RhythGen: Controlling rhythmic complexity in generating symbolic music for interactive serious game interventions.

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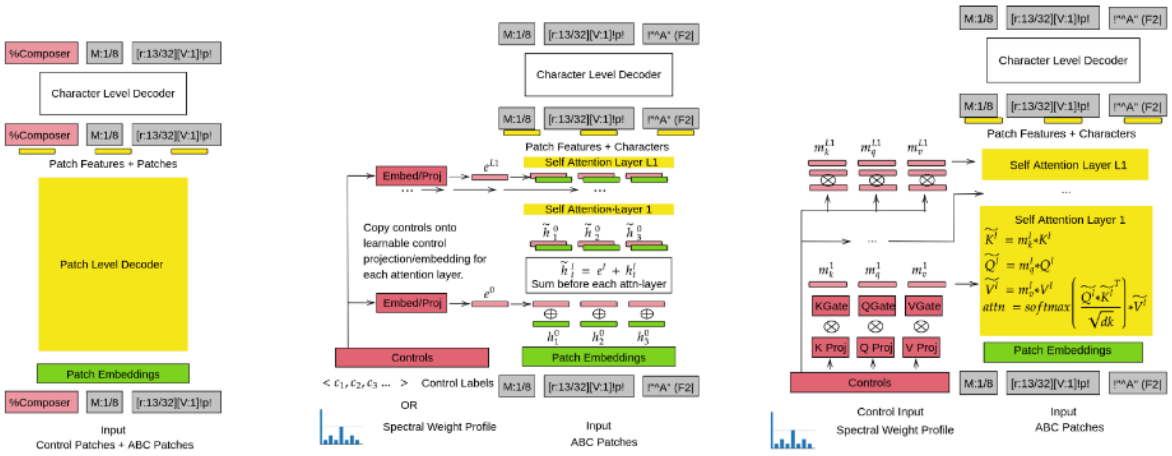
Music is essential in video games, enhancing immersion and engagement of players. However, players tend to disengage from the game music due to excessive repetition or due to differing musical preferences [1]. This is particularly problematic in serious games for therapeutic use such as Musical Attention Control Training (MACT) [2] where sustained engagement and interaction with the game music is essential for the intervention. Music generation offers a scalable solution, enabling a greater variety of music and adapting the music to a player's abilities and preferences, ultimately improving engagement and the effect of the intervention.

To this end, we introduce RhythGen, a transformer-based music generator [10,11] that extends the pretrained symbolic music generator NotaGen[3] with time-varying control over rhythmic structure and complexity. In rhythmic training applications, variations in rhythmic complexity, especially syncopation, are used to vary the cognitive load of music to stimulate attention and working memory [4,5]. Through incorporating control over syncopation levels in generated music, RhythGen expands the range of musical variety, and enables the use of progressively more challenging music, adjusting to a participants' abilities and training needs.

NotaGen is extended with control pathways and conditioned using either Inner Metric Analysis (IMA) [6], or syncopation labels derived thereof [7]. We introduce attention modulation as a novel control mechanism and compare it to adaptive in-attention conditioning [7,8]. Our evaluation explores the tradeoff between generation quality and control fidelity when using IMA versus discrete labels. Results show that label-conditioned models effectively produce music with targeted syncopation levels, while IMA-conditioned models primarily control note density, without capturing syncopation. The ability of our model to produce musical pieces of varying rhythmic complexity, to introduce a recognizable change in rhythmic structure within a piece and to create enjoyable music, is further demonstrated in a small-scale user study.

Figure



(a) Original Notagen model with standard conditioning

(b) RhythGen with In-Attention Conditioning

(c) RhythGen with Attention Modulation

Figure 1: The architecture of RhythGen using different conditioning mechanisms

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