IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
PP 92-95

Computational Model for Kathak Recitations

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Abstract: *ShastriyaNrutya or India Classical Dance is an umbrella term used for various performing arts rooted in Indian classical music. Whose theory and practice is mentioned in the Sanskrit text Natyashasra and other texts from the same tradition for the principal elements of Taal. Kathak is the classical dance style with its rich theory and practice content. Dance comprise of a sequence of possible and graceful dance steps,intricate footwork, spins and recitation Padhant. Our world is becoming progressively more technology driven where we strive to develop machines that are faster and a great assistance to human. This paper proposes a model architecture which will help the artist to recite traditional bolwith theka and that will be stored in a voice to text format with the notations and Khand. This would assist an artists and accompanists to understand the notations and the sequence of bandishwhich wouldsupport them during live performances. It would help to document the paramparikbol and rare recitations in the database repository. The work will be useful to enhance the teaching-learning and performing more visual and artistic stance in performers' lives.*

Keywords: *recitations, voice to text, artists, theka, taal*

I. Introduction

To design a voice to text computational model of Kathak covering taals (rhythmic cycle of beats) and its notations , every taal can be conceptually decomposed into some constituent base like khand, sam, matra, taali, khali. This decomposition helps to prepare a template which will be common to that specific taal. This research attempts to structure these decompositions in a model using voice to text, practical experience and existing literature. This model will help the performers, teachers, students and accompanists to understand the notations and its weightage during live performances, during teaching and learning and to preserve the rare compositions. This would help evolving better teaching programs, ability to compare one taal with the other taal with the variations to the matras , and weightage, use of ICTtools in composing and designing lessons for students from various classical dance fraternity.

This model will be developed using evolutionary programming, artificial intelligence and speech recognition program which converts spoken to written text.

Structure of Kathak: Kathak is one of the Indian classical dance forms; it is highly formalized dance form as described in Natyashastra and other texts from ancient texts.

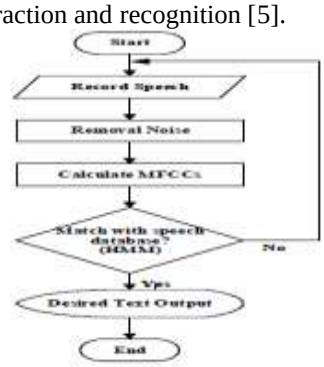
This includes various bandish and compositions like tode, paran ,chakradhar , kavitta and footwork. There are two major facets to this form :Nrutta (rhythmic dance movements) and Nritya (representational dance). Here we are going to focus on Nrutta part of it. In Kahak recitals (padhant) has a great importance and requires command on taal, laay and timing. During the performance it is required to recite the bol with other accompanist like tabla, harmonium, sitar to be on same laay and in coordination with the performer. The focus of the research is to make automated notations and weightage of the recitation which would assist all the accompanists and performers to be on same pace at a time.

II. Literature review

Although many research papers would be found dedicated to western dance forms and very few to be found for Indian classical dance form. However the articles and research papers are related to actions identification and classifications using CNN tools. Computational models for Bharatnatyam Choreography. Computer vision based dance posture extraction using slic, dance and technology an Evolving body of dance. In these articles they focus on the postures and movements of the performer during the composition, but one of the most important aspects of this is the recitation and perseverance of the rare compositions. These compositions can be reused and be modified if developed through this model in various taals.

Dance notation: In the field of Western Dances 'Labanotation' a system using symbols to write down the movements of dancers, especially in a ballet has been developed particularly following the research conducted at theUniversity of Frankfurt [6] and Ohio State University [6]. Using labanotation several software programs have been developed such as LabanWriter[9], CALABRAN[10], LabanPad[7], Limelight[8] and LifeForms[11], However most of these programs are useful mainly either for notating and archiving dance or for animating dance.

Following model explains the conversion of voice to text developed using MATLAB. These steps are speech database, preprocessing, feature extraction and recognition [5].



Flowchart of speech to text conversion

Figure: 1 Flow chart Speech to text conversion[5]

III. Proposed Computational Model

As Kathak includes varioustaals the smallest tall is of 6 (beats)matrastaalDadara to biggest 28 matras Brahma taal. This model will assist the accompanists and performer to create their own compositions and to convert them to voice to text format to retain it for long time.

For formalizing the model considering taalteentaal which is of 16 beats

The process starts with the listing number of matra (beats), khali (sign 0 on 9th beat), taali (total 3, on 1st, 5th, 13th beat) ,sam (sign x on every 1st beat) and vibhag(comprises of 4 matras each)

```
1                   2                   0                   3
Dhaa Dhin Dhin Dhaa | Dhaa Dhin Dhin Dhaa | Dhaa Tin  Tin  Taa | Taa Dhin Dhin Dhaa
1    2    3   4     5    6    7    8     9    10   11  12    13   14   15  16

dhaa
x
```

Figure 2: TaalTeentaalTheka

The above figure shows the structural representation of taalteentaal with 16 beats in it, where 4 beatsare in one division likewise there are total 4 divisions and 4x4= 16 beats. All the compositions which are composed in teentaal are supposed to fit in this structure. This entire set of 16 beats is called one aavartan likewise during the composition sometimes more than once this rhythmic pattern is called and those many aavartans(cycles)are repeated.

Now the important part is structuring and identifying where and how to mark these partitioning after every 4th beat. It is important to divide the segment in total 4 sections after every 4th beat also identifying the 3 taali, 1 khaali and total number of beats plus 1 beat of sum.

```
1                   2                   0                   3
Titi kata gadi gan | dhaa 1 Titi kata | gadi gan dhaa  2 |Titi kata gadi gan |
1    2    3   4     5    6 7    8     9    10   11  12    13   14   15  16

dhaa
x
```

Figure 3: Tihai representation in Teentaal

Computation Method: For making segments after every 4th beat proposed method would be as followed

Step 1: writing the recitation in sequence

Step 2: reciting it in specific laya or rhythm while making a clap (taali) on every beat

Step 3: wherever there is a clap mark that word

Step 4: once marked count 4 marked beats and put a segment there

Step 5: make set of 4 segments where each segment includes 4 beats each

Step 6: as per the segments put signs of matra, taali, khali, sam

```
Tig  daa  dig  dig  thai taa  thai taa  thai ___  1  ___

Tig  daa  dig  dig  thai taa  thai taa  thai ___  1  ___

Tig  daa  dig  dig  thai taa  thai taa  thai
```

Figure: 4 Teen TaalTihaiStep 1

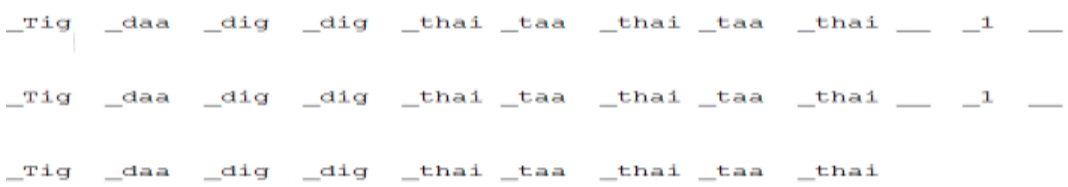


Figure: 5 Teen TaalTihaiStep 3

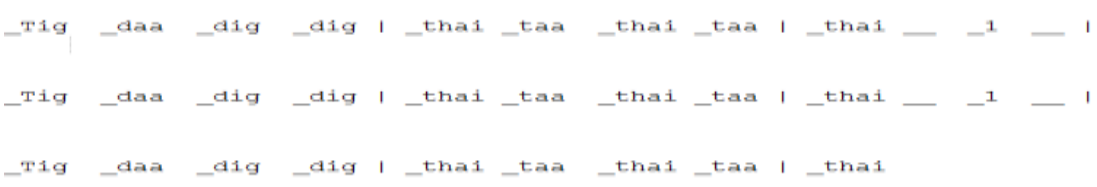


Fig:6 Teen Taal Tihai Setp 4

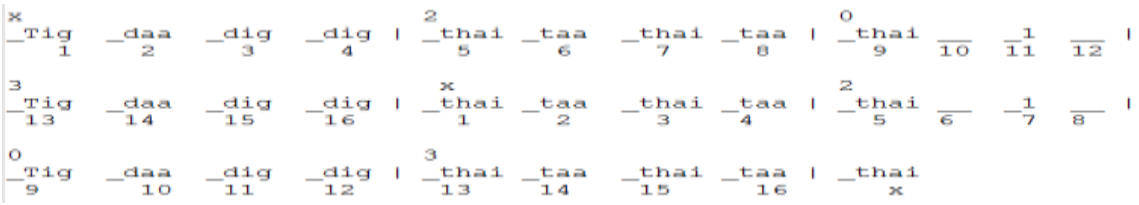


Figure:7 Teen Taal Tihai Setp 5

IV. Tracking the audio and performing computation process

Once the rough draft is ready this can be recited by the performer using the voice to text converter which would be capturing the voice with the sound of a clap. Whenever it identifies a clap it will mark an underline (counting 1 beat) and once it completes the process it will start segmenting and marking the notation which a performer can print and store for later references. Based on this calculation even accompanists can get an idea where to pause and where exactly the recitation will end.

The observations of final Figure: 7

1. Since it has 4 beats in one segment and each segment has 4 beats this is a TaalTeentaal
2. Since there are 2 cycles of 16 beats it requires 2 aawartan or 2 rhythmic cycles
3. Blank positions on 10^{th} , 12^{th} ,6^{th} , 8^{th} position depicts a pause during the recitation

It is required to collect many instances of varioustaals with variations in even and odd beats and segments which will help to use this data to generate the knowledge base of such constraints.This model will be helpful for the various combinations of taals and recitals. The recitals will be converted from voice to text using speech recognition pattern by tracking the sound waves. Sound is transmitted by waves which are unidirectional where computer understands the binary.

Every time when the sound travels it has a single value with highest and lowest peak, to turn these sound waves into numbers high and low of the wave will be calculated with equalspace of distance.

Recognizing characters from short sounds: The audio will be in small chunks, for each audio slice it will identify the letter that corresponds to the sound currently being spoken using Artificial Intelligence with neural network for speech recognition or voice to text conversion. This process will be used to capture and digitize the sound waves, transformation of language using the sound of clap in between dividing the same in segments.

Among the current proposed model challenges are capturing the voice with clarity, noise removal,managing frequency of the speech or voice signals.

V. Conclusion

An attempt is made to collect the various recitations in Kathak which would be an input to the voice to text converter. These converted notations will help the performers, students, accompanists to preserve the rare compositions and understand the weightage of difficult recitations in Kathak. It can also be used as a tool or application in dance theory exams preparation which will help students to explore new ways to expressively combine the challenging recitations.

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