Due: 11th week

2.2 Signal Separation

In this problem you will use NMF to separate a mixed signal into its component signals. Specifically, your goal is to separate music and speech sounds from a signal consisting of both.

The basic idea is that you will use NMF to first learn bases for speech and music. Then you will use the learned bases to separate out music and speech from a recording consisting of both.

Do the following processing steps.

1. In `problem2` folder of homework materials, you will find `speechf1.wav` file. Read speech signal and compute its spectrogram. You did this in previous homework. Use the stft function as before `spectrum = stft(s',2048,256,0,hann(2048))` followed by mag computation.

2. Do the same for `musicf1.wav` wav file.

Now using the spectrograms for music and speech you are first going to learn bases, B_m and B_s for speech. Use the function you wrote in previous problem. Set $K = 200$ and use `Bminit` and `Wminit` in `problem2` folder for initializing B and W for music. Similarly for speech use `Bsinit` and `Wsinit`. Use $niter = 250$

Now compute the spectrogram ($\mathrm{V}_{\mathrm{mixed}}$) and phase of the the mixed signal.

1. Implement a function `[speech_rec, music_rec] = separate_signals(`$\mathtt{V}_{\mathtt{mixed}}$`,`$\mathtt{B}_{\mathtt{music}}$`,`$\mathtt{B}_{\mathtt{music}}$`, niter)`. $\mathtt{V}_{\mathtt{mixed}}$ is spectrogram of mixed signal, $\mathtt{B}_{\mathtt{music}}$ is bases you learned for music, $\mathtt{B}_{\mathtt{speech}}$ is bases for speech. `speech_rec` is recovered speech spectrogram and `music_rec` is recovered music spectrogram.

Now using the phase for the mixed signal along with reconstructed spectrograms, reconstruct time domain music and speech signals. You did this in last homework as well. You can use the `stft()` function again to do this. Listen them. Do you think NMF does a decent job in separating signals.

2.2.1 What to submit and report ?

- Submit all scripts for this problem, including `separate_signals()` function. Your main script should be called `sigsepMain.m`. A template is available in "problem2" subdirectory.
- Submit learned bases B_m and B_s for music and speech. Save them as `.mat` files.
- Submit your time domain music and speech signals, which you obtained by decomposing the mixed signal.