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Music Theory Ontology

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Original problem

Development of music score retrieval system, that performs content-based retrieval having a score fragment as input query. The system works with a database of music scores stored as MusicXML files, the format that is supported in various music notation software. MusicXML files are structured documents, but the traditional structured retrieval methods have to be modified to work in the domain: the files with formally different content can represent the same composition (e.g. written in different keys).

The task is to find compositions containing fragments similar to the given one.

Solution

Method. The query and a music score from the library are similar in some measure, so the retrieval method based on rippling is proposed. Rippling is used in automated reasoning with mathematical induction (www.rippling.org). The induction hypothesis is syntactically similar to conclusion, so we mark their common parts (skeleton) and try to reduce differences by applying rewriting rules. The skeleton should not be changed during rewriting. To apply the method for music information retrieval we defined a set of wave-rules and a measure to estimate similarity between music fragments.

Improvement. Up to the moment the rules are embedded in the system, they are stored as a part of the program code. We propose to store a set of rules and other information useful for retrieval as a knowledge base organized as an ontology. That allows to modify and extend the knowledge base.

Result

Ontology

URI: http://purl.org/warble/
Number of triples: 3597 (calculated with SPARQL query using openrdf-sesame + OWLIM-Lite)
Language: OWL 2 RL. This langauge allows effective reasoning and has many implementations, including triplestores.
Content: The ontology describes pri-mary western music model and includes such concepts as notes, pitches, octaves, musical intervals, modes, scales, etc.

Architecture

The ontology is divided into several modules: *common.owl*, *note.owl*, *interval.owl*, *tonality.owl*, and *chord.owl*. All these files are imported by the main file *warble.owl*. In common.owl the main and general for entire ontology entities are defined. *note.owl* describes notes, accidentals, octaves, pitches, and different note subclasses and families. *interval.owl* include interval types and intervals description, as well as relationships between intervals. *tonality.owl* contains definitions of modes, scales, and corresponding relationships. And finally, chords.owl defines chord types.

Development

Some parts of the ontology describe a large number of very similar objects (e.g. 120 audible pitches or 328 corresponding notes). These descriptions are generated automatically with *python scripts*. All generated and manually created ontology files are implemented in *n-triples syntax* and translated to *rdf/xml* with *cwm* utility.

Related work

There is already the set of ontologies by OMRAS2 project (http://www.omras2.com) describing music theory but they are made in OWL 2 Full profile and lack some integrality.

Conclusion and future work

We've presented a music theory ontology, that makes the information from music theory be accessible by search engine from one side and accessible by knowledge engineers from the other. The work is still in progress, but the use of ontology helps to organize knowledge base for our system.