LINKING AND VISUALISING PERFORMANCE DATA AND SEMANTIC MUSIC ENCODINGS IN REAL-TIME

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EXTENDED ABSTRACT

We present a visualisation interface for real-time performance-to-score alignment based on the Music Encoding and Linked Data (MELD) framework for semantic digital notation [6], employing the Matcher for Alignment of Performance and Score (MAPS), an HMM-based polyphonic score-following system for symbolic (MIDI) piano performances.

Performance metadata and alignment information is presented to the pianist during the performance in real-time through a web application. This application, implemented using the MELD-clients-core[1] Javascript libraries, presents digital score notation (rendered from MEI encodings using the Verovio[2] engraving tool) augmented with real-time note highlighting corresponding to current performance position, coloured according to attack velocity (Figure 1).

Prior score-following systems have typically associated the performance timeline with pixel positions on score images (e.g., [2]) or semantically sparse MIDI representations (e.g., [3]). More recent approaches have offered support for digital music scores encoded according to the Music Encoding Initiative's machine-readable MEI XML schema[3] (e.g., *ScoreTube* [4]).

Going beyond these approaches, MAPS offers native MEI support for synchronisation of digital score encodings with piano performances in real-time, enabling the capture of alignment information at the note level that is musically meaningful to both human performers and software agents. The captured performance MIDI stream—characterising note events according to their pitch, duration, and attack velocity—is aligned with the MEI-encoded score using Linked Data (RDF) structures according to the MELD semantic framework. Thus exposed, the alignment information is made available for immediate reuse, e.g., to review one's own performance, or to audit and compare different interpreters' renditions of the same score.

By anchoring within the comprehensive musical model of the MEI schema, but lifting the alignment structures themselves into the higher layers of abstraction offered by Linked Data, the score-synchronised performances become available for annotation and interlinking within a wider Web of data. This provides a foundation for the enrichment of public-domain music materials available on the Web, both by software processes, and by musicians, music scholars, and music enthusiasts, as envisioned by the TROMPA project [5][4].

MAPS is implemented within the context of development of the *ACCompanion*, an artificial accompaniment system [1] for four-handed piano performance (one human performer with machine accompaniment). Aside from providing feedback to the performer and to interested listeners, the visualisation of performance-to-score alignment is thus also useful as a development tool, enabling alignment issues to be identified and addressed in order to improve the matching performance of the accompaniment system.

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[1] `https://github.com/oerc-music/meld-clients-core`
[2] `https://verovio.org`
[3] `https://music-encoding.org`
[4] `https://trompamusic.eu`

ISMIR Late-Breaking/Demo [Unrefereed]

Figure 1. During the pianist's performance, the score-following system highlights individual notes in real-time, coloured according to attack velocity from pianissimo (light yellow) to fortissimo (dark red). Alignment information is published as Linked Data, available for immediate reuse by musicians, music scholars, and music enthusiasts, as well as machine agents (e.g., for review, analysis, annotation, and comparison).

ACKNOWLEDGMENTS

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