JCMS Special Issue of the First Conference on AI Music Creativity

1 Introduction

The International conference on AI Music Creativity (AIMC; https://ai-musiccreativity.org/) is the merger of the international workshop on Musical Metacreation (MUME; https://musicalmetacreation.org/) and the conference series on Computer Simulation of Music Creativity (CSMC; https://csmc2016.wordpress.com/). This special issue gathers selected papers from the first edition of the conference along with paper versions of two of its keynotes.

This special issue contains six papers that apply novel approaches to the generation and classification of music. Covering several generative musical tasks such as composition, rhythm generation, orchestration, as well as some machine listening task of tempo and genre recognition, these selected papers present state of the art techniques in Music AI. The issue opens up with an ode on computer Musicking, by keynote speaker Alice Eldridge, and Johan Sundberg's use of analysis-by-synthesis for musical applications.

Cale Plut, Philippe Pasquier, and Anna Jordanous, co-editors.

2 Included papers in order

Eldridge, Alice. ***Computer Musicking as Onto-Epistemic Playground: On the Joy of Developing Complexity Literacy and Learning to Let Others Be***

Abstract

Theories across sciences and humanities posit a central role for musicking in the evolution of the social, biological and technical patterns that underpin modern humanity. In this talk I suggest that contemporary computer musicking can play a similarly critical role in supporting us through contemporary existential, ecological, technological and social crises, by providing a space for reworking

our relationships with each other and the world, including the technologies that we make. Framed by Gregory Bateson's analysis of the fundamental epistemological error which leads to interrelated existential, social and ecological crises, I will draw upon a range of personal projects to illustrate the value of computer music practices in learning to think better: from cybernetic generative art, through ecosystemic evolutionary art and feedback musicianship to the need for interactive approaches to algorithm interpretation in machine listening to biodiversity. I will illustrate how computer musicking can help in three ways: firstly by developing complexity literacy, helping us to better understand the complex systems of the anthropocene; secondly by providing a space to explore other modes of relation through learning to let others be; and thirdly to clarify the importance of aligning technologies with and not against, the biosphere. As prehistoric musicking made us human, so contemporary computer musicking can help us learn to think through the challenges we face today and be better humans tomorrow.

Sundberg, Johan. ***Three Applications of Analysis-by-Synthesis in Music Science***

Abstract

The article describes how my research has applied the analysis-by-synthesis strategy to (1) the composition of melodies in the style of nursery tunes, (2) music performance and (3) vocal singing. The descriptions are formulated as generative grammars, which consist of a set of ordered, context-dependent rules capable of producing sound examples. These examples readily reveal observable weaknesses in the descriptions, the origins of which can be traced in the rule system and eliminated. The grammar describing the compositional style of the nursery tunes demonstrates the paramount relevance of a hierarchical structure. Principles underlying the transformation from a music score file to a synthesized performance are derived from recommendations by a violinist and music performance coach, and can thus be regarded as a description of his professional skills as musician and pedagogue. Also in this case the grammar demonstrates the relevance of a hierarchical structure in terms of grouping, and reflects the role of expectation in music listening. The rule system describing singing voice synthesis specifies acoustic characteristics of performance details. The descriptions are complemented by sound examples illustrating the effects of identified compositional and performance rules in the genres analysed.

Dubnov, Shlomo; Chen, Ke; and Huang, Kevin. ***Deep Musical Information Dynamics: Novel Framework for Reduced Neural-Network Music Representation with Applications to MIDI and Audio Analysis and Improvisation***

Abstract

In this paper we use a recently proposed framework called Deep Musical Information Dynamics (DMID) to explore information contents of deep neural models of music by applying bit-rate reduction to latent representations that are used to generate the musical surface. Our approach is partially motivated by rate-distortion theories of human cognition that claim that in order to deal with the complexity of sensory information some information must be lost or discarded in the act of perception. When lossy encoding is done over time, this may alter the anticipations that are formed within and across voices at different levels of representation of the musical structure. Moreover, we postulate that a goal of a musical machine learning system, and possibly human musical learning system, is learning a latent representation that "explains out" most of the Information Dynamics of the Musical surface. This assumption is explored in DMID through several experiments on symbolic (MIDI) and acoustic (spectral) music representations using a Variational Auto Encoding scheme with an additional bit-rate reduction step. Our results suggest that higher mutual information can be found between latent representations encoded with reduced rates. The DMID framework is significant for studies of computational creative music systems since it allows exploration of information relations in latent and surface levels of musical data in a quantifiable and computationally tractable manner.

Cella, Carmine Emanuele; Dzwonczyk, Luke; Saldarriaga-Fuertes, Alejandro; Liu, Hongfu; and Crayencour, Hélène-Camille. ***Neural Models for Target-Based Computer-Assisted Musical Orchestration: A Preliminary Study***

Abstract

In this paper we will perform a preliminary exploration on how neural networks can be used for the task of target-based computer-assisted musical orchestration. We will show how it is possible to model this musical problem as a classification task and we will propose two deep learning models. We will show, first, how they perform as classifiers for musical instrument recognition by comparing them with specific baselines. We will then show how they perform, both qualitatively and quantitatively, in the task of computer-assisted orchestration by comparing them with state-of-the-art systems. Finally, we will highlight benefits and problems of neural approaches for assisted orchestration and we will propose possible future steps. This paper is an extended version of the paper "A Study on Neural Models for Target-Based Computer-Assisted Musical Orchestration" published in the proceedings of The 2020 Joint Conference on AI Music Creativity.

Vigliensoni, Gabriel; McCallum, Louis; Maestre, Esteban; and Fiebrink, Rebecca. ***Contemporary Music Genre Rhythm Generation with Machine Learning***

Abstract

In this article, we present research on customizing a variational autoencoder (VAE) neural network to learn models and play with musical rhythms encoded within a latent space. The system uses a data structure that is capable of encoding rhythms in simple and compound meter and can learn models from little training data. To facilitate the exploration of models, we implemented a visualizer that relies on the dynamic nature of the pulsing rhythmic patterns. To test our system in real-life musical practice, we collected small-scale datasets of contemporary music genre rhythms and trained models with them. We found that the non-linearities of the learned latent spaces coupled with tactile interfaces to interact with the models were very expressive and lead to unexpected

places in composition and live performance musical settings. A music album was recorded and it was premiered at a major music festival using the VAE latent space on stage.

Foroughmand Arabi, Hadrien and Peeters, Geoffroy. ***Extending Deep Rhythm for Tempo and Genre Estimation Using Complex Convolutions, Multitask Learning and Multi-Input Network***

Abstract

Tempo and genre are two interleaved aspects of music, genres are often associated to rhythm patterns which are played in specific tempo ranges. In this article, we focus on the Deep Rhythm system based on a harmonic representation of rhythm used as an input to a convolutional neural network. To consider the relationships between frequency bands, we process complex-valued inputs through complex-convolutions. We also study the joint estimation of tempo/genre using a multitask learning approach. Finally, we study the addition of a second input convolutional branch to the system applied to a mel-spectrogram input dedicated to the timbre. This multi-input approach allows improvements to the performance of tempo and genre estimation.