

# Network of Musical Strings

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## Abstract

In this project we are considering a set of Ragas from Hindustani Classical Music and we are building a Network from them to analyse the obtained network for finding out certain interesting characteristics.

Here in each raga there are several compositions without any distinct composition boundary. But for our convenience we are assuming that consecutive 4 lines corresponds to a composition.

The basic notes are represented as **S r R g G m M P d D n N**, where the capital notes are sudhdha swaras, whereas small letters represent komal swaras. The only exception is madhyam (ma), where 'm' stands for sudhdha madhyam, and M stands for tivra madhyam (kadi ma). A note in lower octave is followed by '<', e.g. "d<" means komal dhaivat in the mandra saptak. Similarly, "d>" means komal dhaivat of the tad saptak (upper octave).

For example, we are considering a file, say Bhairavi.txt, where the compositions are written. We are taking a window of size four and considering them as a node in the network. For example, "g g r S n< S d d n d d g m d m P" is the composition and the nodes are:

- g g r S
- g r S n<
- r S n< S

- $S_n < S_d$
- $n < S_d$
- ....

Here we are looking at overlapping windows, because that way we do not have to justify where we start counting the window. In other words this is just the note 4-gram. In this way we are finding the unique nodes from these compositions. For each such composition the nodes present in that composition will be completely connected. The weights of the edges between any two nodes will be the number of compositions where these two nodes are present. So finally we are getting some cliques which are basically subgraphs of the total graph obtained from all the compositions of the considered Ragas.

So, in this project our objective is:

1. To analyze the weighted degree distribution (DD) of the obtained network.
2. To apply clustering on nodes.
3. To analyze the obtained clusters, i.e. what these clusters signifies? Whether they are the note sequences corresponding to the same raga (i.e. one cluster corresponds to one raga) or are they of the same composition (i.e. one cluster corresponds to one composition) or are they of similar ragas (i.e. one cluster corresponds to a set of similar ragas/ragas belonging to same "*That*")? The answer will depend on:
  - The set of compositions that we choose
  - The clustering algorithm, as well as the clustering parameters.
  - The inherent nature of the network and Hindustani music.