in the MIR errands of percussion design translation and order in syllabic percussion frameworks, considering Indian percussion designs as an examination case. The all around characterized oral syllabic framework and the restricted arrangement of percussion examples settle on it a perfect decision for a first investigation. Since these syllables have an unmistakable similarity to discourse and language, we present a discourse acknowledgment based way to deal with interpret a percussion design into an arrangement of syllables.

We at that point utilize this translation to order the grouping into one of the predefined set of examples that happen in India. We initially give a prologue to percussion designs in India.

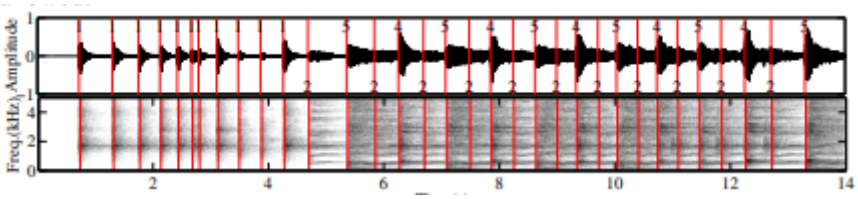

Figure 1: An audio example of the pattern shanchui. The top panel shows the waveform and the bottom panel is the spectrogram. The vertical lines (in red) mark the onsets of the syllables. The onsets are labeled to indicate the specific syllable group: DA-1, TAI-2, QI-3, QIE-4, and CANG-5 (QI is not present in this pattern).

2. Previous Work

Damodaran et al.(2015) displayed the utilization of composite materials to the chenda, a traditional Indian drum. They manufactured a sandwich structure made out of carbon fiber/epoxy face sheet and balsa center on which the drum head is connected. The drum shell structure was manufactured by wet lay-up and a vacuum shaping procedure. They looked at the sound qualities of both the composite just as wooden drum and found that the frequency reactions of both the drum were tantamount. They reasoned that the drum with composite materials to be a promising musical drum with high damping attributes and same may supplant the wooden structure.

Krishnamurthy (2012) then again chipped away at tuning of mridangam to increment and modify strains by shortening the length of cowhide strip (http://www.google.co.in/licenses/US8153876). His development tuner contains a lot of jolts with strung shank. At any rate one of the fasteners is coupled through strings to a nut. These jolts are similarly verified on the fringe of the drum shell. An adaptable lengthened part is woven on the other hand between the drumhead and every one of the jolts till the stretched part is tight. The fastener shanks might be pivoted comparative with the screw nuts in order to maneuver the extended part into an increasingly rigid condition, whereby the pressure of the drumhead increments.

https://www.academia.edu/31368339/The_Eternal_Pulse_Creating_with_konnakkol_and_its_adaptation_into_contemporary_vocal_performance

Ravichandhira (2014) Ravichandhira disclosed to me that additionally Thathakaram is a Tamil expression utilized most normally among Tavil and Nagaswaram craftsmen when alluding to a rhythmic section of solkattu (that perhaps alluded to as chollkattu), which can be changed over to a melodic entry. He likewise expressed that: "the word thathakaram is presently ordinarily utilized in college schedules for instance, at the Mahathmagandhi University India, and furthermore in Illayaraja's music in the contemporary film industry".

Suresh (2013) The solkattu system includes created inside a living aural tradition over numerous hundreds of years. Classes for percussionists and konnakkol specialists are generally directed up close and personal 'aural drenching style'. Mani, Suresh and Ravichandhira all communicated that they once in a while record the structures. Suresh expressed that once in a while he makes a note of the principal line of a structure however clarified that: "As a youngster it is molding that you don't compose [it down] you should retain it".

Sankalp Tiwari and Anurag Gupta (2017) The effects of air loading on the acoustical properties of tabla, an Indian musical drum, are investigated by idealizing it as a composite membrane backed by a rigid cylindrical cavity. The coupled boundary value problem for membrane vibration and acoustic pressure, assuming acoustic radiations to be the only source of dissipation, is solved using a Green's function method. It is shown that air loading helps in only fine tuning of the harmonicity of the composite membrane in the right hand tabla, but significantly improves the harmonicity in the left hand tabla. In both cases, it increases the decay time of the musically important modes. With a suitably defined error as the objective function, optimum tabla designs are found, which yield the most harmonic frequency spectrum. The obtained results are found to be consistent with the actual design of the tabla. Modal sound synthesis of the percussion instrument has also been attempted.

Anita Mahanta & Ina Shastri (2016) Research on musical instruments and their tuning had attracted researchers worldwide. Indian classical music is distinct from western classical music and is unique in its form and presentation. Indian classical music can be divided in two classes (a) Carnatic and (b) Hindustani classical music. Musical instruments used in Hindustani classical music are different in design from the Carnatic musical instruments. Present study involves an exhaustive literature review on tuning of Indian classical musical instruments with a special emphasis on the Hindustani classical music.

3. The Approach

The syllables are non-stationary sign and to model their timbral elements, we fabricate a HMM for every syllable (comparable to a word-HMM). Utilizing these syllable HMMs and a language model, an information sound example is interpreted into a succession of syllables utilizing Viterbi translating, and afterward ordered to an example class in the library utilizing a proportion of separation.

A square chart of the methodology is appeared in Figure 2. We first form syllable level HMMs {λm}, $1 \le m \le M(= 5)$, for every syllable Sm utilizing highlights removed from the preparation sound examples. We utilize the MFCC highlights to model the timbre of the syllables. To catch the worldly elements of syllables, we include the speed and the increasing speed coefficients of the MFCC. The stereo sound is changed over to mono, since there is no extra data in stereo channels. The 13 dimensional (counting the 0th

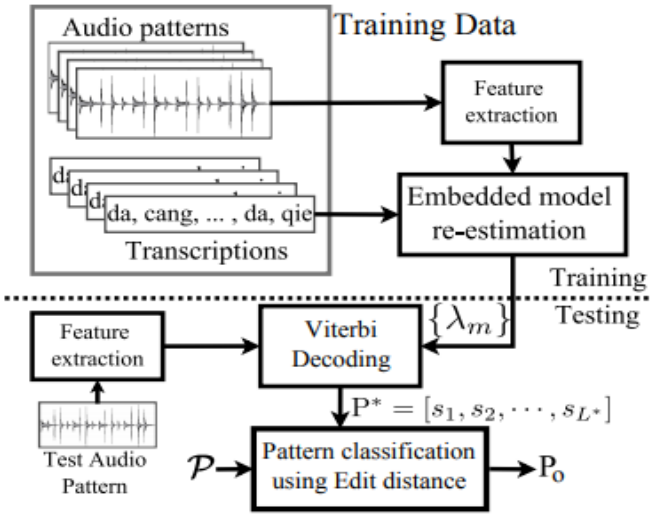

Figure 2: The block diagram of the approach

coefficient) MFCC highlights are figured from sound examples with a casing size of 23.2 ms and a move of 5.8 ms. We likewise investigate the utilization of vitality (as estimated by the 0th MFCC coefficient) in order execution. Henceforth we have two arrangements of highlights, MFCC_0_D_A, the 39 dimensional element including the 0th, delta and twofold delta coefficients, and MFCC_D_A, the 36 dimensional vector without the 0th coefficient.

We model every syllable utilizing a 5-state left-to-right HMM including a passage and an exit non-transmitting states. The outflow densities for each state is modeled with a four part Gaussian Mixture Model (GMM) to catch the timbral changeability in syllables. We explored different avenues regarding eight and sixteen part GMMs, however with little execution improvement. Since we don't have time adjusted interpretations, a segregated HMM preparing for every syllable is preposterous. Subsequently we utilize an implanted model Baum Welch re-estimation to prepare the HMMs utilizing only the syllable arrangement comparing to each component grouping. The HMMs are instated with a level beginning utilizing the entirety of the preparation information. Every one of the trials were finished utilizing the HMM Toolkit (HTK).

For testing, since we just need an unpleasant syllabic translation autonomous of the example class, we treat the test design as a first request time-homogenous discrete Markov chain, which can comprise of any limited length succession of syllables, with uniform unigram and bi-gram (change) probabilities, for example p(s1 = Si) = 1/M and p(sk+1 = Sj/sk = Si) = 1/M, 1 ≤ I, j ≤ M and with k being the succession list. This additionally frames the language model for shaping the percussion examples utilizing syllables. Given the element grouping removed from test sound design, we utilize the HMMs {λm} to do a Viterbi (constrained) arrangement, which intends to give the best succession of syllables P ∗ , given a syllable system built from the language model.

Given the decoded syllable arrangement P ∗ , we process the string alter separation between P ∗ and components in the set P. The utilization of alter separation is spurred by two variables. To begin with, because of mistakes in Viterbi arrangement, P ∗ can have additions (I), erasures (D), substitutions (B), and transposition (T) of syllables contrasted with the ground truth. Also, to deal with the permitted varieties in designs, an alter separation is favored over a definite match to the successions in P. We investigate the utilization of two diverse string alter separation measures, Levenshtein separation (d1) that thinks about I, D, B mistakes and the Damerau–Levenshtein separation (d2) that thinks about I, D, B, T blunders.

Feature	Syllable		Pattern	
	C	A	d_1	d_2
MFCC_D_A	78.14	26.32	93.23	89.47
MFCC_0_D_A	84.98	39.63	91.73	89.47

Table 1: Syllable transcription and Pattern classification performance, with Correctness (C) and Accuracy (A) measures for syllable transcription. Pattern classification results are shown for both distance measures d1 and d2. All values are in percentage.

As talked about before, there can be redundancies of a subsequence in certain examples. In spite of the fact that the quantity of reiterations is uncertain, we saw in the dataset that there are all things considered two redundancies in a greater part of example occasions. Henceforth for the example classes that permit redundancy of a subsequence, we register the alter separation for the instances of zero, one and two reiterations and afterward take the base separation got among the three cases. Along these lines, we can deal with rehashed parts in an example. At last, the P ∗ is relegated to the example class Po ∈ P for which the alter separation d (either d1 or d2) is least, as in Eqn 1.

$$P_o = \underset{1 \le k \le N}{\operatorname{argmin}}\, d(P^*, P_k) \qquad (1)$$

4. Results and discussion

We present the syllable interpretation and example arrangement results on the dataset depicted in Section 3. The outcomes appeared in Table 1 are the mean qualities in a forget about one cross approval. We report the syllable interpretation execution utilizing the proportions of Correctness (C) and Accuracy (A). In the event that L is the length of the ground truth grouping, C=(L−D−B)/L and A=(L−D−B−I)/L. The Correctness measure punishes cancellations and substitutions, while Accuracy measure moreover punishes additions as well. The example grouping execution is appeared for both alter separation measures d1 and d2 in Table 2. Every one of the outcomes are accounted for both the highlights, MFCC_0_D_A and MFCC_D_A. The distinction in execution between the two highlights was seen as measurably critical for both Correctness and Accuracy measures in a Mann Whitney U test at p = 0.05, accepting an asymptotic typical conveyance.

When all is said in done, we see a decent example arrangement execution while syllable interpretation exactness is poor. We see that MFCC_0_D_A has a superior execution with syllable interpretation, while the two sorts of highlights give an equivalent execution to design grouping. In spite of the fact that syllable translation isn't the essential undertaking we center around, an examination of its presentation gives a few bits of knowledge. The arrangement of percussion instruments in India is fixed, however there can be slight varieties crosswise over various instruments of a similar kind. The

preparation models are fluctuated and delegate, and models assembled can be dared to be source autonomous. By the by, there can be unrepresented syllable timbres in test information prompting a more unfortunate interpretation execution. A greater preparing dataset can improve the presentation in such a case. The vitality co-effective gives huge data about the sort of syllables and thus gives a superior syllable translation execution.

ID	1	2	3	4	5	Total
1	100					62
2		93.9			6.1	33
3	10.5		68.4		21.1	19
4			18.2	81.8		11
5		12.5			87.5	8

Table 2: The confusion matrix for pattern classification, using the feature MFCC_0_D_A with d1 distance measure. The rows and column headers represent the True Class and Assigned Class, respectively.

We see that the Correctness is higher than Accuracy demonstrating that the accurate grouping of syllables, as showed in the score was never accomplished in a lion's share of the cases, with a few addition blunders. This is because of the joined impact of mistakes in disentangling and permitted varieties in designs. An alter separation based separation measure for grouping is very strong in the present five class issue and gives a decent characterization execution, regardless of the low translation exactness. Both separation estimates give similar execution, demonstrating that the quantity of transposition blunders are low. To check whether there are any deliberate arrangement mistakes, we manufacture a disarray network (Table 2) with one of the well performing designs: MFCC_0_D_A with d1 separation. We see that duotou has a low review, and gets mistook for shanchui (ID=5) frequently. A nearby assessment of the scores demonstrated that a piece of the example duotou is contained inside shanchui, which clarifies wellspring of perplexity. Such perplexities can be taken care of with better language models, which need further investigation.

5. Conclusions and summary

We exhibited a definition dependent on associated word discourse acknowledgment for translation and arrangement of syllabic percussion designs. On an agent gathering of Indian percussion designs, the exhibited methodology gives a decent arrangement execution, regardless of a shortsighted language model and deficient syllabic interpretation exactness. In spite of the fact that the methodology is promising, the assessment utilizing a little dataset requires a further evaluation of the speculation capacities of the proposed methodology. We expect to investigate better language models that utilization succession and cadenced data all the more viably, and stretch out the assignment to an a lot bigger dataset spreading over more example classes. We utilized disengaged designs in this investigation, however a programmed division of examples from sound is a decent heading for future work. We likewise plan to expand this definition for computational depiction of percussion designs in other music societies, for example, Hindustani and Carnatic music, which have progressively complex syllabic percussion frameworks.

References

1. Hughes and E. Gerson-Kiwi. Solmization. In Grove music online. Oxford Music Online. Oxford University Press, accessed July 18, 2014.
2. D. Hughes. No nonsense: the logic and power of acousticiconic mnemonic systems. British Journal of Ethnomusicology, 9(2):93–120, 2000.
3. S. J. Young, G. Evermann, M. J. F. Gales, T. Hain, D. Kershaw, G. Moore, J. Odell, D. Ollason, D. Povey, V. Valtchev, and P. C. Woodland. The HTK Book, version 3.4. Cambridge University Engineering Department, Cambridge, UK, 2006.
4. G. Navarro. A Guided Tour to Approximate String Matching. ACM Computing Surveys, 33(1):31–88, March 2001.
5. Damodaran A, Mnasour H., Lessard L, Scavone G, and Suresh Babu A (2015), “Application of composite materials to the chenda, an Indian percussion instrument”, Applied Acoustics, 88, pp 1-5.
6. Sankalp Tiwari and Anurag Gupta (2017), “Effects of air loading on the acoustics of an Indian musical drum”, J. Acoust. Soc. Am. 141 (4), April 2017 0001-4966/2017/141(4)/2611/11/$30.00 VC 2017 Acoustical Society of America
7. ANITA MAHANTA & INA SHASTRI (2016), “A REVIEW ON TUNING OF MUSICAL INSTRUMENTS” BEST: International Journal of Humanities, Arts, Medicine and Sciences (BEST: IJHAMS) ISSN (P): 2348-0521, ISSN (E): 2454-4728 Vol. 4, Issue 8, Aug 2016, 47-64
8. Ravichandhira provided this link to the university syllabus which shows the use of the term thathakaram [Online] Available http://mgu.ac.in/CBCSS/B.A%20MRITHANGAM/B.A.%20Mridangam.htm [Accessed 2014, November 8].
9. Suresh, V. 2013. Interview by the author. Audio and Film recording. Chennai, India, 1st and 2nd March, 2013
10. GulshanSaxena, BharateeyaTaal Meh Anekata meh EkhthakeKhoj (Hindi), Radha Publishers, New Delhi, 2006
11. AnnamanadaBaburaj, Sadakam-Shasthtreeya Sangeetham (Malayalam),Paravam, Thrissur, 2006

