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# Trance generation by transformation

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## 1 Introduction

Music generation methods can be broadly divided into two categories: *rule-based* methods use specified rules and constraints for style emulation and algorithmic composition; *machine learning* approaches generate musical objects by sampling from statistical models built from large corpora of music. In this paper we apply a mixed approach, *generation by transformation*, which conserves structural features of an existing piece while generating variable parts with a statistical model (Bigo and Conklin, 2015; Goienetxea and Conklin, 2015).

In recent years several music informatics studies have started to explore *electronic dance music* (EDM) using audio analysis (Diakopoulos et al., 2009; Collins, 2012; Rocha et al., 2013; Yadati et al., 2014; Panteli et al., 2014). The symbolic generation of EDM is a new problem that has been explored in the work of Eigenfeldt and Pasquier (2013), who use a corpus of 100 EDM songs for the extraction of low order statistics. In our approach to EDM generation, a single *template piece* in Logic Pro X (LPX) format is transformed using a statistical model. As in most digital audio workstation formats, an LPX project contains effects, instrumentation, and orchestration, which can all be inherited by a transformed piece.

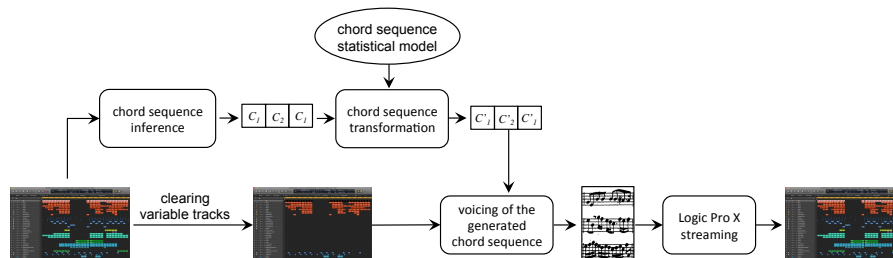
## 2 Methods

In this work we focus on generation of the EDM subgenre of *trance*. The approach to trance generation follows three steps: chord sequence extraction and transformation; chord voicing; and LPX streaming.

For chord sequence extraction, the MIDI tracks having pitch content are extracted from the original LPX template. A chord sequence (all chords with duration and onset information) and key region segmentation are inferred from the set of pitch tracks using automated harmonic analysis. A new chord sequence is then generated using iterative random walk (Whorley and Conklin, 2015) on a learned statistical model of chord sequences. The chord generation method conserves semiotic patterns (sequences of chord variables) during the statistical generation process (Conklin, 2015).

Following chord sequence transformation, the chord sequence is voiced in a way that transforms the original pitches respecting their original harmonic function in the template and attempting to minimize their distance to the template

itches. Various different search strategies for chord voicing have been implemented (Bigo and Conklin, 2015).



After transformation, the pitch content of the template piece is *streamed* back into LPX using the MIDI communication protocol to record transformed generated events into the variable tracks of the sequencer while leaving invariant tracks (e.g. percussion, audio effects: colored red in the figure above) and track effects unmodified. The figure shows this process where the lower sequence, cleared of variable tracks, has been filled again with transformations of the original LPX template (tracks colored in blue or green).

### 3 Results and discussion

Two professional trance templates (*Uplifting Trance Logic Pro X Template by Insight*, and *Uplifting Trance Logic Pro X Template by CJ Stone*, Daw Templates, Germany) were used to test the trance generation method. For example, the first template has the chord structure:

$$(f, Db, f, c)\{2\} + (f, Db, Ab, Eb)\{11\} + (f, Db, f, c)\{4\} + f$$

where  $\{n\}$  refers to  $n$  repetitions of the sequence in  $()$ . To transform this piece, several possible semiotic patterns can be used, for example:

$$\begin{aligned} &\circlearrowleft(ABAC) + \circlearrowleft(ABDE) + \circlearrowleft(ABAC) + A \\ &\circlearrowleft(ABCD) + \circlearrowleft(XXXX) + \circlearrowleft(ABCD) + A \\ &\circlearrowleft(AXXX) + \circlearrowleft(AXXX) + \circlearrowleft(AXXX) + A \end{aligned}$$

where the labels represent variables that map to chords, and  $\circlearrowleft$  indicates a cyclic pattern that is repeated an indefinite number of times (see Conklin, 2015). The first pattern thus represents a direct abstraction of the template piece; the second preserves repetition of the first and third loop chord sequences; the third only enforces that the first chord (the assumed tonic) is coherent throughout the piece.

The evaluation of music generated by statistical models is always a fascinating issue and naturally any final determination must be made by human listeners. The approach described herein has also been used to generate experimental stimuli for trance loop evaluation (Agres et al., 2015), using a model trained on a small corpus of trance anthem loops, with many of the sequences being rated highly by listeners.

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