

EECS 207: Digital Image Processing

Spring 2025

Lab #2

Spectrogram Optimization

Due 11:59 pm Thursday, April 10 via CatCourses as .pdf file

(version 4/4/25 1pm)

Goal

To investigate certain design choices—specifically the window length, window overlap, and window shape—to see what settings produce the best spectrograms, at least visually, for bird calls from five different species. Also, do the same for an audio file of your choice.

To Do:

1. Download from CatCourses the file “EECS_207_Lab_02_Spring_2025_files.zip” which contains the following files:
 - spectrogram_birdcall.ipynb: The Jupyter notebook for creating the spectrograms.
 - DEJU.wav: 15 second clip of calls from the Dark-eyed Junco (*Junco hyemalis*).
 - PSFL.wav: 15 second clip of calls from the Pacific-slope Flycatcher (*Empidonax difficilis*).
 - SPTO.wav: 15 second clip of calls from the Spotted Towhee (*Pipilo maculatus*).
 - WAVI.wav: 15 second clip of calls from the Warbling Vireo (*Vireo gilvus*).
 - WIWA.wav: 15 second clip of calls from the Wilson's Warbler (*Wilsonia pusilla*).
 - Lab_02_Spectrogram_Optimization_Sample_Report.pdf: Sample report.
2. Use spectrogram_birdcall.ipynb to create spectrograms of the bird calls for the five birds. Experiment with the settings:
 - `window_length = <>`
 - `window_overlap = <>`
 - `win = <>`

That is, the window length, the window overlap, and the shape of the window. Look online (documentation) for options for the SciPy function `signal.get_window()` to choose different window shapes.

Try see which settings result in the best spectrograms at least visually. (Use whatever criterion to determine “best”.) You will later try determine this quantitatively using an image retrieval framework.

3. Find a .wav file online of a sound of your choice. Perform step 2 for your sound. You can download the free software Audacity if you need to shorten your clip, etc.

To Submit:

A single PDF with one page for your results for each of the five bird audio clips and one page for your results for the audio clip of your choice (six pages in total). Each page should:

- List your “optimal” parameter settings.
- Display the **figure** of the grayscale log of spectrum spectrogram corresponding to the optimal settings. This is the output of the command
`plt.savefig('figure_spectrogram_log.png', dpi=300, bbox_inches='tight')`
- Display the **image** of the grayscale log of spectrum spectrogram corresponding to the optimal settings. This is the output of the command
`plt.imshow(spectrogram_filename, s_spectrum_log, cmap='gray')`

See the file “Lab_02_Spectrogram_Optimization_Sample_Report.pdf” as an example.