Обработка и интерпретация речевого сигнала. Обработка сигнала во временной области

П. А. Холявин

p.kholyavin@spbu.ru

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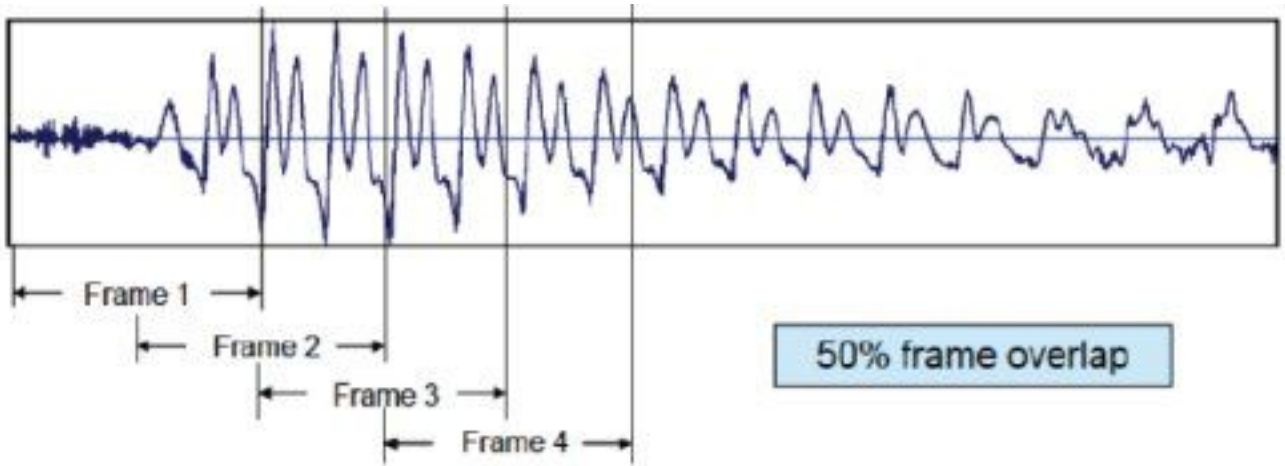
Обработка сигнала

1. Разбиение сигнала на окна (frames):

+ проблема последнего окна (чему равно количество фреймов в сигнале?)

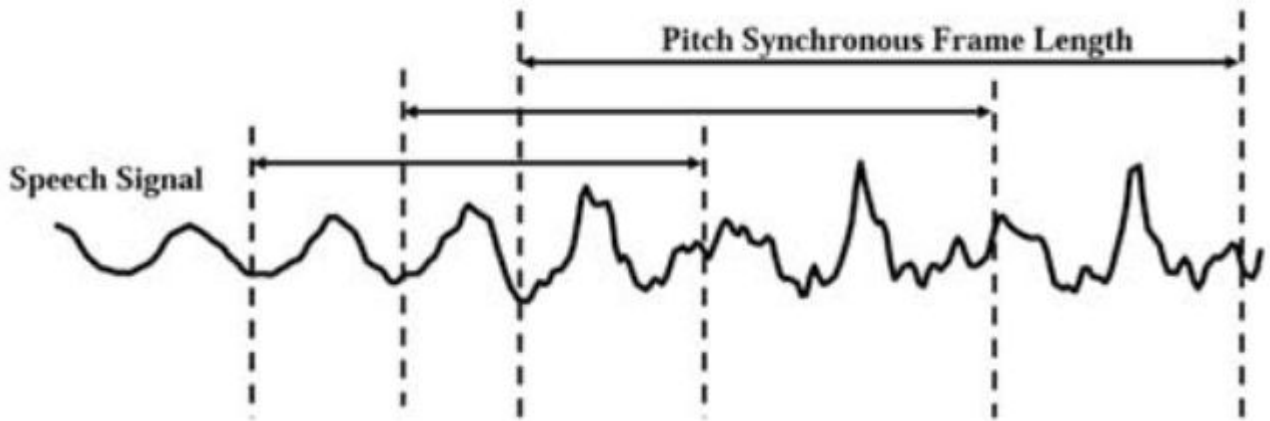


Обработка сигнала

Длина фрейма:

1. Фиксированная

2. Равная периоду ОТ

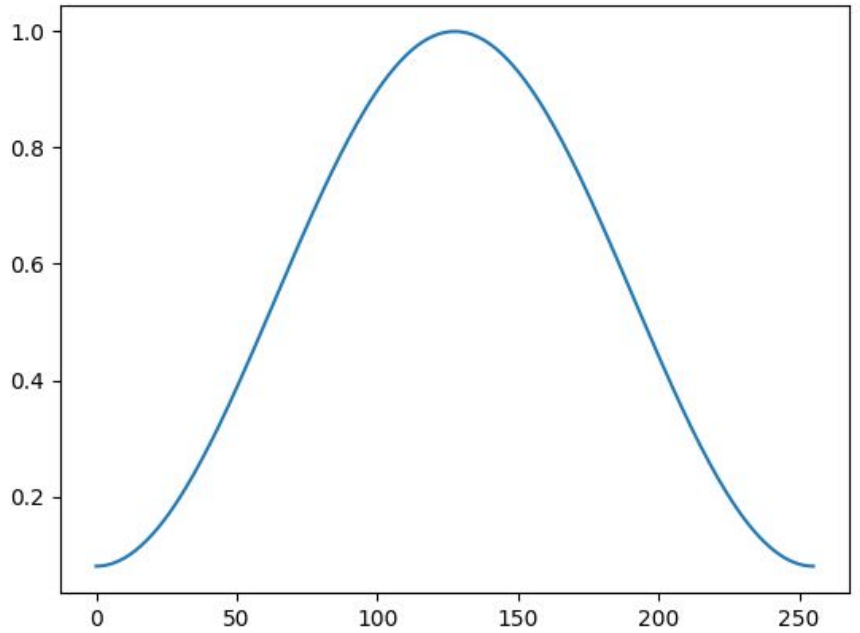


Обработка сигнала

2. Оконные функции:

а) прямоугольное окно

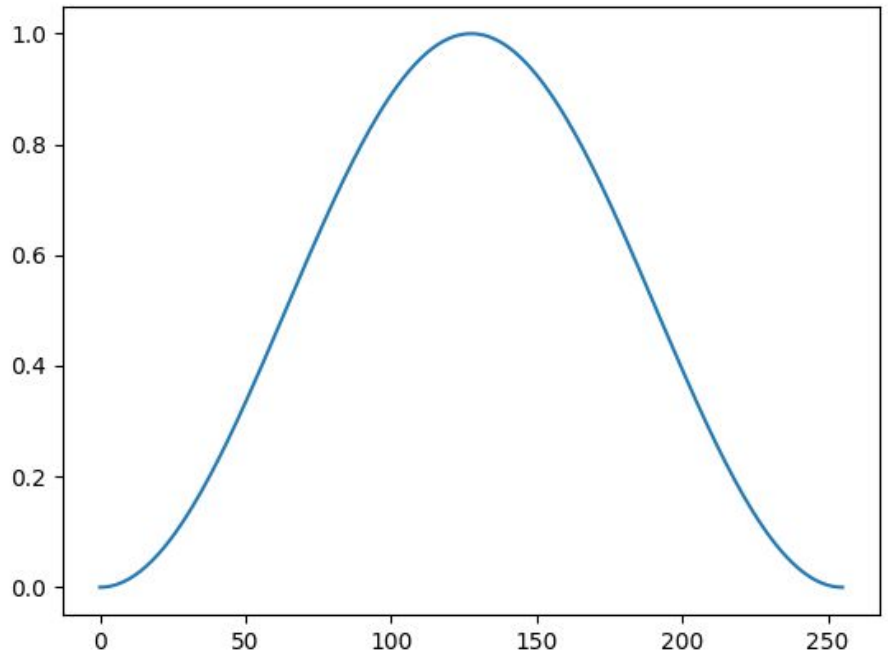
б) окно Хэмминга (Hamming)



Обработка сигнала

2. Оконные функции:

в) окно Ханна/*Ханнинга* (Hann/*Hanning*

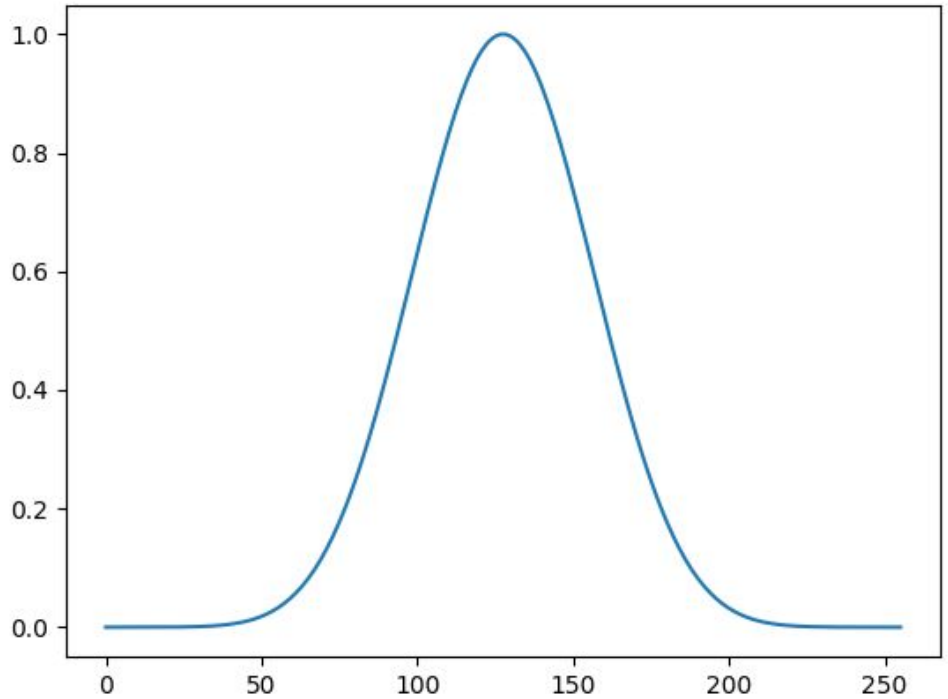


Обработка сигнала

2. Оконные функции:

г) окно Кайзера (Kaiser)

$$w(n) = I_0\left(\beta\sqrt{1-\frac{4n^2}{(M-1)^2}}\right)/I_0(\beta)$$



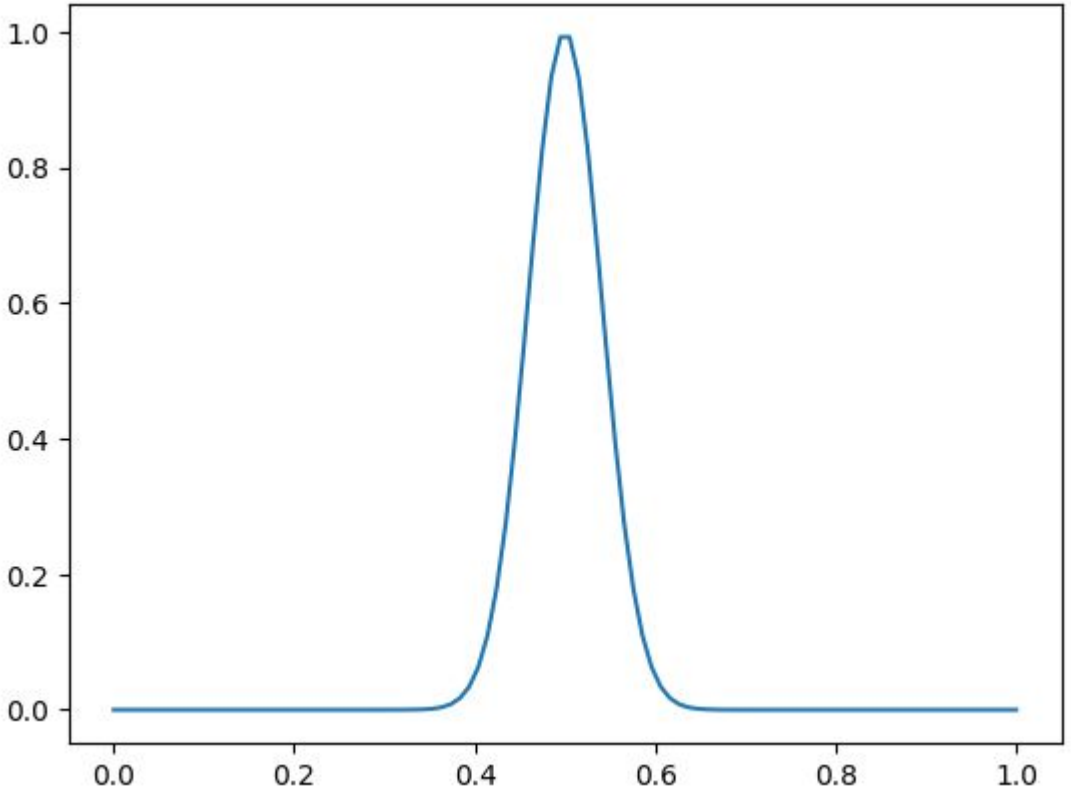
Обработка сигнала

2. Оконные функции:

д) Гауссово окно

$$w[n] = \exp\left(-\frac{1}{2}\left(\frac{n - N/2}{\sigma N/2}\right)^2\right), \quad 0 \le n \le N.$$

$\sigma \le 0.5$



Признаки сигнала

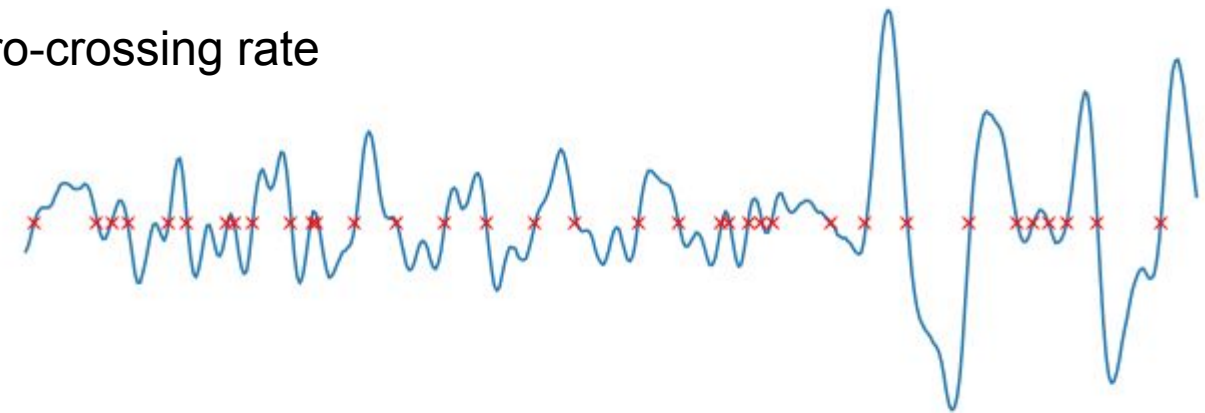
1. Энергия

$$\int_{t1}^{t2} x^2(t)\,dt$$

2. Интенсивность

The values in the sound are first squared, then convolved with a Gaussian analysis window (Kaiser-20; sidelobes below -190 dB). The effective duration of this analysis window is 3.2 / *pitchFloor*, which will guarantee that a periodic signal is analysed as having a pitch-synchronous intensity ripple not greater than 0.00001 dB.

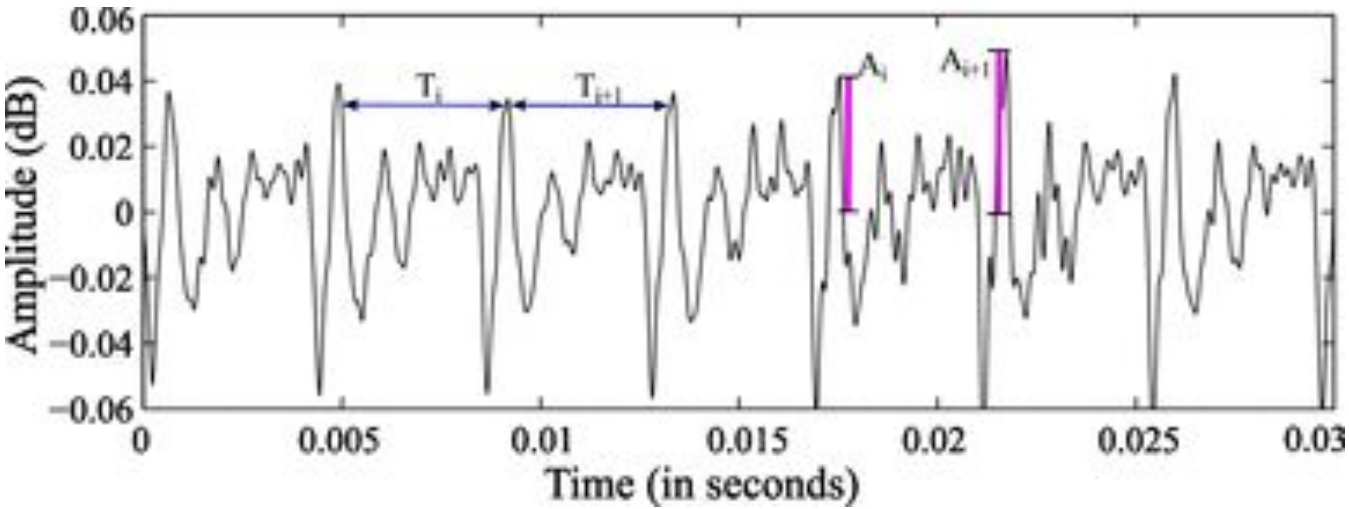
3. Zero-crossing rate



Признаки сигнала

4. Джиттер

5. Шиммер



Джиттер

First, we define the absolute (non-relative) local jitter (in seconds) as the mean absolute (non-negative) difference of consecutive intervals:

$$jitter(\text{seconds}) = \sum_{i=2}^{N} |T_i - T_{i-1}| / (N - 1)$$

where T_i is the duration of the ith interval and N is the number of intervals. If an interval T_{i-1} or T_i is not between **Period floor** and **Period ceiling**, or if T_{i-1}/T_i or T_i/T_{i-1} is greater than **Maximum period factor**, the term $|T_i - T_{i-1}|$ is not counted in the sum, and N is lowered by 1 (if N ends up being less than 2, the result of the command is undefined).

Second, we define the mean period as

$$meanPeriod(\text{seconds}) = \sum_{i=1}^{N} T_i / N$$

where T_i is the duration of the ith interval and N is the number of intervals. If an interval T_i is not between **Period floor** and **Period ceiling**, or if T_{i-1}/T_i or T_i/T_{i-1} is greater than **Maximum period factor** *and* T_{i+1}/T_i or T_i/T_{i+1} is greater than **Maximum period factor**, the term T_i is not counted in the sum, and N is lowered by 1; this procedure ensures that in the computation of the mean period we use at least all the intervals that had taken part in the computation of the absolute local jitter.

Finally, we compute the (relative) local jitter as

$$jitter = jitter(\text{seconds}) / meanPeriod(\text{seconds})$$

Спасибо за внимание!