PERCUSSIVE MUSIC GENERATION

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AUDIO INFORMATION RESEARCH

Abstract

One of the main weak points of many automatic music generation systems is their over-focus on harmonic parts and paying less attention and in most of cases, omitting rhythmic sections of music.

Whereas, non-harmonic (percussive) elements of music are likely to have as important role in forming the general structure of music as harmonic parts

In this paper, a new rhythmic section generator is proposed that first detects music tempo leveraging dynamic programing and then creates multiline dynamic drum parts for the music track by considering some music rules and utilizing random vectors

Proposed System

Given that the rhythmic part of music is very delicate in time and deals with it in milliseconds scale, to generate an appropriate drums part for a piece of music:
1- At the first stage, it is essential to create a practical, precise and flexible event detection system including onsets, beats, tempo detection and 2- Determining if the beat is activated or inactivated in each time segment.
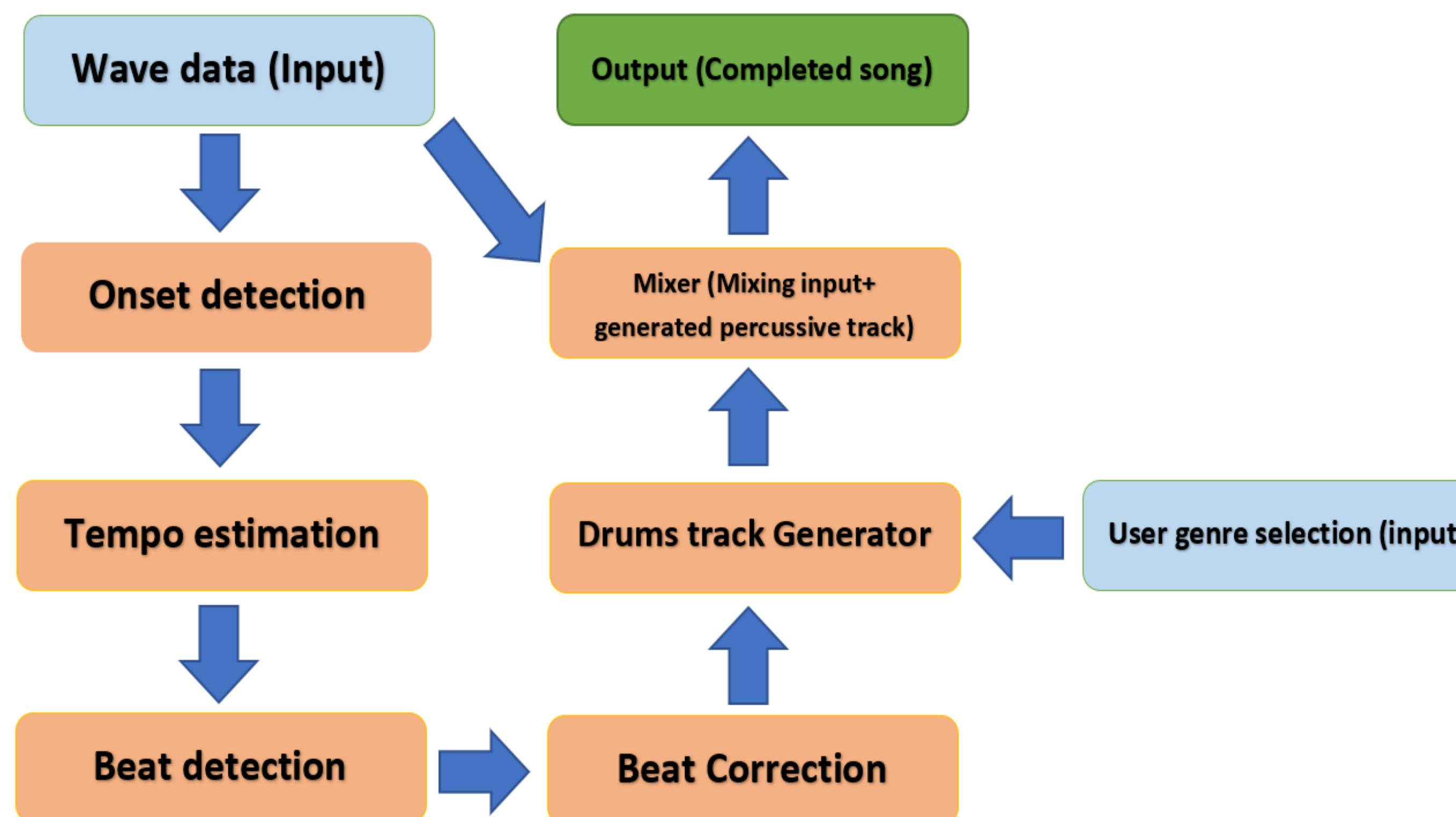*3-synthesize drum loops that fit the music features including music genre, emotion, dynamics, etc.*

Dataset

- DSD100 music dataset including 100 real (acoustic wave) music with comprising bass, drum, vocal and others in different genres and separate wave files
- Utilizing the mixture of all parts except drums and test system


Total Model Architecture

- **Step1:** Utilization of Spectral flux for onset detection

$$\Delta_{\text{Spectral}}(n) := \sum_{k=0}^{K} |\mathcal{Y}(n+1,k) - \mathcal{Y}(n,k)|_{\geq 0}$$

- **Step2:** Automatic tempo expectation using onset autocorrelation
- **Step3:** Beat tracking using dynamic programming and estimated tempo

$$S(B) := \sum_{\ell=1}^{L} \Delta(b_\ell) + \lambda \sum_{\ell=2}^{L} P_\delta(b_\ell - b_{\ell-1})$$

- **Step4:** Beat detection correction using tempo conditions
- **Step5:** Removing the estimated beats with very low energy in neighborhood
- **Step6:** Drums track generation using data set of single hits of each element of the drums considering detected beat map, percussive music rules and entered genre by the user
- **Step7:** Mixing generated drums track with input wave music without drums part to obtain a complete song

Wave song (no percussive) + Generated rhythm = Complete song
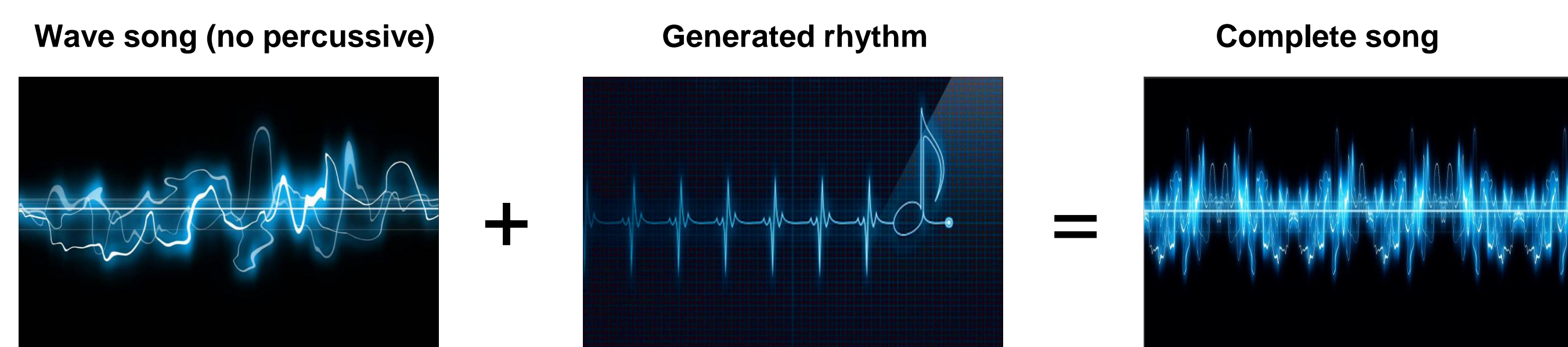
Drums Track Generator Architecture

- For each detected beat, it is fed to Semi-random loop generator
  (For each of 10 track, if the loop number is zero, it generates a new loop)
- The function rhythm generator is called
  (According to music generation rules applied to an array of random number generators and regarding each track and music genre, it updates rhythm matrix)
- The function put is called
  (It adds corresponding wave sounds of different elements to the original song)

Results - Evaluation - Future Work

For a wide range of music genres, preliminary subjective tests show promising music improvisation outcome and generation of creative drums section.

Next, we will extend our research on mentioned fields:

- Adding more music information retrieval methods such as music meter detection for better music generation
- Utilizing other approaches for detection of inactive beats.
- Extracting more cues such as music events could be so helpful in deciding loops' length
- Considering energy level in the neighborhood of each beat as a key factor for deciding the amount of density of generated hits (peak chorus-bridges-verses)
- Considering velocities and dynamics of the song in adding each element

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