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Research Software Engineering for Musicological Research: Towards Feature-based Versioning for Music Analysis

Thursday 27 February 2025 09:00 (20 minutes)

Musicological research is challenged with the complexities of analyzing multiple revisions and variants of musical compositions [2]. The need for systematic tools to handle this variability has become increasingly important as musicologists rely more on computational methods for analysis. This talk presents an approach that introduces feature-based versioning known from software engineering to help manage revisions and variants of both music compositions and their analyses. The goal of our ongoing work is to develop software that can provide musicologists with the tools to streamline their research workflows in the domains of music philology and analysis.

Musicologists use domain-specific languages (DSLs) such as the Music Encoding Initiative (MEI), MusicXML, and LilyPond for encoding scores and performing analyses. However, these tools lack specific support for managing the many revisions and variants of musical works. Current tools do not provide a structured way to track and compare these changes, or to manage the layers of analysis required for both the score and its musicological interpretation. Our research thus applies feature-based versioning used in software product lines [1], to create software that can map music features – such as harmony, dynamics, and voice-leading patterns – directly to different versions of a musical composition. This approach will allow musicologists to compose new variants of musical works or their analyses by selecting and combining specific features. Specifically, we aim to integrate version control capabilities using ECCO, a feature-based version control system that can manage fine-grained changes in both musical scores and their associated analytical annotations.

This Research Software Engineering (RSE) project involves developing and customizing software that is specifically tailored for the needs of musicologists. By encoding musical features into DSLs like the Music Encoding Initiative (MEI), LilyPond, DCML, and combining this with feature-based versioning, we are enabling automatic tracking of revisions and variants [2,3]. Key challenges addressed in this RSE effort include managing the granularity of music features, dealing with scattered and highly interacting features, and modeling complex dependencies between various musical elements. This interdisciplinary research offers a novel application of feature-based techniques in the digital humanities. By creating specialized software tools that manage the complexity of musical works and their variations, this project exemplifies how RSE contributes to enhancing research capabilities in the humanities, supporting the integration of computational techniques into the research practices of musicology.

[1] Lukas Linsbauer, Felix Schwägerl, Thorsten Berger, Paul Grünbacher: Concepts of variation control systems. *J. Syst. Softw.* 171: 110796 (2021)

[2] Paul Grünbacher, Markus Neuwirth: Towards Feature-based Versioning for Musicological Research. *Va-MoS* 2024: 77-82

[3] Paul Grünbacher, Rudolf Hanl, Lukas Linsbauer: Using Music Features for Managing Revisions and Variants of Musical Scores. *Computer Music Journal* 2024; doi: 10.1162/comj_a_00691

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