jMIR: Tools for Automatic Music Classification

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Overview

jMIR is a free and open-source Java software suite designed for research related to automatic music classification.

Primary Goals

- Provision of powerful easy-to-use MIR software tools usable even by music researchers with limited technical training
- Prevention of wasteful duplicated work by providing standardized file formats and algorithm implementations
- Provision of a framework for collaboratively developing algorithms and performing original research
- Promotion of research combining features derived from audio, symbolic and cultural sources of data

A Few Sample Applications

- Genre classification
- Mood classification
- Song identification
- Composer identification
- Performer identification
- Instrument identification
- Pitch tracking
- Music recommendation
- Playlist generation
- Hit prediction

Fundamental Music Classification Tasks

- Collecting and annotating ground truth data for training and testing classifiers
- Extracting characteristic features from the data
- Using machine learning to associate feature patterns with particular classes

Types of Musical Data

- Audio (wav, aiff, flac, mp3, aac, etc.)
- Symbolic (midi, osc, Music XML, etc.)
- Cultural (tags, sales data, album art, etc.)

Alternative Systems

- MIR Toolbox and MIDI Toolbox
  - Modular tools for designing and extracting audio and symbolic features
  - Implemented in Matlab
- CLAM
  - Emphasizes audio processing
  - Can be used to extract features too
- Marsyas
  - Well-established audio feature extraction and pattern recognition system
- M2K
 - Patch-based Java prototyping system

jMIR Feature Extractors

jAudio

- Extracts 28 features from MP3s, wavs, etc.
- Many more features can be automatically generated using metafeatures and aggregators
- Plug-in approach encourages iterative feature development and sharing
- Pre-processing functionality such as normalization and downsampling
- Time- and frequency-domain visualisations
- Synthesis functionality to facilitate testing
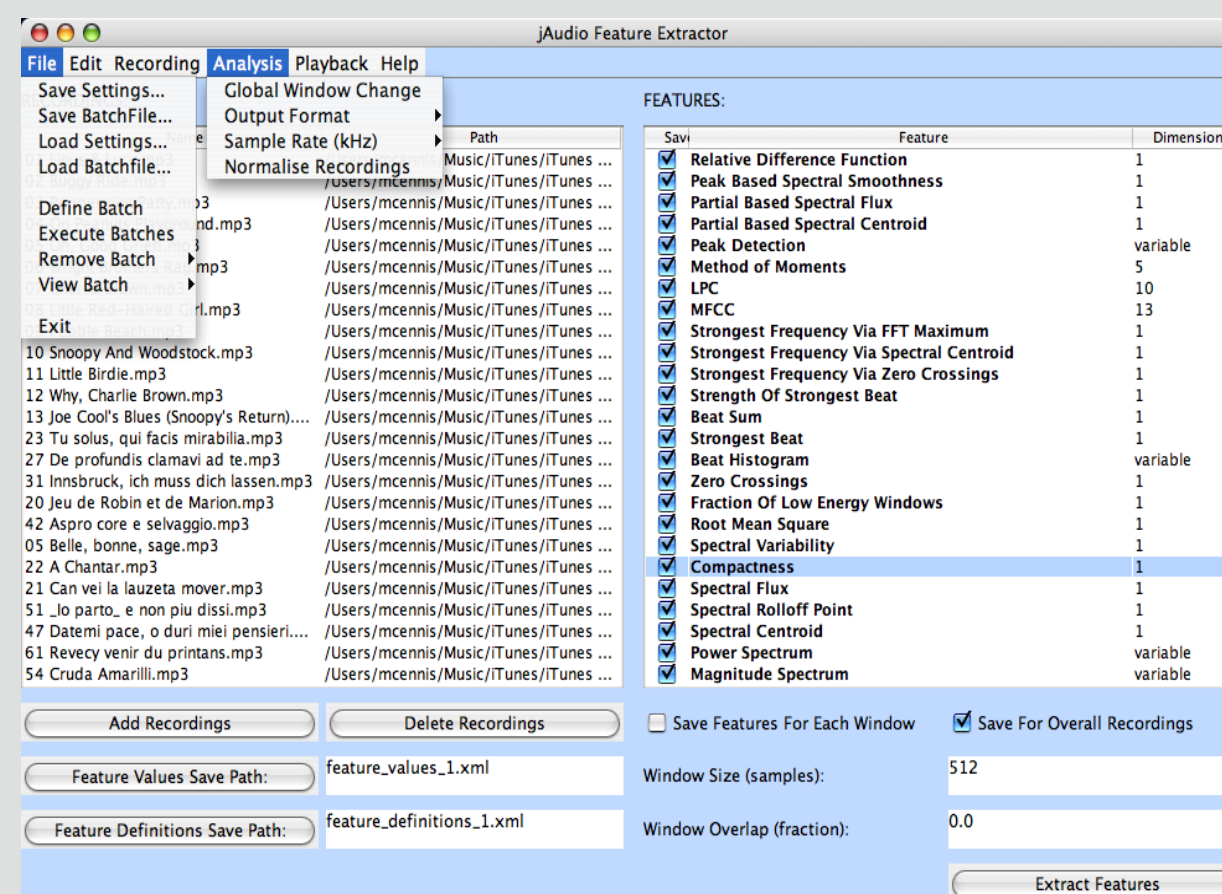
jSymbolic

- Extracts 111 features from MIDI files
- 49 further features are proposed
- Features are based on instrumentation, texture, rhythm, dynamics, pitch statistics, melody and chords
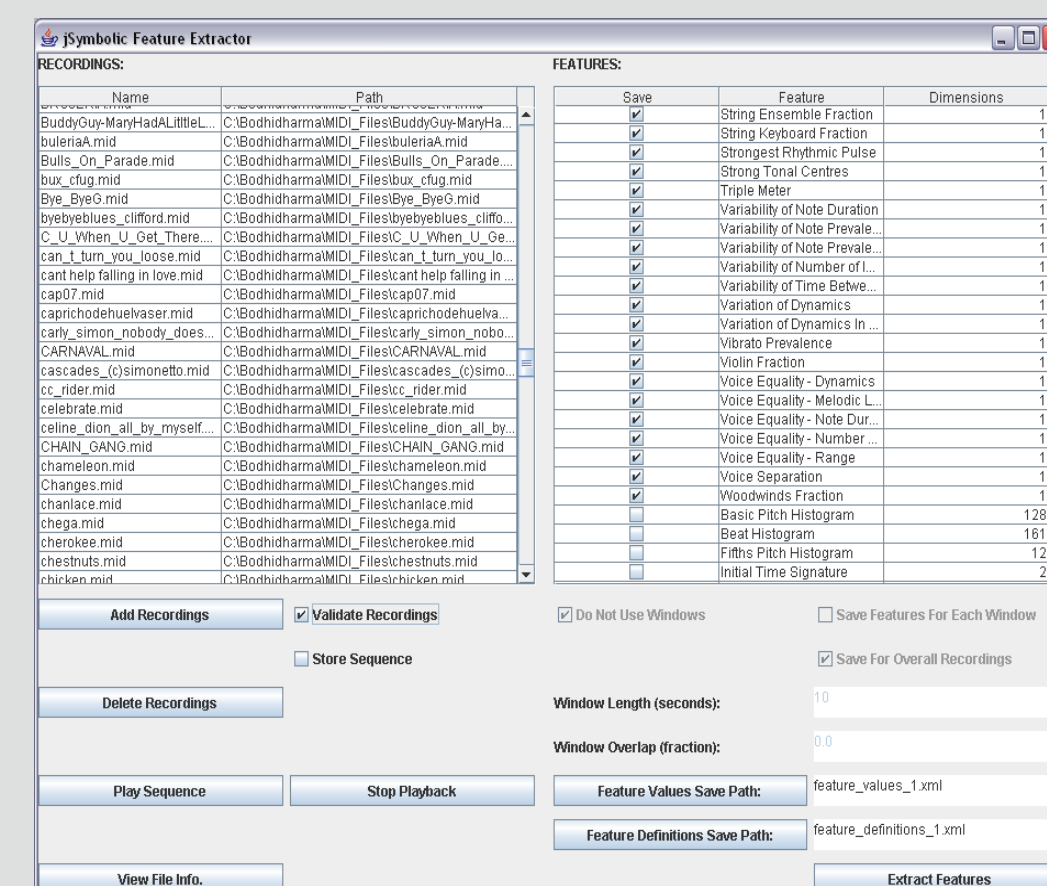
jWebMiner

- Extracts cultural features from the Internet
- At its most basic level, it uses Google and Yahoo! web services to access co-occurrence page counts, which are then processed statistically in a variety of ways
- Additional functionality includes site weighting, positive text filtering and negative text filtering, etc.
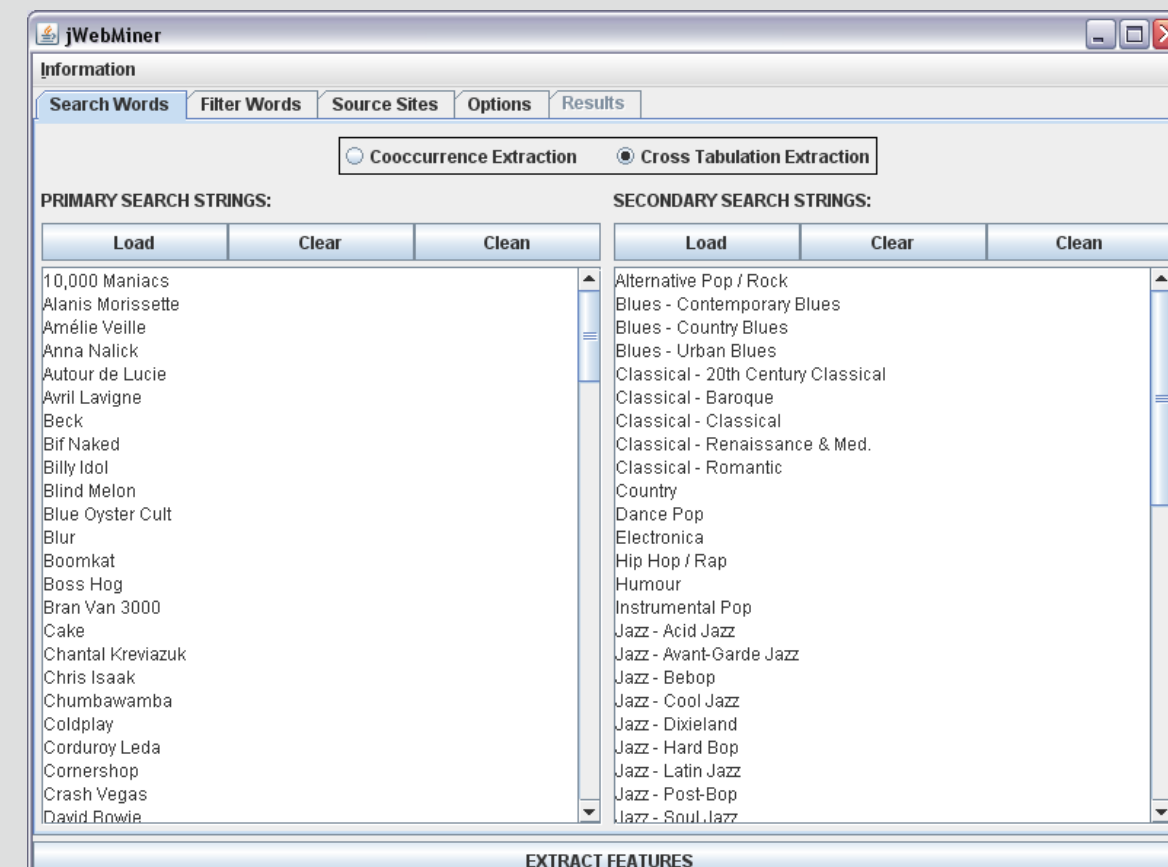
jMIR ACE XML File Formats

- ACE XML consists of four standardized XML file formats for representing feature values, feature metadata, instance labels and metadata and class ontologies.
- Existing file formats have shortcomings that are addressed by ACE XML
- Supported by all of the jMIR components
- ACE XML is also intended for use outside the jMIR context, and is supported by Java parsing and processing libraries

jMIR Ground Truth Data

Codaich Dataset

- 31,300 MP3 recordings
- Music by 2811 artists
- 57 genres of music
- Labelled with 19 metadata fields

Bodhidharma MIDI Dataset

- 950 MIDI recordings
- 38 genres of music
- Labelled by artist, title and genre

SAC Dataset

- Intended to encourage research combining symbolic, audio and cultural data
- 250 matched MP3 and MIDI pairs
- Cultural data accompanies each recording
- 10 genres of music
- Labelled by artist, title and genre

jMusicMetaManager

- Dataset management software
- Automatically detects metadata errors, inconsistencies and redundancies
- Statistically profiles datasets
- Generates 39 HTML reports
- Parses iTunes XML files and ID3 tags
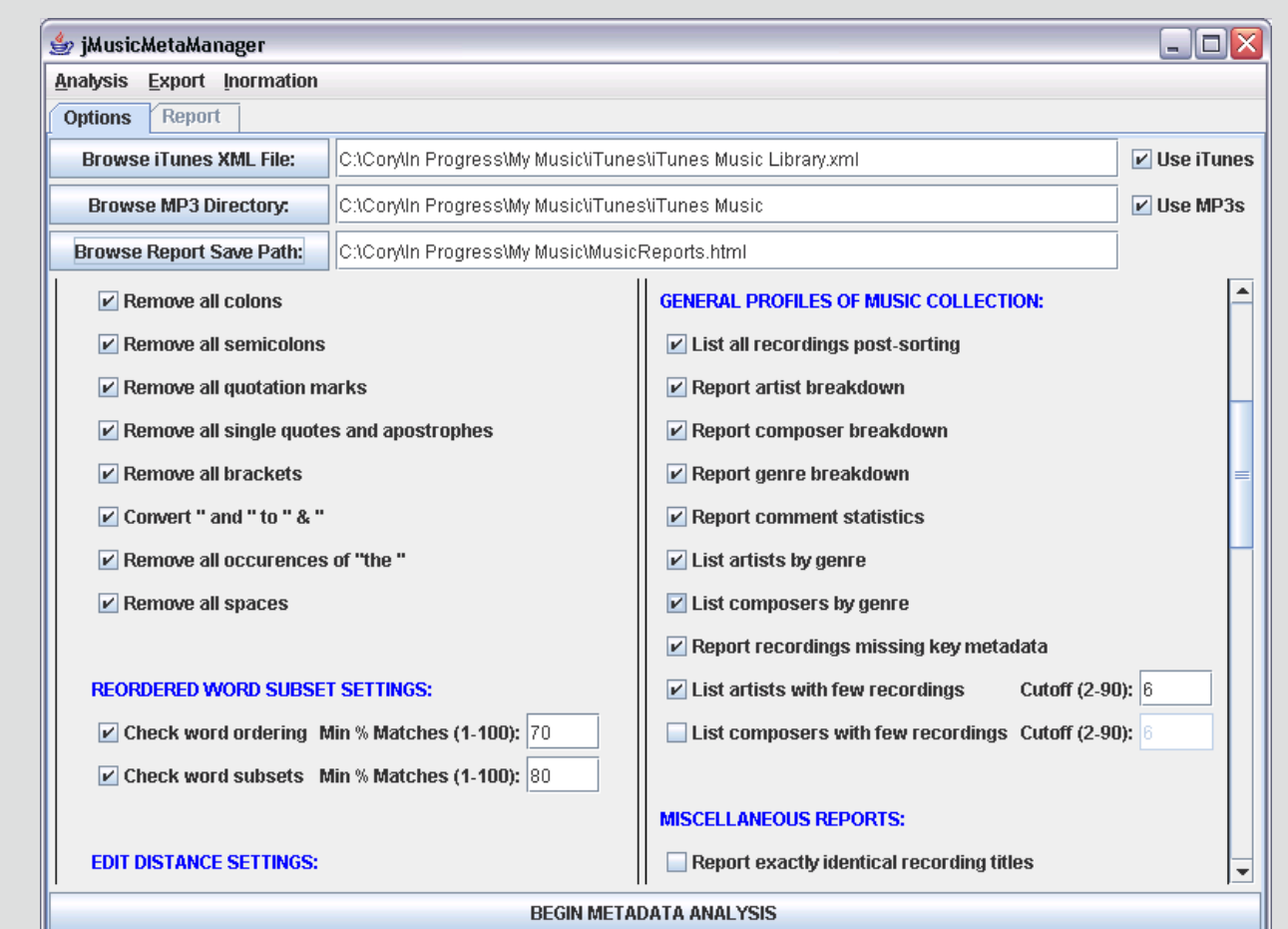
jMIR ACE: Machine Learning

- Meta-learning software
- Experiments with different algorithms to automatically find ones that are well-suited to a particular research domain
- 7 classification algorithms (parameters are also varied)
- 3 dimensionality reduction algorithms
- Weka-based, easy-to-add new algorithms
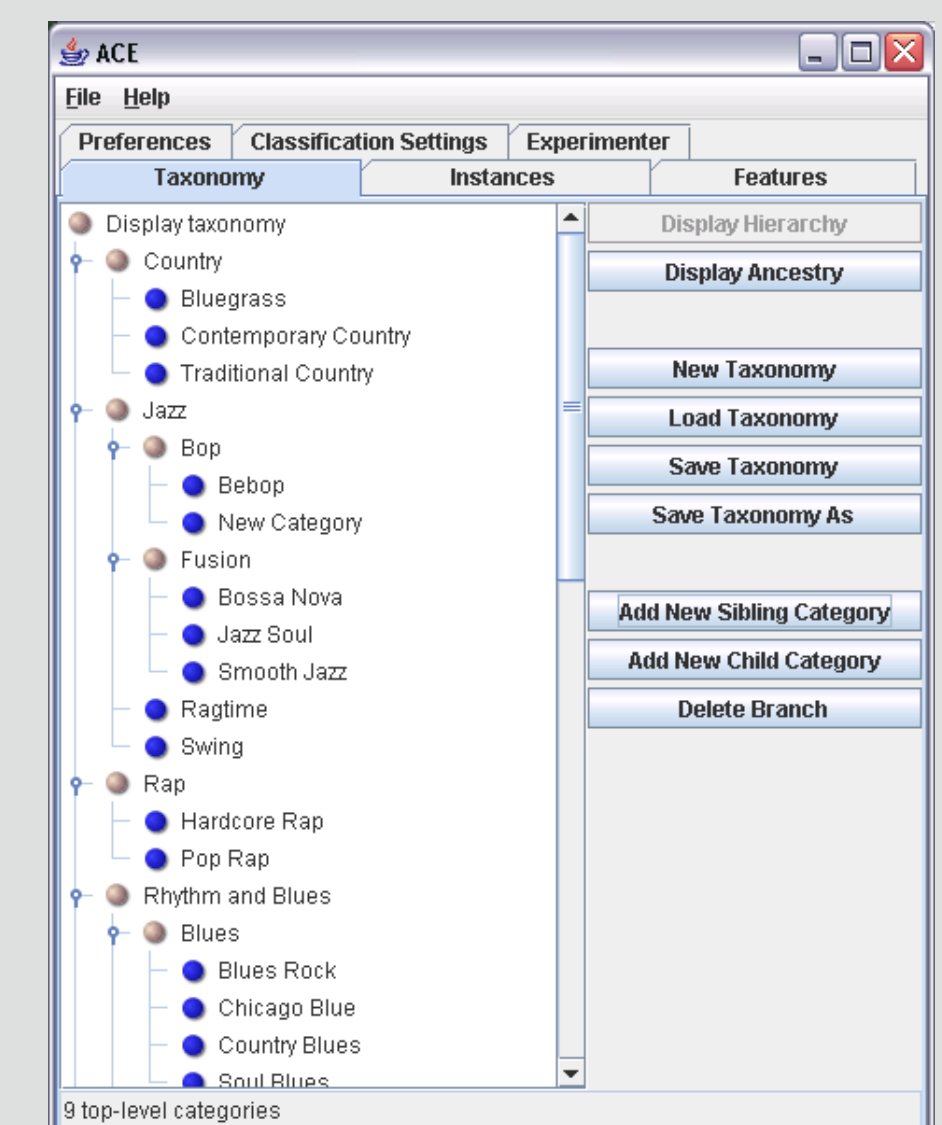
Downloading jMIR

- Available at jmir.sourceforge.net
- Basic user packages are available, as well as developer packages that include source code
- Development is continuing as part of the NEMA project (nema.lis.uiuc.edu)