

Proposal

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1 Introduction & Background

Detecting musical time is a skill which is not only a fundamental musical skill [1] but also something that can seemingly come naturally to humans, the majority being able to analyse and reproduce discrete metrical structures of a piece of music [2]. Producing algorithms to replicate this nature human ability is probably first attempted by Longuet-Higgins [1], where he began to consider that rhythm as a binary tree with each node representing a note or rest. This theory developed into a system which would use a static tolerance limit on how much the downbeats varied and enabling the perceived tempo to be adjusted accordingly [add longuet references]. Since Longuet-Higgins first work there have been a number of systems developed to perform beat tracking and temporal analysis with the majority using the “surfboard” method first described by schloss which observed the peaks of sound energy within a piece of music in order to discern the beat locations and temporal information [schloss].

This method however was not considered accurate enough to fully replicate the skill of a trained musician at beat detection, it was soon recognised that onset detection would play a fundamental part in any future beat detection algorithms. Where the an indicator of a new onset is seen as “an increase in energy (or amplitude) within some frequency band(s)” [4].

Needs to add history of all the work carried out on audio analysis with an emphasis on tempo detection

Beat detection and tempo analysis is a fundamental skill honed by musicians and in particularly drummers, their ability to perform at a consistent tempo determines a piece of musics rhythm.

Describe how far it has come and MIREX group

There has been a lot of work carried out in the field of tempo detection, Hugh Christopher Longuet-Higgins work probably represented the first attempt to follow beat performance in relation to tempo [1].

Describe current tempo detection systems for drummers in midi and how current use of tempo detection algorithms in software for djs - highlight possible implementation of a training system for drummers to perfect their timing.

<http://www.roland.co.uk/blog/exploring-roland-dt-1-v-drums-tutor-software/>
- such systems currently are only available for midi instruments as the timing

data is recorded using midi triggers (describe triggers) so offer an very high degree of accuracy

1.1

2 Aims and Objectives

As part of my project I propose to build a real time drumbeat tempo analyser which wiill implement a variety of different wave analysis algorithms. sound energy analysis and discrete wavelet transform technologies. I will provide more details regarding the system architecture in the following sections.

Investigate with a sole focus on drums how accurate/reliable the beatroot and discrete wavelet transform algorithms are in order to ascertain how viable a future mobile metronome and drum tempo training application would be.

2.1 Proposed Architecture

In order to function sufficiently the system will need to encompass the following features:

- Provide real time feedback to player on the tempo of the current drum beat.
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- Sufficent signal processing, the solution will need to process the audio in appropriate durations

3 Development Plan for the Solution

Adapt beetroot library in order to allow for efficient real time analysis
implement matlab algorithm in scala/java
develop audio capture and processing system

4 Project Schedule