MELODIC ATOMS FOR TRANSCRIBING CARNATIC MUSIC

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ABSTRACT

We had introduced a set of 2D melodic units to transcribe Carnatic music previously, and we now provide some illustrative examples using real pitch tracks to further our discussion on this topic.

1. INTRODUCTION

Twelve notes (or sixteen with four enharmonic equivalents) are not sufficient for an accurate or faithful representation of Carnatic music; the seasoned musician can easily identify many more than 12 musical entities in an octave. We have listed these various "melodic atoms" in previous works [1, 2, 3]. In this article, we continue to describe various aspects of these melodic entities and also provide some illustrative examples using actual, performed audio segments. In this work, interval tuning or intonation is not discussed. Rather, we simply talk about melodic units whose intonation, timing and rendering we have observed to be quite flexible overall. For definitions of terms and symbols, the reader is referred to our previous publications.

Methods to automatically segment Carnatic music pitch tracks and extract these entities from them will be presented in a future report. We will also defer to a future report techniques to identify and classify ragams and pieces using these melodic units.

2. SAME NOTE, MANY VERSIONS

A note in Carnatic music can mean different things or appear in different ways. For example, what does a Carnatic musician mean when he refers to the note "R1" or "Suddha Rishabham?" "R1" could be a particular melodic entity, a "swarasthanam" or it could refer to the entire set of entities associated with R1, as illustrated in Figure 1. (A swarasthanam, simply put, is the location of the "ideal" constant-pitch variety of a note, that also supports or is
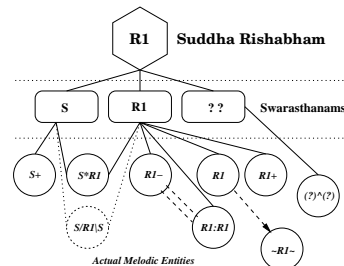
Figure 1. Under the common title of "R1" or "Suddha Rishabham" there exist many distinct melodic entities, supported by two different swarasthanams. All of these entities appear in most ragams that contain the minor second. (The entity denoted by the carat symbol and question marks is a fast, upward inflexion, examples of which are given in Figure 4.)

the anchor point for inflected notes.) Figures 2, 3 and 4 show real pitch tracks of these different entities. Similar graphs and diagrams can be produced for all the notes in Carnatic music.

Though these entities can be distinguished from each other easily in slow speeds, with fast tempos and flexible timing, they may morph or merge into each other. For example, the entities R1- and R1:R1 are very close to begin with, and may be very similar to other elements like S/R1 or S*R1 in certain contexts. Conversely, given a certain pitch contour segment, sometimes it may not be possible to classify it into a particular category with absolute certainty; a pitch segement might fit well into 2 or even 3 adjacent categories, but fortunately in those cases, it usually doesn't really seem to matter which category is chosen.

These categories or melodic entities should be thought of as "reference points" in a multi-dimensional feature space, and pitch contours would traverse continuous paths in this space.

These categories are not arbitrary. In some phrases, only certain melodic entities are acceptable for certain notes. For example, in the phrase from Gaulai shown in Figure 10, only S+ would work where it appears. This graph also shows this entity morphing slowly into another: S*R1, and also shows that in another context, a different entity may appear: R1+.

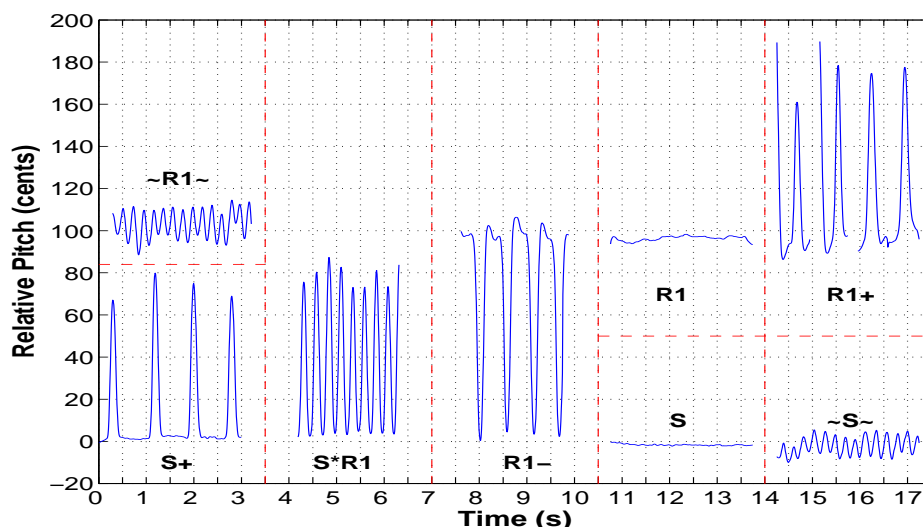But in other phrases, a wide variety of melodic entities

Figure 2. Segments drawn from real melodic contours, illustrating some of the entities listed in Figure. Examples of S and R1 played with a mild vibrato are also included. The meaning or interpretation of the symbols is given in [1].
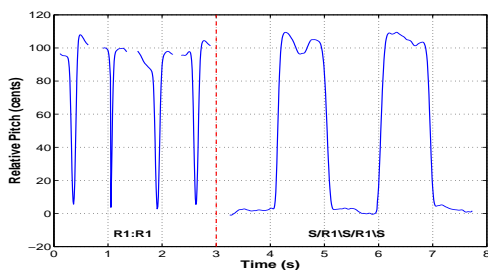

Figure 3. Additional entities listed in Figure. R1:R1 is called a "jandai" (double) phrase and is practically very close to R1-, sometimes even indistinguishable from or replaceable with it. The contour on the right shows a slide (transitions) between the constant-pitch versions of S and R1, which can be easily distinguished from the other entities at slow tempos.
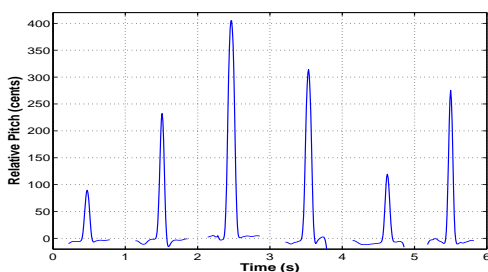

Figure 4. In certain phrases, a fast upward spike, toward a "flexible" upper end is used for a short-duration or transient note. Called "viraladi-s" in violin playing, above are examples of R1 "hit" from S.

are acceptable to be used as shown in Figures 5, 6 and 7.

In ragams that do not have certain notes, entities which are normally anchored on those missing notes will also usually be absent. For example, in Hindolam, the lack of P means that P+ doesn't appear in favor of D1, while D1-,

D1 and D1+ are employed. Since P+ sounds the "lowest" in perceived pitch and is missing, this leads people to state that the D1 in Hindolam is "higher," which is true to a certain extent. Similarly, in Sunadhavinodhini, which is again missing P, P- does not appear for M2, leading people to opine that its M2 is lower than the M2 of Kalyani where P- is allowed to used for M2. Again, there is a certain element of truth in this statement, but it would be more accurate to describe each occurrence of a note in terms of the melodic entity category.

There are also ragams which use entities anchored on swarasthanams that are not part of the ragam. For example, in Thodi, R2+ appears as a particular form of G2 sometimes. And in Madhyamavati, M1 is render via the G3*P inflexion, while G3 does not figure in Madhyamavati.

3. CONCLUDING REMARKS

We believe that the various entities we have published thus far are a necessary and sufficient set to be able to represent or synthesize any phrase in Carnatic music. We believe that all our entities are necessary because for each one, we can find a phrase where it is required. And thus far, we have not encountered a phrase in Carnatic music which can't be modeled or transcribed using only the entities we have published. Whether this would hold forever or if our lists need updating needs to be seen.

Mapping a pitch contour onto our entities will remove any artistic or expressive content in the music and yield a skeletal contour that nevertheless sounds musically correct. For many applications, such as transcription and classification this is exactly what is required.
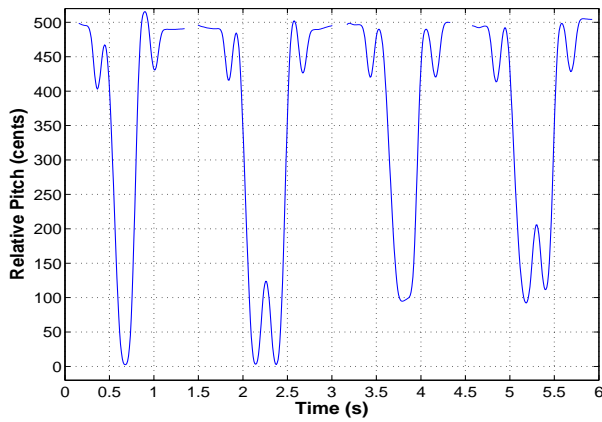
Figure 5. The "r1" in the phrase "m1g3r1g3m1" in ragams like Maayaamaalavagaulai can be rendered using different melodic entities. In fact, due to flexibilities in intonation, and different artists' preferences, a whole continuum of contours can arise, "in-between" the ones shown above.
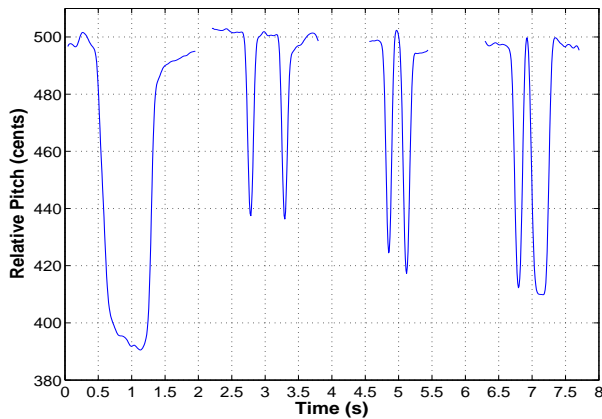

Figure 6. The phrase "m1g3m1" can be rendered in many ways. Shown above are: (i) plain version, (ii) "m1:m1:m1" (jandai), (iii) "m1-," (iv) "m1 g3+ m1" or "m1 g3*m1 g3 m1." There exist a whole continuum of contours in between (ii), (iii) and (iv), and the differences between these different entities sometimes become fuzzy or even non-existent especially at fast tempos.

4. REFERENCES

[1] A. Krishnaswamy, "Inflexions and microtonality in south indian classical music," in *Proc of Frontiers of Research on Speech and Music (FRSM), Annamalainagar, India*, 2004.

[2] A. Krishnaswamy, "Towards modeling, computer analysis and synthesis of indian ragams," in *Proc of FRSM*, 2004.

[3] A. Krishnaswamy, "Multi-dimensional musical atoms in south indian classical music," in *Proc of ICMPC*, 2004.
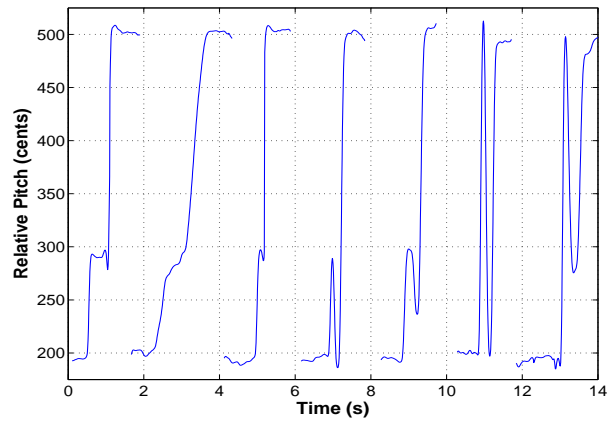
Figure 7. Different ways of playing the phrase "R2 G2 M1" by using distinct melodic entities in place of G2: (i) a constant-pitch G2, (ii) a sliding transition, (iii) half an upward or a "truncated" upward inflexion, (iv) R2+ (v) G2-, (vi) R2+M1 (vii) M1-G2. This is not an exhaustive list.
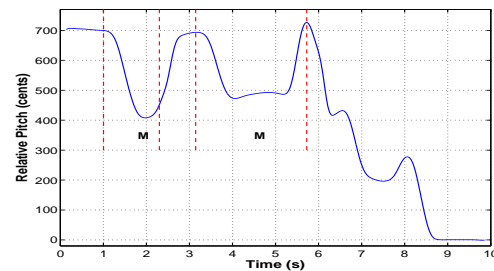

Figure 8. An example of the famous Begada M1. This contour involves larger-sized (much more than 100 cents) inflexions and illustrates two kinds of M1: "P-G3" and "P-M1"
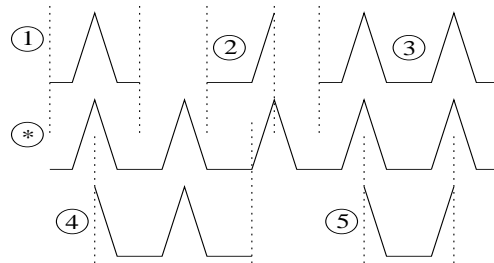

Figure 9. Different occurrences of an inflexion like R2+ can be thought of as coming from or being cut from a larger stable entity denoted by the "*". (1) A "transient inflexion," (2) Half of an inflexion or a "truncated inflexion," (3) Two periods of an inflexion, (4) Used in Thodi in place of G2, (5) Used in Sankarabaranam in phrases like "s R; s".
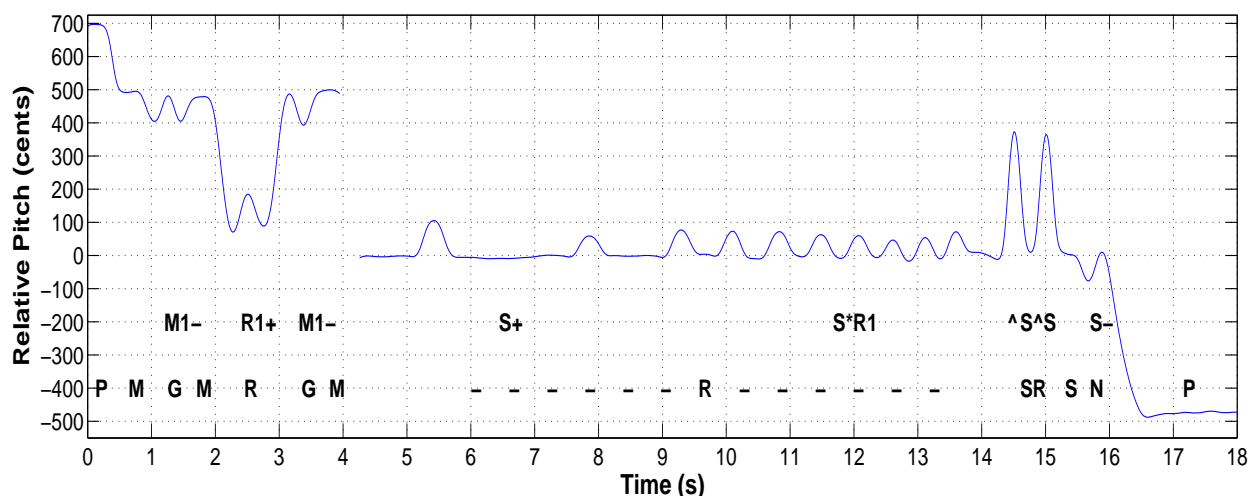
Figure 10. A phrase from the ragam Gaulai, illustrating different kinds of R1 used, some of them even morphing from one into another. The bottom line of notes is the standard notation given in most music books. The top line uses our more refined categories. In Gaulai, G3 appears most often as M1-. But the most famous note in this ragam is R1 which appears as S+. This phrase is a "re-rendition" of a similar phrase presented in [3] (which does not use R1+, but is also equally acceptable).
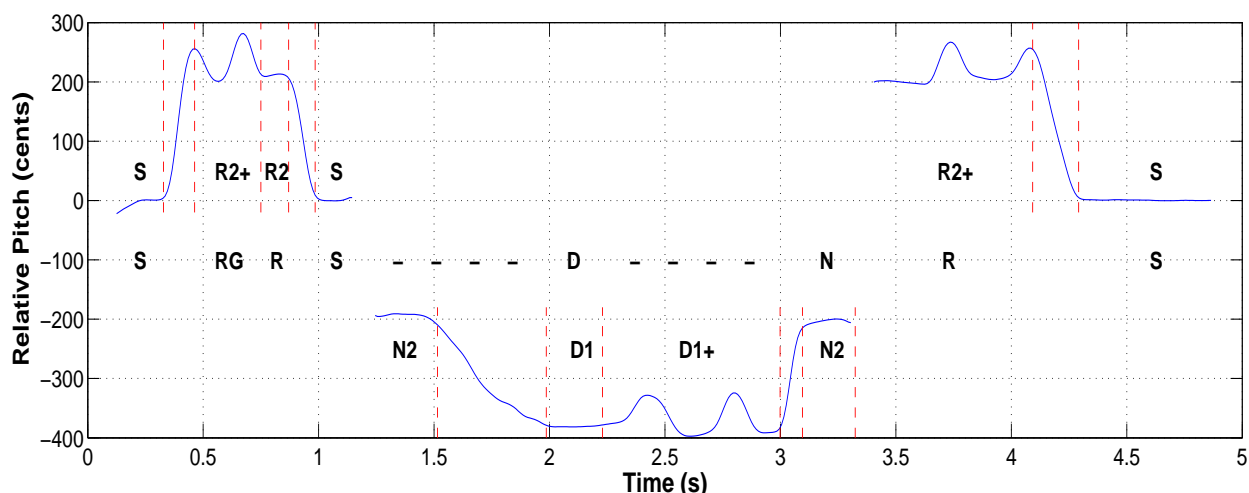

Figure 11. A phrase from the ragam Darbari Kaanada, segmented into melodic atoms and transitions. The middle line of notes is what one would find in standard music books. The top and bottom lines employ our more sophisticated categories of melodic atoms. Note that the R2+ inflexion appears once as G2 and then again as an ornament on R2! The transition from N2 to D1 could also be interpreted as N2*D1.