MorpheuS: constraining structure in music generation

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March 11, 2016

A major problem with much of the automatically generated music is that it lacks a structure and long-term coherence. We have defined the music generation problem as a combinatorial optimization problem [2]. The advantage of this approach is that it gives us the freedom to impose both hard and soft constraints. These constraints can be used to define different types of structure.

One example of a structure that can be hard constrained is repeated, transposed patterns. The cosiatec pattern detection algorithm [3] was used to find maximum translatable patterns. These patterns were then used to constrain the output of a music generation algorithm called MorpheuS[1].

A second form of structure, which is soft constrained, is a tension profile. This type of tension could be relevant to, for instance, automatic generation of game or video music. We have developed a model [4] that captures aspects of tonal tension based on the spiral array [1], a three dimensional model for tonality. Our approach first segments a musical excerpt into equal length subdivisions and maps the notes to clouds of points in the spiral array. Using vector-based methods, four aspects of tonal tension are identified from these clouds: the cloud diameter measures the dispersion of clusters of notes in tonal space; the cloud momentum measures the movement of pitch sets in the spiral array; tensile strain measures the distance between the local and global tonal context; finally, cosine similarity measures the directional change for movements in tonal space.

[1] `http://dorienherremans.com/software`

The results of generating polyphonic piano music with constrained patterns and fit to a tension profile are very promising and sound musically interesting. The reader is invited to listen to full pieces generated by the algorithm at `dorienherremans.com/MorpheuS`.

References

[1] Chew, Elaine. *The Spiral Array*. Mathematical and Computational Modeling of Tonality. Springer US, 2014. 41-60.

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[3] Meredith, David. *COSIATEC and SIATECCompress: Pattern discovery by geometric compression*. International Society for Music Information Retrieval Conference. 2013.

[4] Herremans D., Chew E.. *Tension ribbons: Quantifying and visualising tonal tension*. Second International Conference on Technologies for Music Notation and Representation (TENOR). Cambridge, UK, 2016 (in press).