DSP FINAL PROJECT

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Problem statement : VOP Detection using Spectral Peaks

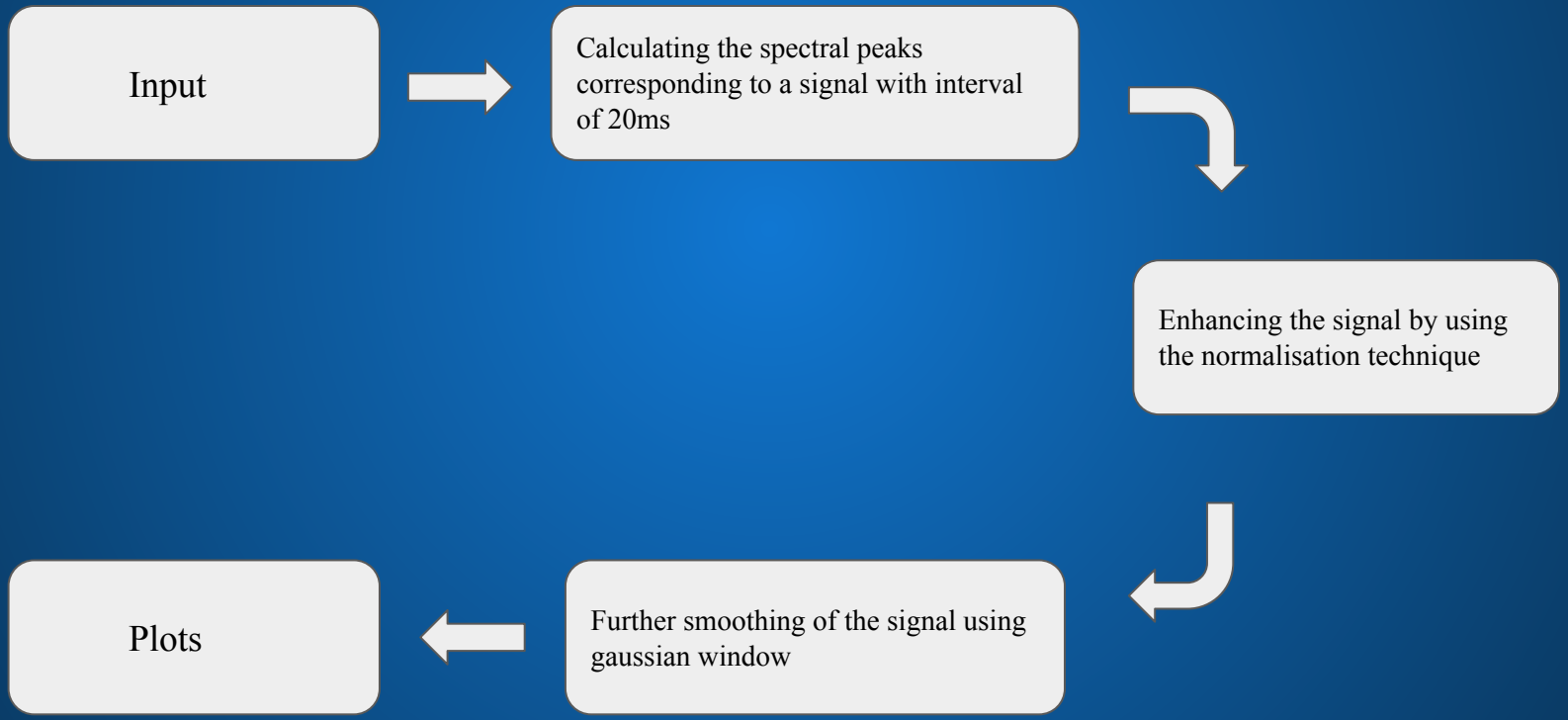
Intuition

VOWELS are produced by keeping the vocal tract in an open position with minimum obstruction along the length and using glottal vibration as the excitation

Vowel Onset Point is the point at which onset of vowel takes place in speech signals, vowel possess more spectral energy as compared to consonants so they can be identified easily.

Since Vowels possess more spectral energy that's why we are doing this using spectral peaks which includes the concept of spectral energy also.

Block Diagram



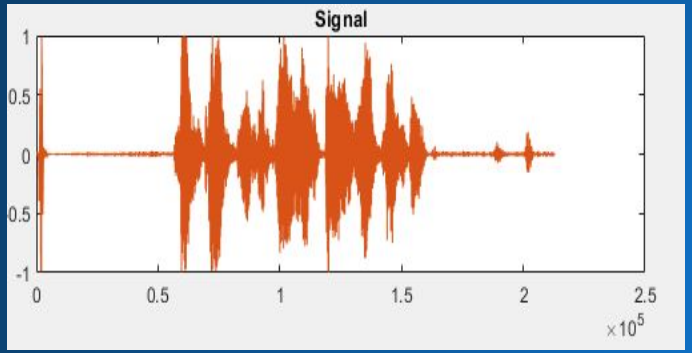
Mathematics Involved

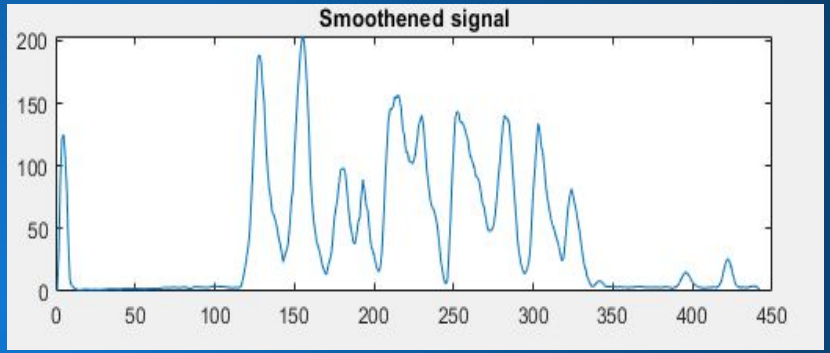
The speech signal is processed in a block of 20ms with a shift of 10ms. For each block of 20ms, 256-point DFT is computed, and ten largest peaks from first 128 points are selected. The sum of these amplitudes is plotted as a function of time which represents the energy of spectral peaks. The onset of vowel is observed as significant change in sum of ten peaks in the DFT spectrum. Further, enhancing is performed by convolving it with FOGD operator and the obtained output is the VOP evidence plot using spectral peaks. The peaks in the VOP evidence plot indicate the possible VOP locations

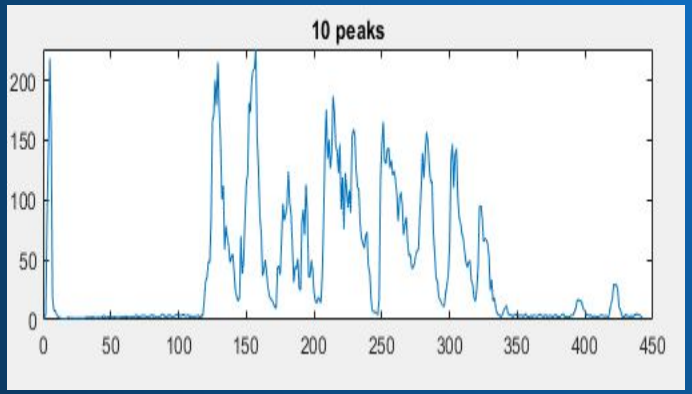
Results

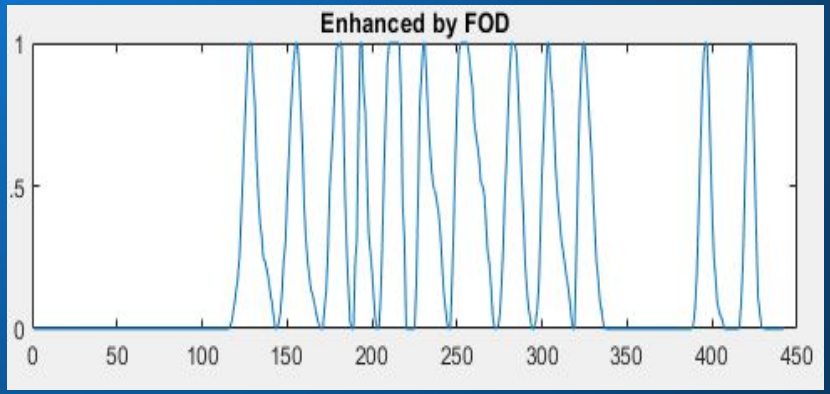
- We have successfully taken voice sample as a input.
- We have successfully identify max 10 peaks in the interval of 20 ms each.
- Resultant signal is enhanced using FOD.
- Final evidence plot is obtained using FOGD operator.

Results

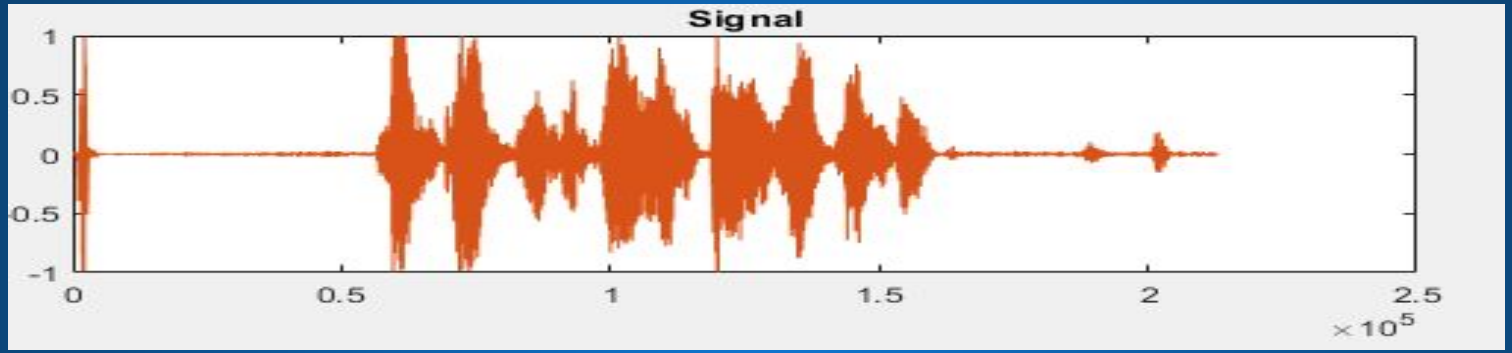

Signal
1
0.5
0
0.5
-1
0
0.5
1
1.5
2
2.5
×10^5

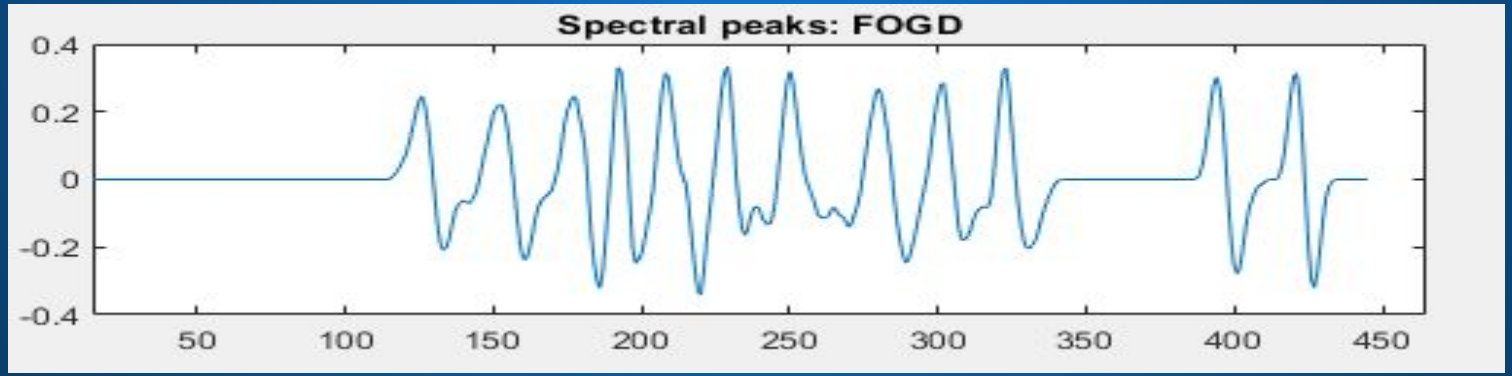

Smoothened signal
200
150
100
50
0
0
50
100
150
200
250
300
350
400
450


10 peaks
200
150
100
50
0
0
50
100
150
200
250
300
350
400
450


Enhanced by FOD
1
.5
0
0
50
100
150
200
250
300
350
400
450

Results


Signal
1
0.5
0
-0.5
-1
0
0.5
1
1.5
2
2.5
×10^5


Spectral peaks: FOGD
0.4
0.2
0
-0.2
-0.4
50
100
150
200
250
300
350
400
450

Drawbacks

- Using filters and operators in matlab can cause delay in the evidence plot of our signal.
- Large amplitude noise cannot be distinguished by this method, which may cause miscalculations.

Reference:

https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=4802173