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```
addpath('toolboxes/malcolm_toolbox/');
addpath('resources/heli_and_boat_short');

nsegments_in = 20; % select number of segments to process for testing
```

Import data

```
[x, fs] = audioread('resources/heli_and_boat_short/
boat2_short.wav'); %assume 44.1kHz
%[x, fs] = audioread('resources/Cessna.wav'); %assume 44.1kHz
x = mean(x,2);% col vector

% Resample to around 8KHz
x = resample(x,2,11);
fs = fs*2/11;
%x = resample(x,1,2);
%fs = fs/2;
xlen = length(x);

% Construct final window
ham_t = .25; %250 ms duration window
ham_N = floor(ham_t*fs);
w = hamming(ham_N);
wshift = 4; %4hz
exp_modulator = exp(1j*wshift.*(1:ham_N)); %mod by 4 hz
exp_modulator = exp_modulator.';
w = w.*exp_modulator;
```

Bandpass using Gammatone Filterbank

```
% Make the center frequency vector
numChannels = 19;
lowFreq = 200; %?
fcoefs = MakeERBFilters(fs,numChannels,lowFreq);
%LOW_CF = 200;
%HIGH_CF = 4000;
%NUMCHANS = 18;
%CFS = iosr.auditory.makeErbCFs(LOW_CF,HIGH_CF,NUMCHANS);
```

Segment the data as needed (nonoverlapping)

```
segmentlen = fs;
```

```
nsegments_total = floor(xlen/segmentlen);

nsegments = min(nsegments_in,nsegments_total); % for testing

start_pos = 1;

% Operate on each time segment
for segmentind = 1:nsegments
    end_pos = start_pos + segmentlen - 1;

    x_segment = x(start_pos:end_pos);

    BM =  ERBFilterBank(x_segment, fcoefs); %operate on every col
    BM = BM.';

    for channum = 1:numChannels

        % calculate envelope and downsample
        envt = envelope(BM(:,channum)); %operate on every col
        envt = downsample(envt, 100);

        % normalize
        envt = envt./mean(abs(envt));

        % bp filter
        bp_sig = log10(abs(filter(w, 1, envt)));

        % threshold
        bp_sig(bp_sig>0) = 0;
        bp_sig(bp_sig<(-30)) = -30;

        out_chann(:,channum) = bp_sig;
    end

    out(:,:,segmentind) = out_chann.';

    start_pos = start_pos + segmentlen;

end


for segmentind = 1:nsegments
    figure;
    data = out(:,:,segmentind);
    imagesc(data);
    title(['mod specgram for frame number ' num2str(segmentind)]);
    ylabel('filterbank frequencies (Hz)');
    xlabel('acoustic frequencies (Hz)');
    axis xy; colormap(jet);
    colorbar;

%     SPACING = (HIGH_CF-LOW_CF)/NUMCHANS;
%     yticklabels = LOW_CF:SPACING:HIGH_CF;
%     yticks = linspace(1, size(data,2), numel(yticklabels));
```

```
%     set(gca, 'YTick', yticks, 'YTickLabel', yticklabels);
end
```

```
Warning: Integer operands are required for colon operator when used as
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 index
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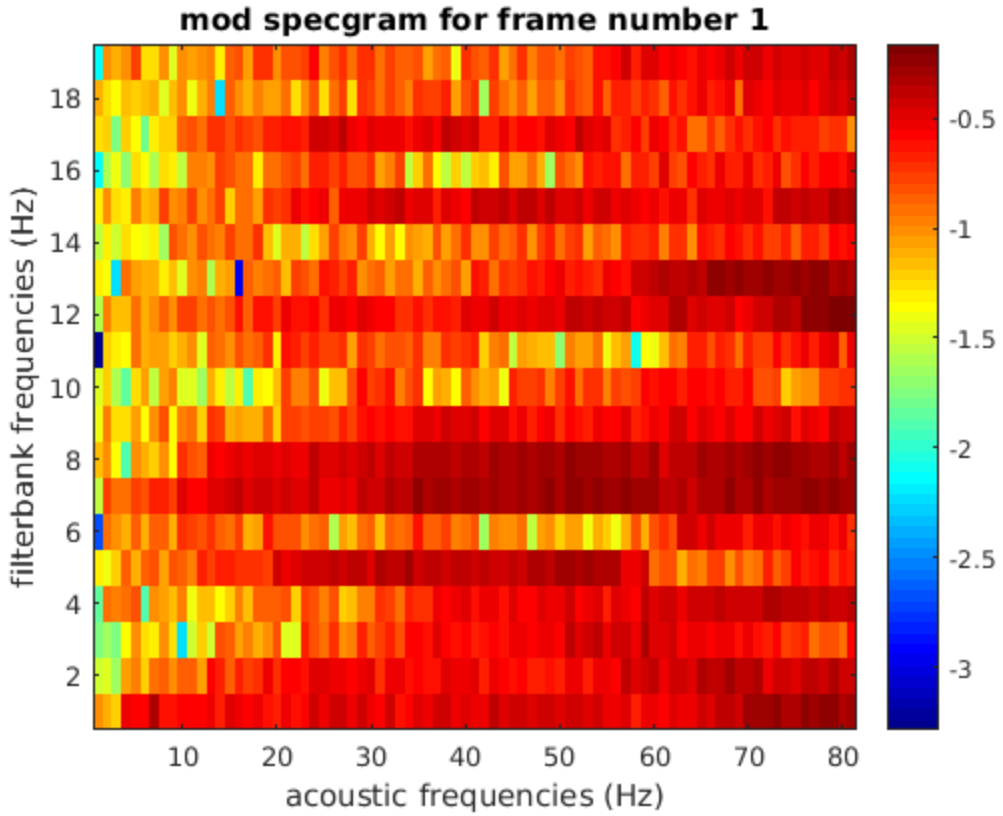
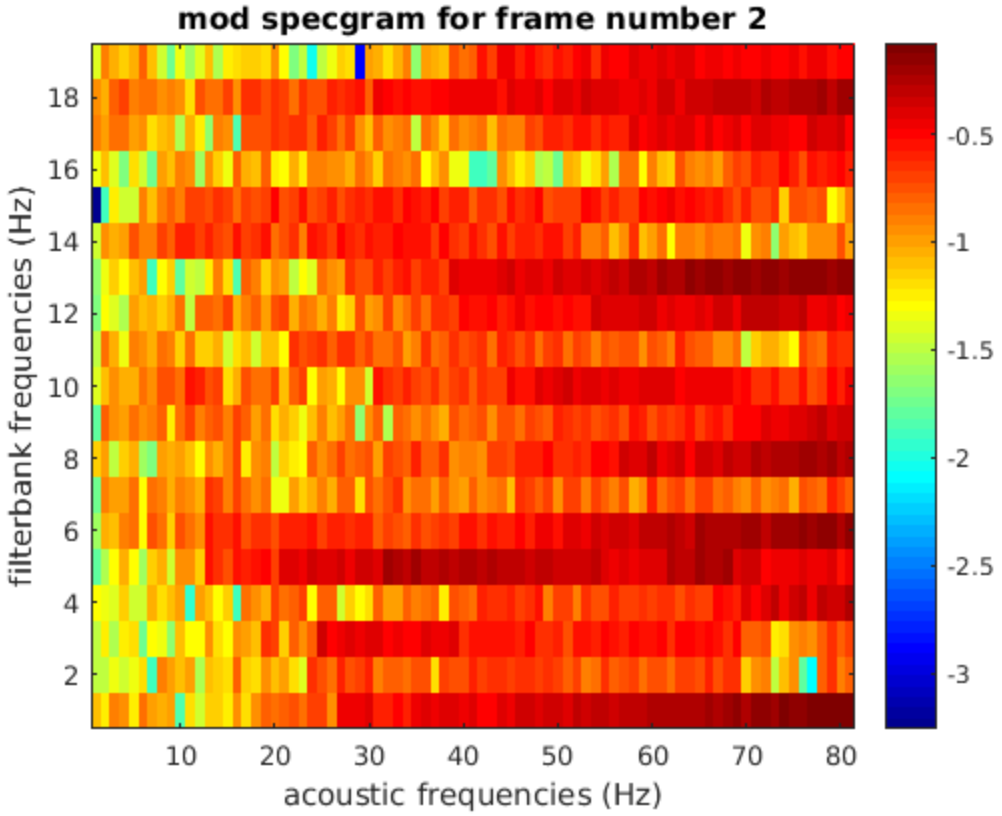
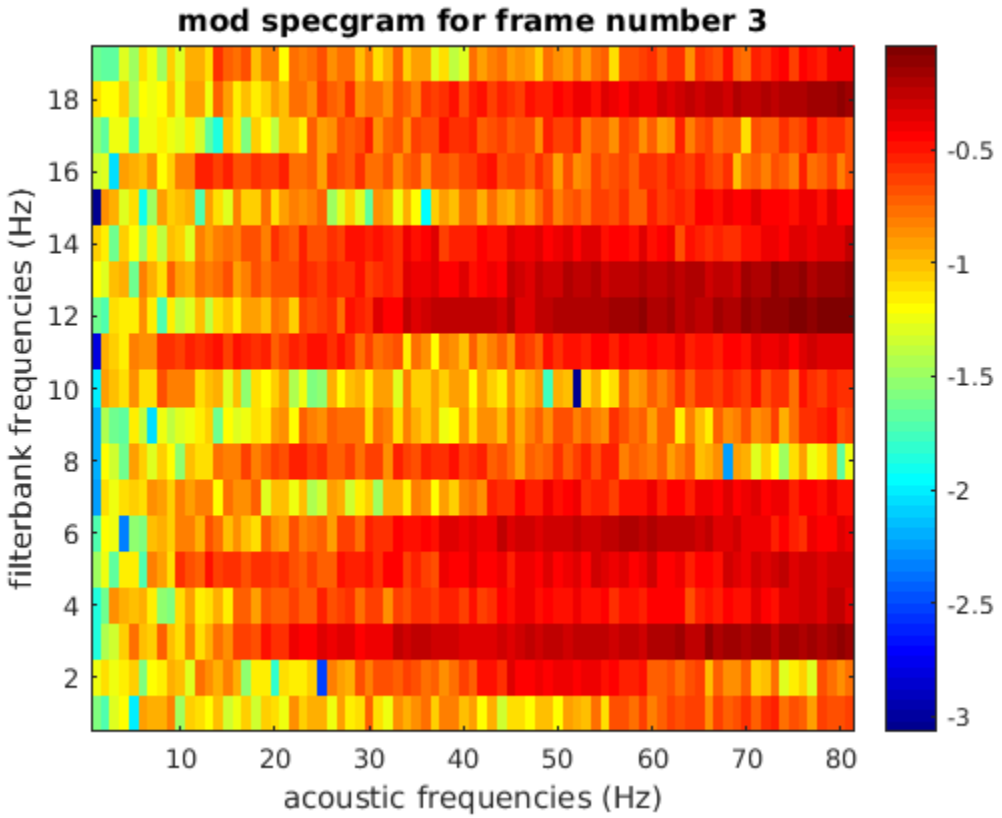
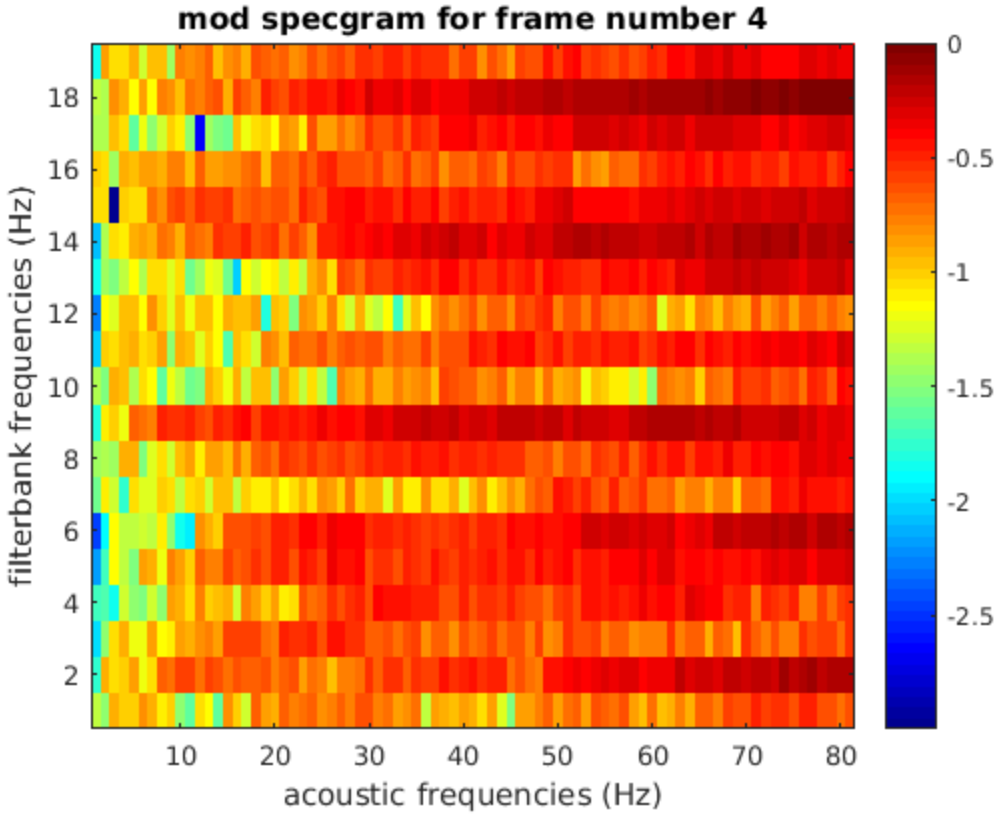
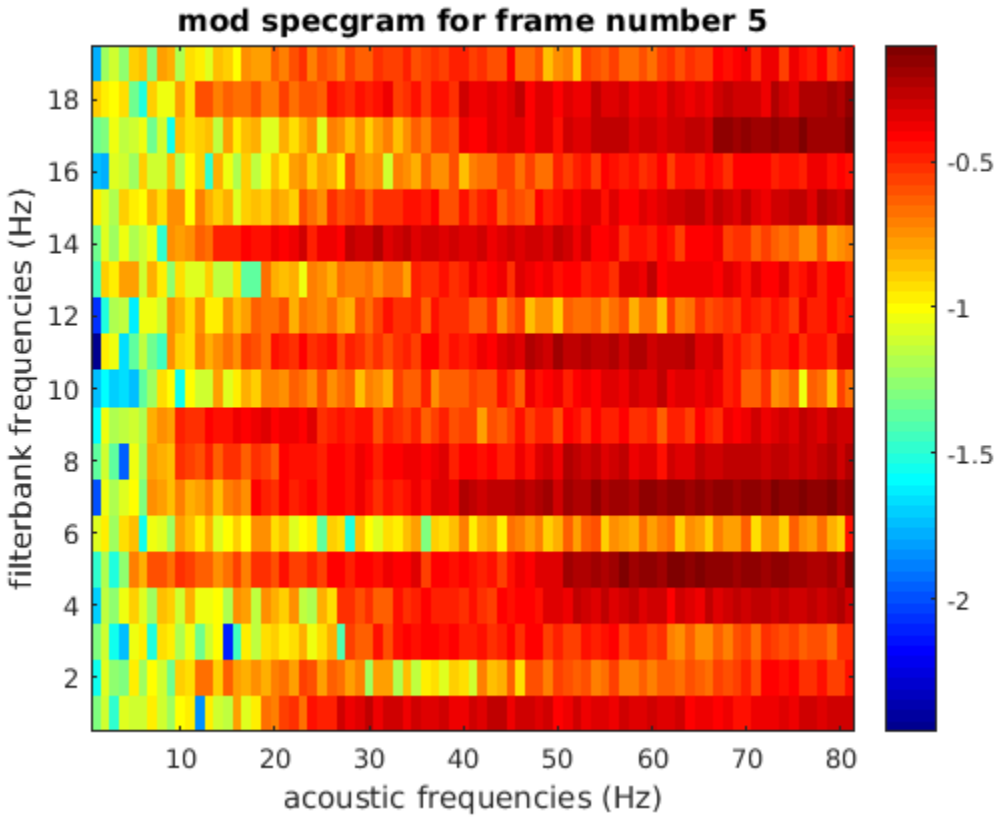
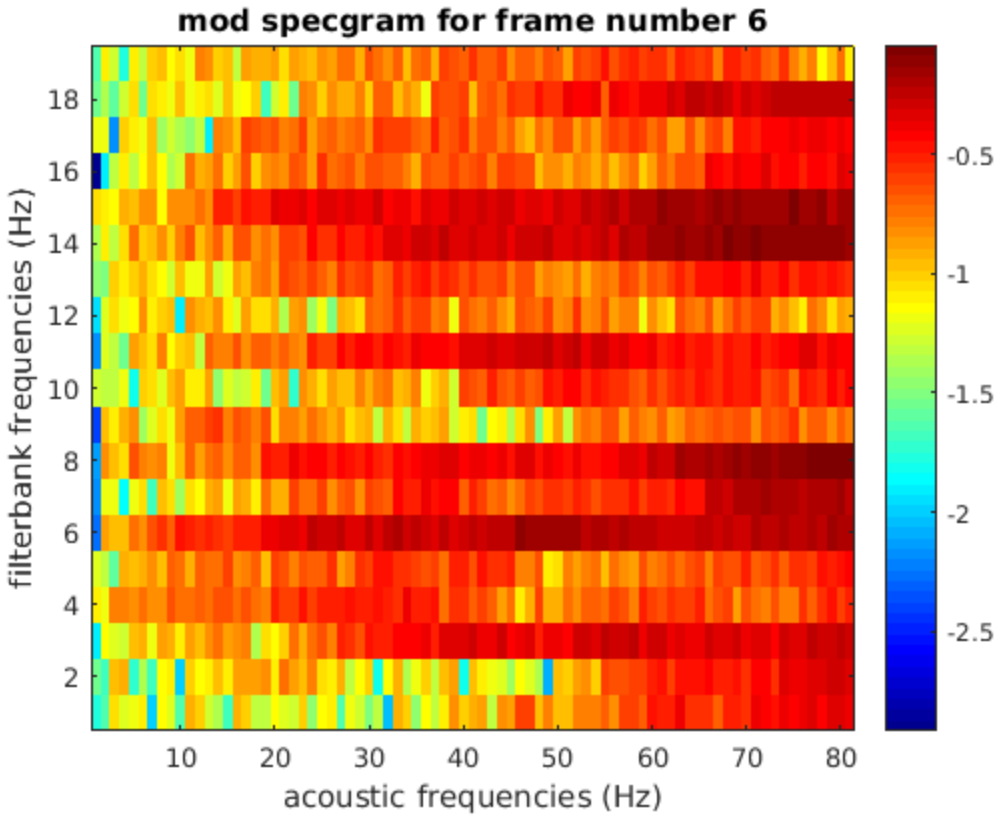


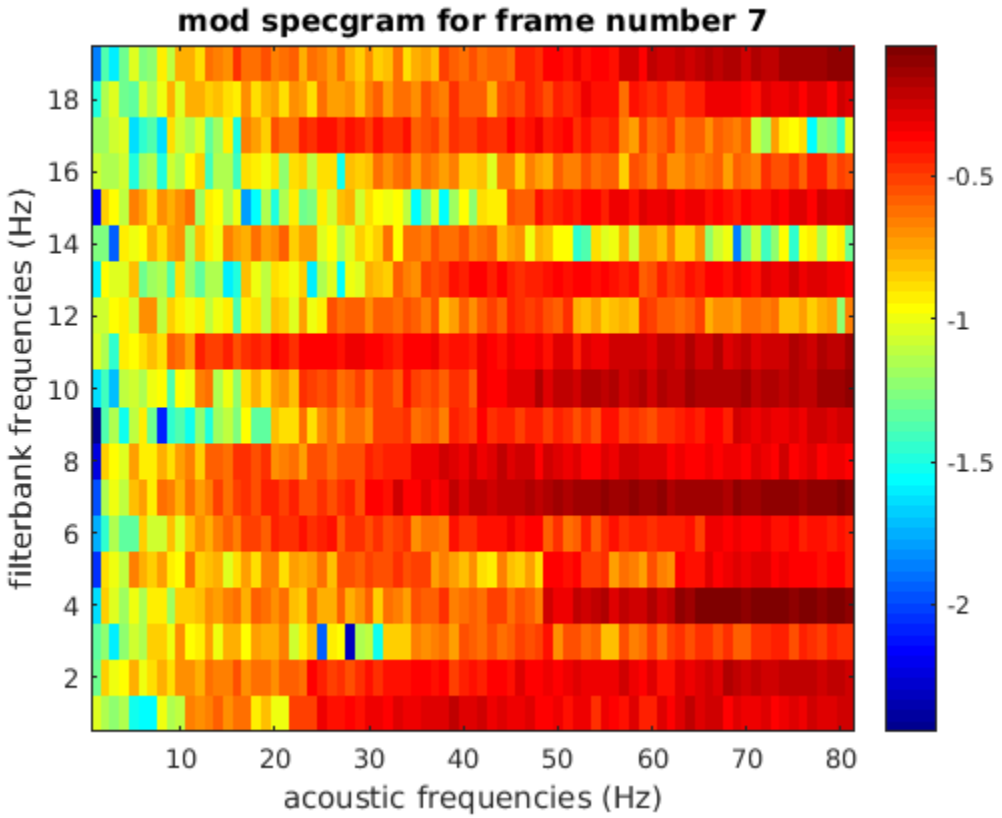

mod specgram for frame number 2
filterbank frequencies (Hz)
acoustic frequencies (Hz)
2
4
6
8
10
12
14
16
18
10
20
30
40
50
60
70
80
-0.5
-1
-1.5
-2
-2.5
-3

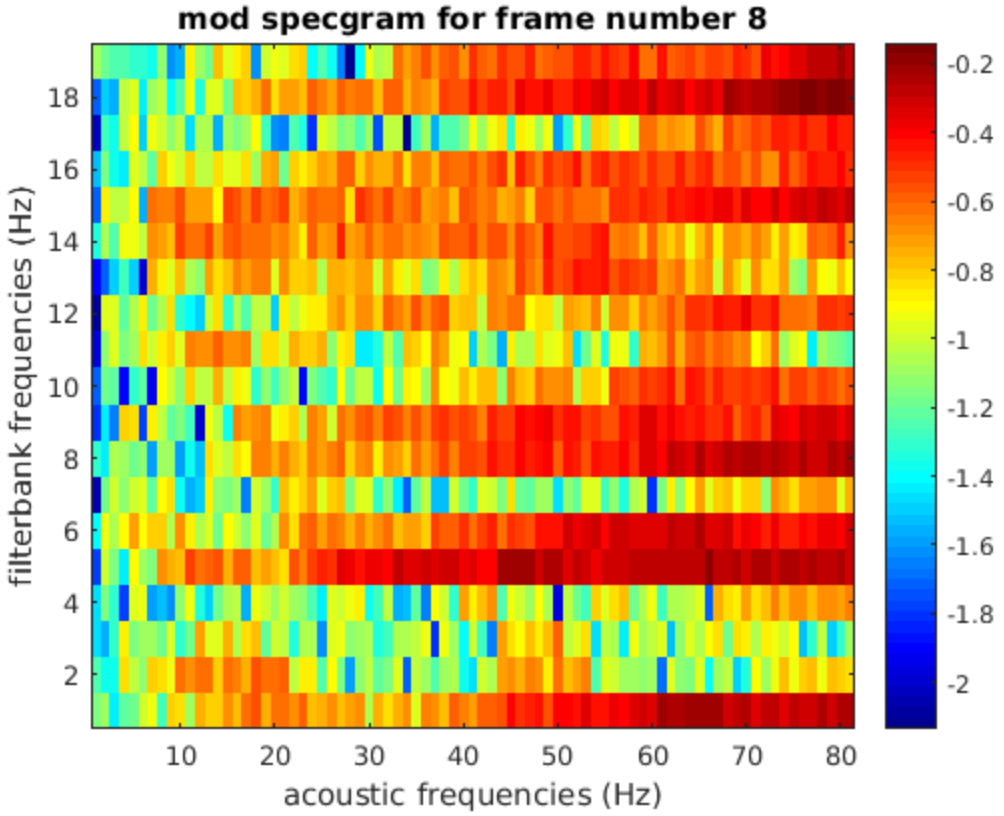

mod specgram for frame number 3
filterbank frequencies (Hz)
acoustic frequencies (Hz)
2
4
6
8
10
12
14
16
18
10
20
30
40
50
60
70
80
-0.5
-1
-1.5
-2
-2.5
-3

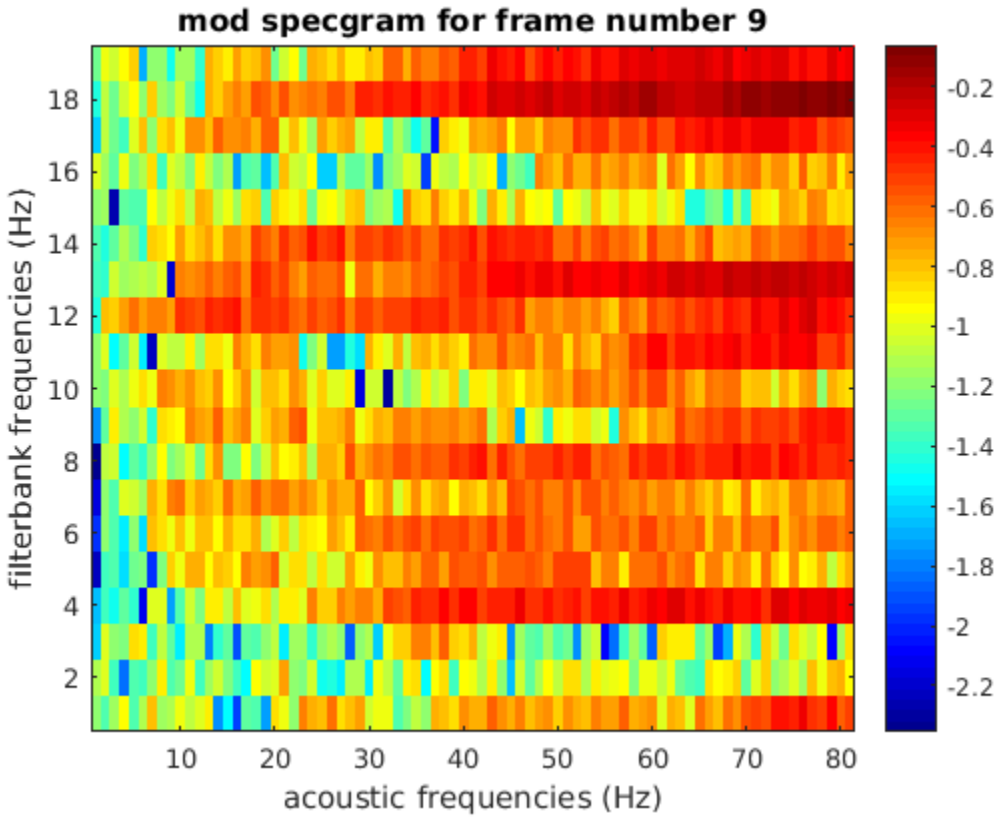

mod specgram for frame number 4
filterbank frequencies (Hz)
acoustic frequencies (Hz)
2
4
6
8
10
12
14
16
18
10
20
30
40
50
60
70
80
0
-0.5
-1
-1.5
-2
-2.5

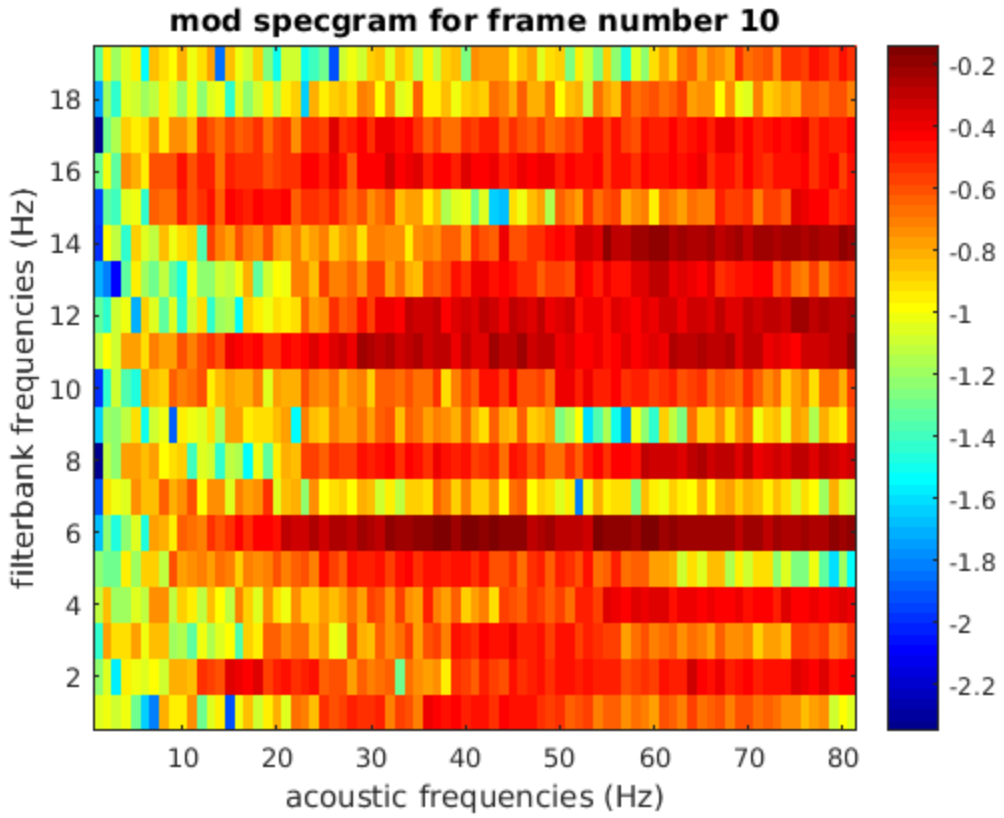

mod specgram for frame number 5
filterbank frequencies (Hz)
acoustic frequencies (Hz)
2
4
6
8
10
12
14
16
18
10
20
30
40
50
60
70
80
-0.5
-1
-1.5
-2


mod specgram for frame number 6
filterbank frequencies (Hz)
18
16
14
12
10
8
6
4
2
10
20
30
40
50
60
70
80
acoustic frequencies (Hz)
-0.5
-1
-1.5
-2
-2.5


mod specgram for frame number 7
filterbank frequencies (Hz)
18
16
14
12
10
8
6
4
2
10
20
30
40
50
60
70
80
acoustic frequencies (Hz)
-0.5
-1
-1.5
-2


mod specgram for frame number 8
filterbank frequencies (Hz)
acoustic frequencies (Hz)
2
4
6
8
10
12
14
16
18
10
20
30
40
50
60
70
80
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2


mod specgram for frame number 9
filterbank frequencies (Hz)
acoustic frequencies (Hz)
2
4
6
8
10
12
14
16
18
10
20
30
40
50
60
70
80
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
-1.6
-1.8
-2
-2.2



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