MUSIC BROWSING USING A TABLETOP DISPLAY

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ABSTRACT

The majority of work in Music Information Retrieval (MIR) follows a search/retrieval paradigm. More recently, the importance of browsing as an interaction paradigm has been realized, and several novel interfaces have been proposed. In this paper, we describe two novel interaction schemes for content-aware browsing of music collections that use a graphical tabletop interface. We further present findings from qualitative user studies. We describe our work in the context of two primary themes: music collection browsing, and collaborative (multiple simultaneous users) interaction and involvement during the browsing/selection process.

1 INTRODUCTION

Similarity and clustering algorithms may be used to automatically incorporate meaningful structure into large, diverse, and disorganized collections of music. In particular, Self-Organizing Maps (SOMs) [3] are sought after for their unsupervised dimensionality-reduction applications.

A growing body of research aims to enhance the effectiveness of automatic content-based analysis algorithms via intuitive user interface (UI) design. We believe the solution to truly effective music collection browsing combines the use of automatic techniques for structuring collections, with a framework for interaction that facilitates systematic and satisfying exploration of music collections. SOMs of music clusters are particularly amenable to satisfying visualization [4], but may also facilitate purely auditory exploration of the cluster map via tangible UIs such as the Radio Drum and Kaoss pad [5]. In particular, we incorporate use of a SOM for clustering of audio-based features, described in [9], automatically extracted from each track in a digital audio collection. Our primary aim is to support both the systematic exploration of music collections, and collaborative interaction between individuals with potentially diverse musical tastes

The perception and appreciation of music is an interactive process that we feel is complimented by rich interaction among multiple individuals within social contexts. Music browsing is also an inherently interactive activity, requiring constant interplay between the user and the system. We believe that the (collaborative) browsing of music collections via existing systems is limited to a large extent by the use of the often cumbersome monitor / keyboard / mouse UI paradigm. The Jukola, a collaborative system for democratic music selection tested in natural communal setting, is presented in [6]. The use of large horizontal displays has been established as a means of supporting collaborative interaction and social cohesion [7]. As such, tabletop UIs are beginning to be explored for a number of music-related applications [2, 8]. We use the multi-touch front-projected DiamondTouch table developed in 2001 by the Mitsubishi Electric Research Laboratories [1].

Figure 1. *User study participants interacting with the tabletop interface.*

Through qualitative user studies, we assess the relative effectiveness of two novel music-collection-browsing paradigms. We investigate consensus-reaching and processes whereby individuals tend to guide each other during exploration of a music collection.

2 SYSTEM OVERVIEW

The MarGrid application uses the Marsyas 0.2 [1] software framework to extract audio features[9] from a collection of digital audio tracks, and a SOM[3] is employed to organize the tracks within a 2D grid. A user can browse the 2D grid using a mouse and keyboard, MIDI controller pad, or tabletop UI (described below). Music collections

[1] http://marsyas.sourceforge.net

are imported via parsing of iTunes (XML) library files. Serveral UIs, providing different approaches to browsing/ interacting with music collections, were explored.

2.1 DiamondTouch Tabletop User Interface

The front-projected DiamondTouch Tabletop UI allows a user to interact with MarGrid in a manner analogous to the surface of a table. Both single-user mouse emulation and multi-user multi-touch capability is supported.

Graphical User Interface – Users interact with a graphical rendering of the 2D SOM of music tracks. Once a collection has been imported, the user is given a list of their entire collection organized by both tracks and playlists. The user is able to personalize the SOM training by dragging and dropping selected tracks and playlists to specific locations on the grid. Each grid square may contain more than one track, and the density of a grid square is indicated by its colour. Track meta-data is displayed if available.

User Interaction – There are two supported interaction schemes: “continuous playback” and “click-to-play”. During “continuous playback”, moving the cursor into a new square immediately starts playback (useful for browsing for a specific song in a collection). During “click-to-play” browsing, a square must be clicked to start playback (useful for listening to an entire track without interruption while continuing to browse). Consecutive user clicks within a single square cycle through multiple tracks mapped to that square.

2.2 Alternative Interfaces

A developer can easily create a new UI by inheriting from a simple abstract class. This class provides drag-and-drop, MIDI, and other common functionality. In addition to the GUI described above, several additional GUIs were developed that were not included in the user study.

Keypad – Motivated by popular handheld electronic devices, the Keypad UI emulates a typical numeric keypad. The Keypad UI can be thought of as a tree structure, with each node (key) containing eight children; users can generate a personalized hierarchy of music by dragging-and-dropping tracks into a node. A user navigates the hierarchy by clicking a child node (all keys except 5) to move down the tree, and the center node (key 5) to move up. The tree structure optimizes use of the limited UI hardware available on handheld devices.

KAOSS MIDI Controller – The SOM is mapped to the pad of a KAOSS MIDI controller, and thus, the need for a graphical display is removed. When the user touches the pad, the system plays the track corresponding to the position the user touched.

3 CONCLUSIONS AND FUTURE WORK

Overall reaction to the MarGrid application was positive. Users found it easy to adapt to the tabletop interface, and they indicated the experience was generally enjoyable.

While the “continuous playback” paradigm produced the most animated, collaborative, and enjoyable user experience, it did not facilitate the most effective music collection browsing. The “click-to-play” paradigm showed greater potential for effective and efficient browsing; interaction between users was facilitated, and consensus was met more frequently. Multi-touch capability, and the display of track meta-data, were cited by users as beneficial features of the music collection browsing system.

Ongoing research involving several rounds of user studies, carried out in both lab and natural public settings, will be conducted to further enhance the user experience during music collection browsing. We intent to incorporate use of more complex hand gestures together with a more advanced graphical rendering (OpenGL).

4 REFERENCES

[1] P. Dietz and D. Leigh. Diamondtouch: a multi-user touch technology. In *Proc. ACM Symposium on User Interface Software and Technology (UIST)*, pages 219–226, 2001.

[2] M. Kaltenbrunner, S. Jorda, G. Geiger, and M. Alonso. The reactable: A collaborative musical instrument. In *IEEE Workshops on Enabling Technologies (WET-ICE)*, 2006.

[3] T. Kohonen. The self-organizing map. In *Proc. of the IEEE*, volume 78, no. 9, pages 1464–1480, 1990.

[4] F. Morchen, A. Ultsch, M. Nocker, and S. Christian. Databionic visualization of music collections acoording to perceptual distance. In *Proc. Int. Conf. on Music Information Retrieval (ISMIR)*, 2005.

[5] J. Murdoch and G. Tzanetakis. Interactive content-aware music browsing using the radio drum. In *Proc. Int. Conf. on Multimedia Expo. (ICME)*, 2006.

[6] K. O’Hara, M. Lipson, M. Jansen, A. Unger, H. Jeffries, and P. Macer. Jukola: Democratic music choice in a public space. In *Proc. Conf. on Designing Interactive Systems*, pages 145–154, 2004.

[7] Y. Rogers and S. E. Lindley. Collaborating around vertical and horizontal large interactive displays: which way is best. In *Interacting with Computers, vol. 16, no. 6*, pages 1133–1152, 2004.

[8] I. Stavness, J. Gluck, L. Vilhan, and S. Fels. The musictable: A map-based ubiquitous system for social interaction with a digital music collection. In *Int. Conf. Entertainment Computing (ICEC)*, pages 291–302, 2005.

[9] G. Tzanetakis and P. Cook. Musical genre classification of audio signals. In *IEEE Transactions on Speech and Audio Processing*, volume 10, no. 5, 2002.