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Methodologies for Expressiveness Modeling of and for Music Performance
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It can be noticed that music performance is an interesting topic for scientific investigation and for technology research. It involves human non-verbal communication. Music is an important means of communication where three actors participate: the composer, the performer, and the listener. The composer expresses his/her emotions, feelings in the piece of music and the performer communicates them to the listener. Music performance includes all the human activity that lies between the symbolic score and the music instrument. The study describes models for understanding, performance synthesis, and artistic creation.

In science, models are employed to evidence and abstract some relations that can be hypothesized, discarding details that are felt to be irrelevant for what is being observed. Models can be used to predict behaviors in certain conditions and compare these results with observations. The first computational models were mainly dedicated to music production and experimentation and were embedded in computer programs for music synthesis and for interactive performance. The complete model tries to explain all the observed performance deviations on the basis of the given data. Another model is the partial model which aims only to explain what can be explained at note level, giving a small set of rules. When rules for categorical decisions used, more understandable results can be obtained.

The classical approach to describe relations in models is by using mathematical expressions composed of observable facts called variables. In the music performance we can distinguish three layers, the first is the physical information that can be measured as timing, the second layer is the symbolic information as the score, and the third is expressive information. In performance modeling, all the information levels should be taken into account in a coordinated way.

The communication of expressive content can be studied by considering the composer's message, the expressive intentions of the performer, and listener's perceptual experience. The contribution of the performer to expression communication should clarify the composer's message and to add personal interpretation of the piece. Expressiveness related to the musical structure may depend on the dramatic narrative developed by the performer, on physical and actual performance situation, and cultural norm. In this study experiments are carried out by asking performers to play the same piece according to diverse specific adjectives, or trying to convey different content. The researchers try to understand and model the strategies used in these performances.

The study describes the music performance and observes the variations a music performer is doing when he/she plays. This kind of information is often called expressive parameters. At a physical information level, the main expressive parameters considered in the models are related to timing of musical events, and tempo, and articulation. There parameters are particularly relevant for keyboard instruments. In contemporary music, timbre is often an essential expressive parameter. The progress of computational analysis techniques should provide useful and standardized tools for parameter detection.

A key issue is how the model represents the information. The most important aspect is the representation of time .Models of timing normally aim to describe the relation between performance and score time. An important aspect of time representation is tempo that is the reciprocal of durations as a function of score position. Models for understanding usually describe tempo as function of score position and measure it in seconds per metrical unit.

Another aspect of the representation is the granularity. The information is represented as numerical values. Music is an organization of events in time; therefore models are developed for representing performance aspects at different time scales.

The performance expressiveness aim at understanding the systematic presence of deviations from musical notation as a communication means between musician and listener. Some models for music performance were described as local models, hierarchical models, and composed models. Models are sometimes combined using the output of a model as input to a second one.

For comparing the performances, a supposed ideal performance is taken as reference by the evaluator. Sometimes, an actual reference performance can be assumed. Performances are represented by a set of values. It is not clear how to combine time and loudness distances for a comprehensive performance comparison.

The most prevalent strategies in developing the structure of a model and in finding its parameters are analysis by measurement and analysis by synthesis. The analysis by measurement method consists of different stages :(1) selection of performance, (2)Measurement of the physical properties of every note, (3) Reliability control and classification of performances, (4) Selection and analysis of the most relevant variables,(5) Statistical analysis and development of mathematical interpretation models of the data. In Analysis by synthesis strategy, it starts from the results of the previous stages and continuing with the following stages: (6) synthesis of performances with systematic variations, (7) Judgment of synthesized versions, (8) Control of the reliability of the judgment followed by classification of the listeners, (9) study of relation between performance and experimental variables, (10) Repetition of the procedure 3-9 until the results converge.

The aim of Machine learning method is to search for and discover complex dependencies in very large data sets, without any preliminary hypothesis. There are some models for music production as performance synthesis models. When we listen to classic music performance, we are aware that it is just a reproduction of an event and not and experience of the music as it was conceived at its time.

This study considered performance models for non-verbal communication in a successful design of multimodal systems. New synthesis algorithms were discovered, such as frequency modulation, and new paradigms were developed for musical sound generation, such as spectral and physical models. In music technology the concept of mapping strategies are important. The simplest approach refers specific relations: like how to convert pitch and loudness information into proper spectral and micro-timing values of a synthetic note. Music is an immaterial art that has a strong tradition of symbolic representation and abstract thinking. This leads to the point that musicians are most successful in finding the relation between art and science. The different scientific approaches for the music performance are needed. One way is to start modeling the classical music performance and then generalize their results and apply them to new music creation. Another way could be starts from practical knowledge of new music creators to extract proposals of new performance models.