Simple Spectrogram

- sample bird call audio

```
[channels, sample_rate] = audioread('../datasets/XC403881.wav');
whos;
```

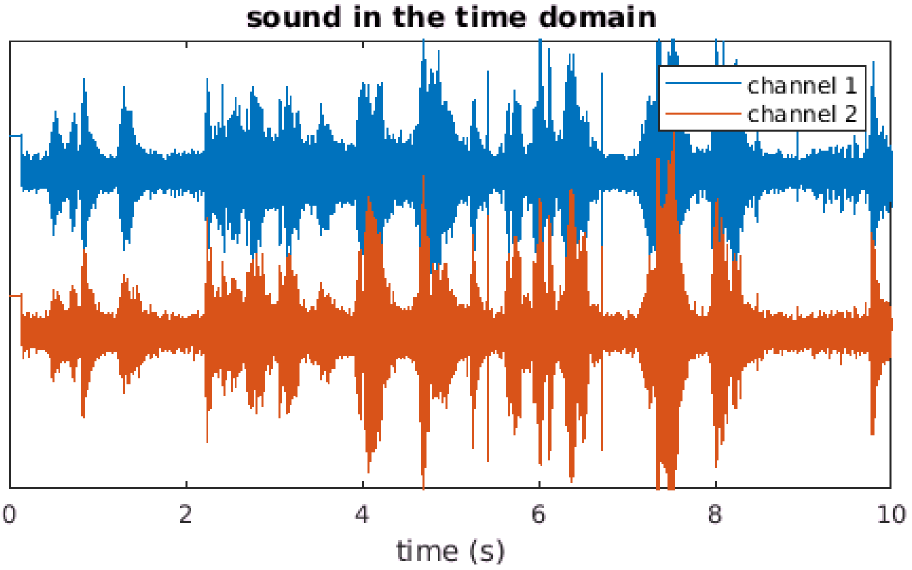
```
  Name                 Size                Bytes  Class     Attributes

  channels        450879x2               7214064  double              
  sample_rate          1x1                     8  double              
```

- note there are 2 channels
- play the audio

```
soundsc(channels, sample_rate);
N = length(channels);
t = (0:N-1)/sample_rate;
```

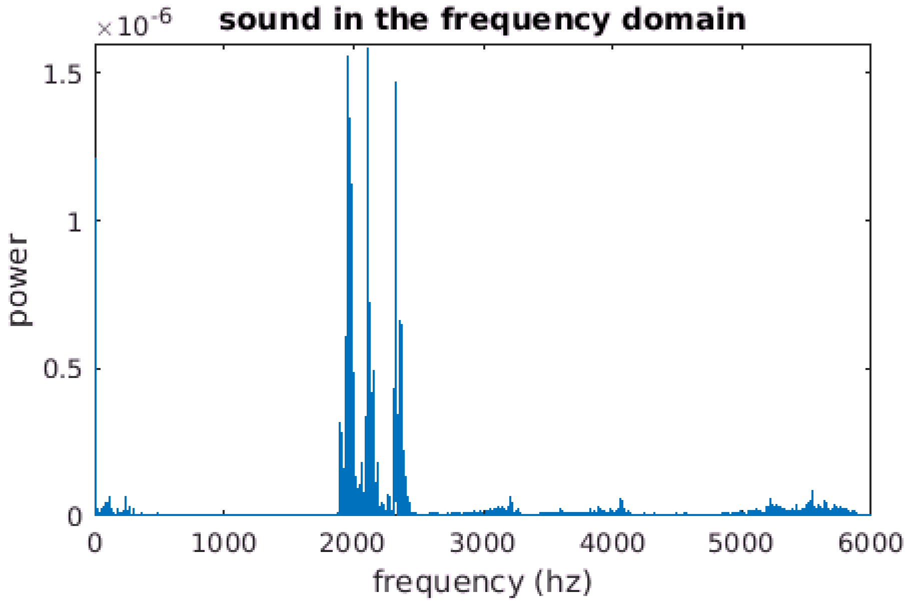
- plot the channels

```
f1 = figure(1); clf;
f1.Position = [0 0 600 300];
plot(t, bsxfun(@plus, channels, [.25 0])); %offset the channels
xlabel("time (s)");
title("sound in the time domain");
xlim([0 10]);
ylim([-.3 .4]);
yticks([]);
legend(["channel 1", "channel 2"]);
```



- compute and plot the power spectrum

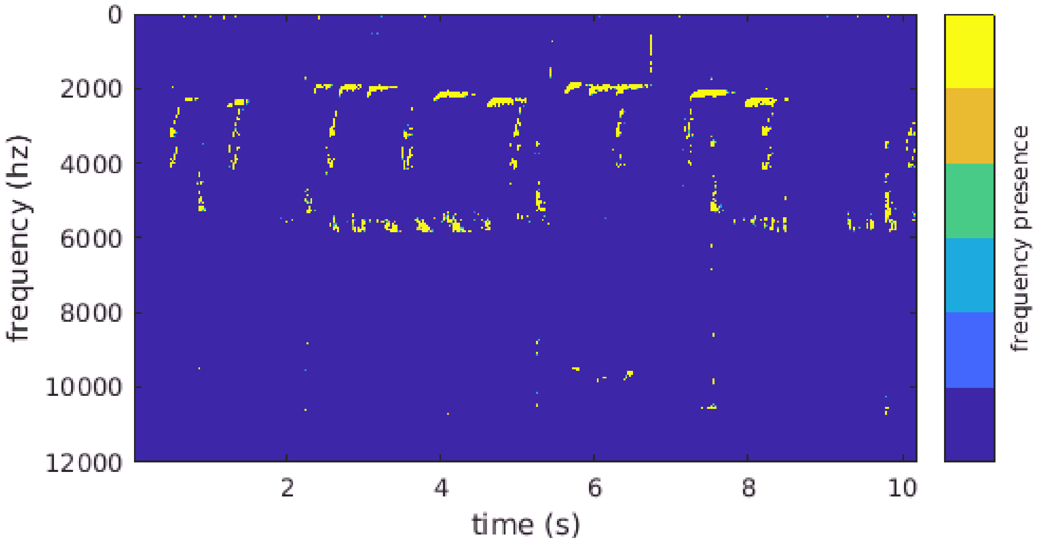
```
hz_vals = linspace(0, sample_rate/2, floor(N/2)+1);
powers = abs(fft(detrend(channels(:,1)))/N).^2;

f2 = figure(2); clf;
f2.Position = [0 0 500 300];
plot(hz_vals, powers(1:length(hz_vals)));
xlabel("frequency (hz)");
ylabel("power");
title("sound in the frequency domain");
xlim([0 6000]);
```



Now Apply spectrogram

- use function in signal processing tool box

```
[spectrum, frequency, time] = spectrogram(detrend(channels(:,1)), hann(1000), 100, [], sample_

f3 = figure(3); clf;
f3.Position = [0 0 600 300];
imagesc(time, frequency, abs(spectrum).^2);
ax = gca;
ax.CLim = [3 4];
ax.YLim = frequency([1 dsearchn(frequency, 12000)]);
ax.XLim = time([1 end]);
colormap(parula(6));
c = colorbar();
c.Label.String = "frequency presence";
set(c, 'YTick', []);
xlabel("time (s)");
ylabel("frequency (hz)");
```


0
2000
4000
6000
8000
10000
12000
frequency (hz)
2
4
6
8
10
time (s)
frequency presence