MININGSUITE: A COMPREHENSIVE MATLAB FRAMEWORK FOR SIGNAL, AUDIO AND MUSIC ANALYSIS, ARTICULATING AUDIO AND SYMBOLIC APPROACHES

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ABSTRACT

The *MiningSuite* is a free open-source and comprehensive Matlab framework for the analysis of signals, audio recordings, music recordings, music scores, other signals such as motion capture data, etc., under a common modular framework. It adds a syntactic layer on top of Matlab, so that advanced operations can be specified using a simple and adaptive syntax. This makes the Matlab environment very easy to use for beginners, and in the same time allows power users to design complex workflows in a modular and concise way through a simple assemblage of operators featuring a large set of options. The *MiningSuite* is an extension of *MIRtoolbox*, a Matlab toolbox that has become a reference tool in MIR.

1. DESCRIPTION

The *MiningSuite* [1] is an open source Matlab toolbox composed of a large set of modules corresponding to the different possible types of signal processing representations and audio and music descriptors. These modules are structured into packages related to the different domains of study: signal processing (*SigMinr* package), auditory modelling (*AudMinr*), music analysis (*MusMinr*), video analysis (*VidMinr*), physics and motion analysis (*PhyMinr*), sequence processing (*SeqMinr*) and pattern mining (*PatMinr*).

Thanks to an innovative syntactic layer, both powerful and user-friendly, designed on top of Matlab, these modules can be easily applied to particular files or batch of files, and the numerous options available for each module can be modified. Modules can be connected and form data flow graphs. As such, complex design of set of audio or music analysis operations can be written in a very concise way through a simple assemblage of modules. They can be applied to large batches of files as well as to long files without memory issues thanks to implicit signal chunking and concatenation mechanisms. Another syntactic layer within the operators' Matlab code enables to simplify and clarify the code. As the internal representation of signals integrates various types of decomposition (into frames, channels, segments) within a unified framework, the modules can adapt automatically to these various types of input.

Audio and symbolic representations and processes are tightly interconnected: The same type of symbolic representation is used to represent discrete constructions inferred from audio representation (such as peaks, segments, onset locations) as well as actual symbolic sequences (such as scores and MIDI sequences). Operators dedicated to high-level musical features extraction (key estimation, tempo, etc.) integrate signal processing, statistical and symbolic-based methods, and can be applied to both symbolic input and audio input (adding automated transcription steps wherever necessary).

The integration of expertise developed in separate areas of study into common modules encourages further reuse of these individual methods and their intermingling into a common framework.

MiningSuite is the official continuation of *MIRtoolbox* [1]. The architecture of the toolbox is much simpler, allowing faster computation and more transparent and clear code. Series of operations can be designed more efficiently and easily. Any signal can be imported and represented as an object of classes available in the MiningSuite. Each result also stores the complete description of the list of operations with all the specified options and parameters. Matrices imported into, used in, and exported from the MiningSuite have their internal structure clarified: the role of each dimension is made explicit using a systematic formalism.

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[1] http://olivierlar.github.io/miningsuite/

2. REFERENCES

[1] O. Lartillot and P. Toiviainen, "Mir in matlab (ii): A toolbox for musical feature extraction from audio," in *International Conference on Music Information Retrieval*, 2007.