ECE-448: Speech Signal Processing -- Monsoon 2018

Assignment 2
DEADLINE: Before 11.59PM on 20th Aug 2018

INSTRUCTIONS:
1. You may do the assignment using wavesurfer (preferable) or audacity.
2. You need to upload a single pdf file in the moodle. The file should contain your answers which may include screenshots, text etc.
3. At the top-right of the first page of your submission, include the assignment number, your name and roll number.
4. IMPORTANT: Make sure that the assignment that you submit is your own work. Do not copy any part from any source including your friends, seniors or the internet. Any breach of this rule could result in serious actions including an F grade in the course.
5. Your grade will depend on the correctness of answers. In addition, due consideration will be given to the clarity and details of your answers.

(For Q1 and Q2 you can use matlab or python; For Q1 and Q2 you can use wavesurfer)

Questions:

1.(a). Explain how the following parameters are extracted from speech signal. With respect to (Voiced/Unvoiced) V/UV detection

- **i) What acoustic behaviour does each parameter capture?**
- **ii) What are some shortcomings (if any) of each parameter?**

(b). Plot speech signal, parameter along with U/UV boundaries (choose any wav file from the given data set), ground truth of U/UV.

- **a: Energy**
- **b: Zero crossing rate**
- **c: Normalized autocorrelation coefficients**
- **d: Pre-emphasized energy ratio**

(c). Among the above parameters, according to you, which one is doing a good job in capturing V/UV regions? Justify your answer.

2. Using autocorrelation method find pitch period and fundamental frequency of speech signal that is recorded by you? What is the intuition behind autocorrelation method in finding the pitch?

3. Record all vowels (अ, इ , उ, ए, ओ or a, e, i, o, u or from our mother tongue) find the formants (f1, f2, f3) using wave surfer. Arrange the vowels in ascending order based on f1, f2, f3 individually.

Write short note on f1, f2 and f3 with respect to tongue height, tongue backness, lip rounding and etc? I.e correlate the f1,f2, and f3 with articulatory changes .

4. Record the consonant pairs "p, b", "t, d", "k, g" in V-C-V context (i.e a-k-a & a-g-a) . Using wave surfer observe the formants in the consonant region and report the formant changes (f1, f2, and f3).

What is VOT (voice onset time)? Find voice onset time for these consonant pairs?