

Improved Pitch Trajectory Estimation for Polyphonic Single-Channel Audio Mixtures

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Abstract— Estimating pitch trajectories for harmonic sources in single-channel polyphonic mixtures is a difficult task, especially when significant changes in volume and background instrumentation are present. A novel strategy is proposed to extract an improved and reliable dominant source pitch trajectory, based on one existing multipitch estimator, high-pass filtering, salience measurement and continuity.

I. INTRODUCTION

Multipitch estimation, i.e. the task of extracting fundamental frequencies associated with harmonic sources in polyphonic signals, is an active area of research activity as an essential part of algorithms aimed towards applications such as automatic music transcription, audio source separation or creative sound transformation. It remains, however, a difficult endeavor, highly dependent on the number and relative volumes of the sources involved.

Duan's algorithm [1, 2] is an example of such a system. It estimates the number of harmonic sources present in the mixture and their fundamental frequencies, based on a maximum likelihood approach.

II. POTENTIAL PROBLEMS

Strong background instrumentation and changes in relative volume of the sources usually cause the multipitch estimator to deliver misleading pitch trajectories. In Figure 1, an incorrect estimation for a commercial recording of flute and drums is presented.

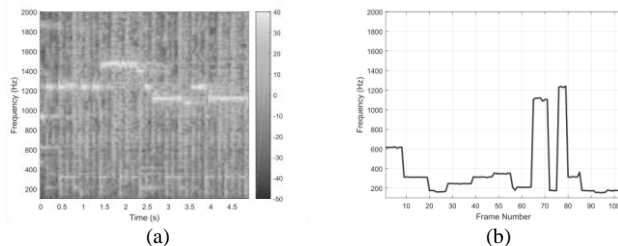


Figure 1. (a) Spectrogram of the original audio mixture. (b) Mislead pitch trajectory estimated by Duan's algorithm [1, 2].

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III. THE PROPOSED APPROACH

A novel strategy is proposed to extract an improved and reliable dominant pitch trajectory, as described below.

- A set of high-pass filters is applied to the original mixture to create several modified versions of it.
- Each filtered version is processed separately to generate a set of preliminary pitch trajectories.
- A measure based on salience in frequency and continuity is used to select the best pitch candidate for each frame.

IV. RESULTS

Using four high-pass filters and the energy of the first five harmonic partial as a measure of salience, the results in Figure 2 were obtained.

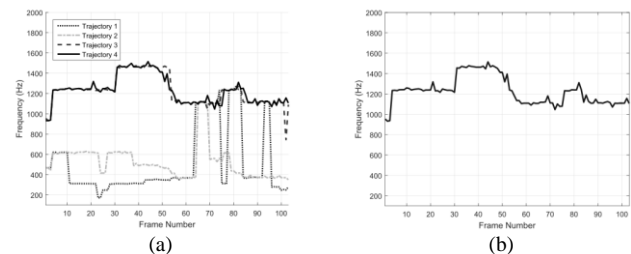


Figure 2. (a) Preliminary trajectories. (b) Final pitch trajectory.

V. CONCLUSIONS

The extraction of the dominant pitch trajectory can be improved by applying multipitch estimation to several versions of the original mixture and then evaluating the fundamental frequency estimates using different criteria.

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