

# Extracting Vivadi Ragas and Avivadi Ragas Using BFS Algorithm

A L Sriram, Subramanian, Swarna Sweety

**Abstract:-** Sampoorna ragas are the backbone of the Indian classical music. The sampoorna ragas in south Indian classical music can be divided into vivadi and avivadi ragas. The vivadi ragas are the one which produce discordant effect and hinder the free flow. The proposed identifying the vivadi and avivadi ragas through BSF can help in retrieving all the janya ragas and implementing the same in automated accompanying system.

**Keywords:-** Vivadi ragas, Sampoorna ragas, Avivadi ragas, BFS algorithm.

## I. INTRODUCTION

### Vivadi swaram

The vivadi swarams are those swaras which when rendered along with its adjacent swara produces a discordant effect and also hinders the free flow of swara sancharas. A difficult, careful and elaborate rendering can help one in doing swara sancharas. It is entirely different from apaswara or wrongly rendered swara or the frequency not at all belonging to its allowed range.

### Vivadi ragam

Sampoorna ragas which contain the above said vivadi swaras are categorised into this group. Mostly the ragas with sudha rishabham and sudha gandharam or shatsruthi rishabham and anthara gandharam or sudha daivatham and sudha nishadham or shatsruthi dhaivatham and kakali nishadham falls into this group.[5] In the 72 sampoorna raga list there are 40 vivadi ragas that is ragas with vivadi swaras are found. One need to take utmost care in dealing with ragas or one has to very skillfully handle and render to make it presentable and melodious. Though vivadi swaras need to be avoided in certain occasions these swaras are applied by eminent musicians to add color to swara prasthara or raga exploration. Even there can be janya ragas with vivadi swaras but some vivadi janya ragas which rendered applying some techniques are highly popular and acclaimed like natai, varali etc.

### Avivadi Swaras

Avivadi swaras are those which are of utmost significance in a raga and can be further categorised as vadi and samvadi swaras. [7]

A vadi swara is the first most significant swara or primary frequency or we can say it is the life giving swara for a raga and samvadi is the second most significant swara which help one to give a complete and concrete form to the raga during swara prasthara. The combination of vadi and samvadi swaras will give a very effective and melodious sound and can life and form to the raga that is being elaborated. Even some janya ragas with same arohana and avarohana can be skillfully distinguished with the apt and skillful use of vadi and samvadi swara combination.

## II. SAMPOORNA RAGA ALGORITHM

Step1: Sampoorna ragas in carnatic music has all the basic seven swaras.

Step2: The swaras found in sampoorna ragas are shadjam(s), rishabham[ sudha rishabham(r1),chathusruthi rishabham(r2) and shatsruthi rishabham(r3)],gandharam(shudha gandharam(g1), sadharana gandharam(g2), anthara gandharama(g3) ), Madhyamam(sudha madhyamam(m1) and prathi madhyamam(m2)),Panchamam(p),Dhaivatham(shudha dhaivatham(d1), chathusruthi dhaivatham(d2) and shatsruthi dhaivatham(d3)),Nishadham(shudha nishadham(n1), kaishiki nishadham(n2) and kakali nishadham(n3)).

Step3. listing all the possible combinations from the 16 swaras used to form the sampoorana raga list.

Step 4: Out of the 16 swaras keeping sudha madhyamam and prathimadhyamam as main reference for division, and excluding shadjam and panchamam as constant swaras with the rest of the 12 notes the possible combination without the frequencies getting repeated is 36[4].

Step 5. The shadjam frequency taking harmonium as reference is 440 Hz. It is a universal constant.

Step 6. The rest of the frequencies are calculated with the formula  $F_n = \text{BaseFreq} * 2^{(n/12)}$ , where n is the key number from the base key for which the frequency need to be calculated.

Step 7. If two frequencies are found to be same while traversing then that particular route is not taken into account.

## III. AVIVADI RAGA EXTRACTION ALGORITHM

Step1: take the shadjam(s), keeping the A as basic pitch, as root node with weight assigned as 440 hz.

Step4: Next assigning the shudha rishabham(r1), chathusruthi rishabham(r2) and shatsruthi rishabham(r3) as the next level nodes with weights assigned as 493.9, 523.25 and 554.24.

Step5: Next assigning the next level nodes as sudha gandharam(g1), sadharana gandharam(g2) and anthara gandharam(g3) respectively with weights as 523.25, 554.24 and 587.5.[6]

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Step6: Next assigning the next level nodes as sudha madhyamam(m1) and prathi madhyamam(m2) with weights 622.25 and 659.10 respectively.

Step 7. Assigning the next level node as panchamam(p0) with weight 698.6

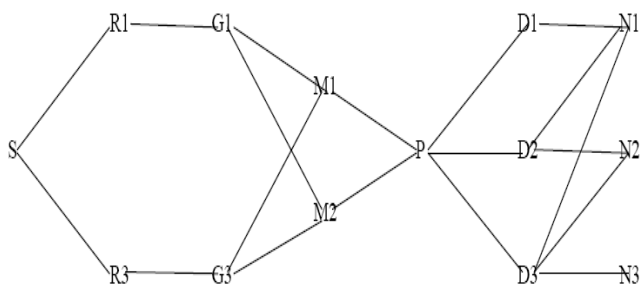
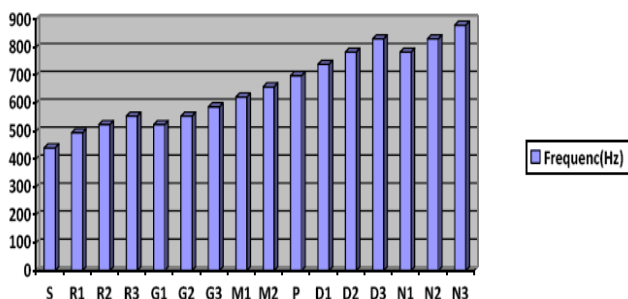
Step 8: Assign the next level nodes as sudha dhaivatham(d1), chathusruthi daivatham(d2) and shatsruthi daivatham(d3) with weights as 739.98, 783.8 and 830.6 respectively.

Step8. Assigning the leaf nodes to be sudha nishadham(n1), kaisiki nishadham(n2) and kakali nishadham(n3) with weights 783.8, 830.6 and 880 respectively.

Step 9. Traversing the above tree using breadth first search algorithm and derive all the possible 72 sampoorna ragas

Step 10: While traversing if the path has (r1 and g1) or (r3 and g3) or (d1 and n1) or (d3 and n3) , both in the same raga group it under vivadi ragas.[3]

Step 11: Group all other sampoorna ragas as avivadi ragas.

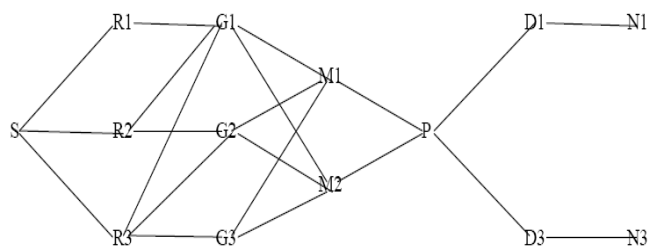


Graph-1 (VIVADI SAMPOORNA RAGAS SET 1)

In the first set of vivadi sampoorna raga set 1 all the swaras except R2 and G2 are included.[1]

1. Starting from shadjam and keeping R1 and G1 will yield 12 ragas
2. Again starting with shadjam and keeping R2 and G2 will yield 12 ragas, which are vivadi ragas.

In the second set of vivadi sampoorna ragas all swaras except the D2 and N2 are included.



Graph 2 (VIVADI SAMPOORNA RAGAS SET 2)

1. Start with shadjam and traversing in the path including D1 and N1 will yield 12 ragas
2. Again traversing in the path including D3 and N3 will yield 12 more ragas

Altogether in the above two graphs we will get 48 ragas out

of which 8 are repetition. Omitting the repeated one we will get 40 vivadi ragas

VIVADI RAGA Set 1. with (R1 and G1) and (R3 and G3)

1. S R1 G1 M1 P D1 N1

2. S R1 G1 M1 P D1 N2

3. S R1 G1 M1 P D1 N3

4. S R1 G1 M1 P D2 N2

5. S R1 G1 M1 P D2 N3

6. S R1 G1 M1 P D3 N3

7. S R1 G1 M2 P D1 N1

8. S R1 G1 M2 P D1 N2

9. S R1 G1 M2 P D1 N3

10. S R1 G1 M2 P D2 N2

11. S R1 G1 M2 P D2 N3

12. S R1 G1 M2 P D3 N3

13. S R3 G3 M1 P D1 N1

14. S R3 G3 M1 P D1 N2

15. S R3 G3 M1 P D1 N3

16. S R3 G3 M1 P D2 N2

17. S R3 G3 M1 P D2 N3

18. S R3 G3 M1 P D3 N3

19. S R3 G3 M2 P D1 N1

20. S R3 G3 M2 P D1 N2

21. S R3 G3 M2 P D1 N3

22. S R3 G3 M2 P D2 N2

23. S R3 G3 M2 P D2 N3

24. S R3 G3 M1 P D3 N3

VIVADI RAGA Set 1. with (D1 and N1) and (D3 and N3)

25. S R1 G2 M1 P D1 N1

26. S R1 G2 M1 P D3 N3

27. S R1 G2 M2 P D1 N1

28. S R1 G2 M2 P D3 N3

29. S R1 G3 M1 P D1 N1

30. S R1 G3 M1 P D3 N3

31. S R1 G3 M2 P D1 N1

32. S R1 G3 M2 P D3 N3

33. S R2 G2 M1 P D1 N1

34. S R2 G2 M1 P D3 N3

35. S R2 G2 M2 P D1 N1

36. S R2 G2 M2 P D3 N3

37. S R2 G3 M1 P D1 N1

38. S R2 G3 M1 P D3 N3

39. S R2 G3 M2 P D1 N1

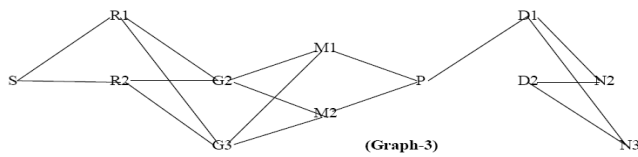
40. S R2 G3 M2 P D3 N3

Here all the swaras except the R3, G1,D3 and N1 are taken and

1. Traversing the graph through R1 will yield 16 ragas and traversing through R2 will yield 16 ragas[2].

The list of ragas derived by traversing the graph is shown below

Avivadi raga



AVIVADI RAGA
1. S R1 G2 M1 P D1 N2
2. S R1 G2 M1 P D1 N3
3. S R1 G2 M1 P D2 N2
4. S R1 G2 M1 P D2 N3
5. S R1 G2 M2 P D1 N2
6. S R1 G2 M2 P D1 N3
7. S R1 G2 M2 P D2 N2
8. S R1 G2 M2 P D2 N3
9. S R1 G3 M1 P D1 N2
10. S R1 G3 M1 P D1 N3
11. S R1 G3 M1 P D2 N2
12. S R1 G3 M1 P D2 N3
13. S R1 G3 M2 P D1 N2
14. S R1 G3 M2 P D1 N3
15. S R1 G3 M2 P D2 N2
16. S R1 G3 M2 P D2 N3
17. S R2 G2 M1 P D1 N2
18. S R2 G2 M1 P D1 N3
19. S R2 G2 M1 P D2 N2
20. S R2 G2 M1 P D2 N3
21. S R2 G2 M2 P D1 N2
22. S R2 G2 M2 P D1 N3
23. S R2 G2 M2 P D2 N2
24. S R2 G2 M2 P D2 N3
25. S R2 G3 M1 P D1 N2
26. S R2 G3 M1 P D1 N3
27. S R2 G3 M1 P D2 N2
28. S R2 G3 M1 P D2 N3
29. S R2 G3 M2 P D1 N2
30. S R2 G3 M2 P D1 N3
31. S R2 G3 M2 P D2 N2
32. S R2 G3 M2 P D2 N3

#### IV. CONCLUSION

The work gives details about the vivadi ragas and avivadi ragas classified out of Sampoorana ragas. Using the BFS

algorithm and taking the swaras as the nodes we have traversed and derived the 40 vivadi ragas and 32 avivadi ragas. The work can be extended to derive the broad number of janya ragas or child ragas and can also be later used in real time musical systems which can perform upon a real time basis and act as a accompanying artist.

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