Globe of Music - Music library visualization using GeoSOM

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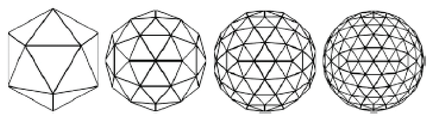
Issue

The experience of browsing music libraries in the pre MP3 era meant picking CDs or records from shelves or rearranging them in stacks and heaps. To recognize a certain sound carrier the artwork was the determining feature. Until shortly the primary user interface representation of digital music libraries were plain textual lists. Most recent versions of commercial audio playback software begin to offer more graphical sophisticated user interfaces. Those are partly appealing, but in respect to possible visualization techniques, no established convenient user interface exists. The arrangement of items in such user interfaces is still predominantly based on annotated metadata and is therefore restricted to sortable lists of attributes (e.g. title, album, artist).
Globe of Music employs a spherical self-organizing map algorithm on the items of a digital music library, described by signal based feature vectors. Thus resulting in a music library visualization, which can be intuitively handled and provides new possibilities for accessing music collections.

Selection of media library user interfaces
of popular playback software
(iTunes, Windows Media Player, Winamp, Amarok)

Approach

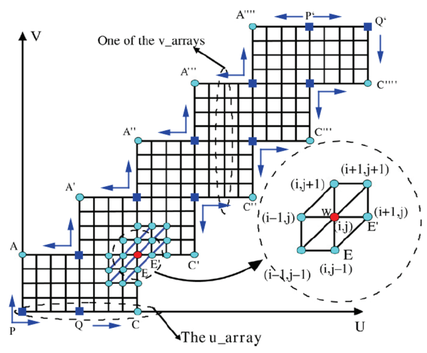
The proposed approach is motivated by the popular landscape metaphor. By using a spherical self-organizing map algorithm on low level audio features and processing the resulting map data, a Geographic Information System (GIS) is used to visualize a music collection. An instantiation of the Globe of Music is created by: (1) extracting signal-based features from audio, (2) using a spherical SOM algorithm to arrange music tracks according to feature vectors, and finally (3) transforming this information into a GIS renderable format, which depicts the user interface.



Tessellated Icosahedron (Fig. by Wu 2006)

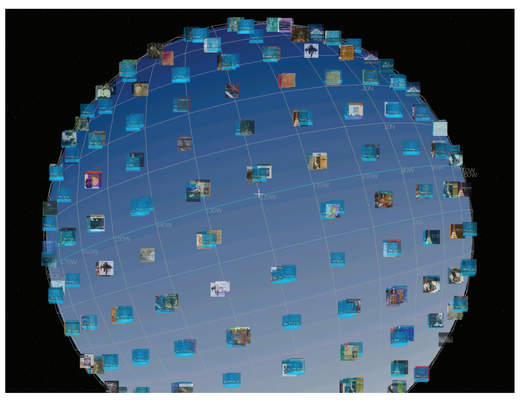
(1) Feature Extraction
- Statistical Spectrum Descriptor [Lidy, Rauber 2004]
- consists of 7 statistical moments per frequency band
- provides reasonable performance for classification by similarity with respect to feature vector length
- any other numerical feature vector descriptor possible

(2) Spherical SOM
- GeoSOM [Wu, Takatsuka 2006]
- SOM grid as tessellated Icosahedron
- every node 6 neighbors (tesselation frequency $f > 1$) , except 12 original nodes have 5 neighbors ($f = 1$)
- the dome is cut open and mapped to orthogonal aligned data structure
- SOM training



GeoSOM data structure (Fig. by Wu 2006)

(3) GIS as user interface
- GIS used: NASA Worldwind
- definition of a custom globe by
  - XML description of a globe (name, radius) and its layers of displayed information, containing places and boundaries
  - XML and binary description of places i.e. music tracks
    (icon, name, height above surface, longitudinal and latitudinal coordinates, link)
  - XML and binary description of boundaries i.e. neurons
    (coordinates of polygon points, visibility range regarding viewers altitude above surface, title, etc.)
- possibe interactions are rotating, zooming, tilting, searching (text based), and listening

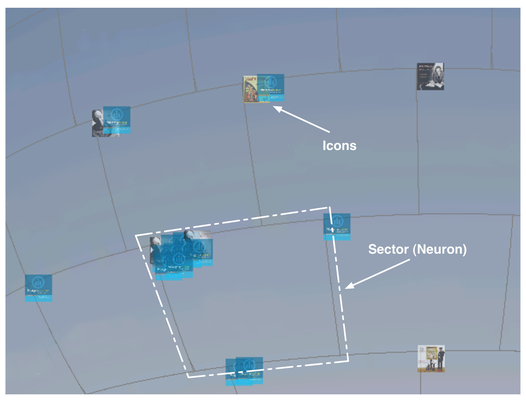


Total view on Globe of Music

Demo-setting
- Collection used is the training part of MIREX 2004 (magnatune collection)
  728 tracks: classical (319), electronic (115), jazz/blues (26), metal/punk (45), rock/pop (101), world (122)
- SSD feature vectors
- GeoSOM (f=4) i.e. 162 Neurons
- input devices: Mouse or Nintendo Wiimote (WiinRemote)

Initial user experiments
- survey setup: short instructions (no information about the composition of the music collection given), followed by
  15-20min. experimenting, questionnaire, and a semi-structured interview
- results
  - genres contained in the collection could be clearly determined
  - classical music was correctly determined as the dominant genre
  - convinced of systematical approach in the placement of tracks (no visual aids)
  - easy to find a certain track by remembering the related artwork
  - overall, users were very interested in using such a visualization and suggested additional playback application features

Nintendo Wiimote
as alternative input device



Detailed view of Globe of Music

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