Developing symbolic and audio data analysis modules for a prototype traditional music repository

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Abstract

Music Information Retrieval Working Group has been officially established by DARIAH-PL Consortium Board in March 2018. The group's objective is to develop and implement state-of-the-art music information retrieval (MIR) tools for large-scale interdisciplinary research in musicology and ethnomusicology. In particular, for scholars working on various aspects of traditional music, a virtual research environment (VRE) is being built based on dLibra Digital Library Framework that has been developed by Poznan Supercomputing and Networking Center (PSNC) since 1999 [1]. The system provides an extended support on: i) data collection and management; ii) data processing, analysis and visualisation; and iii) result publishing.

The sound archive, a selected part of which is to be incorporated in the VRE, is currently administered and operated using a dedicated system designed and built in the Institute of Art of Polish Academy of Science (IAPAS) to address its specific functional requirements [2]. The system includes a dedicated database with a structure optimized for developing ethnophonographic collections and a specialized user application. The database stores descriptive, administrative and technical metadata which describes each digitized medium, its creators and performers, the object's structure, the date of object creation, technical data related to the object, paradata regarding its digitization process, etc.

The works on the VRE started with creation of a prototype MIR content repository based on dLibra digital library software with a sample of IAPAS phonographic collections. Those phonograpic sample records contain metadata describing analog media and their content, audio files, scans of archival documents including song lyrics and related photographs. The objects are organized into several thematic collections. Using the dLibra package, the repository has been set up in a relatively short time required to configure a new library instance tailored for specific MIR needs related to metadata schema, music object characteristics, collection structure, and users access rights.

As a part of VRE framework, two modules were built in their prototype form: 1) a web-based application (WebEsAC) for archiving and retrieval of Polish traditional music in the symbolic text-based EsAC format; 2) a web-based application (SoundScribe) for automatic melodic transcription and correction of traditional music from audio to symbolic format (MIDI and others).

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WebEsAC module offers an online access to a database containing symbolic representation of tunes, mainly acquired from Oskar Kolberg (1814-1890) collection preserved in music notation, where each tune is saved as a separate record with a structure and melody representation in EsAC format. EsAC was developed for monophonic music, with European folk song databases in mind. The implementation of EsAC-to-MIDI converter gives additional flexibility to the system and allows aural verification of encoded melody and rhythm. There were already two software releases of WebEsAC. The second release extended the initial functionality of the module. First of all, user access and rights management was added to prevent the unauthorized access to the repository, e.g. user registration, login, authorization, email verification, and password change. Further enhancements include mechanisms for preventing syntax errors (e.g. validation of the EsAC records when adding single or multiple records in txt format to the repository), extracting the scale from each tune, converting melodic line into a sequence of intervals, calculating statistics of scale-types and rhythmic bar structures, multicriteria retrieval of tunes from the database. Further functions, including pitch and rhythm extraction, and MIDI-to-EsAC conversion, are planned to be developed.

The module for automatic melodic transcription and correction is based on pYIN algorithm [3]. Available as a Vamp plugin, it was adapted as a dll library and used for extracting the predominant melody of an audio recording and converting it into MIDI data and music notation that is saved in an XML file. Additionally, a txt file is generated, containing detailed information about the fundamental frequency value sampled every 0.01 ms. The MIDI and XML outputs together with the source audio file are uploaded to dLibra using editor application and are published in a dedicated dLibra folder format. It is possible to load a single audio file or a folder containing many files or subsequent folders with files. A front end application was also built to enable correction and edition of automatically generated MIDI data in a visual form. This module has positively passed user tests and will be further improved.

Future works will focus on improving the new dLibra music modules and equipping them with new features that allow further-reaching comparative work in the field of traditional music.

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