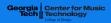


Introduction to Audio Content Analysis

module 7.3.5: fundamental frequency detection — evaluation

alexander lerch



introduction overview



corresponding textbook section

section 7.3.5

lecture content

- evaluation of pitch tracking systems
- challenges in annotation
- metrics

learning objectives

• successfully plan a systematic evaluation procedure for a pitch detection system



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pitch evaluation



goal: compare predicted pitch and ground truth pitch

- differentiate various 'pitch tracking' tasks
 - pitch of individual notes
 - pitch of monophonic melody
 - pitch of **pre-dominant melody** in polyphonic mixture
 - pitches in multi-timbral polyphonic mixture

pitch evaluation tasks



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pitch evaluation annotation challenges



- pitch discretization
 - (MIDI/score) pitch of individual notes
 - F0
- time discretization
 - start and stop time of note
 - equidistant time stamps

how to annotate F0



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how to annotate F0



- all metrics should be computed in the pitch domain, not the frequency domain
- metrics measure a match between ground truth and predicted pitch (⇒ tolerance)
- Raw Pitch Accuracy:

$$RPA = \frac{\sum\limits_{\forall n} TP_n}{\mathcal{N}}$$

$$TP_n = \left\{ \begin{array}{ll} 0, & \text{if } |\mathfrak{p}_{\mathrm{GT}}(n) - \hat{\mathfrak{p}}(n)| \geq 0.5 \\ 1, & \text{otherwise} \end{array} \right.$$

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pitch evaluation result aggregation



- aggregate per datapoint (frame/note)
- aggregate per file



potential data problems

- pitch and time quantization
- reliability of ground truth
- time resolution mismatch of ground truth and system

metrics

- score pitch match (chroma match)
- measures of deviation

factor impacting metrics

voicing detection

