Speech to Singing Synthesis

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What to do?

Input

Our system

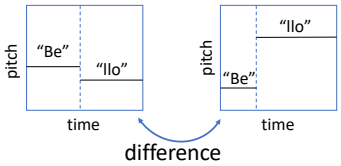
Output

How to do?

speaking

singing

1. Detect the pitch of each phoneme



2. Pitch shifting and tempo change

Pitch Detection

Yin algorithm

Step1: Autocorrelation

$$r_t(\tau) = \sum_{j=t+1}^{t+W} x_j x_{j+\tau}$$

Step2: Difference Function

$$d_t(\tau) = \sum_{j=1}^{W} (x_j - x_{j+\tau})^2$$

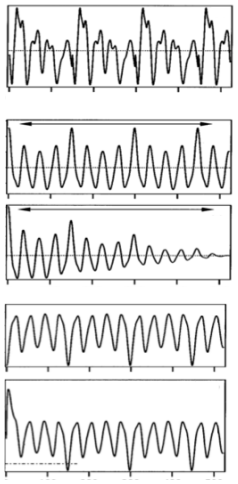
where τ is the lag time

Step3: Cumulative mean

$$d'_t(\tau) = \begin{cases} 1, & if\ \tau = 0 \\ \frac{d_t(\tau)}{\frac{1}{\tau}\sum_{j=1}^{\tau} d_t(j)}, & otherwise \end{cases}$$

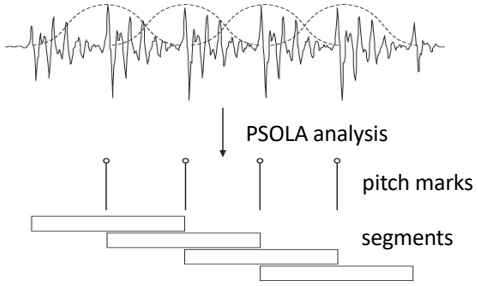
Step4: Absolute threshold

Step5: Parabolic interpolation



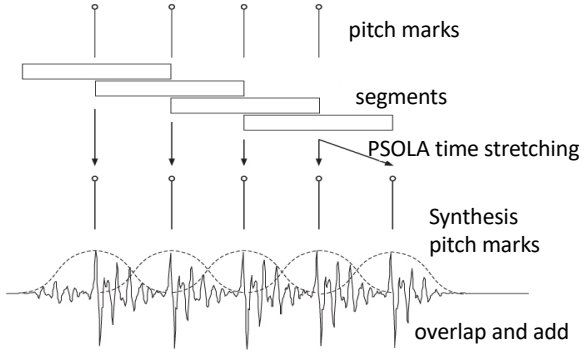
Pitch shifting and tempo change

PSOLA



(a) Determination of the pitch period P(t) of the input signal and of time instants (pitch marks) t_i

(b) Extraction of a segment centered at every pitch mark t_i by using a Hanning window with length $L_i = 2P(t_i)$



(a) Choice of the corresponding analysis segment i to minimize the time distance $|at_i - \tilde{t}_k|$

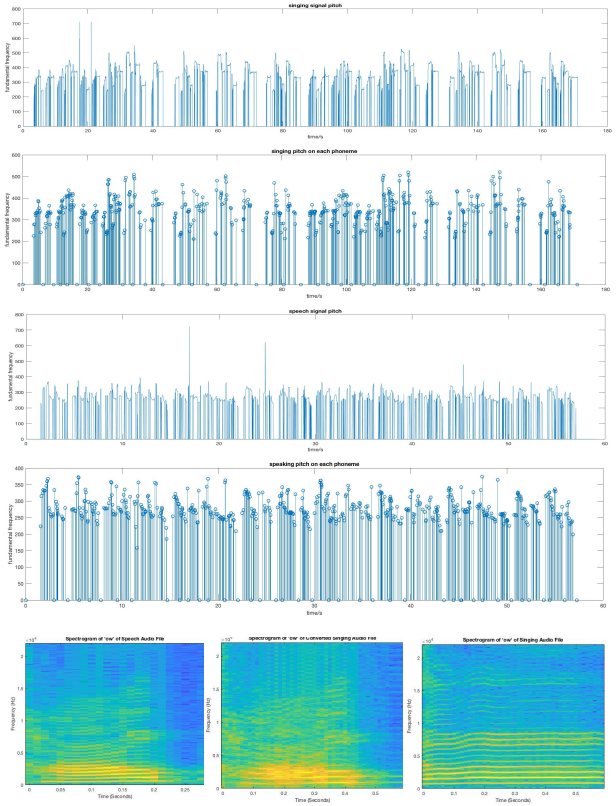
(b) Overlap and add the selected segment.

(c) Determination of the time instant where the next synthesis segment will be centered.

Data

NUS Sung and Spoken Lyrics Corpus.
Speaking lyrics , singing voice, and temp steps baseline of each phoneme.

Result



Listen to the demo!