Transformer-Based Beat Tracking with Low-Resolution Encoder and High-Resolution Decoder

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1. Introduction

We address the beat tracking task which is to predict beat times corresponding to the input audio.

Motivation
- To produce good results, the model needs to consider both local timing and global consistency.
- This brings a contradiction on choosing the temporal resolution.

2. Proposed model

A novel beat tracking model based on the Transformer with low-resolution encoder and high-resolution decoder.

Main modifications
- 1D Conv & Upsampling Block

In comparison to previous models, our model uses both the encoder and decoder.
- Multi-scale features
- A more reasonable resolution for sequence modelling

3. Experiment

Data augmentation
- Tempo-wise
- Triple data using HPSS

Training
- Train the model with the pre-trained encoder

Results
- Impressive results on the encoder by thresholding only.
- The decoder improves results of the Ballroom and GTZAN datasets.
- Post-processing (DBN) improves results especially for continuity-based ones.

Output examples

4. Conclusions

- We present a novel Transformer-based model for beat tracking with the encoder and decoder of different resolutions.
- It provides a new framework for handling multi-scale features and learns features jointly by the cross attention in the decoder.
- It enables us to sample the features with more reasonable time resolutions, which helps to model the sequences more efficiently.
- We believe that the above advantages are beyond beat tracking and can be useful for other tasks too.