Computational Analysis of melodic mode switching in raga performance

Nithya Shikarpur, Asawari Keskar and Preeti Rao

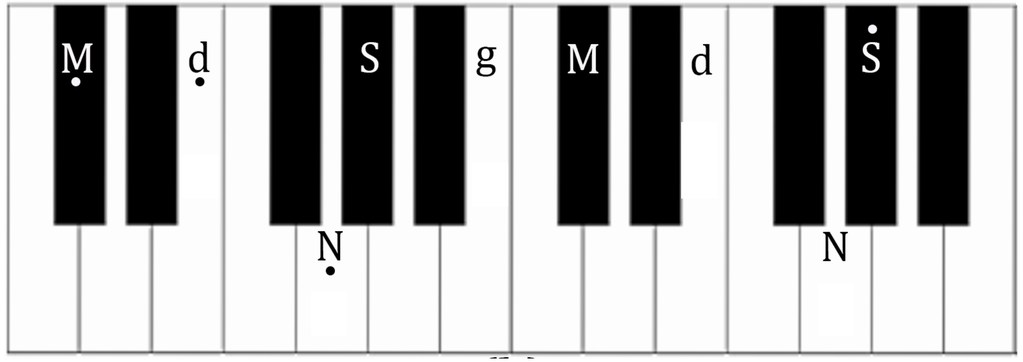
What is a raga?

[1] K. K. Ganguli and P. Rao "On the distributional representation of ragas: experiments with allied raga-pairs ", TISMIR, 2018

Murchana (mode shifting)

With the same set of keyboard notes, we get multiple scales by assuming different tonics

C



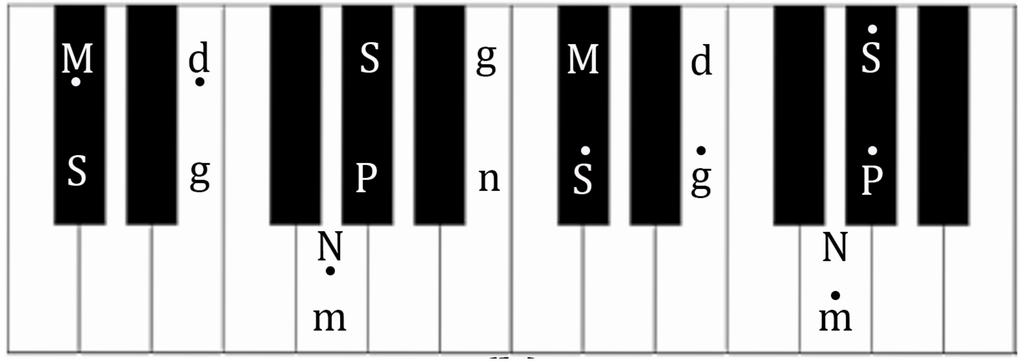
Example of murchana with ragas Chandrakauns and Madhukauns

Murchana (mode shifting)

With the same set of keyboard notes, we get multiple scales by assuming different tonics

C

M



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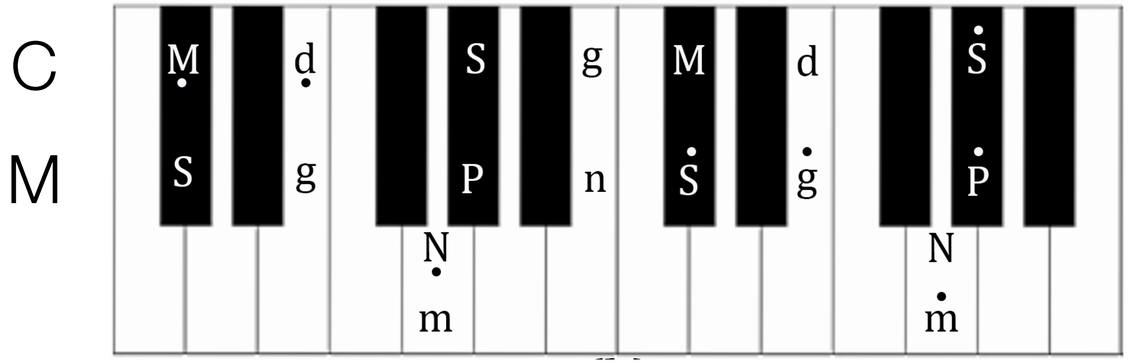
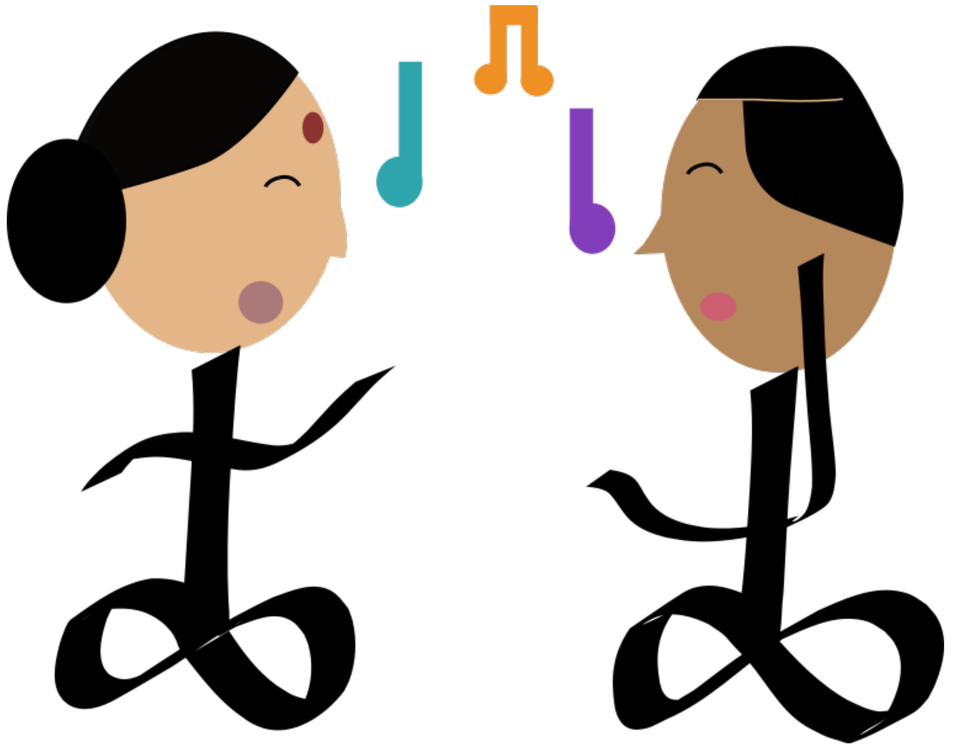


Example of murchana with ragas Chandrakauns and Madhukauns

Example of murchana by Smt. Gayatri [link]

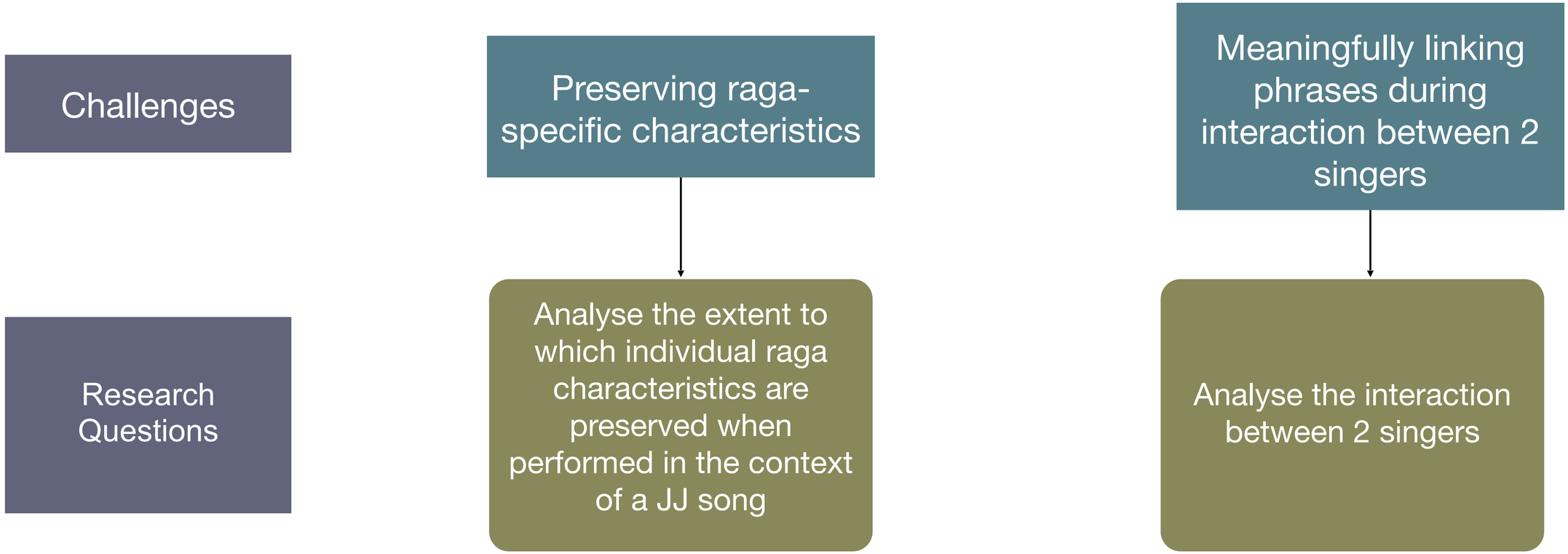
Jasrangi Jugalbandi (JJ)

- A recent development in North Indian Classical music allowing singers (a male and female) with incompatible vocal ranges to sing together using the concept of murchana (mode-shifted ragas)



Example of JJ in raga Abhogi-Kalavati by Dr. Ashwini Bhide Deshpande and Pt. Sanjeev Abhyankar [link]

Challenges & Research Questions



Dataset

Data Sources

1. Hindustani Raga Recognition dataset[2], compiled as a part of CompMusic Project
2. Commercial Recordings
3. YouTube

Raga Pairs

1. Abhogi-Kalavati
2. Chandrakauns-Madhukauns

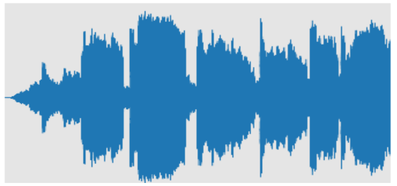
Raga Pair	Number of songs (minutes)		
	Raga 1	Raga 2	JJ
A-K	12 (185)	12 (227)	5 (89)
C-M	13 (214)	14 (171)	4 (69)

Number of songs and duration in minutes collected in our dataset for each raga pair

[2] S. Gulati, J. Serra, K. K. Ganguli, S. Senturk and X. Serra " Time-delayed melody surfaces for raga recognition ", in Proc. of the 17th Int. Soc. for Music Information Retrieval Conference, 2016

Feature Extraction

Song



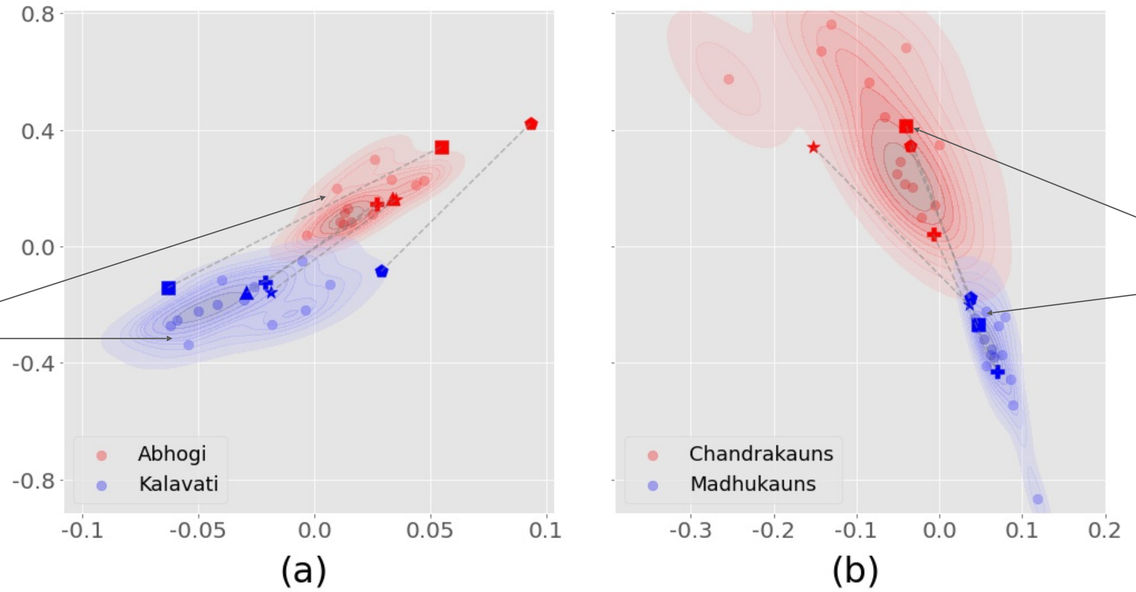
F0 Feature Vector

v_0	v_1	v_2	v_3	v_4	v_5	v_6	v_7	v_8	...
0.036218	0.147307	0.097158	0.015596	0.007429	0.006763	0.007031	0.009857	0.021934	...

Analysis #1 - Preservation of Raga Specific Characteristics

Feature vectors plotted on a 2D plane

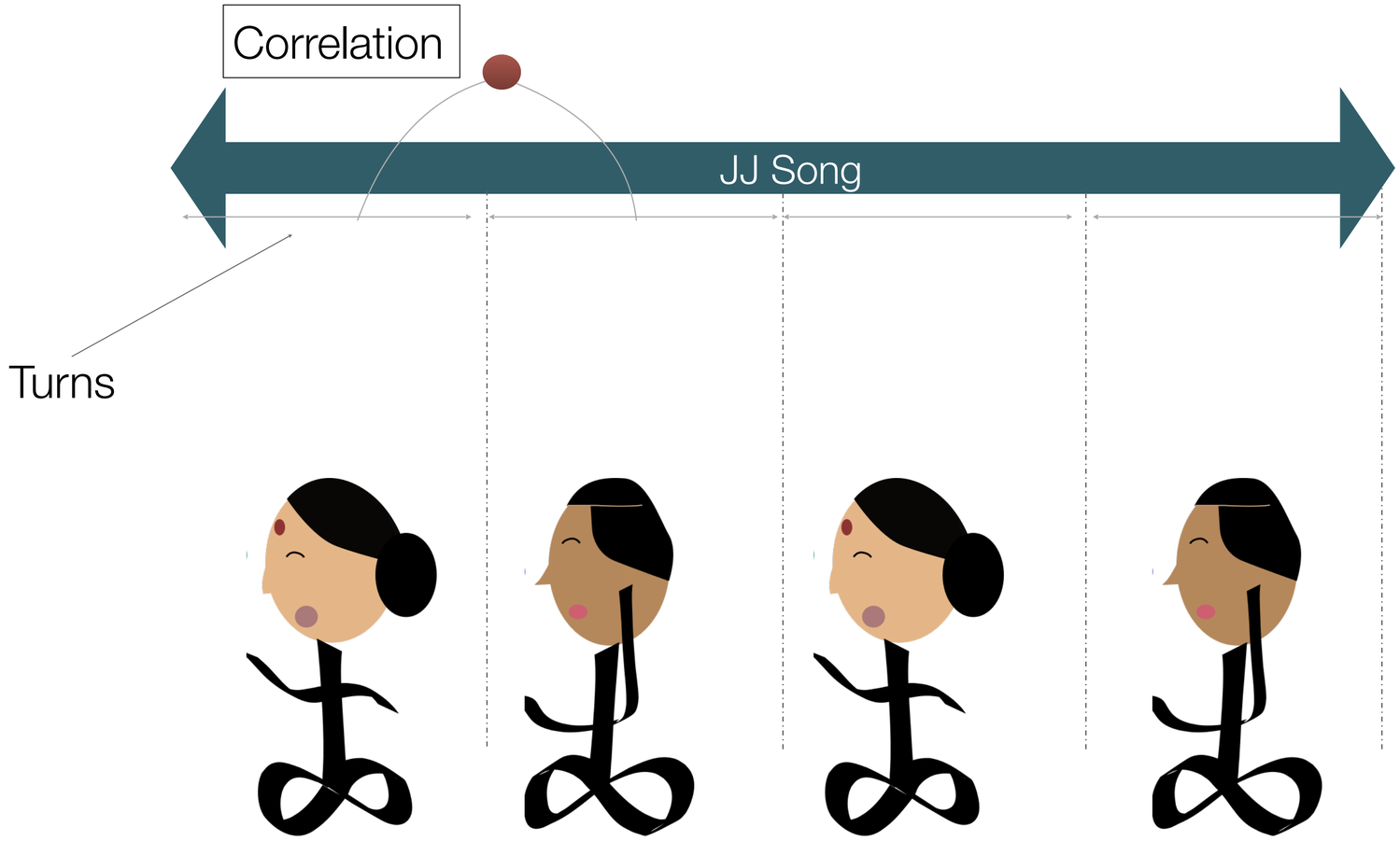
Individual raga specific songs:
- Defined by translucent circles
- Used to define raga cluster



JJ Songs
- Depicted by opaque symbols
- Raga pairs belonging to the same JJ song are represented by the same shape and connected with a dotted line

Observation: JJ song raga components are well separated and cluster well with their respective raga-specific songs

Analysis #2 - Interaction between the singers



Results

Raga Pairs	No. Of Turn Pairs	Duration (s)	No. Of Notes	Pitch Range (Cents)
A-K	83	0.52 (0.02)	0.61 (0.02)	0.47 (0.04)
C-M	80	0.81 (0.02)	0.64 (0.03)	0.55 (0)

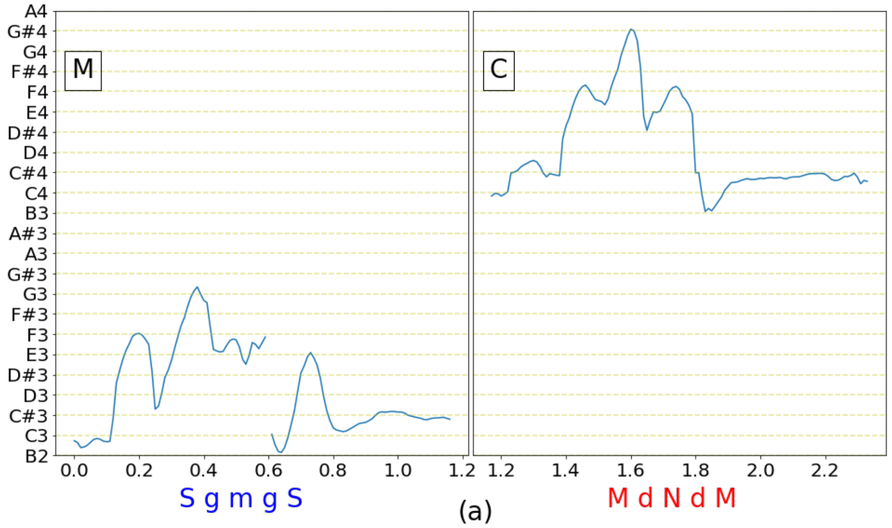
Results of correlation between singer turns. Value in brackets is the baseline.

Observation: Melodic features of turns between singers are well correlated. Implies similarity between melodic contour of corresponding turns.

Analysis #2 - Interaction between singers

- Types of call and response interactions

  (a) Same keyboard notes, different solfege transcription

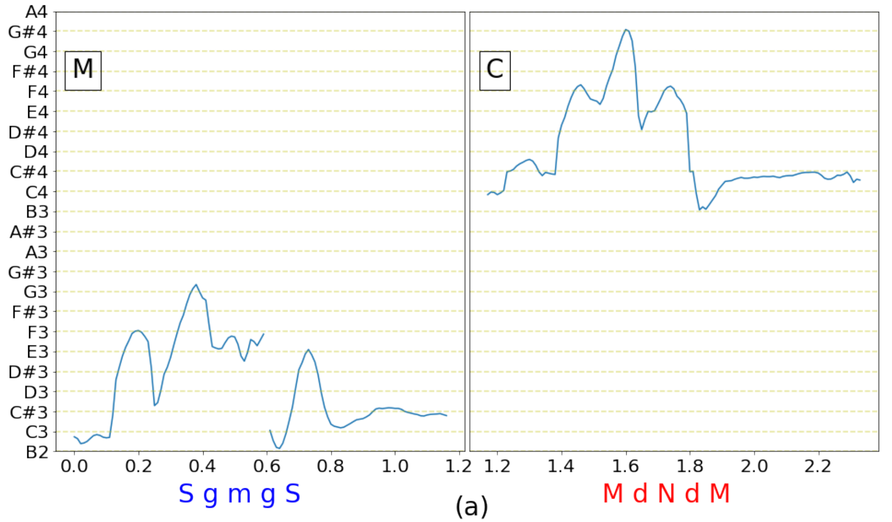


Analysis #2 - Interaction between singers

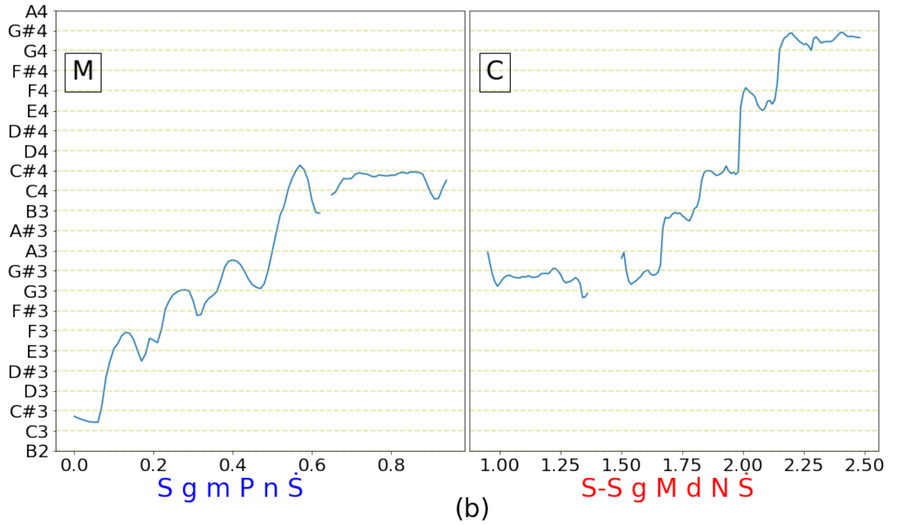
- Types of call and response interactions

  (a) Same keyboard notes, different solfege transcription

  (b) Same solfege transcription, different keyboard notes



(a)



(b)

Summary and applications

- JJ singers adhere to the raga characteristic tonal hierarchy to the same extent as in the corresponding individually performed ragas
- Observed interesting ‘call and response’ patterns where raga phrases are shown to correspond by way of melodic features
- Insights obtained could be used to identify new raga pairs that could potentially fit the JJ performance