The Kansei Music System '90
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ABSTRACT: Our goal is to construct a robotic system that can respond to music as a human, musician does. Musicians can play, write, read music, and transform music in their brains into various media if they have some experience. Even if they are not trained musicians, listeners can listen to and appreciate music and they may compose simple music. The KANSEI music system simulates such processes. This paper presents ongoing developments of the KANSEI music system, focusing on transcription system from sound based on different instruments to score, music interpretation system and assistant system for music composition.

1. Introduction
Our current main project is the construction of the KANSEI music system. "Kansei" is a Japanese word that means sense, feeling, emotion, or sensibility. It is a subjective concept, used as a context of intelligence.

The goal is to construct a system (robot) that can respond to music as a human, musician does. Musicians can play, write, read music, and transform music in their brains into various media, if they have some experience. Even if they are not trained musicians, listeners can listen to and appreciate music and they may compose simple music. It seems very interesting to simulate such processes. The central problem is to make the machine feel music. Note that our goal is not to explain human feeling. The goal is to make the machine feel music, to make it like us.

To carry out this goal, transcription system, music reading system, sentiment extraction, music interpretation system have been developed. Four kinds of data are used in the KANSEI music system; note-representation to represent delicate control of a performance, note-representation to make a score, data structure to represent musical syntax, symbols with parameters to represent kansei. Functions to convert data structure each other are prepared in the KANSEI music system.

In this paper, ongoing activities explored in transcription, music interpretation and computer-assisted music composition will be introduced.

2. Automatic Transcription from sound based on two instruments
Two transcription systems are used practically in our music system. One is a system to transcribe a Japanese folk-song and the other is transcription system for polyphony based on a piano, guitar, or a shamisen (a traditional Japanese instrument like a lute). These are examples of transcription systems which are utilizing AI techniques and lessening constraint of the processing. But they can't deal with source-separation of multiple instruments. A transcription system for polyphony based on two instruments are now being constucted as a prototype. The distinct point of the new system is that it selects the most appropriate processing procedures according to the characteristics of the signal models. For example, the difference of the envelop should be attached importance in order to separate notes of piano and clarinet. The difference of the umbes should be taken into consideration in order to separate the sources whose envelop are similar. The system analyzes the difference of the signal models and calculates the the reliability of each evidence of umbral, envelop and vibrate for the separation of source and notes. Each

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evidence is extracted from the time-frequency map and its differentiation map along time axis.

Experiments we have done are limited to source separation of given two instruments among piano, guitar, clarinet and violin. Most current recognition rates are below 90%. The method however, is very hopeful, because the conceptual basis is very similar to human perception of acoustics.

![Figure 1. Outline of Music Understanding](image)

3. Music Interpretation

Music interpretation, the process of creating a virtuos performance from a score, is an object of our studies. We have been constructed a system that generates sophisticated performance data using MIDI from a score image that is automatically read in using optical scanning system. A score is analyzed as to its style and described as a combination of objects (motives). Performance data of music is generated by the product of obtained results by applying rules that describe how to play the objects and expression marks that are explicitly described in a score. Performance rules must be based on style analysis besides expression marks.

Nuance of performance can be obtained from a performance utilizing score information. This process corresponds to our listening to the music, imagining its score. Our current interest is to have the machine learn how to interpret music. We assume that the rules used in the interpretation process consist of the strategy to group (extract) motives or phrases and performance rules to convert objects and expression marks into MIDI data. The interpretation system has a module to group music based on similarity of the form of note sequence, and tries to
find how to play expression marks, how to express particular motives. The system also tries to understand in which way a human performer group a piece of music, by investigating the position of rests which should be added between phrases.

![Outline of Music Interpretation](image)

4. Computer-assisted music composition

Music composition entails the opposite kind of processing required for sentiment extraction. One extension of our goal is to use sentiments for the decision-making problem in computer composition. An experiment was made to generate chord progressions by specifying gradual changes in feeling with a few parameters which were obtained using factor analysis. A system, based on above experiments, that completes a piece of music from obtained chord progressions has been developed. The functions of the system are melody generation, rhythm arrangement, chord arrangement and structure arrangement.

The expectation model is now being studied to generate a piece of melody. The expectation model groups given notes sequence so that its entropy may become minimum. The entropy is thought to have information of how much the rest of the music can be expected. It is one of the prominent parameters that tie feeling with music.

5. Conclusion

Our ongoing music studies; transcription, music interpretation and computer-assisted music composition have been introduced in this paper. At the conference, we will present the details of KANSEI music system focusing on current development.

References:

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