

Swarm Based System for Music Visualisation

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Overview

Listening to music should be a **multi-sensory** experience

Applications of music visualisations range from large stage shows to simple **music playing applications**.

Dance can be thought of as a form of visualisation of music:



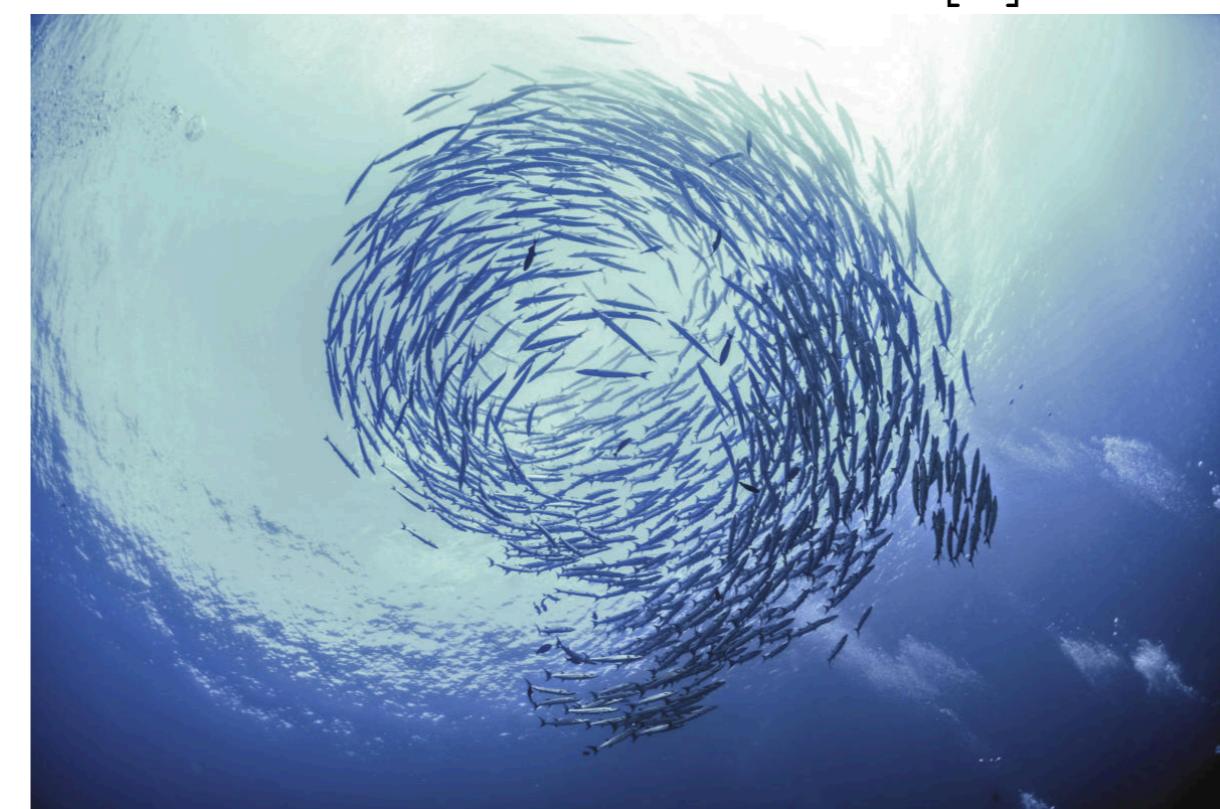
- Synchronisation of dancers in a group/body parts of an individual dancer with the music
- Creating intricate formations with individual dancers

A group of dancers can be thought of as a **swarm of humans** – making it the ideal construct to visualise music

Swarming by definition means moving in a large or dense group [3].

Swarm Behaviour is inherent in nature:

Schools of fishes [4]



Humans in large crowds [2]

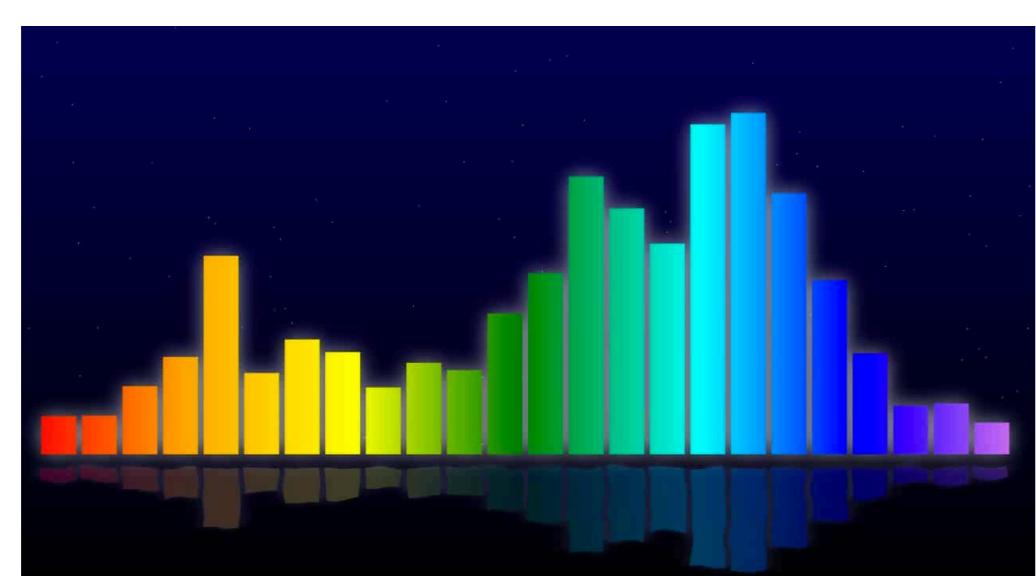


To simulate a swarm, each ‘boid’ in the swarm has to follow these 3 principle behaviours [1]:

1. **Collision Avoidance** – Avoid colliding with neighbouring boids
2. **Velocity Matching** – Match velocity of neighbouring boids
3. **Swarm Centering** – Attempt to stay close to nearby boids

Audio Feature Extraction

Classic visualisations of music would move bars on screen according to frequencies being played in the music at any one time.

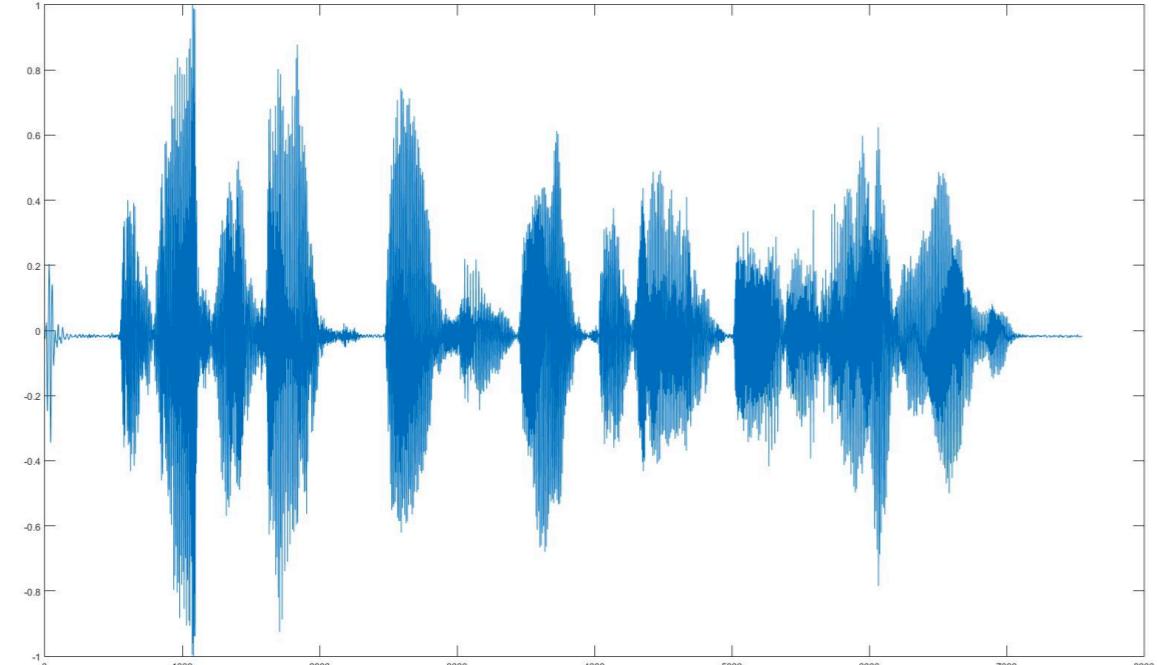


I plan to take it further by extracting these three higher-level features from the music

Tempo/Beat

Key

Melody/Chord Progression



I also plan to **pre-process** the audio files as real-time processing produces less visually appealing results.

Here is my proposed plan going forward:

Research Swarm Visualisation Techniques

Incorporate audio features into Swarm Visualisation

Visualise features extracted in simplistic ways

Research Audio Feature Extraction Techniques

Prototype Swarm Visualisation

Next Steps



References:

- [1] C.Reynolds. “Flocks, Herds, and Schools: A Distributed Behavioral Model”. In: Computer Graphics 21 (1987), pp. 25–34.
- [2] D.Helbing, J.Keltsch, and P.Molnar. “Modelling the evolution of human trail systems”. In: nature 388 (1997), pp. 47–50.
- [3] Definition of ‘Swarming’. url:<https://www.lexico.com/en/definition/swarming>
- [4] E.Shaw. “The schooling of fishes”. In: Scientific American 206 (1962), pp. 128–138.