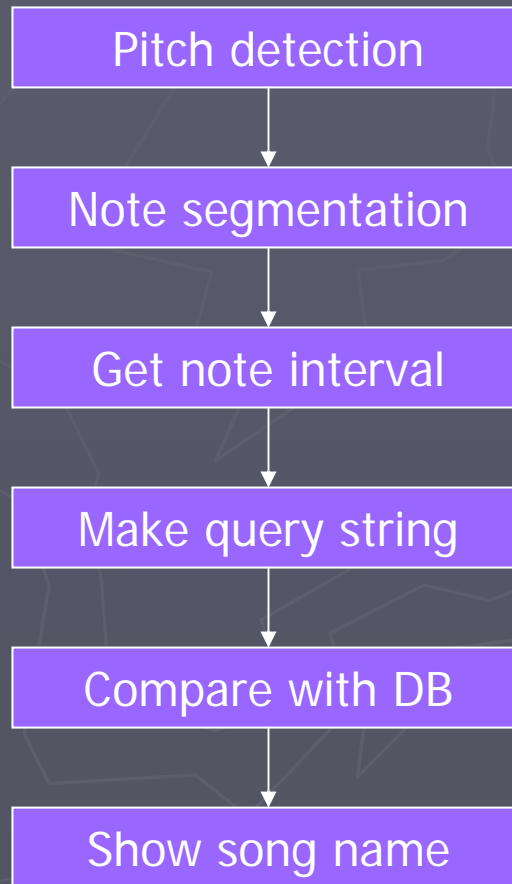


Query by Humming System

Dong In Lee

MA/MST '07

System Overview



Pitch Detection

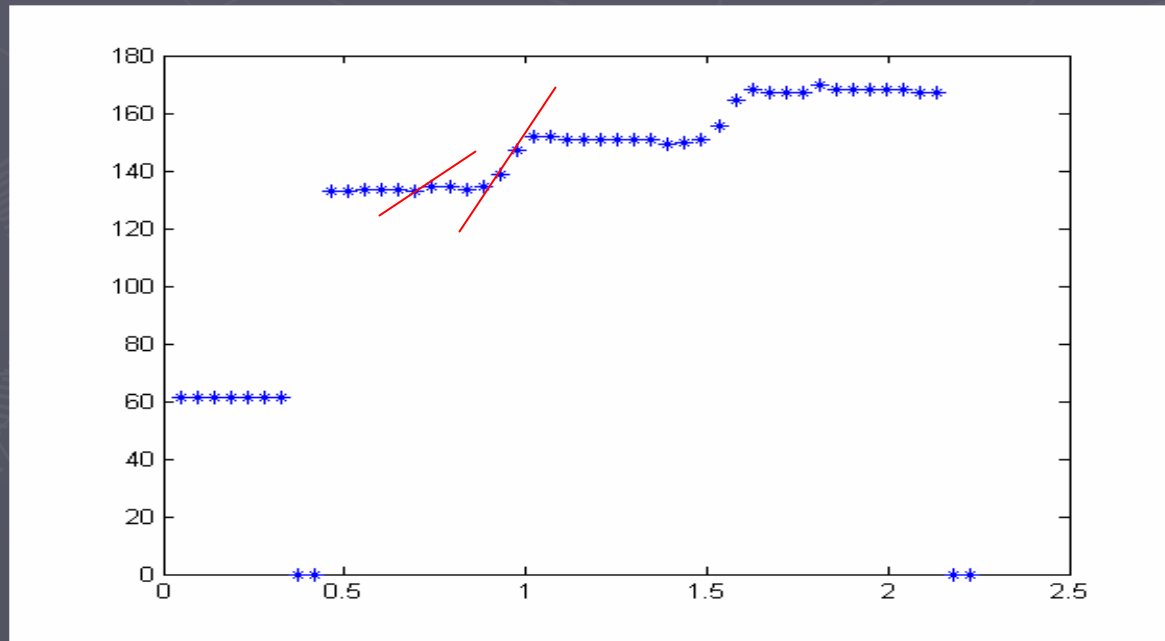
► YIN algorithm

Based on the well known autocorrelation method for detecting a signal's periodicity.

Since the basic autocorrelation method has high error rates, YIN introduces several modifications to reduce the errors while maintaining simplicity and low-latency in its implementation.

Note Segmentation

Set the threshold value for slope between two pitches



Note Interval & Query String

- ▶ People can't hum in original key for any song. Thus, instead of using absolute key note, I used note interval.

Ex) C C G G A A G => 0 7 0 2 0 -2

- ▶ I made simple scheme for converting numbers to string

Ex) 0 7 0 2 0 -2 => 0 g 0 b 0 B

Database specification

- ▶ Same scheme was used to make DB

Ex) Happy birthday song

0bBeAD0bBgBE0ICDABh0ADAa

String Compare Algorithm

► 1st trial : String Edit Distance Algorithm

■ Principle

Query : 0bDA

Database : 0bBeA

Distance : 2

■ Problem

Query : 0bDA

Intended DB : 0bBeAD0bBgBE0ICDABh0ADAa

Distance : 21

Vicious DB : hhhh

Distance : 4!

String Compare Algorithm Con't

► 2nd trial : LCS Algorithm

■ Principle

Query : 0bDA

Intended DB : 0bBeAD0bBgBE0ICDABh0ADAa

=> LCS Length : 3

Vicious DB : hhhh

=> LCS Length : 1

■ Problem

More Vicious DB : xx0xxx**b**xxA

LCS Length : 3

String Compare Algorithm Con't

▶ 3rd trial : Modified LCS Algorithm

- Principle
Check adjacent characters

If common characters are found, modified algorithm check to see if the adjacent characters are also verified to common characters.

=>The more adjacent common characters there exists, the higher value the query has.

Cf. Time complexity : $O(m*n)$ with Dynamic programming technique





















String Compare Algorithm Con't

► Modified LCS Algorithm

Value of intended DB

0 -> 3 -> 2 -> 1 ->

0 -> 3 -> 6

	0	b	B	e	A
0					
b					
D					
A					

Conclusion

► Evaluation

This QBH system shows good performance when the user makes “good” query

► Future Work

- Fast transition detection
- More elaborated algorithm for string matching