**CoE 197P: Speech Signal Processing**

Second Long Exam: PART TWO

December 01, 2014

**INSTRUCTIONS:**

1. This is open-notes, open-books exam.
2. All the problems require that you submit an electronic copy of a bug-free MATLAB/Octave source code (indicate in your code if it runs on Octave). Type your name, student number and the HONOR CODE (as comments) in EVERY code that you will submit. I will run your codes twice. If your code does not run, you lose **60%** of the total number of points for that part. Make sure that all functions required to run your code are included in your submission.
3. Provide explanations or details in your codes as comments. Partial credit will be given for well-explained, but incomplete, solutions. Little credit will be given for correct, but unsupported, results. (For example, specifying a filter order without detailing the steps on how you arrived at that value, will not get you full points.)
4. Submit an electronic copy of the required files to our UVLE site. Make sure that you submit before the deadline, December 8, 2014, 12:00 NN.

**You are only allowed to consult with the instructor. Cheating will not be tolerated.** Good luck!

**HONOR CODE**

I do hereby affirm, on my honor as a student at the end of this exam, that I had no unlawful knowledge of the questions or answers prior to this exercise and that I have neither given nor received assistance in answering any of the questions during this exam.

TOPIC 3: Voice Activity Detection via STZCR

Voice activity detectors (VADs) involve locating speech segments from an audio stream or file. In this exercise, you are going to implement a VAD that uses the short-time zero crossing rate (STZCR) in distinguishing speech from non-speech segments.

You must create the following MATLAB/Octave functions:

* calcSTZCR
  + Description: calculates the STZCR for a given signal
  + Input:
    - Signal vector (samples)
    - Analysis window length (in number of samples)
    - Window overlap (in number of samples)
    - Analysis window type (Rectangular or Hamming)
  + Output:
    - STZCR contour
* doVAD
  + Description: locates the endpoints of speech segment/s present in a given file using STZCR
  + Input:
    - Input signal filename (same directory as the M-file)
  + Output:
    - Signal vector (samples)
    - Sampling frequency of the signal vector
    - Beginning and end locations of speech segments (in sample number): if one speech segment is present, then the output is a row vector of two elements, if there are two or more speech segments present, then the output is a matrix of 2xN where N is the number of speech segments
    - A plot of the signal vector where the speech segments are marked
  + Other notes
    - Your doVAD function must use the calcSTZCR function
* CoE197P\_FinalsP02\_<Surname01>\_<Surname02>
  + Description: an M-file that uses doVAD and calcSTZCR in performing VAD on a set of audio files.

Files needed

* 3 speech recordings, each containing one acoustic unit (can be a vowel or a consonant, any duration, but the files must be different from each other)
* 3 speech recordings, each containing one word (there must be three different words)
* 3 speech recordings, each containing one short sentence (there must be three different sentences)

Grading system (50 POINTS MAX)

* 70%: successfully implemented the STZCR-based VAD for recordings containing one acoustic unit
* 80%: successfully implemented the STZCR-based VAD for recordings containing one acoustic unit and for recordings containing one word
* 90%: successfully implemented the STZCR-based VAD for all recordings
* 100%: successfully implemented the STZCR-based VAD for all recordings plus 3 speech files that will be given by the instructor