Automatic Bass Line Transcription for Electronic Music

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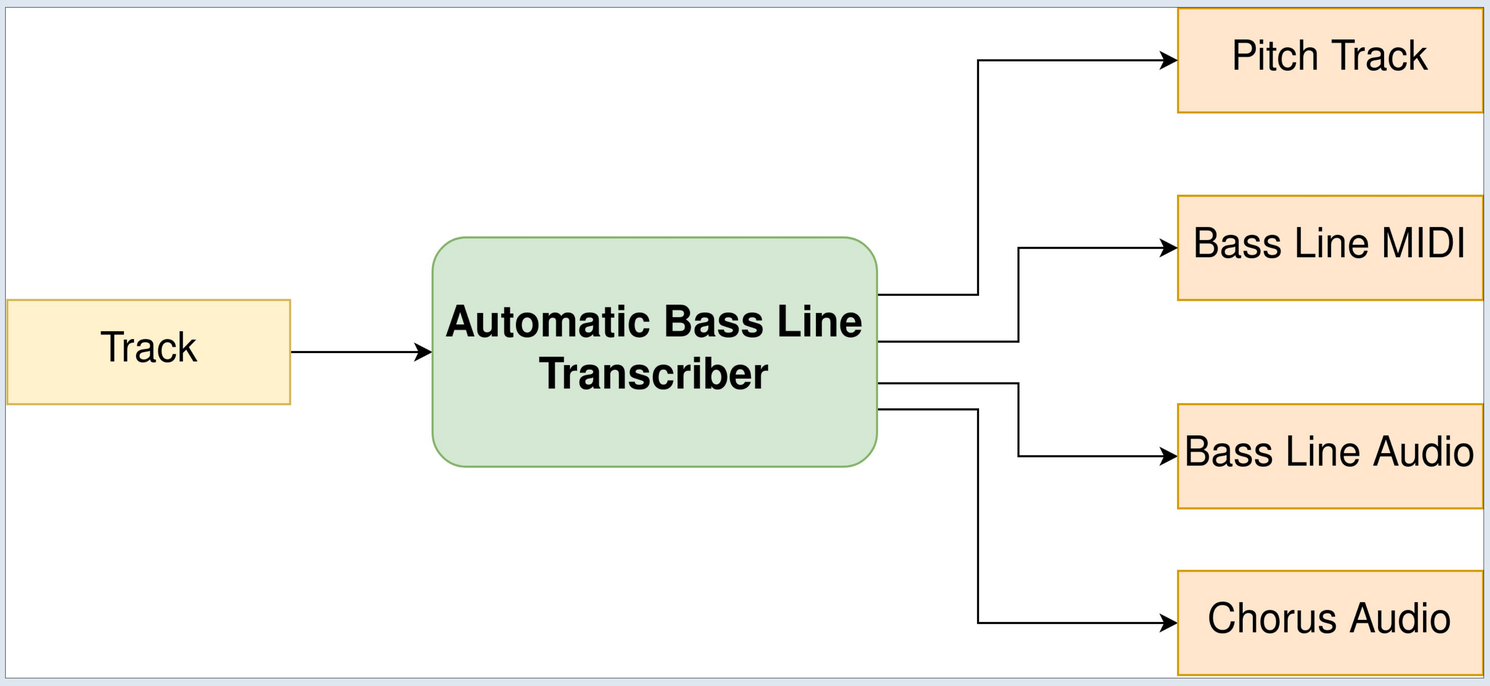

Figure 1: Automatic Bass Line Transcriber System Diagram

Problem Definition

- We use electronic music production principles for transcribing bass lines of polyphonic music.
- Taking a polyphonic audio recording, the system finds a beat-synchronized chorus section and outputs a bass line reconstruction MIDI file.

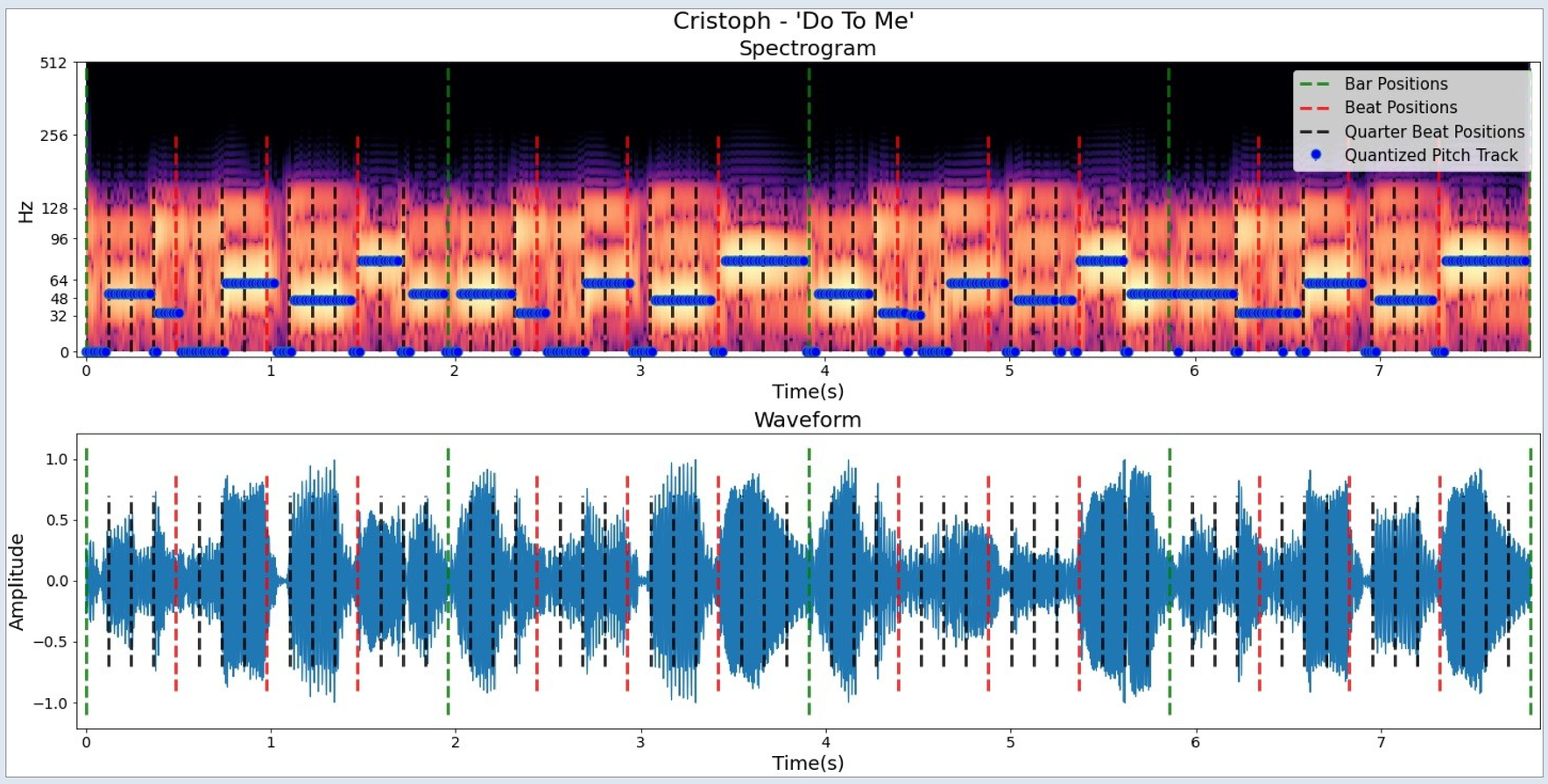

Figure 2: Isolated Chorus Bass Line in the Beat Grid

Methodology

- Beat Detection [1],
- Chorus Detection, (*custom* drop detection)
- Source Separation [2],
- F0 Estimation [3],
- Pitch Track Quantization, *(custom adaptive quantization)*
- MIDI Conversion

  (disjoint epsilon balls on the frequency axis)

- Focusing on the sub-bass frequency range from C1 to C3 (32.7 to 130.81 Hz)
- Experimenting with time and frequency resolution capabilities of F0 estimators
- Searching for parameters that can both resolve the smallest 1.95 Hz frequency interval of the sub-bass pitches and the shortest possible duration of 1/4th beat (1/16th note in common time) bass notes.
- Achieving 1/32th beat onset resolution, capturing rich bass line grooves.
- The Python code is available at: https://github.com/raraz15/automatic_bass_line_transcriber

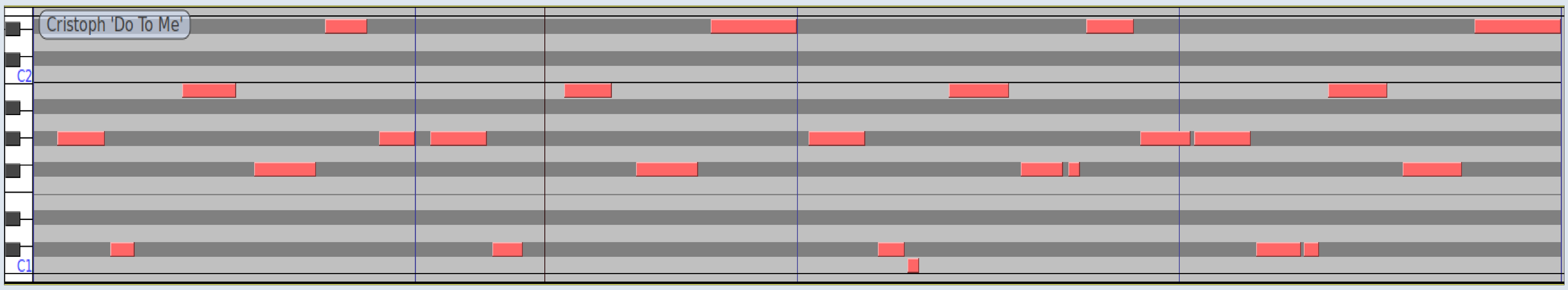

Figure 3: Bass Line MIDI Reconstruction

References
[1] S. Böck, F. Korzeniowski, J. Schlüter, F. Krebs, and G. Widmer, “madmom: a new Python Audio and Music Signal Processing Library,” in Proceedings of the 24th ACM International Conference on Multimedia, Amsterdam, The Netherlands, 10 2016, pp. 1174–1178.
[2] A. Défossez, N. Usunier, L. Bottou, and F. Bach, “Music source separation in the waveform domain,” arXiv preprint arXiv:1911.13254, 2019.
[3] M. Mauch and S. Dixon, “Pyin: A fundamental frequency estimator using probabilistic threshold distributions,” in 2014 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 2014, pp. 659–663.