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CAUI* Demonstration — Composing Music Based on Human Feelings

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Abstract

We demonstrate a method to locate relations and constraints between a music score and its impressions, by which we show that machine learning techniques may provide a powerful tool for composing music and analyzing human feelings. We examine its generality by modifying some arrangements to provide the subjects with a specified impression. This demonstration introduces some user interfaces, which are capable of predicting feelings and creating new objects based on seed structures, such as spectra and their transition for sounds that have been extracted and are perceived as favorable by the test subject.

Introduction

Music is a flow of information among its composer, player and audience. A composer writes a score that players play to create a sound to be listened by its audience. Since a score, a performance or MIDI data denotes a section of the flow, we can know a feeling caused by a piece of score or performance. A feeling consists of a very complex elements, which depend on each person, and are affected by a historical situation. Therefore, rather than clarifying what a human feeling is, we would like to clarify only musical structures that cause a specific feeling. Based on such structures, the authors constructed an automatic arrangement and composition system producing a piece causing a specified feeling on a person.

The system first collects person's feelings for some pieces, based on which it extracts a common musical structure causing a specific feeling. It arranges an existing song or composes a new piece to fit such a structure causing a specified feeling. In the following sections, we describe how to extract a musical structure, some methods for arrangement or composition, and the results of experiments.

Melody and Chords

We attempt to extract a musical structure based on melody and chords as shown in Figure 1. In a musical piece, a function — *tonic* (T), *dominant* (D), *subdominant* (S) or *subdominant minor* (SDm) — is assigned to each chord. This paper discusses the extraction of two aspects of the structure (i.e., each chord and a sequence of functions) from which the system derives constraints for assigning chords to a melody (supplemented by functions).

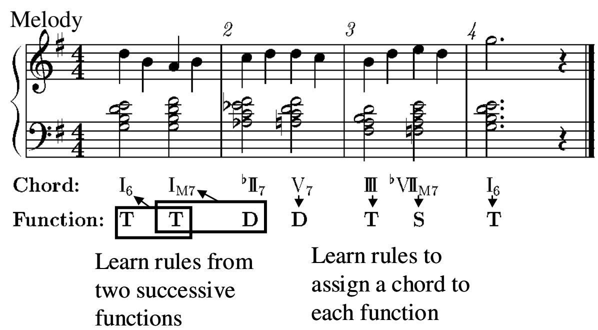

Figure 1: Melody and Chords

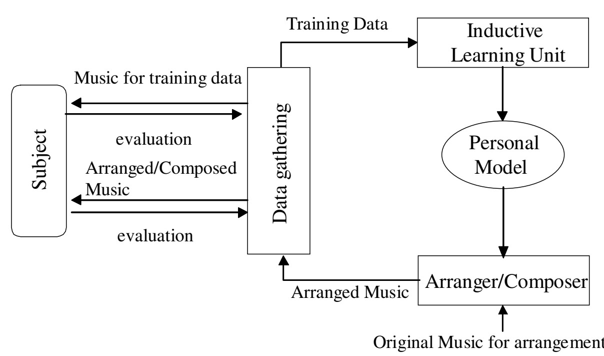

Figure 2: Demonstration Diagram

An arranger can assign chords based on the general theory of harmony, even though they are mediocre. Mimicking human arrangements (Numao, Kobayashi, & Sakaniwa 1997) introduces some *decorations* to the chords, refines the techniques used in the training examples, and improves the arrangement.

*Constructive Adaptive User Interface (See *Conclusion*.)

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Figure 3: A Created Favorite Piece of Subject A

Figure 4: A Created Favorite Piece of Subject B

Arrangement and Composition

Figure 2 shows a diagram of the demonstration. The authors prepared 75 well-known music pieces without modulation[1], from which they extracted 8 or 16 successive bars. For automatic arrangement they prepared other three pieces. The subject evaluated each piece as one of 5 grades for 6 pairs of adjectives: *bright - dark, stable - unstable, favorable - unfavorable, beautiful - ugly, happy - unhappy, heartrending - no heartrending*. For each adjective pair the system constructed a personal model of feeling, based on which it tried to arrange the prepared three pieces into ones causing a specified feeling. It was supplied 3 original pieces, and alternatively specified 6 adjective pairs, i.e., 12 adjectives. Therefore, it produced $3 * 12 = 36$ arranged pieces.

After the experiments in (Numao, Kobayashi, & Sakaniwa 1997), the system has been improved in collecting evaluation of each bar, introducing `triplet/3` and `frame/1`, and the search mechanism for chord progression. The above results support their effects.

Based on a collection of conditions ILP derives, we have obtained a personal model to evaluate a chord progression. A genetic algorithm (GA) produces a chord progression by using the model for its fitness function. Such a chord progression utilizes a melody generator to compose a piece from scratch rather than to arrange a given piece.

This system is profoundly different from other composing systems in that it composes based on a personal model extracted from a subject by using a machine learning method. A composing system using an interactive genetic algorithm (IGA) may be similar method to ours in that it creates a piece based on the user interaction. However, IGA requires far more interactions than ours, which reduces the number of interactions by utilizing a personal model generalized from examples. Other advantages are that we can recycle a personal model in many compositions, and manually tailor a predicate in the system to improve its performance.

[1] 39 Japanese *JPOP* songs and 36 pieces from classic music or textbooks for harmonics.

Conclusion

Figure 3 and 4 show created pieces. Figure 3 is a piece the system tried to make favorite of subject A. Figure 4 is one it tried to make favorite of subject B. These examples show that the system composes a favorite piece without handcrafted background knowledge on favorite songs of each subject and by automatically acquiring his/her favorite musical structures.

Our method extends the concept of adaptive user interfaces (Langley 1998) in a sense that it constructs a new description adaptively. That is why we call our system CAUI (a *constructive* adaptive user interface), whose detail is described in (Numao, Takagi, & Nakamura 2002).

References

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