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Generating Computer Music from Skeletal Notation for Carnatic Music Compositions

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Generating Computer Music from Skeletal Notation for Carnatic Music Compositions

The traditional notation generally lacks

- indications or details of *gamakams* (nuances or continuous movements between or around notes)
- clear markings for silences
- indications for grouping notes into phrases

Importance of Compositions

Present practice revolves around compositions written in the last 250 years.

In spite of extemporization certain amount of stability in singing the compositions exists.

Compositions are often used as models for ragam.

Printed notations for compositions available from the middle of 19th century; for many of these neither recordings nor tunes handed down orally are available

The objective is to be able to generate realistic music from notations available in books.

Carnatic Music Notation is textual and uses the sol-fa 'sa ri ga ma pa da ni' for the 7 notes. (compared with staff notation)



Carnatic
Notation

ma paa ma ma ga pa ma ri saa ni sa sa ni saa sa ri ga ma

Lyric

ma haa ga na pa thim ma na saa sma raa mi



Carnatic
Notation

ga ma pa ni sa ni pa ma ma ga pa ma ri saa ni sa sa ni saa sa ni pa ma ri sa ga ma

Lyric

ma haa ga na pa thim ma na saa sma raa mi

Sample of Notation (scanned from a book of 1954)

29

18. "குகு குறாய"

ஊரம் ரசம்—ஆதி தரவம்

{ ஆ : ஸரிகஸரிமபதஸ்ர
{ அஃ : ஸ்தபமகரிஸா

4	○	○
பல்லவி		
த ப ப ம ர ம ம ர கு கு கு ஹா ய ப ₄ க்	க ர ரீ த ர னு	ஸ ரீ ரி க் ₂ ர ஹா ய
த ப பா ப ம ப த மா ம ர கு கு கு ஹ ர . . ய ப ₄ க்	ம க கா க ரி ரீ த ர . னு . .	ரி ஸ ரீ ப ம க ரி க் ₂ ர . ஹ ர . ய .
த பா த ஸ த ப ப ம ப த மா ம ர கு கு . . கு . ஹா . . ய ப ₄ க்	ப ம மா ம க கா த ர . னு . .	க ஸ ரி கா ரி ரி ரி க் ₂ ர . ஹா . . ய
த ஸ ர ரீ . ப ம க ம க ரீ கு ம ர ர ர . ய ந . மேர	ஸ ஸ த ரி ஸ ந ம . . ஸ	ரீ ரி ஸா, தே . .

Tonic and Tempo are not fixed

- The tonic is not fixed and may be chosen to suit the voice of the singer or nature of the instrument.
- The pitch chosen for the tonic is assigned the symbol 'sa' and the pitches of the other notes are related to it.
- Scales (*Melams*) are built up by choosing 7 of the 12 possible notes in the octave (with certain rules for the choice).
- Note duration is variable, but once chosen it is maintained within a song (with halving, doubling or prolonging in the same units of time).

Nuances (Gamakams)

The notation is skeletal and if played as such on an instrument will not sound like the real music. *Gamakams* or oscillatory movements around or between notes impart the full flavour of the *ragam*

Music synthesized from plain notation



Music after adding notation for *gamakams*



Notation with Gamakams

For the 2 clips played earlier the notations for the first line are:

Simple Notation

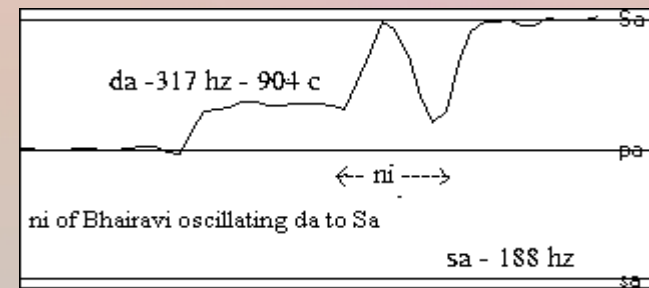
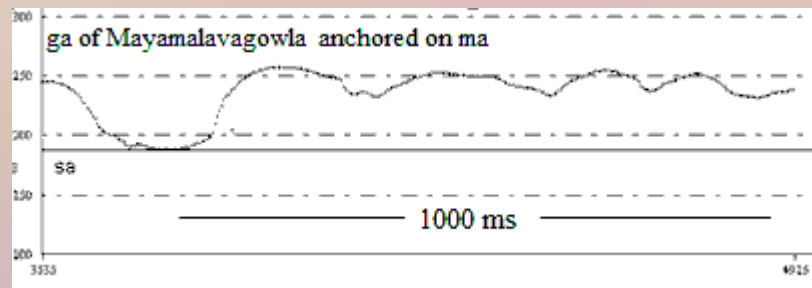
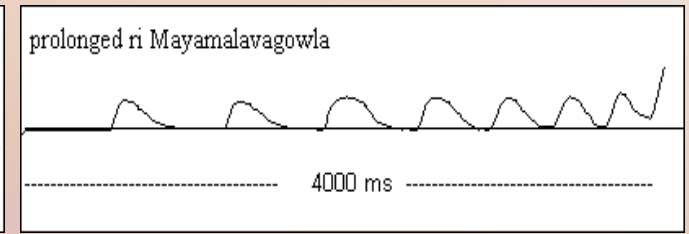
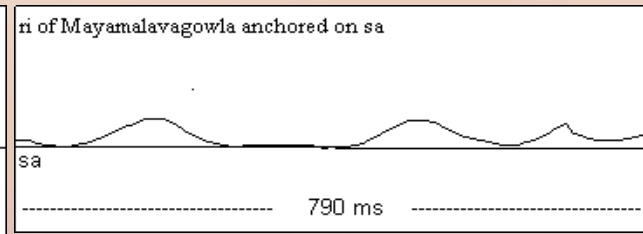
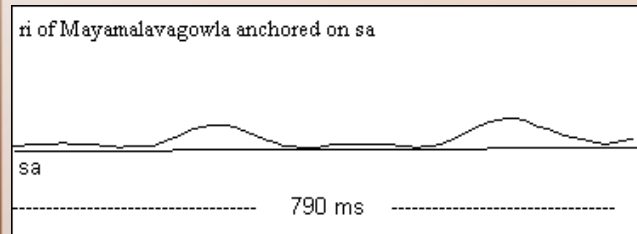
ree, sa ri pa gaa ga ma ri saa

With notes added for Gamakam

ree -, sa - ri- ri paa, - pa ga ma ga ma - ga ma - ri -saa



Some pitch graphs of *Gamakams*



GAAYAKA

Gaayaka, a notation player for Carnatic music uses traditional sol-fa and produces music in the tones of *Veena* or Flute.

Slight modifications have been made to enable ordinary text files to be used.

Instead of dots above and below the notes, octaves are indicated thus:

<u>Traditional</u>	<u>Gaayaka</u>
da ni sa ri ga ma pa da ni sa ri ga ma	dA nI sa ri ga ma pa da ni Sa Ri Ga Ma

Instead of lines over the notation for half or quarter notes brackets used.

<u>Traditional</u>	<u>Gaayaka</u>
pa ni da ni-, Saa	(pa (ni da ni -,) Saa)

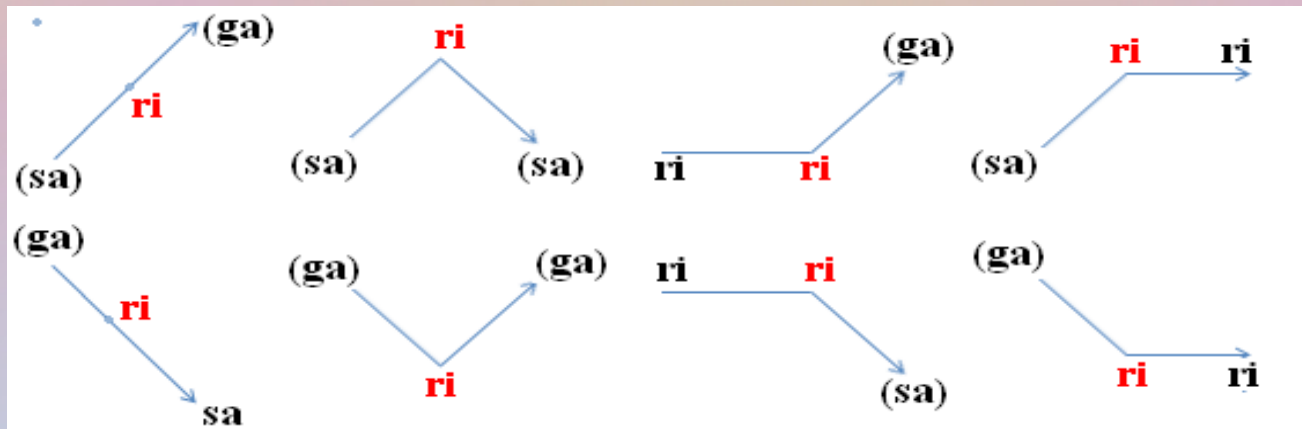
Insertion of *Gamakam* notation - 1

- Manual notation writing for *Gamakam* requires knowledge of the nuances in a ragam.
- *Gamakam* on a particular note varies among *ragams*. and according to the context within the same *ragam*.
- Variations in *Gamakam* usage exists in different schools and regions.
- Neither of the pitches of the end points of the oscillations may coincide with the pitch of the note assigned.
- The skeletal notation now used allows the singer to interpret it according his own traditions and a given notation could be rendered in more than one way – all acceptable.

Insertion of *Gamakam* Notation - 2

Major parameters influencing *Gamakam* on a note are:

- The *Ragam*
- Duration of the note
- The context – 12 contexts could be considered at the first level (8 shown below and 4 more for preceding or following silence)



- Sometimes the actual note preceding or following and the position of the note in the phrase may influence the *gamakam*.

The AddGamakam Program

For each *ragam* a *gamakam* definition file is required.

Durations are grouped into ranges.

For each note the program generates a context string which has information on duration range, direction of movement, actual duration etc.

The appropriate *gamakam* notation is looked up from the *ragam* definition file using the context string.

The *gamakam* notation is ‘stretched’ or ‘shrunk’ to the original duration of the note and is inserted in the place of the note.

AddGamakam program – Results

- 20 Ragam definition files have been compiled
- In some cases 2 alternatives are provided
- Results for *varnams* (which are composed with notation as the primary ingredient) are good
- Results for *krithis* generally acceptable. Rare usages not reflected.
- Stretching or shrinking the notation from the definition file to the actual duration is sometimes not satisfactory.

Some Examples of Automatic *Gamakam* addition

Sankarabharanam

paa- daa- ni- Saa - Sa- ni- daa- paa

Sa- ni- paa

ga- maa- paa-;

pa- maa- gaa-;

Plain



With Gamakam



Bhairavi

pa da*- nee -Saa-;

Saa ni- da-paa



Dhanyasi

pa.(pa) ma ga -maa- paa- paa;-

paa Saa-Sa ni-Ri Sa-daa paa



Other Approaches

- Instead of giving the actual notation in the *ragam* definition file, parameters could be prescribed to generate numerical code (for music generation).
- Parameters could be the duration, anchor point, proportion of steady note at the anchor, range etc.
- Parameters required for each context as described earlier.
- ‘Generic’ *gamakam* notations could be used for notes of newer *ragams*

Manual interventions required

- Notation has to be typed in Gaayaka format.
- Phrase separation (based on the lyric) to be marked with “-” as required in Gaayaka (could be automated).
- Tempo has to be guessed as the note duration is not standard and there is no indication in the notation.
- Silences have to be marked in excessively long notes (could be automated).
- Short silences preceding consonant combinations not shown in the notation have to be entered (could be automated).

Phrase Marking

- For clear lyric rendering, phrases have to be marked by a separator (in Gaayaka the hyphen “-”).
- No standard system is adopted in books.
- Consonants in the lyric are natural points of phrase separation. Prolonged vowels require judgement.
- Inappropriate phrase separation can render a lyric unrecognisable in instrumental music.
- Inappropriate Separation

```

; paa pa(ma<(pa).)((ma paa ma)ga),-((ma pa)ga,)(ga ri),-
[; Ap pa Raa ma]-
saa ; (saa(ri nl) sa) sa.- ri. gaa,-
[bhak thi en tho ]-|
    
```



Proper Separation

```

; pa.-pa(ma<(pa)-)((ma paa ma)ga),(ma pa)ga,)-(ga ri). - .
[; Ap pa Raa ma]-
saa ,-, (saa(ri nl) sa)- sa. ri.- gaa.-
[bhak thi en tho ]-|
    
```



Notation available in English

Notation in English is available both in the printed form and on the internet and requires conversion into the format of notation player preferably by a program

Only the consonant part of the sol-fa is used and 2 different formats are found

Type 1 -All notes are in capitals and have one unit duration

Type 2- Notes in upper case are of 2 units and others 1 unit duration

- Indication of octave not available in most cases - has to be guessed by the conversion program

(Type 1)

```
P ,,- P, M R - G R | S N , - P N S R N
Sa - - mi - - ni - | nne - - ko - - - - |

S , , , , - N S | R G R S R M P N ||
Ri - - - - yu - | - - - - nna - - nu ||
```

(Type 2)

```
M - mg R - S G M P ; | D ds nn- D P ; ; ; ||
Ga jaa - - na na yu tham Ga- ne -- shwa ram - - -

mpd pmgr , - S G M P ; | D ds nn- D P ; nddp ||
Ga -- jaa - - na na yu tham Ga- ne - shwa ram - -
```

Silences

- The same symbols (' , ' and ' ; ') are used both for extending a note and for silences.
- Large array of such symbols have to be broken into parts indicating prolonging the previous note and silence.
- Short silences in voice when consonant combinations (such as 'bhakthi' or 'appa') occur in the lyric have to be reflected in the notation.

saa , - , - (saa(ri nI) sa)- sa. ri- . - gaa.-.
[bhak thi en tho]
(silence added)

From the Book to Music

