GUITAR-SET PREVIEW: A DATASET FOR GUITAR TRANSCRIPTION AND MORE

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ABSTRACT

The guitar is a highly popular instrument for a variety of reasons, including its ability to produce polyphonic sound and its musical versatility. The resulting variability of sounds, however, poses significant challenges to automated methods for analyzing guitar recordings. As data driven methods become increasingly popular for difficult problems like guitar transcription, sets of labeled data are highly valuable resources. In this paper we present a preview of the Guitar-Set dataset, which will provide high quality guitar recordings alongside rich annotations and metadata. In particular, by recording the instruments using a hexaphonic pickup, we are able to not only provide recordings of the individual strings but also largely automate the expensive annotation process. The dataset will contain recordings of both acoustic and electric guitars, as well as annotations including time-aligned string and fret positions, chords, beats, downbeats, and playing style.

1. INTRODUCTION

The automated analysis of recordings of polyphonic instruments like the guitar is a difficult task. Many of the current state-of-the-art approaches are data driven and thus high-quality labeled datasets have become crucial components.

In this paper we present a preview of Guitar-Set, containing acoustic and electric guitar recordings with rich time-aligned annotations. The recordings are collected using a hexaphonic pickup, in which each string is recorded individually. By analyzing the hexaphonic recordings and the use of lead sheets, we are able to capture rich annotations for each recording, including a transcription of the guitar playing with string and fret position level labels, chords, beats, downbeats, and playing style.

2. RELATED WORK

A handful of datasets exist for polyphonic instrument transcription. The MAPS dataset [2] contains a large collection of transcribed piano notes, chords, and pieces (by means of using a disklavier), recorded in different acoustic conditions. Similarly, the UMA-Piano [1] dataset provides a database of all possible combinations of notes at varying dynamics. These two datasets have been critical for the development of automated piano transcription methods.

For guitar, the Guitar Playing Techniques dataset [8] contains 6580 clips with single note-level playing technique annotations. The IDMT-SMT-Audio-Effects dataset [7] contains approximately 20 hours of guitar notes and chords with varying audio effects. Finally, the IDMT-SMT-Guitar dataset [4] contains four types of guitar data: (1) 4700 single notes annotated with playing techniques (2) 400 annotated notes and note clusters (3) 5 short guitar recordings with note annotations and (4) 64 polyphonic excerpts with chord and rhythm style annotations. While each of these guitar datasets provide useful annotations, none of them provide note-level annotations of polyphonic guitar pieces on a larger scale, which is a limiting factor in exploring many interesting new research directions.

3. DATASET DESCRIPTION

Hexaphonic pickups are magnetic pickups that have individual outputs for each magnet. For use with an acoustic guitar, we ordered a clip-on hexaphonic pickup from ubertar.com, made by Paul Rubenstein. The pickup has 6 individual single coil magnets, and is manually attached to an acoustic guitar. For better pickup signal-to-noise ratio, nickel wound steel strings are used for the guitar. For the electrical guitar recordings, a Fender American Standard Stratocaster was fitted with a Roland GK-KIT-GT3 internal hexaphonic pickup by a luthier. The GT3 also consists of six single coils with individual string outputs, but is an active pickup, requiring power.

Guitarists are asked to play 16 bar excerpts in different keys, progressions, tempos, and styles from a lead-sheet. For each excerpt, players are asked to play both a comping version, and a solo version where they would play over their own comping. During recording, guitarists are provided with a style-fitted backing track that consists of click

track, drum set, and bass for each excerpt through monitoring headphones. Overall, seven channels of audio are recorded from the player: six from the hexaphonic pickup, and one from the reference microphone.

For the acoustic guitar we use a Neumann U87 condenser microphone as our reference microphone. For the electric guitar, the monophonic output of the regular pickups is used as reference. The latter is fed directly into the hi-impedance input of a sound card to get a direct input signal. This allows us to process it later with a variety of effects/amplifier chains, either virtually through software such as Native Instruments' Guitar Rig [1] or by re-amping the signal in a recording studio.

Inspired by the MAPS piano dataset, we will first start with recording single notes on the electric guitar in a systematic way. This will be followed by common combinations of two notes, scales and common chords. The goal is to cover all notes and positions on the guitar neck approximately equally. In the second instance full songs will be recorded, potentially mirroring the experimental setup with the acoustic guitar.

4. ANNOTATIONS

We chose to use JAMS files format [3] as annotations to accompany this dataset. For each recording, the JAMS file will have annotations for tempo, key, and style (metadata); beat and downbeat (via click track); chords (via leadsheets); and note-level transcription, including string and fret position (via automatic estimation).

A complete transcription can be generated by annotating each string individually and then aggregating, and steps are taken to ensure the transcriptions are as accurate as possible. Because the single coil magnets inevitably pickup vibrations in adjacent strings, the hexaphonic recordings are first processed with KAMIR bleed removal algorithm [6]. The note-level transcription is generated by running pYIN-notes [5] over the recording of each string after bleed removal. Additionally, from the string-level annotations we can infer fret position, giving us string plus fret level annotations after aggregating.

5. CHALLENGES

A central goal for the dataset is to provide highly-accurate note-level transcription for all of its recordings. While the availability of individual string recordings simplifies the annotation process considerably, a full automation is still challenging. In our preliminary experiments with monophonic transcription on the hexaphonic recordings, we observe high recall of notes, but also a high rate of false positives. Many of these false positives originates from muted strings in a chord or extraneous noises happening on individual strings that are not salient in the reference recording. pYin-Note also tends to group pull-offs and hammer-ons with their preceding note, probably because these notes lack a clear onset.

[1] https://www.native-instruments.com/en/products/komplete/guitar/guitar-rig-5-pro/

Since the guitar playings in this dataset are not perfectly tuned at all times, note-level transcription would not precisely reflect the recording if it is quantized to half-steps. Currently the annotations uses fractional midi note number to annotate pitch.

6. CONCLUSIONS

In this paper, we present a preview of a richly annotated guitar dataset in progress. Besides aiding the guitar transcription research, which is the initial incentive for this dataset, we foresee it aiding other tasks as well: source separation, understanding sympathetic resonances in acoustic guitar, understanding guitar right-hand activity, just to name a few. We believe this dataset will be a valuable asset to the MIR community.

7. REFERENCES

[1] Ana M Barbancho, Isabel Barbancho, Lorenzo J Tardón, and Emilio Molina. *Database of Piano Chords: An Engineering View of Harmony*. Springer, 2013.

[2] Valentin Emiya. *Transcription automatique de la musique de piano*. PhD thesis, Télécom ParisTech, 2008.

[3] Eric J. Humphrey, Justin Salamon, Oriol Nieto, Jon Forsyth, Rachel M. Bittner, and Juan P. Bello. JAMS: A JSON annotated music specification for reproducible MIR research. In *International Society of Music Information Retrieval (ISMIR)*, October 2014.

[4] Christian Kehling, Jakob Abeßer, Christian Dittmar, and Gerald Schuller. Automatic tablature transcription of electric guitar recordings by estimation of score-and instrument-related parameters. In *DAFx*, pages 219–226, 2014.

[5] Matthias Mauch and Simon Dixon. pyin: A fundamental frequency estimator using probabilistic threshold distributions. In *Acoustics, Speech and Signal Processing (ICASSP), 2014 IEEE International Conference on*, pages 659–663. IEEE, 2014.

[6] Thomas Prätzlich, Rachel M. Bittner, Antoine Liutkus, and Meinard Muller. Kernel additive modeling for interference reduction in multi-channel music recording. In *Acoustics, Speech and Signal Processing (ICASSP), 2015 IEEE International Conference on*, May 2015.

[7] Michael Stein, Jakob Abeßer, Christian Dittmar, and Gerald Schuller. Automatic detection of audio effects in guitar and bass recordings. In *Audio Engineering Society Convention 128*. Audio Engineering Society, 2010.

[8] Li Su, Li-Fan Yu, and Yi-Hsuan Yang. Sparse cepstral, phase codes for guitar playing technique classification. In *ISMIR*, pages 9–14, 2014.