CAMeL: Carnatic Percussion Music Generation Using N-Gram and Clustering Approaches

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Automatic generation of music has been a focus of computational music research for a long time. Researchers have been designing systems to imitate or compose various musical styles from Classical to Jazz music [1], [2]. Despite the progress achieved so far in the development of music-generated systems for Western music genres there is limited work regarding methodologies of automatic generation of music performances in non-western music.
In this work, we propose CAMeL an automatic music generation system, which focuses on the generation of Carnatic style percussive rhythms. Carnatic music has a very well defined rhythmic framework and an interesting rhythmic structure [3], which makes it a perfect musical culture to explore the automatic music generation system.

The training corpus consisted of 15 percussion solo compositions in āditāla (8 beat-cycle) in three different tempo levels (slow/moderate/fast). The compositions were performed by a Carnatic music percussionist with the Kanjira and Mridangam traditional drum. All excerpts were manually annotated using Sonic Visualizer [4] with beats and downbeats. Each stroke event was coded as a string based on its frequency content (Lo-Mid-Hi), the inter-onset-interval (IOI) duration of the stroke and a value indicating the velocity of the stroke. Two musicians annotated the music excerpts. The normalized velocity values of the strokes were obtained by computing an onset detection function and estimating its amplitude level with a value between 0.2 and 1 according to the strength of the stroke. Initially, we used n-gram analysis to model the rhythmic sequences and structure of the music. This approach was partially successful and a new strategy based on clustering of groups of strokes was developed. A rhythmic grouping algorithm based on a theoretical model of distances between the pulses were used to model the rhythmical structure of the music and the K-means clustering approach was used to cluster the groupings in terms of similarity. We used a visualization technique to convert a high-dimensional data set into a matrix of pairwise similarities called, t-SNE [5] and computed the Euclidean distance between clusters of rhythm patterns. While generating rhythms in Carnatic percussive style, users can interact creatively with a 2 dimensional map with the rhythms by traveling in space and generate rhythms based on proximity and similarity.

Future work will test other approaches in the analysis-resynthesis process based on a musical dictionary of rhythmic phrases and deep learning methodologies. The dictionary approach will let us model the structure and grammar of the music by matching rhythmic phrases of the dictionary with the structure of the music. Long Short Term Memory Recurrent Neural Network (LSTM-RNN) can be more effective to model the long-term evolution and representation of rhythmic progression and enable to model longer segments of percussive music by creating recognizable sections of Carnatic music compositions such as moras and korvais.

References

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