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Logical Representation of Musical Concepts (for Analysis and Composition Tasks Using Computers) by Somnuk Phon-Amnuaisuk

This paper proposes a new form of knowledge representation for music based on the first-order logic reasoning. In the paper, Phon-Amnuaisuk first described the previous research works on musical concept representation, and pointed out the requirements of such system, including the capability of managing a reasonable number of rules, an explicit encoding of heuristics, and supports for explanation. He then classified the existing representations into four categories: notation typesetters, sequencers, synthesizers, and inferers.

In order to support the computation tasks of music analysis and composition in computers, Phon-Amnuaisuk argued that building a good musical representation is a prerequisite and should involve various considerations, such as abstraction, expressiveness, multiple-views and reasoning efficiency. Before proposing his representation, Phon-Amnuaisuk defined three types of musical analysis tasks: narrative and descriptive approach records musical concepts in text descriptions; analyze structural patterns search for certain pre-defined musical patterns from the pieces; and analyze extra-musical contents interpret more details of music materials.

Phon-Amnuaisuk then described his logical representation. In order to satisfy the requirements of abstraction and expressiveness, he represented musical concepts in logical language based on the primitives he selected, including pitch-related attributes, performing instruction-related attributes, structure-related attributes, etc. He also defined certain operations for reasoning with musical concepts. For example, he described how to form a new concept, how to compare concepts in terms of similarity, and how to transform concepts in time domain and pitch domain. At last, Phon-Amnuaisuk provided an example of the harmonization results of Bach's chorales using the logical representation.

First-order logic is a very traditional way for representing knowledge in artificial intelligent. It is human readable and computationally efficient. In order to use it, the basic terms and operations need to be carefully designed. In this paper, the author mapped certain musical concepts such as pitch, duration, and phrase to the logical terms. He also defined some basic operations among those terms but not discussed comprehensively. The worst part of the paper is that he provided a score of the harmonization results of Bach's chorales without providing the details of the process and the whole part seemed to be out of place. But his design of the representation seems reasonable to me. I do give him credits for the design because coding music in logic language is not a straightforward process. However, without seeing the details of the operations, it is difficult for me to believe the representation really works.