

# RELEASE HISTORY

## *MIRtoolbox 1.2*

4 June 2009

Major changes since version 1.1

### New features

#### M I R D I S T

Distance between analysed files.

#### M I R Q U E R Y

Query by example.

#### M I R P U L S E C L A R I T Y

Pulse clarity.

#### M I R E V E N T D E N S I T Y

Frequency of note events.

#### M I R B E A T S P E C T R U M

Beat spectrum, characterising tempo based on similarity matrix.

#### M I R M A P

Statistical mapping between predictors and ratings.

#### M I R C L U S T E R

Extended: Clustering of frames within one audio file.

M I R M E A N , M I R S T D

Average and standard deviation along frames.

L O G , + , \*

Partially generalized to diverse data.

## Improvements

M I R C H R O M A G R A M

- The '*Normal*' option (or '*Norm*\_' ) accepts an integer indicating the chosen norm: 1 (1-norm), 2 (2-norm, or euclidian), ..., *Inf* (*Inf*-norm, or max). The option is toggled on by default, to the value *Inf*.
- The range of spectrum computation can be specified with the options '*Min*\_' and '*Max*'. The actual higher frequency limit is further increased in order to ensure that the frequency range covers an integer number of octaves, for the sake of balance between chromas. Similarly, if the spectrum was already given as input of the function, the frequency range exceeding the last whole octave is truncated.
- The '*Res*' option specifies the resolution of the chromagram in number of bins per octave. Default value,  $r = 12$ .
- The minimal frequency resolution of the FFT is set such that the two first bins of the chromagram can be conveniently separated.
- The weighting window is normalized in order to keep a constant superficie for each chroma.

M I R F I L T E R B A N K

- New '*Manual*' filterbank type for user-defined set of non-overlapping low-pass, band-pass and high-pass filters (Scheirer, 1998).
- New '*Order*' option to specify the filter order of the manual filterbank.
- New '*Hop*' option to allow overlapping between manually specified channels.
- New predefined filterbanks '*Mel*', '*Bark*', '*Scheirer*' (Scheirer, 1998) and '*Klapuri99*' (Klapuri, 1999).

M I R E N V E L O P E

- New class of methods '*Spectro*' based on the computation of spectrogram and optionally its decomposition into bands of various kinds ('*Mel*', '*Bark*', '*Cents*'), further upsampling ('*UpSample*'), or complex spectral flux computation ('*Complex*').
- New '*FilterType*\_' option accepting either '*IIR*' (default filter type, also used in previous versions) or '*HalfHann*\_', a half-raised cosine convolution used in (Scheirer, 1998).
- New '*PreDecim*\_' option for decimation before the low-pass filtering. ('*Down*\_' option can now also be called '*PostDecim*\_.')

- New ‘*Log*’ option for logarithm computation before the eventual differentiation, or ‘*Power*’ option for squaring of the results.
- New ‘*Lambda*’ option for summing both half-wave rectified and non-differentiated envelopes, and more detailed implementation of Klapuri et al. (2006) model (*Klapurio6*).
- New option ‘*ZeroPhase*’ to toggle on or off the use of zero-phase digital filtering.
- New option ‘*Trim*’ to remove the transitory phase at the beginning of the envelope curves.
- The delay caused by the filtering in the ‘*Smooth*’ option is nullified.

#### M I R O N S E T S

- New pre-selections ‘*Scheirer*’ and ‘*Klapuri*’, implementing onset detection models proposed respectively in (Scheirer, 1998) and (Klapuri, 1999).
- More options related to *mirenvelope* can be specified in *mironsets*.

#### M I R P E A K S

- The ‘*Reso*’ option can accept numerical value. In this case, the difference between neighbour peaks should be higher than this value. Besides, the strategy of peak selection can be specified using a new ‘*First*’ keyword if necessary.
- New option ‘*Only*’ keeping from the original curve only the data corresponding to the peaks.
- New option ‘*Track*’ enabling to track approximately aligned peaks along time.

#### M I R S P E C T R U M

- The Mel-scale transformation requires a minimal frequency resolution of 66 Hz in the spectral representation. If the ‘*Mel*’ option is performed in the same *mirspectrum* command that performs the actual FFT, then the minimal frequency resolution is implicitly ensured, by forcing the minimal frequency resolution (‘*MinRes*’ parameter) to be equal or below 66 Hz. If on the contrary the ‘*Mel*’ is performed in a second step, and if the frequency resolution is worse than 66 Hz, then a warning message is displayed.
- New ‘*Phase*’ option that controls the computation of the FFT phase information.

#### M I R A U T O C O R

- The ‘*Resonance*’ option includes a new resonance curve ‘*vanNoorden*’, the default curve being called ‘*Toivaiainen*’.
- Before performing the enhancement (‘*Enhanced*’ option), the left part of the curve is modified in order to remove any discontinuity. See Users’ Manual for more details.
- The ‘*coeff*’ option is generalized to multi-channel data, such that the normalization at zero lag appears once the channels are summed back.

#### MIRSAVE

- Segmented, channel and/or frame-decomposed audio file can be saved, the segments are separated by bursts of noise.
- Envelopes can be saved in the same way, they are filled with white noise.
- To avoid trimming, the waveform is normalised from 0 to 1. If there are several waveforms as input (*Folder*), all waveforms are normalised by the same value, which is the global maximum of all signals.

#### MIRPLAY

- New *'Increasing'* and *'Decreasing'* option to order the files to be played according to a specified feature or array of numbers.
- New *'Every'* option that enables to play only a sample of a collection of audios.

#### MIRAUDIO

- Can load MP3 files.
- New *'Mono'* option to control the channels summation.
- When creating a *miraudio* object from an array of numbers, the number of bits per sample, previously unspecified, is set by default to 32 (highest quality).
- The *'Label'* option now accepts string arrays again.
- When using the *'Extract'* option, it is possible to specify whether to extract at the beginning, in the middle, or at the end of the audio file.

#### MIRSEGMENT

- Can accept the *'Design'* keyword, and load each successive segment separately if necessary.

#### MIRCLUSTER

- Can also clusters data decomposed into frames using a specific method.

#### MIRFEATURES

- New *'Segment'* option.

#### MIRATTACKSLOPE

- New *'Contrast'* option.

#### MIRFLUCTUATION

- Model closer to original (Pampalk et al.) model, based on *'Terhardt'* filtering, *'Bark'* (instead of *'Mel'*) spectrum scale and *'Mask'* transformation.

#### MIRSIMATRIX

- Accepts Matlab matrices as input.
- Analyse successive segments separately.

#### M I R N O V E L T Y

- Analyse successive segments separately.

#### M I R I N H A R M O N I C I T Y

- ‘fo’ accepts numeric values.

#### U N C E L L

- Can handle multiple channels separately.

#### M I R S T A T

- Generalized to multichannel.

#### M I R E N T R O P Y

- New ‘Center’ options that centers the input data before transforming it into a probability distribution.

## Modifications

#### M I R T O N A L C E N T R O I D , M I R H C D F

- The frame length is now equal to .743 s.

#### M I R E N T R O P Y

- Negative values were previously avoided by shifting the curve such that the minimum was set to 0. Now, there are no curve shifting any more: negative values in the input data are simply ignored.

#### M I R S T A T

- Same modification concerning the entropy estimation as the modification above related to *mirentropy*.

#### M I R A U D I O

- ‘Extract’ option can also be called ‘Excerpt’.

#### M I R P L A Y

- ‘Frame’ option has now the same effect that for other *MIRtoolbox* functions: it toggles on the frame decomposition and specifies the frame parameters.

#### M I R E X P O R T

- Discrimination between data with first dimension higher or lower than 24, shifted to 50.

#### M I R P E A K S

- Suppress the apparently unused *‘InverseThreshold’* option.

#### M I R O N S E T S

- Default envelope extraction strategy is now *‘Spectro’* instead of *‘Filter’*.
- Default *‘ContrastL’* is now .01 instead of .05.
- Smoothing parameter for *‘Attack’* and *‘Release’* options associated to a dedicated *‘Gauss’* option.

## Bug fixes

#### M I R S P E C T R U M

- In *‘Mel’* transformation, the logarithmic transformation was omitted.
- In *‘Mel’* transformation, the coefficients were badly scaled: the triangular weighting functions were not scaled such that each triangle has same unit area.

#### M I R M F C C

- In the Discrete Cosine Transform, the zeroth rank – related to the stationary energy – should be multiplied by a particular constant. This multiplication was instead applied erroneously to the first rank – related to the cosine of lowest frequency.

#### M I R F L U X

- When using the default *‘EuclidianL’* distance for the *‘DistL’* option, the results were erroneously divided by the frame size.

#### M I R E N T R O P Y

- If the input was audio, the entropy was computed directly from the waveform, and not from the FFT.

#### M I R C L A S S I F Y

- The correctness rate was normalized with respect to the size of the test database, instead of the size of the training database.

#### M I R F E A T U R E S

- The *‘StatL’* option was not taken into account.

#### M I R O N S E T S

- The post-processing operations of *mirenvelope* (summation, resampling, filtering, half-wave rectification) were called in the wrong order, leading to a significant distortion of the results.
- For the *‘Pitch’* option, the initialization phase did not specify the output type.
- The *‘Sampling’* option did not work because the concurrent *‘DownL’* option was always toggled on.

- The ‘*Detect*’ option was not taken into account.

#### M I R E N V E L O P E

- The envelope extraction was still now working with chunk decomposition, because a debug switch was left in the code.
- Some error with channel decomposed input.

#### M I R P E A K S

- An error was returned by *filtfilt* when using the ‘*Extract*’ with too short signals .

#### M I R A U T O C O R

- ‘*Min*’, ‘*Max*’ and ‘*Enhanced*’ options were not adapted when input was already an autocorrelation function represented in frequency domain.

#### M I R E V A L

- The combination of the results did not work for results containing text arrays.
- The chunk recombination did not work for operators not returning data (such as *mirplay*), for *mirkey-som*.

#### A N D M O R E . . .

Not every correction or improvement has been tracked between versions 1.1 and 1.2 unfortunately.

# *MIRtoolbox 1.1*

10 April 2008

Changes since version 1.0

## New general-use features

### MIRLENGTH

Temporal length of audio signal.

### MIRSPECTRUM

- 'Cents' option decomposes the spectrum in MIDI-cents.
- 'Collapsed' option collapses all the octaves and shows the repartition of spectrum energy along the 1200 "cent-classes".
- 'Smooth' and 'Gauss' filtering available here as well.

### MIRLOWENERGY

- 'ASR' option computes Average Silence Ratio.

### MIRWAITBAR

- Toggles on/off the display of progress bars.

### MIRVERBOSE

- Toggles on/off the text display of ongoing operations in the Command Window.

## Improvements

Accesses to field objects have been significantly optimized throughout the toolbox by using the *isfield* option instead of *ismember*.

### MIRENVELOPE

- Zero-phase filtering (*filtfilt*) is now implemented for chunk decomposition as well, through the integration in the toolbox of a new memory management mechanism based on temporary file. The initial conditions integrated in *filtfilt* are not taken into consideration yet.
- A new 'Sampling' option enable a resample of the envelope at any rate. (On the contrary, the 'DownL' sampling parameter has to be an integer.)



- The '*DownL*' sampling can also be performed afterwards, by calling *mirenvelope* a second time.
- The '*Gauss*' filtering actually used only the second half of the gaussian kernel. Now the whole kernel is used.

#### MIRAUTOCOR

- The '*Enhanced*' post-processing operation is improved with the addition of an optimized curve centering mechanism (for the determination of the Y-axis origin, used for half-wave rectification and enhancement procedure). Indeed, if the Y-axis origin is too high, relevant peaks might be erroneously removed by the half-wave rectification; reversely, if the Y-axis is too low, the enhancement procedure might be too destructive.
- Normalization of filterbank-decomposed autocorrelation is carried out through a global normalization of all the filterbanks such that the sum of the channels will give a properly normalized autocorrelation.

#### MIRSCALAR

- Scalar values of non-frame decomposed but filterbank-decomposed objects are represented now in a curve, displaying successively the successive channel values.
- When the unit is '/I', the displayed unit is "(between 0 and 1)".
- When the unit is not specified, no unit is displayed.
- Diamonds are filled in curve displays, improving their visibility.

#### MIRFLUX

- Chunks are now one-frame overlapped, avoiding missing value at chunk transition.
- '*Frame*' option integrated.

#### MIRPEAKS

- The peak selection based on the '*ContrastL*' strategy has been optimized.
- '*ExtractL*' option extracts from the initial curves all the "bells" ("curve portions" between two local minima) containing peaks.

#### MIRCENTROID, MIRSPREAD, MIRKURTOSIS, MIRSKEWNESS

- Analyze each multiple curve portion separately.

#### MIRONSETS

- New strategy '*Pitch*' based on novelty of similarity matrix of frame-decomposed autocorrelation.

- New options '*Attack*' and '*Release*' replacing the previous *mirattack* function. Attacks and releases are explicitly displayed in the onset curve. The attack and release phase detection has been improved with the use of a zero-phase low-pass filtering.
- The set of options has been reorganized and enriched, enabling to call options related to preliminary operations. It is now possible to call *mironsets* several times iteratively. The toggle state of the '*Detect*.' option is persistent throughout these iterative calls.
- Similarly to *mirenvelope*, a new '*Sampling*' option enable a resample of the onset curve at any rate. (On the contrary, the '*Down*.' sampling parameter has to be an integer.)
- The output is explicitly titled "Onset curve".

#### M I R T E M P O

- The onset detection curve can be based on the new strategy '*Pitch*'.
- The set of options has been enriched, enabling to call options related to preliminary operations.
- Better estimation using peak interpolation.

#### M I R P I T C H

- Better estimation using peak interpolation.
- *mirspectrum* can be passed as input. The *cepstrum* method is selected by default.

#### M I R F R A M E , ' F R A M E '

- '*Hop*' factor can be expressed in '*Hz*' unit, with proper control of the sample size rounding error.
- Frame decomposition of segmented audio can be graphically displayed.

#### M I R E R R O R

Error messages sent by *MIRtoolbox* can now be displayed in dialog windows.

#### M I R N O V E L T Y

- The beginning and ending of the novelty curve, featuring very low values due to border effects, is automatically removed from the resulting curve.
- New '*Normal*' option that enable to control the use of curve normalization.
- Code finally integrated into the *mirfunction* framework, and adapted to chunk decomposition.

#### M I R S I M A T R I X

- Code finally integrated into the *mirfunction* framework.
- Adequate ordinate labeling of the graphical display in '*Horizontal*' mode.

- Can compute and display multi-channel similarity matrices.

#### M I R R M S

A '*Root*' option controls the application of the root operation.

#### M I R L O W E N E R G Y

- The new '*Root*' option used in *mirrms* can be specified here as well.
- The '*Threshold*' can be changed.
- The RMS curve is returned as second output.
- '*Frame*' option integrated.

#### M I R E V A L

- The evaluation of a *mirdesign* object now returns all the possible outputs available in the related function, in a cell array. For this reason, all the *mirtoolbox* operators called with *mirdesign* objects ('*Design*' and the successive outputs) now returns as a first design output one design object related to all the outputs of the operator. The other design outputs are simply methods for selecting the related output in the resulting cell array. Actually it is unnecessary – and even non-recommended – to use several *mirdesign* outputs from each of these functions, because it would force several evaluation of that function.

#### M I R E X P O R T

- Field containing only *NaN* values are automatically removed.
- When exporting structured data, all the fields names are explicitly mentioned in the variable titles.

#### M I R S T A T

- Concatenation of results improved by calling the *uncell* routine.

#### M I R S E G M E N T

- An array of temporal positions can be specified as input.

#### M I R R O U G H N E S S

- Optimized using matrix computation.
- Also returns the computed spectrum and its peaks.
- Similarly to *mirregularity*, if the input is a *mirspectrum* with picked peaks, the peak picking is not performed once again.

#### M I R Z E R O C R O S S

- Optimized using matrix computation.

#### MIRPITCH

- Pitch extraction can be smoothed using '*Median*' filtering.

#### MIRAUDIO

- Unit '*s*' or '*sp*' can be specified for the '*Extract*' option.

#### MIRSPECTRUM

- Can guarantee a minimal frequency resolution '*MinRes*'.
- A particular frequency resolution '*Res*' can be imposed as well.
- Alternatively, the '*Length*' of the FFT can be directly specified.

#### MIRATTACKTIME, MIRATTACKSLOPE

- Thanks to the integration of attack detection in *mironsets*, these functions can call *mironsets* more efficiently.

#### MIRHARMONICITY

The computation is based on a fo estimated using *mirpitch*.

#### MIRGETDATA

The resulting matrix is represented in a maximally compact way.

#### MIRFILTERBANK

- When more than 20 channels are used, the output is represented as a bit-mapped image where color levels show signal amplitude.
- '*Channel*' can also be written '*Channels*'.
- '*Channel*' can also be used for '*2Channels*'.

#### MIRSPECTRUM

- '*Mel*' band conversion significantly faster.

#### MIRSAVE

- Accept file name and '*Folder*' as input.

#### MIRCEPSTRUM

- If '*Complex*' is not used, the phase unwrapping is not performed, and no phase is returned.

#### MIRPLAY

- Envelopes are normalized before sonification, enabling an audible sonification of differentiated envelopes.

## Modifications

#### MIRROUGHNESS

- Normalizations have been removed because they cause problematic effects. For instance, when dissonant partials were progressively added, roughness might sometimes decrease.
- The peak picking is more tolerant ('*ContrastL*' equal to .01 instead of .1) in order to collect as many partials as possible.
- Frame decomposition toggled on by default, as it does not make sense to compute sensory dissonance using a long-term spectrum.

#### MIRTEMPO

- Default number of channels in filterbank decomposition reduced from 40 to 10.
- '*NormalWindow*' option related to *mirautocor* is toggled off. Long periodicities seem less prominent than shorter ones, so maybe high lags do not need to be re-emphasized. This parameter is also available as an option of *mirtempo*.
- Uses the '*coeff*' normalization option for *mirautocor*. This has no effect in the tempo estimation, but ensures normalized coefficients for the autocorrelation curve.

#### MIRONSETS

- The '*ContrastL*' option is now set to .001.
- Peaks are chronologically ordered.

#### MIRENVELOPE

- The '*Hilbert*' option is now toggled off by default, because Matlab's *hilbertL* function does not seem to always work properly.

#### MIRPITCH

- Maximal pitch set by default to 2400 Hz. Because there seem to be some problems with higher frequency, due probably to the absence of pre-whitening in our implementation of Tolonen and Karjalainen approach.
- No default limitation concerning the number of peaks to detect. A new '*Mono*' option is added, corresponding to '*Total*' = 1.
- Default value for '*Enhanced*' set to 110.

- The '*Generalized*', which can also be called more specifically '*Compress*' as it actually refers to magnitude compression, is always set by default to 0.5.
- The '*Contrast*' option is set by default to 0.1.
- For '*Frame*' decomposition, the default frame length is set to 46.4 ms and the default hop length is 10 ms, following Tolonen & Karjalainen (2000).

#### M I R A U T O C O R

- The normalization option is set to '*coeff*' instead of '*none*'

#### M I R C H R O M A G R A M

- Abscisse of unwrapped chromagram is labeled "chroma", and of wrapped chromagram "chroma class".

#### M I R S E G M E N T

- Segments are graphically highlighted with curved rectangles. This enables to distinguish between segments and frames (both now be displayed simultaneously).

#### M I R A U D I O

- The 'Label' option cannot accept string arrays any more.

## Clarifications

#### M I R P U L S E C L A R I T Y

- The simplistic and unreliable function from previous versions of the toolbox (and for these reasons not previously developed in the user manual) has been removed. A new version is under construction.

#### M I R F L A T N E S S

- The result is simply the ratio between the geometric and the arithmetic means, and no more the logarithm of that ratio.

#### M I R L O W E N E R G Y

- The output unit is specified.

#### M I R A U T O C O R

- The normalization options (from *xcorr* options) work also with chunk decompositions.
- The '*Window*' option is now obsolete, the windowing option can be specified directly in the '*NormalWindow*' option. (Since there is no much sense to window the input signal if '*NormalWindow*' is not performed.) '*NormalWindow*' can be performed even without any actual windowing by setting the '*NormalWindow*' parameter to '*Rectangular*'.

- When the input is a spectrum, no windowing is performed by default. When the input is an envelope, the '*NormalWindow*' is set to '*Rectangular*' by default.
- '*Resonance*' can accept '*no*' and '*off*' as equivalent to 0.

#### MIRPEAKS

- Better explanation of the '*Normalize*' option in the *help*. The default value is in fact '*Global*'.

#### MIRCENTROID, MIRSPREAD, MIRKURTOSIS, MIRSKEWNESS

- The minimum of the input distribution is shifted to 0, in order to avoid negative values.

#### MIRAUDIO

In the '*Trim*' option, the trimmed signal was forced to began at time  $t = 0$  seconds. This time-shifting has been suppressed.

#### MIRCEPSTRUM

- The output is by default in the quefrency domain, even if the input is a mircepstrum in the frequency domain.

#### MIRCHUNKLIM

- Verify that the argument is a number, in order to avoid any further error.

#### MIRFEATURES

- Completely reorganized into musical dimensions.
- Non-framed-decomposed version of the features are discarded.
- Tempo estimation and attack characterization use distinct versions of onset detection using respectively differentiated and non-differentiated envelopes.

#### MIRSTAT

- For data that can have variable number of values for each successive frame (such as peaks for instance), the statistics is concentrated on the first value of each frame (which corresponds to the best peak in *mirpeaks*, by default).
- Does not work with multi-channel objects.

#### MIRFLUX

- The default values for the frame decompositions are clarified in the help.

#### MIRTEMPO, MIRAUTOCOR

- The '*Resonance*' positive value is replaced by the more specific option '*ToivaiainenSnyder*', enabling further resonance options for future versions of the toolbox.

#### M I R S P E C T R U M

- The '*Resonance*' value '*Meter*' can be also called more specifically '*ToivainenSnyder*'.
- '*Resonance*' can accept '*no*' and '*off*' as equivalent to 0.
- The '*Normal*' option now performs the division by the euclidian norm, as previously specified in the documentation.

#### M I R A U T O C O R

- A value of 1 for the '*Enhanced*' option is from now on considered as a "true" boolean value and is associated therefore to the default value, i.e., [210].

#### M I R B R I G H T N E S S

- A warning is displayed if the frequency range of the spectrum is below the threshold.

#### M I R F U N C T I O N , M I R D I S P L A Y

- Removed reference to the notion of "file" when display "Computing" messages, in case the initial data was not an audio file, but a *Matlab* array.

#### M I R R E G U L A R I T Y

- Checks that the '*f0*' input has same frame decomposition than the main input.

#### M I R K E Y

- The second output is called key clarity.

## New technical-level features

#### M I R F R A M E N O W

- For all the operators, '*Frame*' accepts the same syntax, including the use of length unit and hop unit. For that purpose, operators that need to specify frame decomposition in their own flowchart can simply call the new script *mirframenow*.

#### M I R O P T I O N S

- When an operator is applied a second time on its first output, the options that were toggled off during the first call are prevented from being toggled on by default here. Requirement If the output type name of the operator is not of same name than the operator itself, it is necessary to add for that purpose a '*Title*' field to the '*Specif*' field of the operator, that indicates the operator name.
- The *opposite* field is now optional.
- If a *choice* field is specified, the suitability of the called parameter is checked. The value 0 (off) can be inserted in the choice array.



- The *key* field can accept a cell array of possible variants for the same key.
- A new field *chunkcombine* enables to specify the post-processing options that need to be performed during the chunks recombination.
- The *When* option can accept a new value '*Both*' that enables to store the option both for processing and post-processing.

#### MIRFUNCTION

- The *mirdesign* class includes a new field *FrameOverlap* enabling a chunk overlap of a specifiable number of frames.
- From now on, the *main* routine of each function has to deal with the possibility of an empty *option* parameter, corresponding to a simple a posteriori call of that function (just using the *postoption* parameters).
- Besides, the first argument of the *main* routine can be an array of cells, containing the multiple output returned by the *init* routine.

#### GETTMP, SETTMP

- Ensures an automatic transmission between successive chunks of the whole *Tmp* fields related to all the steps of the computation.

#### MIRCOMPUTE

- The called function can return several values (as an array of cells).

#### MIREVAL

- The input can be a cell array of (cell arrays of) design objects.

#### UNCCELL

- Can adapt to data of various size, as long as one dimension remains constant.

## Bug fixes

#### MIRAUTOCOR

- The '*Enhanced*' option was highly erroneous.
- The scaling assumes that the curves were defined from the origin of the abscissae. If this was not the case, the enhancement procedure gave completely wrong results.
- The negative parts of scaled autocorrelation curves were also subtracted to the initial curve.
- The default value when '*Enhanced*' is called without parameters was 2 instead of 2:10.

- '*Resonance*' could not be computed with filterbank decompositions.
- The autocorrelation of the window for the '*NormalWindow*' option did not take into account the *xcorr* normalization option.
- The '*Normal*' keyword was not optional, contrary to what is said in the documentation.
- The '*Min*' and '*Max*' options did not work for autocorrelation of spectrum.
- When '*Window*' was toggled off, the input signal was not centered.
- Input containing *NaN* values returned solely *NaN*s.

#### MIRENVELOPE

- The chunk decomposition was not working correctly discontinuities were present between the chunks.
- Due to the two-way filtering, the actual time constant was doubled.

#### MIRAUDIO

- The '*Extract*' option did not work properly and returned error.
- The '*Extract*' option was ignored when the input was already a *miraudio* object.
- The '*Trim*' option was toggled on by default.
- The '*Normal*' option was not always considered when *miraudio* was called several times recursively in case of chunk decomposition.
- The temporal scale was erroneously shifted 2 sample forward.
- The '*Sampling*' option was not working with multi-channels input.

#### MIRLOWENERGY, MIRGETDATA, MIRCENTROID, MIRSPREAD, MIRKURTOSIS, MIRSKEWNESS

- Could not be computed with filterbank decompositions.

#### MIRTEMPO

- Tempo was not extracted in many frames due to the fact that the *mirpeaks* used a global normalization.
- A false warning were sent when *mirtempo* was called with a spectral flux.

#### MIREVAL

- *mirkey*('Folder') returned error because the Mode field was not properly concatenated.
- empty *mirstruct* objects could not be evaluated.

- Various bugs in evaleach function.

#### M I R F L U X

- Produces an error if the last chunk contained only one frame.

#### V E R

- The Matlab ver command could not recognize MIRtoolbox.

#### M I R P L A Y

- The 'Channel' option did not work properly if the filterbank did not contain all the channels.

#### M I R G E T D A T A , G E T

- mirgetdata could not return the peaks of a framed object. Idem for get('PeakPosUnit').
- Returned the interpolated peaks of the first audio file only.
- Values were sometimes mistakenly considered as chromas, and converted into pitch class sets.

#### M I R C E P S T R U M

- 'Min' and 'Max' options caused errors.

#### M I R R O L L O F F

- Absolutly silent frames caused errors.

#### M I R S U M

- The 'Centered' option was ignored.'
- Summation of peaks did not work.

#### M I R S T A T

- Certain features not decomposed into frames were analyzed as if they were actually frame-decomposed, producing many fields filled with NaN values.

#### M I R F U N C T I O N

- Empty folder lead to error messages.

#### M I R F E A T U R E S

- The 'fo' argument passed to mirregularity was not correct, as it did not contain the same frame decomposition than the main argument.

#### M I R E X P O R T

- When saved in text files, data columns were erroneously shifted to the right, resulting in a large set of empty columns.

#### G E T

- 'PeakMaxVal' returned error if any frame did not contain any peak.
- 'PeakPosUnit' returned error when used with mirscalar object.

#### M I R P E A K S

- Did not work with filterbank decompositions.
- in 'Valleys' mode, returned peak values were sign-inverted.
- Peak interpolations values were represented in rows instead of columns.

#### M I R S I M A T R I X

- Analysis of very short audio sequences could return error if the length was lower than the kernel size.
- Error were returned when the input was a mirspectrum object.

#### M I R S P E C T R U M

- When computing spectrum 'AlongBands', the description of the frame decomposition was not removed from the data representation (causing problems for the graphical display).
- The 'Normal' option did not work for frame or filterbank decompositions.
- The 'ZeroPad' option did not work with chunk decompositions.
- The 'Mel' option did not work with filterbank decompositions.

#### D I S P L A Y

- Analysis of segmented data are not always displayed correctly.

#### M I R F I L T E R B A N K

- The low-pass filter of the high register channel in the '2Channels' filterbank did not have persistent memory, causing fake transitory phases.
- Calling mirfilterbank with already channel-decomposed data produced errors.

#### M I R S E G M E N T

- The starting position of the first segment was erroneously set to zero, even if the initial temporal position was not zero.
- When computing a scalar feature from a segmented audio, only the first segment was displayed.

- Could not base the segmentation on non-scalar data.
- Various operators did not work for segmented input.

#### MIRINHARMONICITY

- Returned an error when no pitch was detected.

#### MIRLOWENERGY

- The frame structure was not modified.

#### MIRBRIGHTNESS, MIRZEROCROSS, MIRROLLOFF, MIRROUGHNESS, MIRREGULARITY, MIRINHARMONICITY

- Was not working with filterbank decompositions.

#### MIRKEYSTRENGTH

- Legend in graphs may sometimes contains erroneous marker symbols.

#### MIRHIST

- Returned an error when the input did not contain numerical data.

# *MIRtoolbox 1.0*

## *(MIRtoolbox First Public Version)*

21st September 2007

Changes since version 0.8.2

New general-use features

`mirenvelope`

Performs the envelope extraction from the Hilbert transform of the signal (optional, toggled on by default).

`mirspectrum`

New 'Power' and 'Sum' options for respectively power spectrum and spectral sum.

New 'Bark' option for Bark-band decomposition, 'Terhardt' option for outer ear modeling, 'Mask' for masking effects simulation.

`mircepstrum`

New 'Complex' option for complex cepstrum.

New 'Phase' output field.

New 'Min' option.

`mirframe`, 'Frame'

Units can be specified for the frame length and hop factor.

`plus`

When superposing miraudio objects, the longest audio are no more truncated, but on the contrary the shortest one are prolonged by silence.

When audio have different sampling rates, all are converted to the highest one.

#### mirtempo

Autocorrelations are enhanced by default, leading to better results.

#### mirchromagram, mirkeystrength

Default frame size and hop are much lower, leading to a better time resolution. Frequency resolution is ensured using zeropadding during the spectrum analysis.

#### mirpitch

New 'Multi' option, for multi-pitch extraction (equivalent to 'Total', Inf).

Default configuration improved

Default filterbank type is '2Channels', instead of Gammatone. If Signal Processing toolbox not installed, no filterbank decomposition.

Default method is 'Autocor' alone.

The 'Contrast' option is set to 0 in this case.

'Enhanced' method set to [16] by default.

#### mirpeaks

New 'Normalize' option to specify if the normalisation of the signal from 0 to 1 is done frame by frame or for the whole frame once.

#### Clarifications

#### miraudio

More explanation about the 'Label' option.

The 'trim' option previously used the 90th percentile of RMS as the threshold unit reference. Now the RMS values are simply normalized between 0 and 1.

#### `mirspectrum`

Spectral product should be performed on the power spectrum.

#### `mircepstrum`

The inverse Fourier Transform is replaced by a direct Fourier Transform, to comply with the historical definition of cepstrum. The impact in the output is a rescaling and a half-wave rectification. And now the phase is stored in a 'Phase' field.

#### `mirchromagram`

Default frequency range for spectrum analysis has been fixed to 100-5000 Hz.

#### `mirautocor`

Default window is the hanning window, instead of the hamming window, as suggested in (Boersma 1993).

Maximum lags of the autocorrelation is set to a third of the signal length hence there is at least three periods to analyze, as suggested in (Boersma 1993).

If the 'Enhanced' option is not followed by any value, the default value is 210

#### `mirenvelope`

Checks that the 'Down' sampling rate is an integer and returns an error otherwise.

#### New technical-level features

#### `miroptions`

A new option type 'Integers' enable to specify vector of numbers as option parameters.



#### `mirfunction`

The syntax has been changed the main and post methods are specified separately.

#### Bug fixes

#### `mirdisplay`

Graphical representation of frame decompositions did not show the last frame.

#### `mirspectrum`

The spectral product ('Prod' option) was not computed properly due to errors in the compression operations, and the factors vector `m` related to the 'Prod' options was not properly taken into account.

The hamming window could not be recomputed (in the case the Signal Processing Toolbox is not installed) due to conflicts with the 'pi' constant.

#### `mircepstrum`

The modification a posteriori of `mircepstrum` objects was not possible.

#### `mirdisplay`

When displaying the results in figures, the caption added in the Command Window actually specifies the name of the output variable (instead of "ans").

#### `mirsave`

The `.mir` subextension was not appended when the extension was specified, leading to possible overwriting of old audio files.

#### `miraudio`

The default value for 'Label' was 0 (labelling each audio with its original file name) instead of '' (no labelling).

mirval

When using the 'Folder' keyword or evaluating a mirdesign object, the numbers of bits associated to the different audio files were not combined.

mirplay

An error was returned when playing mirenvelope objects.

mirenvelope

Did not detect properly when Signal Processing toolbox is not available. Now can manage without it.

mirfilterbank

Filterbank type specification was case sensitive.

mirautocor

Could not display properly the error message when windowing function name were not recognized.

mirpitch

Did not convert the cepstrum in the frequency domain, when used alone, leading to false results.

Could not handle with autocorrelation or cepstrum as input of the function.

mirroughness

The peak picking, due to the global normalization, did not pick many partials from spectrogram using default contrast value 0.1. Now the new 'Local' 'Normalize' option is used.

The normalization of the roughness results has been improved. It is now a simple average.

evaleach

Errors were produced when the CombineChunk option was set to 'Average'.

Functions returning no output, such as mirplay, did not work with chunk decomposition.

## *MIRtoolbox 0.8.2 (MIRtoolbox Beta #2)*

1st September 2007

Changes since version 0.8.1

New general-use features

*mirpeaks*

New 'Interpol' option for more precise peak estimation using quadratic interpolation. Toggled on by default.

For frame decompositions, the data is normalized once for all frame, instead of frame by frame.

*mirtempo*

The 'ZeroPad' option related to the spectrum computation can be specified. Default value set to 10000 samples.

*mirregularity*

The 'Contrast' option used in *mirpeaks* can be controlled, and is set by default to .01.

New technical-level features

*mirdata*

A new field 'Interpolable' checks if the abscissae data is numeric and therefore if interpolation can be used in peak picking.

Bug fixes

mirspread, mirskewness, mirkurtosis

The temporal positions were not used consistently in frame decompositions.

mirval

When using the 'Folder' keyword, audio files were not always ordered correctly.

mirpeaks

When 'Contrast' was set to 0, the 'Total' option was not taken into consideration.

Some options were not working for multimodal data (with matrices using the 4th dimension).

mirfunction

Results were not returned correctly when analyzing an empty folder.

mirregularity

Was not displayed properly as a scalar curve.

mirenvelope

With 'Frame' option, the frame decomposed was performed before the envelope extraction, which is not recommended at all.

## *MIRtoolbox 0.8.1 (ISSSM workshop)*

24th August 2007

Changes since version 0.8.0

Clarifications

`mirinharmonicity`

This function presupposes that there is only one fundamental frequency per frame.

`mirchromagram`

'Triangle' option documented.

`mirpulseclarity`

Values between 0 and 1.

New general-use features

`mirenvelope`

New 'Gauss' option for gaussian smoothing.

`miraudio`

'TrimBegin' can also be written 'TrimStart'.

`mirspectrum`

Default parameter for 'Prod', when called, set to 26

*MIRtoolbox Release History 0.8-1.2*

## mirpeaks

Peaks in frame-decomposed matrices are represented in white instead of black.

## mirpulseclarity

'Frame' option toggled off by default.

The intermediary spectrum computation can be returned as second output.

## New technical-level features

### mirfunction

A new specification option 'combineframes' enables to define a combination function for frame decomposed computations.

## Bug fixes

### miraudio

The conversion of the 'Extract' values (in seconds) to sample index was not rounded, leading to possible error messages.

A mirtemporal object could not be converted into a miraudio object.

### mirsave

An error was returned when the second argument was '.au'.

An error was returned when the miraudio object contained only one audio file and when the second argument was '.au' or '.wav'.

### mirflux

Options were not considered when the input was already a mirflux object.

Checks that 'Complex' option is used only for spectral flux.

mirexport

Attribute type ("NUMERIC") was missing in ARFF exported files.

mirlowenergy

Chunk decomposition produced error.

mirattacks

Peak positions were not formatted properly.

mirregularity

The 'Krimphoff' option was not implemented.

mirmode

The 'Sum' option was inconsistently misspelled 'Dum'.

mirautocor, mirspectrum

The options were not handled properly if the input was a mirdesign object (should be checked later in all functions).

mirspectrum

A problem dealing with the key default of 'Resonance' has been temporarily solved but will require further treatment.

# *MIRtoolbox 0.8.0 (MIRtoolbox Beta)*

1st August 2007

Changes since version 0.7.1

## New general-use features

`mironsets` (NEW)

estimates note onset positions.

`mirstat` (NEW)

returns statistics of any feature mean, std, slope, periodicity.

`mirmode` (NEW)

estimates the mode.

`mirattacks` (NEW)

estimates the starting position of the note attacks.

(replace the previous `mirattack` function).

`mirattacktime` (NEW)

returns the duration of each note attack.

`mirattackslope` (NEW)

estimates the slope of each note attack.

`mirexport`



can now export in ARFF format and as Matlab variables.

can handle diverse input types.

`mirzerocross`

new options 'Per'('Sample' or 'Second') and 'Dir'('One' or 'Both').

`mirpeaks`

optimized (local minima are computed only when necessary).

new options 'Reso'('SemiTone'), 'SelectFirst' and 'Contrast'.

default value for 'Total' is Inf.

`mirenvelope`

new option 'Average'.

`mirfeatures` (NEW, replaces `mirtimbre`)

computes large sets of features that can be customized.

`haspeaks` (NEW)

for `mirdata` objects, indicate whether it contains any peak.

for `mirdesign` objects, indicate if it is designed to perform a `mirpeaks` call.

`miroptions`

Boolean options now also accept 'on', 'off', 'yes' and 'no' as values.

`mirspread`, `mirskewness`, `mirkurtosis`

Optimized algorithms.

mirchromagram

Abscisse of unwrapped chromagram is labeled "register".

miraudio

The 'FileName' keyword used in association with 'Label' keyword, being unnecessary, has been removed.

New technical-level features

mirtype (NEW)

In the initialisation function of each feature, it is now possible to know in advance the exact type returned by each input, even when these input are still in the state of mirdesign objects. This requires in return that each initialisation function specify its output(s) type.

Generalized chunk decomposition to multi-output functions.

mirval (previously eval)

can be applied not only on mirdesign objects, but also on structure arrays containing mirdesign objects.  
reorders files lexico/numerically.

mirstruct

Multiple features to be extracted can be stored using this generalization of the Matlab structure array 'struct' type.

miroption

A new field 'position' in the options structure array optionally enables to define a specific argument position in the function call syntax, that can be used as an alternative to option keywords.

`purgedata` (NEW)

removes all the peaks of a given object.

`mirgetdata`

To ensure greater consistency, one-dimensional data are no more forced to be returned as column vectors. They can remain as row vector if they are for instance the result of a frame decomposition of a one-dimensional feature.

`uncell` (previously part of `mirgetdata`)

Replaces cell arrays by matrices. If the number of rows of the elementary matrices varies, the missing values are replaced by NaN in the final matrix.

`get`

Can be used to access properties of `mirdata` objects, even when these objects are first declared as `mir-design` objects.

`display` (of `mirscalar` objects)

Better display of multi-channel non-frame-decomposed data.

`mirdata`

New field 'Peaks' indicating whether peaks have already been extracted or not.

`mirfunction`

New specifier field 'nochunk' enables to better control the position of the chunk decomposition along the process.

Bug fixes

#### miroptions

When minimum and maximum values for a given function are given in seconds instead of Hz (or reversely), the values were correctly inverted, but not swapped between the two parameters. This induced in particular bad behavior of the mirpitch function. A new 'opposite' field in the optionsstructure array enables this swapping.

The 'Frame' options was badly parsed.

#### mirtimes

When superposing the curve of the two operands, the union of their sampling were considered. The trouble is, that union may have different size depending on the exact matching of the sampling positions of the two curves, which induced errors in chunk or frame decomposition. Hence, from now on, the sampling of the result is equal to the sampling of the first operand.

The normalization of the second curve, when flat, returned NaN.

#### mirregularity

The computation was performed on the rough spectrum whereas it should be done on spectral peaks only.

#### mirtempo

Post-processing options were not taken into account.

'Spectrum' option was not properly taken into account.

Did not return proper results when inputs were already envelopes.

#### mirflux

'Inc' option was not a boolean.

Resolves problem when there is only one frame.

mircentroid, mirentropy, mirflatness, mirhisto, mirkurtosis, mirregularity, mirskewness, mirspread  
updated to the 0.7.1 syntax

Incorrect unit was associated to the results.

mirbrightness

prevent multiple calls of mirspectrum.

mirpulseclarity

0.7.1 rewriting improved.

The 'frame' option was not taken into consideration.

mirfilterbank

correct the generalization of the '2Channels' options to chunk decomposition.

final conditions of filters were not stored in conveniently sized data structures.

mirsummary

partially generalized to chunk decomposition.

mirval

The 'extract' option of miraudio function was applied twice.

In combinedata function, data whose segments do not need to be stored in cell array (such as warped chromagram) were not taken into account.

A bug occurred when coming across the mirspectrum 'AlongBands' option.

Ensures that the chunk made of frames does not exceed the maximum chunk size.

The peak values of different audio files were not combined properly.

The positions of successive chunks were not combined properly.

Functions that do not return output produced error.

mirdata

The get method for 'PeakPosUnit' returned error for empty segments.

mirinharmonicity

Potential non-detection of peak was not taken into account.

mirmfcc

If the argument was itself a mirmfcc, the initialisation function returned an error.

isframed

Previously only defined for mirdesign objects. Now generalized to any mirdata objects.

mirrms

Generalized to multi-channel inputs.

mirfunction

The 'frame' option was not taken into account if the input was already a mirdata object.

Initialisation scripts were not executed when the input of a function was a mirdata object.

Could not deal with empty data as input.

mirgetdata

Can deal with empty data as input.

mirenvelope

A bug in chunk mode dealing with option management.

The 'halfwavediff' was not implemented correctly.

mirscalar

Display of key strength curves returned an error.

`mirpeaks`

When several peaks have same value, the maximal number of peaks could be exceeded.

`mircompute`

Error in segment decomposition.

`display`

Textual y-axis legends of `mirscalar` objects were not correctly placed.

Empty graphs produced errors.

`mirframe`

If the input contains peaks, they were not updated in the frame decomposition. For the moment, the peaks are simply removed from the data.

`mirplay`

The parameter associated to the 'Sequence' option does not need to be a raw vector any more.