Music Transformer and DDSP Études of Composition and Digital Performances

This work[1] explores the use of the Music Transformer[2] and DDSP[3] models to introduce compositions, sound objects and performances in the practice of human–computer music. This follows work on machine musicianship from researchers like David Cope and George E. Lewis and explores AI as an instigator of compositional and performance explorations. This practice-based research takes compositional repertoires from the Music Transformer model as a formalised and structural instigator to which the author gives it form. These pieces are transformed, recombined and curated by their author's fundamentally aesthetic and contextualising manners. These pieces are then used as input structures and translated into tenor saxophone, trumpet, violin and flute performances performed by the DDSP model and explored further to form new pieces. My role in this practice exists in the role of curator and producer, providing behaviours, arrangements and context to these pieces, turning these scores and audio outputs into sonic explorations and performances through computational means.
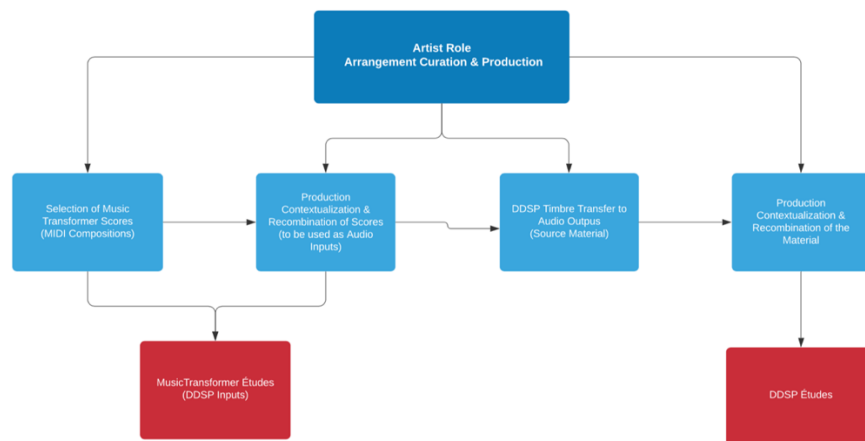

Fig 1. Diagram showcasing the creative process & practice-based approach to these models

This work presents a practice-based environment, where the practice is guided by scenarios imposed by a set of defined compositions (audio recordings given as inputs) and an audio model (DDSP) that translates such compositions into novel sonic performances. These elements are later explored and appropriated by their author, who uses them as source materials and tools to 'paint' this practice. From the multiplicity and abstraction of approaching and transforming a score to a set of defined performances and recordings, this practice embraces a concept of machine musicianship, indeterminacy, passive determinism and curational causality that intensifies the perception of structure (enabled by the Music Transformer model) and expression (enabled by the DDSP model) as agents of a practice of alteration. The DDSP model is explored to generate idiosyncratic performances and musical circumstances and presents machine-learning explorations through three layers of the creative process: composition, sound design and performance. Here, I refer to them as machine learning performative translations. I address that they are performances to the listener and myself in the

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[1] Link to the musical pieces - https://soundcloud.com/guilhermeguilhermecoelho/sets/music-transformer-and-ddsp-etudes-of-composition-and-digital-performances/s-7PBVdWKuR1q

[2] Huang, C et al. "Music Transformer: Generating Music with Long-Term Structure." Magenta, Dec. 2018, magenta.tensorflow.org/music-transformer.

[3] Engel, Jesse, et al. "DDSP: Differentiable Digital Signal Processing." *Magenta*, 15 Jan. 2020, magenta.tensorflow.org/ddsp.

role of the curator because I believe they should be listened to as aleatoric outputs from machine musicianship filled with blemishes and moments of alluring idiosyncrasy.

In my view, the most astonishing ability of this model is its ability to generate compelling and idiosyncratic performances. Digital software iterations of instruments have often homogenised music and their expression, but tools using AI such as the DDSP model by Google Magenta present iterations of these instruments with their own objectives, with a kind of machine musicianship that exhibits self-purpose and 'a life of its own'. Whereas traditional digital software instruments embody qualities of reliable behaviour and continuity, the DDSP versions of these instruments provides new levels of functions and definitions that expand the constraints of musical dimensions and musical practices associated with these instruments, thus presenting them as cultural and ontological probes. Here, the 'flaws', peculiarities, and abnormal characteristics of this model provide new modes of approaching, performing and creating sound with these instruments.

These études explore these models, not as digital artifacts intended to create a finished work, but to explore and form creative conceptual structures that use these tools as a means instead of an end. The DDSP model in particular, moves beyond the digital operations of composing with symbolic writing through MIDI to a new digital method of synthesis that merges the externalisation of audio in a new form of audio translation and sampling that is involved with composition, translation, performance and synthesis. This model presents potentials of new musical expression where old and previously-defined modes of instruments can be thought of as fluid sonic entities that open themselves to new definitions and usage, resulting in new musical behaviours by traditional instruments. This model transcends its function as an aleatoric, creative tool and resembles a fully creative performance partner that exhibits behaviours of machine musicianship and musical sensitivity towards peculiar and idiosyncratic performances. Hence, the DDSP études are mainly dedicated to free, inhibited études: the work presented here focuses on performative idiomatic music and extends to the general topic of improvisational frames, exploring compositions that exist inside and outside of the issue of practicing established idioms.

AI models present opportunities that can open new definitions of artistic practices, performance contexts and computer-assisted composition—thus bringing new modes of approaching musical interaction, improvisation, performance, psychological computational models of creativity, and their relation with existing psychological architectures and epistemological accounts. Moreover, AI methodologies enable the possibility to perceive and expand existing foundations, presenting new considerations and novel approaches towards them. Music is a militarised language (John Cage, 1980), and this technology presents opportunities to reconsider forms of musical literacy and musical practices. These methodologies provide unique opportunities to the limitations of the perception and creativity of individuals and enable such to be formulated and expanded, allowing the practitioner to investigate their practice and music as a whole with novel insights.

AI methodologies provide a growing body of strategies and applications towards musical approaches and new forms of creative abstraction. Computational creativity techniques using these models have enabled me to not only get out of the confinements of my repetition, writing blocks and habits but also to consider this practice as a whole in anthropological and socio-cultural ways. Hopefully, this work showcases how AI can benefit and be explored by artists to explore unique methodologies, practices and sonic explorations. Examples of AI in music are often used as an end instead of a means, and hopefully this project showcases how artists can extend the scope of their approaches and insights by engaging with this technology. I personally found that my relationship with this practice did not replace the human, but instead invigorated and reinforced its engagement and perspective on creativity, approaches, decisions, roles and my practice and music in general.