Modele i metody komputerowego generowania aranżacji muzycznych oraz badania ich podobieństwa

Models and Methods of Automated Music Arrangement and Similarity Measurement

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In the PhD thesis the author provides a description for methods of music arrangement and comparison. The main aim of the study is to: improve the currently existing graph-based models of a musical piece, describe methods of generating arrangements upon this graph-based representation and create new methods of comparing musical pieces.

The research was focused on two main topics. First of them was formalization of methods allowing to create arrangements based on the original piece, maintaining its style and relationships between notes. To achieve this, the author provides a formal description of representing a musical piece (stored originally in a MIDI/XML file) as a graph or network (i.e. weighted graph). Three different approaches for mapping notes to vertices have been defined and various methods of reflecting the relationships between notes have been formally introduced.

This part of the study was followed by a description of methods to create arrangements based on this graph structure. Using the theory of stochastic processes there are various approaches of so-called *random walk* used to create the arrangement. The author provides formulae to calculate the initial distribution vector and the transition matrix determining the probability of choosing the particular neighboring vertex.

The second part of the thesis describes methods for comparing musical pieces. The author defines a set of metrics to calculate the similarity of musical pieces (both arrangements created above as well as entirely different tracks). To do so, their graph representation are being compared instead of comparing the musical pieces themselves. By calculating graph-based characteristics and calculating the distance between both tracks some similarities may be discovered in terms of relations between notes (thus ignoring details irrelevant in this application – like a key of both pieces). The thesis also describes a set of text-based methods and a similarity metric that takes into account both the structure and quantitative measures that are preserved in a network representing a piece.

In the last thesis' part the author conducts a series of experiments to validate the results for the described methods. The evidence was provided that the more information from the original

track is retained in the graph structure, the bigger the similarity between original pieces and generated arrangements. Also the research proves that the methods for comparing musical pieces may be used for detecting plagiarism.

The possible applications of the research differ between the parts of the thesis. Automated music arrangement may be used by the composers to discover new musical themes that preserve the style of the original pieces yet differ in some details of the notes being used. These methods may also be used for composing ambient music. The second area of research – comparing different pieces – may be used for comparing arrangements (both abovementioned computer-generated as well as human-created). There is also a possibility to utilize them in legal applications – for automated plagiarism control.