

SINGING MELODY EXTRACTION IN POLYPHONIC MUSIC BY HARMONIC TRACKING

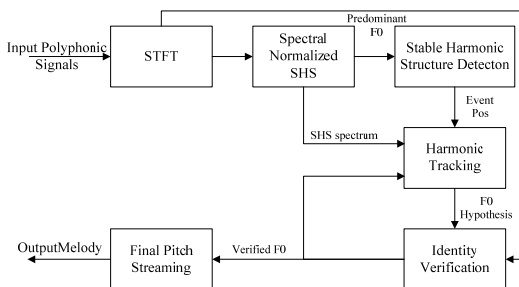
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TASK DESCRIPTION

Given a polyphonic music audio, this method extracts the fundamental frequency values of the melodic music instrument (sometimes human singing).

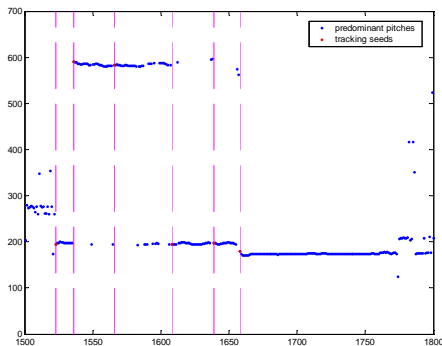
Our method is based on **Sub-Harmonic Summation (SHS) spectrum** and a novel **harmonic structure tracking strategy**.



STABLE HARMONIC STRUCTURE DETECTION

Stable condition:

- dominating the mixture
- lasting for enough long time



HARMONIC TRACKING

We use the **SHS spectrum** to track harmonic structure forward and backward.

- Taking stable harmonic structures as **track seeds**
- Tracking process goes **forward and backward**

CANDIDATE SELECTION

Hypothetic F0s that satisfy the following condition are selected into the candidates pool.

$$\{f_i \in F_{Cand} \mid |f_i - f_c| < \theta_c \cdot f_c, H(f_i) \geq H(f_{i+x})\}$$

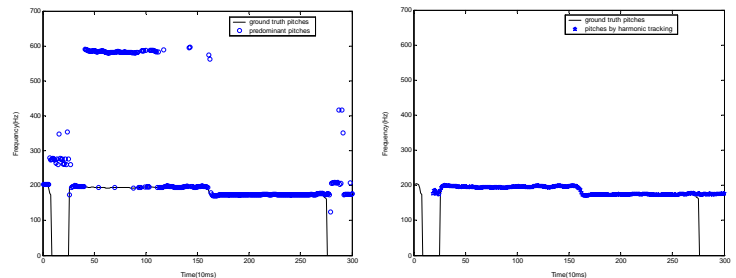
in which, f_c is the **last confirmed pitch**, θ_c is continuity factor, $H(*)$ is the **SHS** value of a certain pitch hypothesis and $x \in [-d_s, +d_s]$, d_s is the check range for **local SHS spectrum maximum**.

IDENTITY VERIFICATION

We try to use **timbre information** and calculate the **cross-correlation** between the **hypothetic harmonic family** and the **confirmed harmonic family**. Hypotheses survive if they satisfy:

$$Corr(F_H, F_C) > \theta_{Thres}$$

then F0 with the biggest saliency is chosen and the tracking process **goes on!**



EXPERIMENTAL RESULTS

Test Sets:

- Set1: **LabROSA** database
- Set2: **vocal part of Set1 + 4 pop songs** in IS-MIR04 test set

Test Set	Acc_p	Acc_f
Set1	78.30%	82.23%
Set2	74.12%	79.39%

Acc_p is the pitch accuracy of the **predominant pitch** and **Acc_f** is the accuracy of the **tracked out pitch**, the tolerance is $\pm 1/4$ tone.

CONCLUSION

The **improvement** upon predominant pitch is **3.87%** on test Set1 and **5.27%** on Set2.