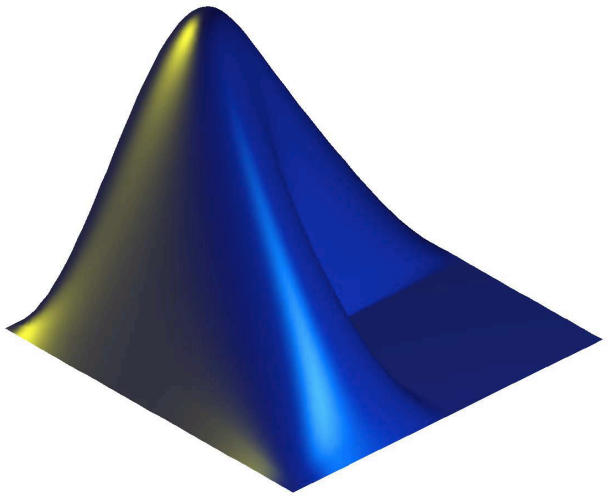
MIR PROGRAMMING WITH MININGSUITE

AIST2010 Lecture 4P

MININGSUITE WITH MATLAB

MIRtoolbox is widely used as a set of tools in MATLAB for MIR

- Development started in 2009, led by Olivier Lartillot
- "It has evolved quite significantly this last decade, downloaded tens of thousands of times, and cited in more than one thousand scientific papers."
- "MIRtoolbox 2.0": MiningSuite (by the same author)
  - Open-source
  - Supporting both audio and symbolic (MIDI) representations



MININGSUITE WITH MATLAB

Official website

- http://olivierlar.github.io/miningsuite
- Version 0.10 (first beta)
- May not be good enough for research use, but good enough for studies
  - Some features are not complete yet
- To be put into MATLAB path

Modules

- SigMinr: signal processing
- AudMinr: auditory modelling
- MusMinr: music analysis
- VidMinr: video analysis
- PhyMinr: physics and motion analysis
- SeqMinr: sequence processing
- PatMinr: pattern mining

Still in progress

SIGNAL PROCESSING

Loading a waveform

- `x = sig.signal('test.wav') % audio: wav/mp3/…, text: csv/txt/…`
- A plot is made if output is not suppressed by `;`
- Also a number of parameters for transformation of the audio, or extracting only partial data (channel, frequency band, time, etc.) from the audio
  - https://github.com/olivierlar/miningsuite/wiki/sig.signal

Data hidden in the return object

- `d1 = sig.getdata(x); % d is the waveform samples`
- `sr = get(x, 'Srate'); % sampling rate`

SIGNAL PROCESSING

Displaying the spectrum

- `y = sig.spectrum('test.wav') % or sig.spectrum(x), x → signal`
- `sig.spectrum('test.wav', 'Frame') % spectrogram of 50ms, 50% overlap`
- Frequency resolution can be specified
  - https://github.com/olivierlar/miningsuite/wiki/sig.spectrum
  - https://github.com/olivierlar/miningsuite/wiki/sig.frame-and-'Frame'-option

Data hidden in the return object

- `d2 = sig.getdata(y); % d is the FFT points`
- `ph = get(y, 'Phase').view; % phase of every FFT point`
  - Besides `.view`, there are also methods like `.max`, `.mean`, `.size`, etc., see `doc sig.data`

DETAILS OF THE SIGNAL

Amplitude related

- RMS amplitude: `sig.rms('test.wav')`
- Amplitude envelope: `sig.envelope('test.wav')`
- Autocorrelation: `sig.autocor(…)`
- Self-similarity: `sig.simatrix(…)`

Statistics from spectrogram

- `% where s=sig.spectrum(…)`
- Flux: `sig.flux(s)`
- Average: `sig.mean(s)`
- Standard deviation: `sig.std(s)`
- Median, histogram, centroid, spread, skewness, entropy, …

FINDING PEAKS AND EVENTS

Finding peaks

- `p = sig.peaks(y) % all local maxima`
- `p = sig.peaks(y, 'Total',1) % only highest peak`
- `get(p, 'PeakPos').view % output positions`
- `get(p, 'PeakVal').view % output the value at peak`

Segmentation based on events

- `o = sig.events('test.wav', method); sig.segment('test.wav', o)`
  - *`method`* can be `'Envelope'`, `'SpectralFlux'`, etc.

AUDIO ANALYSIS

Redistributing frequencies

```
% similar to sig.spectrum() with a different frequency axis
aud.spectrum(…, 'Mel')
aud.spectrum(…, 'Bark')
```

Spectral shape in Mel-scale

```
aud.mfcc(…, 'Frame') % plot mel-spectrum and MFCCs
```

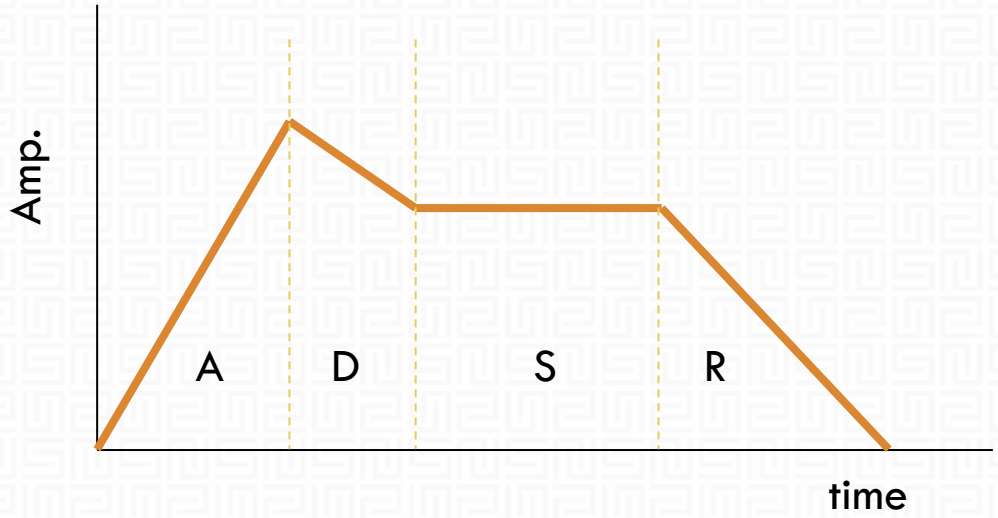
Pitch estimation

```
pit = aud.pitch('test.wav'); pitmat=cell2mat(getdata(pit))
pitamp = get(pit, 'Amplitude') % amp of each pitch component
```

TIME OF THE SOUNDS

Temporal shape

- `aud.attacktime()`
- `aud.attackslope()`
- `aud.attackleap()`
- `aud.decaytime()`
- `aud.decayslope()`
- `aud.decayleap()`



Tempo estimation (beat per minute)

- `aud.tempo()` `% can be done in 'Autocor', 'Spectrum' or both`
- `aud.tempo(…, 'Frame')` `% tempo change in time`

MUSIC ANALYSIS

Available for both .wav/.mp3/… and .mid formats

- `mus.score(…) % a plot of pitch vs. time`
- `mus.chromagram(…) % a plot of pitch distribution`
- `mus.chromagram(…, 'Frame') % a plot of chromagram with time`
- `mus.key(…) % a plot of possible key centre and guess of key`
- `mus.majorness(…) % is this major or minor?`

Many more in development

- Try them: *https://github.com/olivierlar/miningsuite/wiki/Guided-Tour:-Music-analysis*

AMONG THE THREE MODULES

Basic features

- Statistics and data getting methods are in the **`sig.`** module

Specialization

- For example, **`sig.spectrum()`** provides general mechanisms, while **`aud.spectrum()`** adds support of various auditory models and **`mus.spectrum()`** adds support of music-related operations

Refer to the overview of operators:

- https://github.com/olivierlar/miningsuite/wiki/Overview-of-operators-in-MiningSuite

READ FURTHER

MiningSuite Guided Tour

- https://github.com/olivierlar/miningsuite/wiki/Guided-Tour

MIRtoolbox 1.7 User's Manual

- https://www.jyu.fi/hytk/fi/laitokset/mutku/en/research/materials/mirtoolbox/manual1-7.pdf