Padded bGLS - an Approach for Near Real-Time Estimation of Synchronisation Parameters for Ensemble Musicians

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Abstract (max. 250 words)

When musicians play in ensemble, they continuously adapt to each other to ensure that the group keeps time together. This adaptation can be captured by a linear phase correction model, representing how they adjust to one another. The Augmented Reality Musical Ensemble (ARME) project is building a system for solo musicians to practise with a virtual ensemble of AI players that will interact with the individual, and keep time in a natural manner. The work presented here analyses and improves the feasibility of estimating the parameters of the linear phase correction model at the required speeds.

These parameters can be estimated using the work of Jacoby et al. (2015), but simulations of real-time estimation performance show that while the mean error remains negligible even with little information (e.g., less than ~20 note onsets), the variance increases - potentially rendering a real-time system unusable. We provide insights on the effect of initial correction parameters on estimation performance, and suggest a number of solutions to potentially facilitate real-time estimation, in particular, the use of a sliding window approach and Kalman filter. Through these, we demonstrate the feasibility of real-time estimation required to build the interactive agents for virtual musician ensembles - such as the one the ARME project is working to build.