

MuSA.RT: Music on the Spiral Array . Real-Time *

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ABSTRACT

We present MuSA.RT, Opus 1, a multimodal interactive system for music analysis and visualization using the Spiral Array model. Real-time MIDI input from a live performance is processed, analyzed and mapped to the 3D model, revealing tonal structures such as pitches, chords and keys. A user can concurrently navigate through the Spiral Array space using a gamepad or set the camera control to automatic pilot. The interaction among and concurrent processing of the different data streams is made possible through the Modular Flow Scheduling Middleware.

Categories and Subject Descriptors

H.5.5 [Information Interfaces and Presentation]: Sound and Music Computing—*Systems*; I.5.5 [Pattern Recognition]: Implementation—*Interactive Systems*; J.5 [Computer Applications]: Arts and Humanities—*Performing Arts*

General Terms

Algorithms, design, experimentation, human factors, theory

Keywords

Spiral Array, SAI, MFSM, music analysis, system implementation, music visualization

1. INTRODUCTION

A defining feature of tonal music is the unfolding of pitch structures over time. Real-time tracking of tonal patterns in

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Figure 1: The MuSA.RT System.

music has widespread applications in music analysis, information retrieval, performance analysis and expression synthesis. Each piece of music consists of a sequential arrangement of notes that generates pitch structures over time. An expert listener is able to ascertain the keys and harmonic patterns traversed over time. But a novice or a computer would benefit greatly from a geometric model that can provide visual cues and numeric quantifying of these tonal properties. We present MuSA.RT (Music on the Spiral Array . Real-Time), a system for real-time analysis and interactive visualization of tonal patterns in music.

MuSA.RT maps real-time MIDI input, for example from a live performance, to the Spiral Array [1], a 3D model for tonality. The analysis and graphical rendering reveal the presently active set of pitch classes, and higher level constructs, such as the current chord and key. At the same time, the user can control the camera using a gaming device and navigate through the Spiral Array space.

2. THE SPIRAL ARRAY

The Spiral Array model is a geometric model for tonality rooted in the theory and perception of music. Tonality exhibits a high degree of symmetry and transformational invariance. For this reason, spiral and toroid structures are particularly well-suited to representing tonal relations.

The Spiral Array model incorporates multiple levels of descriptions by generating an array of spirals each representing entities at a different hierarchical level. The outermost pitch spiral has a configuration that clusters pitches

