Query by Humming

Musical Information Retrieval in An Audio Database

by

Asif Ghias, Jonathan Logan,

David Chamberlin, Brian Smith

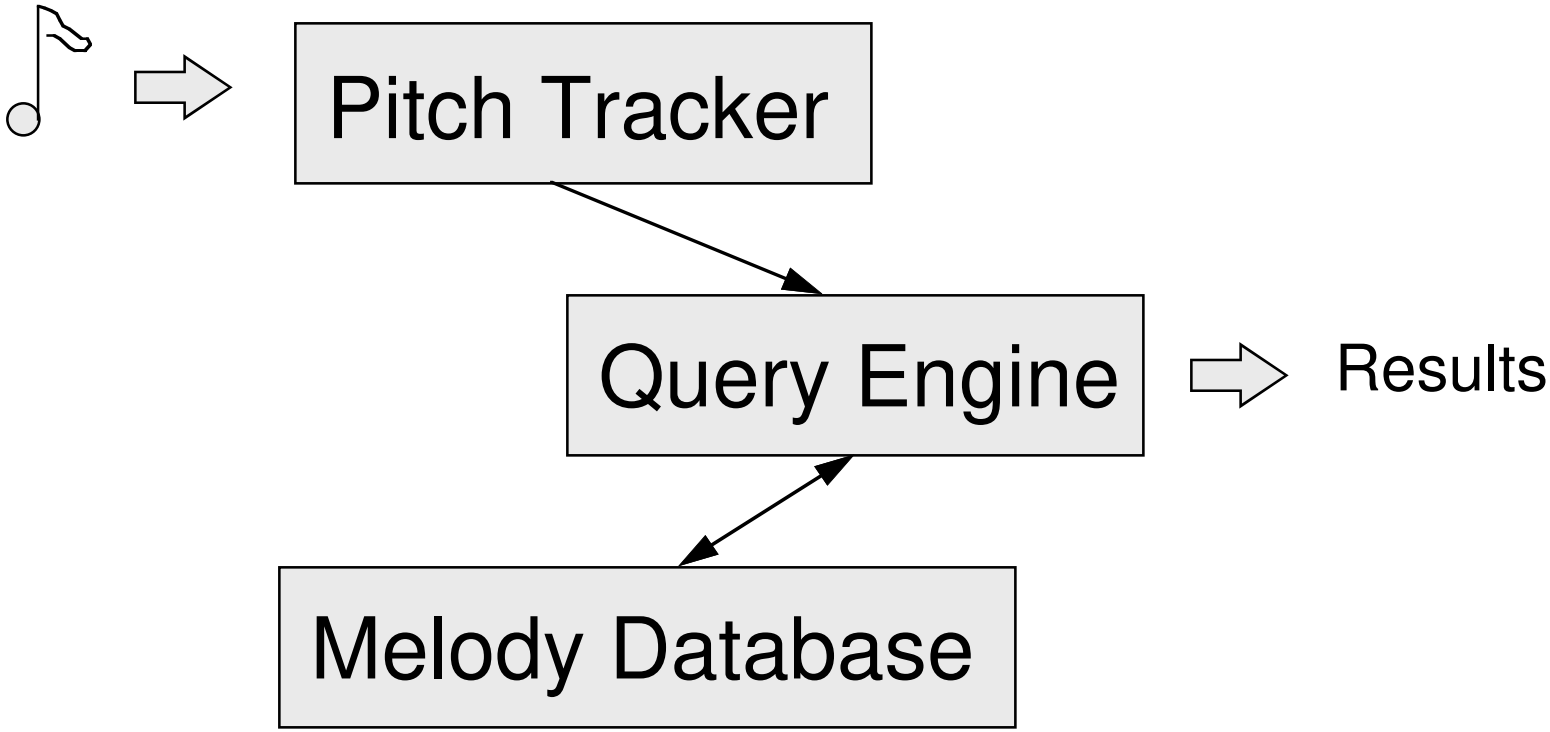
Presented by

Aaron McClennen

Query by What?

- The natural way to query a database of music.
- Give the computer an audio clip and let it find the piece.

The System



Your Voicebox the Machine

- Air flows through the glottis
- The chords vibrate
- The glottis closes
- A linear passive transmission system

How Computers Hear Music

- Autocorrelation (Slow)
- Maximum Likelihood (Slower)
- Cepstrum Analysis (Inaccurate)

Autocorrelation

- Isolate Signal Peaks for Instantaneous Pitch
- Create Signal Pitch with Transfer function

$$R(l) = \sum_{k=-\infty}^{\infty} h(k)h(l+k)$$

The Others

- Maximum Likelihood
  - » Gives better results than autocorrelation
  - » Order of Magnitude Slower
- Cepstrum
  - » DFT based
  - » Inaccurate for this application

Searching 1

- Melodies simplified to S,U,D
  - » Same note
  - » Upward changing pitch
  - » Downward changing pitch
- Queries and Stored Music have string representations

Searching 2

- Baesa-Yates & Perlberg string matching with *k* mismatches
- Returns a list of possible matches

Music Futures

- Improved pitch-tracking
- Alter the key searching to differentiate between different “spelling” errors
- Increase the alphabet size