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 buildng 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 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.

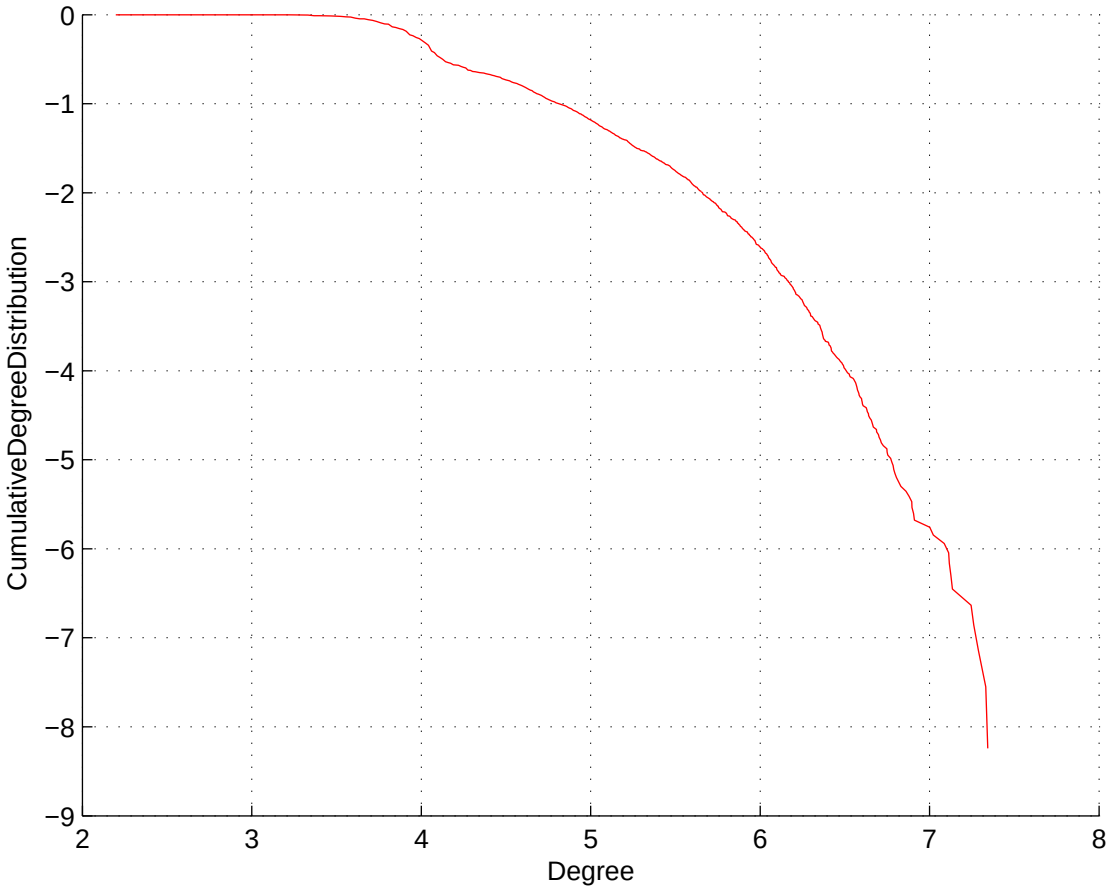

Figure 1: Loglog plot of Cumulative Degree Distribution

Progress:

- We have collected compositions for 10 Ragas.
- Encoded compositions for 2 more Ragas in the above stated format.
- Then created the network considering above assumptions.
- We have plotted the *Cumulative Degree Distribution* for the obtained network. The curve we have obtained for window size 4 is shown in Figure 1.

- We have created the network varying the window size from 2 to 7 and observed that the cumulative degree distribution curve is becoming steeper with increasing size of window.

Future Plan:

- Analyze the cumulative degree distribution curves for different window size; i.e., why the nature of the curve is so.
- Apply clustering on the network so that we can analyze what these clusters signify? Whether they are the note sequences corresponding to the same Raga (i.e. one cluster corresponds to one raga) or are they of similar Ragas (i.e. one cluster corresponds to a set of similar 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 Classical Music.
- Whether there exist some nodes having very high degree. If exists then whether they belong to most of the chosen Ragas and whether these note sequences are soothing or not. If they are soothing then what are the specialities about these sequences and whether there are any similarities among these nodes.
- We are also planning to construct the network considering each composion as a node. The egde between any two nodes exists if they have any note sequence in common. The weight of the edge will be number of occurences of such similar note sequences. We are planning to analyze this network in the same manner as we are going to do with the already created one and compare the significance of these two networks.