

# Complexity of musical patterns

Reserved for Yuping Ren

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At the simplest level, musical pieces consist of the repetition of a discrete set of different sounds, which differ in pitch and duration. In Western music, each musical instrument, or singer's voice, can emit only a limited number of such sounds, as there are only 12 different pitches per octave, and 7 commonly used note values. Nevertheless, a wealth of different compositions and styles can arise from just these elements.

This project aims to analyze classical music compositions using a multiplex network approach, where each voice or instrument in a piece corresponds to a layer. Each layer is represented by a directed weighted network, where the nodes correspond to notes, distinguished both by pitch and duration, and the directed links connect notes played in sequence. The inter-layer connections are undirected, and correspond to the simultaneous playing of two notes by two different instruments or notes. The resulting multiplex will then be analyzed by means of different network metrics and projections, trying to infer differences and similarities between musical styles.

As a network representation of the kind described above is clearly static, the student will also measure the time-complexity of the musical pieces by computing a family of time-displaced correlation functions, thus attempting to quantify the recurrence of musical motifs.