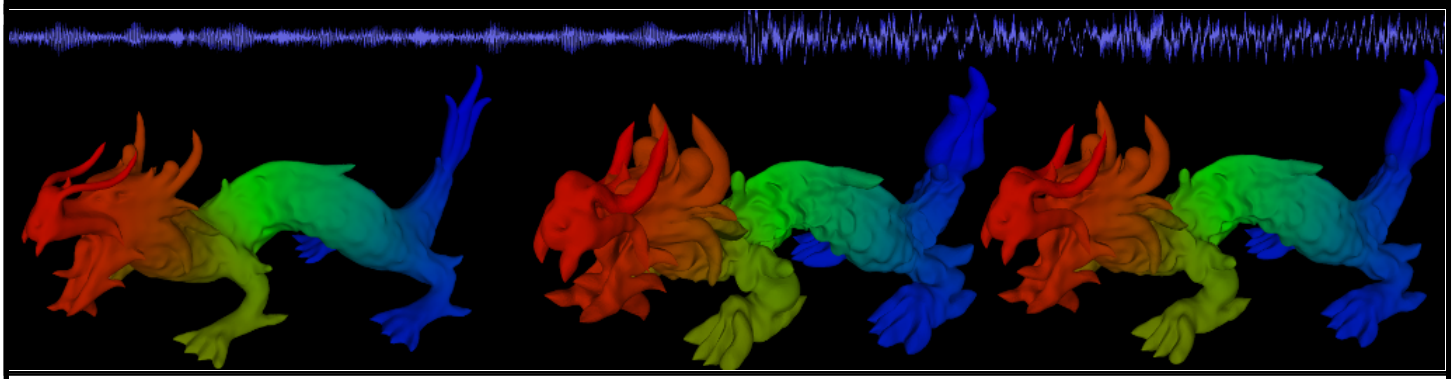
Project / Thesis
Spatial Music Visualization using Localized Manifold Harmonics

University of Zurich[UZH]



Introduction

Music visualization has been around for a long time already. Nearly every mediaplayer had some kind of 2D visualization for the song you were playing (see Figure 1 for an example). The goal of this work

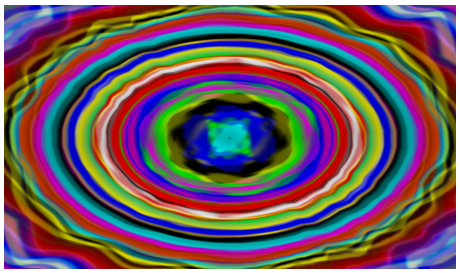


Figure 1: A 2D music visualization.

is to implement a music visualization on 3D meshes. The titlepicture shows one example of how this can look like. While the titlepicture has been created using global features on the mesh (as described in [1]), this work also takes into account different sound channels. These sound channels are placed as sound sources around the mesh and should affect the visualization depending on their location and distance to the mesh. This way, e.g. the sound of a car coming from one side and leaving to the other, will cause the mesh to have some kind of a "wave" going through it, with the amplitude at the current "location" of the car. The number of music channels should be variable, such that you are able to visualize a simple stereo soundtrack, as well as a full orchestra with each group of instruments on their own channel.

Assignments

There are three main targets for this work:

1. Implement the methods of "Localized Manifold Harmonics for Spectral Shape Analysis" [2].
2. Find a pleasing mapping from sound-features to manifold harmonics.
3. Create a frontend, including the real-time visualization.

If you feel yourself more attracted to one of the three, it is also possible to split this work into three separate tasks of which you would solve one (or two).

Work Type

We are flexible in the type of project or thesis (bachelor / master), depending on your situation and needs.

Requirements

The implementation will be in C++. Thus, basic C++ knowledge is desired. For the graphical part, OpenGL will be used.
Moreover, you should be familiar with linear algebra.

Work Load

- 50% Theory
- 40% Implementation
- 10% Test

Supervision

- Prof. Dr. Renato Pajarola
- Lars Zawallich

Contact

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References

[1] Bruno Vallet and Bruno Lévy. Spectral geometry processing with manifold harmonics. *Comput. Graph. Forum*, 27:251–260, 2008.

[2] Simone Melzi, Emanuele Rodolà, Umberto Castellani, and Michael M. Bronstein. Localized manifold harmonics for spectral shape analysis. *Comput. Graph. Forum*, 37:20–34, 2018.

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