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The Role of Computer Simulation of the Process of Musical Creativity

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Abstract: A method of applying mathematical modeling to the process of creating musical scores in MIDI format as an abstract text based on the analysis of statistical parameters is considered, followed by modeling the process of musical creativity based on the data obtained.

Key words: modeling, identification, hard-to-formalizable subject areas, music-computer technologies.

INTRODUCTION

In the second half of the XX - beginning of the XXI century. a new direction appeared in the art of music and in modeling the regularities of musical creativity, due to the rapid development of electronic musical instruments (from the simplest synthesizers to powerful musical computers). A new interdisciplinary field of professional activity has emerged, associated with the creation and use of specialized musical software and hardware, requiring knowledge and skills both in the musical field and in the field of computer science - music and computer technologies (hereinafter - MCT) [3]. This served as an effective basis for constructing a model of musical creativity, which allows for the analysis and synthesis of musical texts based on the statistical parameters of fragments of musical works [1].

MATERIALS AND METHODS

Many research centers around the world are conducting research in the field of modeling the logical patterns of music, digital synthesis, analysis and transformation of sounds based on MCT: University of Hertfordshire, The University of Salford, Access to Music Ltd., Bedford College in the UK; Institut fur Musik und Akustik (Zentrum fur Kunst und Medientechnologie) in Germany; CEMAMu (Centre d'Etudes Mathematiques et Automatiques Musicales), Institute for Research and Coordination of Acoustics and Music (IRCAM) at the Pompidou Center in France; Center for Musical Experiment University of California; Centers for Computer Research in Music and Acoustics (CCRMA) Stanford University, New York University, Full Sail University (Florida) in the USA), etc.

RESULTS AND DISCUSSION

In the proposed approach, musical fragments in MIDI format (scores) are considered as an abstract text. The main attention is paid to the processing and structuring of statistical information obtained from text analysis by standard methods. Research at this stage makes it possible to identify a greater number of patterns (compared to the standard approach), to make modeling and interactive experiments possible, and in the future to provide the possibility of semantic analysis. Such a

research tool makes it possible to obtain specific results in the following theoretical and practical areas:

- building models of sound sequences that meet the given conditions;
- study of the peculiarities of the perception of sound signals as an information flow; establishing the belonging of various sound fragments to certain types; establishing the authorship of sound recordings;
- restoration of lost fragments of audio recordings; imitation of sound signals of a given nature, etc.

Suggested research methods and approaches

Statistical analysis, graph theory, and integer methods for solving statistical problems are used as research methods in our work. Computer implementation of the developed algorithms was carried out on the basis of an object-oriented approach.

The following new approaches have been developed:

1. A model consisting of separate independent blocks that reflect the patterns of the sound sequence, which allows you to study the patterns both independently and in their connection with each other, consider both the internal connections of a particular block of the model, and the role of each block in the model on one's own.

2. The model does not use various kinds of rigid templates containing parts of ready-made sound fragments.

3. The model is built in such a way that changing the parameters during its operation does not cause errors in the calculation and allows you to make changes during the operation of the model, which ensures interactive experiments.

We especially emphasize that the developed approach can be used to analyze other types of abstract texts that are difficult to formalize in various subject areas, for example, in the study of biological and social processes.

These features distinguish the proposed model from analogues and provide its advantages as a tool for studying patterns in sound recordings in comparison with existing models. A method of stage-by-stage analysis of the stream of sound events is proposed, aimed at identifying patterns in the analyzed stream:

1) determination of the analyzed parameters and the type of their values;

2) determination of the area of acceptable values for all parameters;

3) preliminary frequency analysis of parameter values;

4) search for cycles/periods;

5) secondary frequency analysis taking into account periods;

6) analysis of frequency correlation with periods;

7) analysis of matrices of transition coefficients;

8) semantic analysis within periods.

Also, as one of the approaches, methods of formalization of musical notation are used, including the correlation of modern forms of computer notation with the general mathematical theory of sets and with mathematical models that take into account the probabilistic-statistical parameters of musical logic [2].

Thus, the task of modeling is to describe the largest number of patterns determined by various traditions, imposed on a random sequence in order to “filter” the musical text from it.

Execution. In order to shorten the boundaries of the model, we single out those characteristics of sounds that depend on the performance and exclude them from consideration. The characteristics that determine performance will include:

- timbre – an individual timbre of the instrument, determined by the design features of the instrument, the individual characteristics of the sound extraction inherent in the musician, and the articulation indicated in the score;
- loudness determined by the design features of the instrument and listening conditions, the desired volume of the instrument, set during listening, pitch and articulation indicated in the score.

The identified patterns of execution are quite complex and are subject to separate study. In our work, their analysis is not considered; however, the minimum possibilities of synthesis are implemented. When modeling synthesis, it is enough to limit ourselves to the capabilities of existing synthesizers that allow you to reproduce the sound of various musical instruments with some fixed timbre and volume.

CONCLUSION

It should be noted that at the moment, on the one hand, there is a need to train musicians who are versed in modern MCT and information technologies in music; on the other hand, technical specialists with the basics of general musical education and knowledge in the field of sound programming, sound synthesis, audio engineering, sound-timbral programming, modeling of musical and creative processes and professionally owning studio sound recording technologies, specialized software; specialists who are able to engage in modeling as one of the promising methods for an objective study of musical creativity.

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