MIR Assignment 5. Spring 2016 (10 pts)

IMPORTANT The assignment is worth 10% of the final grade. There is some variance in the amount of time each question probably will require. Therefore dont expect them to be equally difficult even though they are all worth the same number of points. Please provide your answers in a SINGLE PDF file. There is no need to copy the assignment specification. Also please answer the questions in order and explicitly mention if you have decided to skip a question. You can either hand me a paper copy of your submission in class or email me an electronic copy.

The goal of this assignment is to simulate the full process of working on a research problem including understanding existing work, implementing your own variant and formal evaluation over a large data set. The problem you will be working on is tempo estimation.

Hope you find it interesting,
George Tzanetakis

As part of the prepartion for this assignment you will need to read three publications (they are all available through Google Scholar):

- Two Data Sets for Tempo Estimation and Key Detection in Electronic Dance Music Annotated from User Corrections - Knees et al, 2015

- Streamlined tempo estimation based on autocorrelation and cross-correlation with pulses - Percival and Tzanetakis, 2014

- Beat tracking for multiple applications: A multi-agent system architecture with state recovery - Oliveira et al, 2012

Question 1 (3 points)

Based on your reading of the three publications above answer the following questions - try as much as possible to explain the underlying concepts in simple language assuming the target audience is your class mates. I expect the answers to be about at minimum a paragraph (4-5 sentences) :

- How are the pulse sequences used to refine the tempo estimation in the paper by Percival and Tzanetakis ? **(1pt)**

- Why is the beat tracking system described by Oliveira et al described as multi-agent ? What are the agents ? **(1pt)**

- What are the most common errors in tempo estimation ? What strategy is used to reduce them in Percival and Tzanetakis ?

Question 2 (3 points)

Implement a very simple base-line algorithm for tempo estimation. You can base your implementation on the code provided by Percival and Tzanetakis, or implement your own from scratch or using existing processing objects from *Marsyas*. Basically any way you do it is ok as long as you understand how it works. The algorithm should consists of the following steps: 1) calculation of an onset strength signal (OSS) 2) computing the autocorrelation of the OSS and picking as the tempo the highest lag in the right range for tempos (let's say 50-150 BPM). If this reminds you of the simple pitch extraction algorithm based on autocorrelation you have already implemented you are correct it is very similar only at a different time scale and on the OSS. The deliverable should be a listing of your code with a short text explanation of how it works.

Question 3 (4 points)

Use the data set provided by Knees et al to evaluate the following algorithms: streamlined tempo estimation (the tempo executable in Marsyas), the IN-ESC beat tracker (the ibt executable in Marsyas) and your own baseline implementation. The deliverable should be a table showing both Accuracy1 and Accuracy2 (read the papers to see what this means) for this data set for all three configurations.