

# Not Just Dance

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## Project Description

Not Just Dance is a game where the player can use their smartphone to dance along to a song. There will be a set of 5 possible dance moves that will change to the beat of the song. It is the dancer's goal to follow along to the displayed dance moves to the best of their ability. At the end of the game, a score will be displayed that combines how "on the beat" the player was and how well they followed the moves displayed.

For reference:

<https://www.youtube.com/watch?v=2T0K40DjODc>

We will create a demo involving the song "Beat It" by Michael Jackson. There will be a set of predetermined motions that the player has to follow, and at the end our algorithm will give a score out of 520 (because 100 is boring and feels like you are taking a test).

## Learning Requirements

We will need to learn different algorithms to compare two signals to find their error. This will involve attempting to align the two signals by calculating the phase shift. Once this is done, we can find the error.

We will also need to learn a lot about live processing in MATLAB.

Lastly, we will need to think a lot more about what sort error is expected and how to distinguish between glitches and actual player error.

## **How We Anticipate It Will Work**

### **MVP**

We will use signal processing to be able to tell whether or not you are dancing the dance move to the beat, and correctly. We will use FFT, signal aligning, and accelerometer data to figure this out.

### **Stretch**

We will record ourselves dancing the 5 dance moves to compare any player dances against. These will be as perfect as possible so as to not dock players for errors that are just glitches. Once a player starts playing the game, as they dance the dance move, we will stream that accelerometer data to MATLAB using the phone application. Once the dance move has been completed, we will compare the accelerometer data to our recorded data.

Once we recognize that the dance move has been completed, we will align the player data with the recorded data and find the error in all three directions. We will use this to score. To check how on the beat a player is, we will take the FFT of their accelerometer data and compare that to the FFT of the recorded accelerometer data and find the error. This will also contribute to the final score for that dance move. We will use MATLAB to handle all of our signal processing.

On the python side of things, we will randomly choose a dance move and display an image depicting it in a window. The player's job is to keep up with the changing dance moves. We will use a serial communication port to MATLAB to tell MATLAB which dance move we are now displaying and whether or not the move has been completed.

## **Learning Objectives**

Anna's goal is to gain a deeper understanding of FFT and gain more experience analyzing real world, ie not problem set data. In this project, we will be using FFT to analyze real world data so it seems perfect.

Navi's goal is to use the tools learned in QEA in a fun and exciting application. I think this not just dance project will do it.

## Resources

- Align signals with different start times

<https://www.mathworks.com/help/signal/ug/align-signals-with-different-start-times.html>

- Writing the algorithm

<https://pdfs.semanticscholar.org/bd95/9f747df59265cda782c4a64ed6f3248ab6f6.pdf>

Pohl, Henning, and Aristotelis Hadjakos. DANCE PATTERN RECOGNITION USING DYNAMIC TIME WARPING. Darmstadt, Germany: Technische Universität Darmstadt, n.d.

- FFT

<https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=1447887>

Cochran, William T., James W. Cooley, David L. Favon, Howard D. Helms, Reg A. Kaenel, William W. Lang, George C. Maling, David E. Nelson, Charles M. Rader, and Peter D. Welch. What Is the Fast Fourier Transform?, n.d.

This is credible as it is published by a reputable publisher.

- Live scoring (signal processing) in MATLAB

<https://www.mathworks.com/matlabcentral/fileexchange/46685-live-data-acquisition-for-real-time-signal-processing-in-matlab?focused=0ff76663-3606-ad42-d31b-52aa3ef4d2aa&tab=example>

“Live Data Acquisition for Real-Time Signal Processing in MATLAB - File Exchange - MATLAB Central.” Live data acquisition for real-time signal processing in MATLAB - File Exchange - MATLAB Central. Accessed November 18, 2019.

<https://www.mathworks.com/matlabcentral/fileexchange/46685-live-data-acquisition-for-real-time-signal-processing-in-matlab?focused=0ff76663-3606-ad42-d31b-52aa3ef4d2aa&tab=example>.

This is credible as mathworks - the creator of matlab - has written it as a tutorial for matlab