Multiresolution Analysis of Acoustic Diversity *

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The present document reports a set of basic instructions to run the Multiresolution Analysis of Acoustic Diversity (MAAD) on audio recordings. This program is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License http://www.gnu.org/licenses/. While due care has been taken and it is believed accurate, its use is solely the responsibilities of the user.

1 System requirements

The basic system requirements are:

- Matlab R2014b or later with ScatNet (v 0.2) toolbox. Scatnet toolbox can be downloaded from `http://www.di.ens.fr/data/software/scatnet/download/`
- R version 3.3.2 (2016-10-31) or later with package HDclassif (v 2.0.2)

2 Code description

To run the analysis you need to switch between two software environments. For preprocessing, detection and characterization of ROIs, and visualization you need to use a Matlab console. For the clustering step, you need to use the R console. The software is also indicated at each step by a commented line.

Open a **Matlab console**, load audio and default options for the analysis:

```
% MATLAB %
run ./default_options.m
s=audioread('demo.wav');
```

Transform passive acoustic recordings into the time-frequency domain using the windowed short-time Fourier transform. The Fourier coefficients are filtered to remove noise and to highlight sounds that can be delimited in time and frequency, here defined as regions of interest (ROIs):

```
% MATLAB %
[s_filt,im,im2]=preprocess_audio(s,fs,preproc_opt,spectro_opt,ss_opt);
[~,rois_ij]=find_rois(im2,imfilt_opt);
```

Visualize results:

```
% MATLAB %
imshow_rois(im,rois_ij,[]);
```

Characterize ROIs with features in the time-frequency domain using 2D wavelets and the median frequency.

*Text S7. Manual for Matlab and R scripts. Supporting information for article Ulloa *et al.* Estimating animal acoustic diversity in tropical environments using unsupervised multiresolution analysis. *Ecological Indicators*, under review.

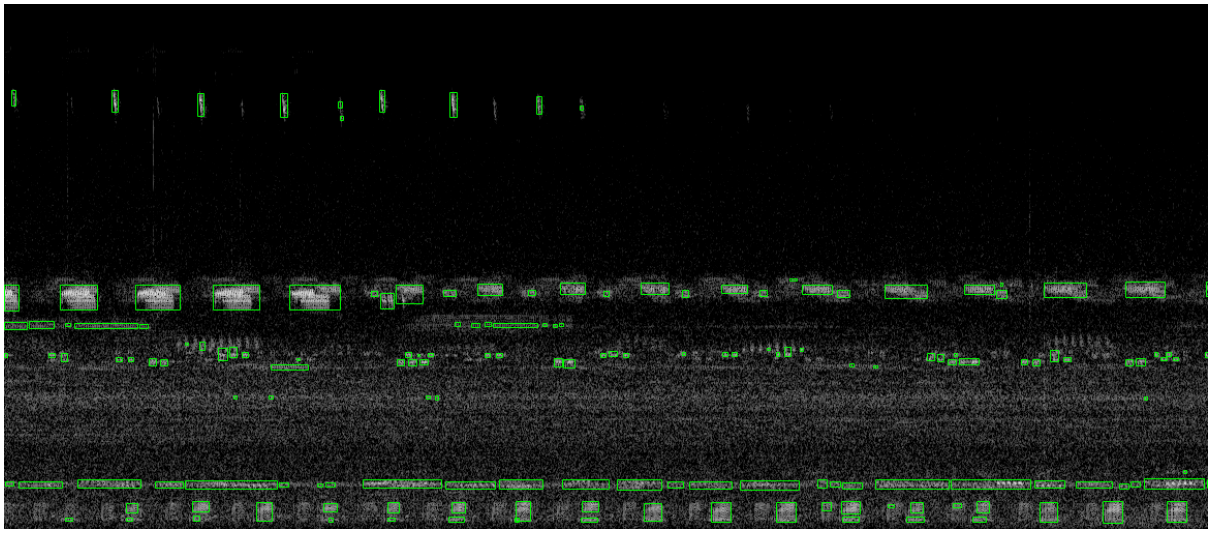

Figure 1: Example of the ROIs found in the audio recording. Spectrogram of the audio signal in gray scale colormap averlayed with ROIs. ROIs are represented as green rectangles

```
% MATLAB %
shape_features=calc_features('scatnet_op2',s,im,rois_ij,fs,filt_opt,[]);
frequency_feature=calc_features('spectral_centroid',s,im,rois_ij,fs,[], ...
                                                        spectro_opt);
```

Organize the features in a table and save the output to a csv file. The csv file is used to transfer the data to the R software environment.

```
% MATLAB %
rois_features=table(shape_features,frequency_feature);
writetable(rois_features,'rois_features.csv','Delimiter',',');
```

Cluster the ROIs into homogeneous groups based on their attributes. This step requires to open a R console and run the following commands.

```
# R #
library(HDclassif)
rois_features=read.table('rois_features.csv',sep=',',header=T)
set.seed(1234) # for repeatable example
data_hddc = hddc(rois_features,K=6,threshold=0.2,nb.rep = 10)
write.table(data_hddc\$class,
                        file = 'rois_group.csv',
                        row.names = F,
                        col.names = T)
```

Load and plot results

```
% MATLAB %
rois_group=readtable('rois_group.csv');
imshow_rois(im,rois_ij,table2array(rois_group));
```

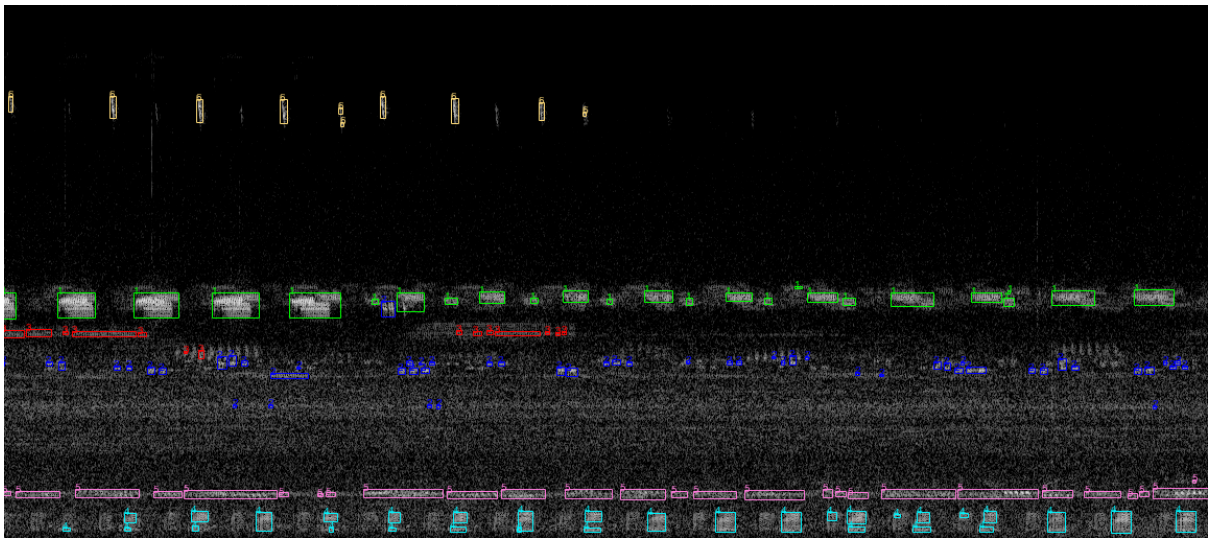

Figure 2: Example of the grouped ROIs found in the audio recording. Spectrogram of the audio signal in gray scale colormap overlayed with the ROIs. ROIs are represented as rectangles coloured according to the MAAD partitioning.