

Musical style again: A mathematical analysis of musical intertext

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Background in Systematic Musicology. One of the main problem the systematic musicology faces today is to study the complex phenomena of musical “intertextuality” that spread the contemporary music production through the collage and mixture of different musical styles and genres. While the investigation on musical style has been one of the crucial aspect of systematic musicology (e.g. La Rue 1970, Imberty 1981, Meyer 1989), stylistic influence turns out to be a less studied phenomena. Stylistic influence has been interpreted either as a negative aspect or, on the contrary, as a creative element (Rosen 1980), or again, as an anxiety feeling towards the predecessors (Korsyn 1991, Straus 1991). Burkholder (1995) has created a taxonomic system for classifying the different ways a given musical style can be used (quotation, pot-pourri, quodlibet, collage, patchwork etc). With respect this issue, the theory of Intertextuality represents an innovative approach that deserve further analysis and exploration. Starting from the concepts of “dialogicity” (Bachtin 1981) and “intertext” (Barthes 1973, 1986), the musical piece is analysed and interpreted as a place where different languages, styles and identities cohabit at the same time (Hatten 1985, Agawu 1991, Ramaut 1998, Addressi 2000).

While different computational approaches have been developed in order to describe and explore single styles (Baroni et Al 1999, Cope 2001), very little is known concerning quantitative and algorithmic intertextual approaches to musical creations sharing different styles.

Background in Mathematics.

Even if we still don't have a satisfactory mathematical theory of “styles”, few recent and distinct developments in “quantitative information extraction” out of symbolic sequences and time series indicates possible directions for a mathematical approach to “musical intertexts”.

For example, recent experiments concerning authorship attribution in literary texts yields to the development of new similarity measures and novel entropy methods that seems quite useful also for detecting similarities and for solving

"clusterization" problems when applied to signals of other nature (e.g. biological, see Degli Esposti et Al 2007). In their original form these methods are not indicate for a direct application to music files but they nevertheless inspire possible approaches for measuring music styles correlations and influences.

Another important mathematical issue in the background of this research is represented by recent theoretical and experimental advances in "feature extraction" and "feature selections" for audio signals (Pachet and Roy 2007) : a genetic algorithm based on the evolution of several canonical elementary operators acting on the segmented signals, together with a suitable method for evaluating the "discriminating capacity" of the selected features might allow a better understanding of the mathematical structure of "musical intertexts".

Background in Artificial Intelligence.

In this field , two main approaches have been developed for the characterization of musical style: the first one, inspired by Chomski's theory , is based on musical grammar (Baroni et Al. 1999); the second one, roughly speaking, is instead based on information theory (Cope 2001). We are not aware of any computational approach to "musical intertexts".

At the CSL Sony an innovative interactive system, called the Continuator, was elaborated able to create a sort of musical intertext, by imitating the style of the human playing a keyboard (Pachet 2003). Furthermore, studies on audio signal analysis are carried out in order to extract musical descriptors characterizing musical genres (Pachet 2004, Pachet and Roy 2007).

Aims

The main aim of our research project is to combine the intertextual musicological approach with recent perspectives in computer based "musical descriptors extractors". Starting from the analytical description of musical styles, we work for developing and testing novel mathematical and algorithmic results aimed to analyze given musical pieces within an intertextual approach.

Main contribution

One of the main problem we face is to study from different perspectives (poietic and esthetic analysis) the complex phenomena of musical intertextuality. Our project is divided in two phases: the first one is to analyse the recurrences of different stylistic topics in a given musical pieces by suitable mathematical analysis of the audio signals. Then, inspired by recent theoretical and experimental advances in "opinion dynamics" in social networks, we plane to explore the social-cultural aspects of musical intertext through web based experiments.

Conclusions and Implications.

This research project is still in its infancy and must be considered as a working in progress. Nevertheless, our main contribution is to discuss and investigate the problem by suggesting novel theoretical and practical methods for investigating musical intertextuality, both from the analytical and auditive point of view. We are strongly convinced that the cooperative exchange of ideas between systematic musicology and pure/applied mathematics will lead to a significance progress in this kind of research, and we wish to report on these initial steps.

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