

Informatik Masterstudium Intelligente Systeme 066 934

# **ATLANTIS** Or Towards a Multi-Modal Approach to

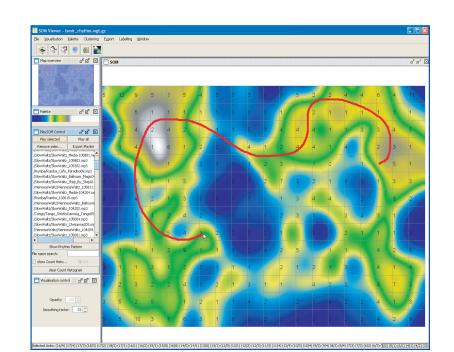
Music Information Retrieval and its Visualisation Robert Neumayer neumayer@ifs.tuwien.ac.at

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## **Basics: SOM Clustering**

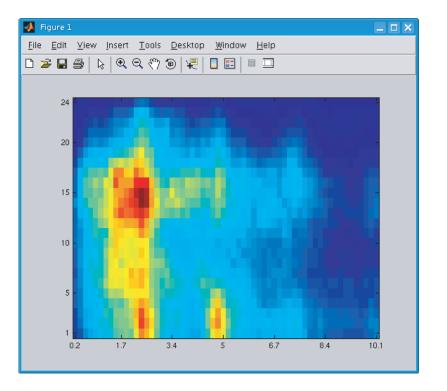


For clustering, the Self-Organising Map, an unsupervised neural network that provides a mapping from a high-dimensional input space to usually two-dimensional output space is used.

The Music Information Retrieval community has been gaining many insights into the area of abstract representations of music by means of audio signal processing. Recommendation engines provide novel ways of creating playlists based on users' preferences. Another im application of audio representation is automatic genre categorisation. However, for many applications audio features alone do not contain enough information. A song's lyrics often describe its genre better than what it sounds like, e.g. 'Christmas carols'. Therefore, approaches for the combination of additional data like song lyrics, artist biographies, or album reviews for music recommendation are examined. Further, the application of the SOM for clustering to audio collections with respect to multi-modal feature sets is investigated. Additionally, a new visualisation for simultaneous display of multi-modal clusterings as well as cluster validation metrics are presented.

#### Basics: Audio Features

We use a modified version of the Rhythm Patterns features. Basedon that feature set Statistical Spectrum Descriptors yield good results at a lower dimensionality of 168 as compared to the original 1440 feature values.



#### **Basics: Information Retrieval**

In classic text categorisation low-level features are computed from a labelled training set of sufficient size. New documents can be assigned to the class represented by the most `similar' documents.

Additional data sources for the audio context:

- Album Reviews
- Artist descriptions
- Genre descriptions - Song lyrics

The basic idea is to treat text as a bag of words or tokens. This form of IR abstracts from any kind of linguistic information. Documents are represented as term vectors.

Main research questions are:

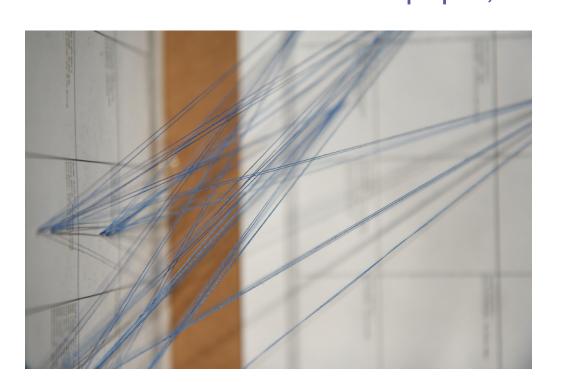
- Multi-Modal similarity ranking
- Multi-Modal cluster visualisation

For genre classification and multi-modality experiments we used a parallel corpus of audio and song lyrics files for a music collection of 7554 titles organised into 52; genres were assigned manually. The collection contains songs from 644 different artists and 931 albums. Additional textual information was retrieved from the Internet for genre, artist, and albums.

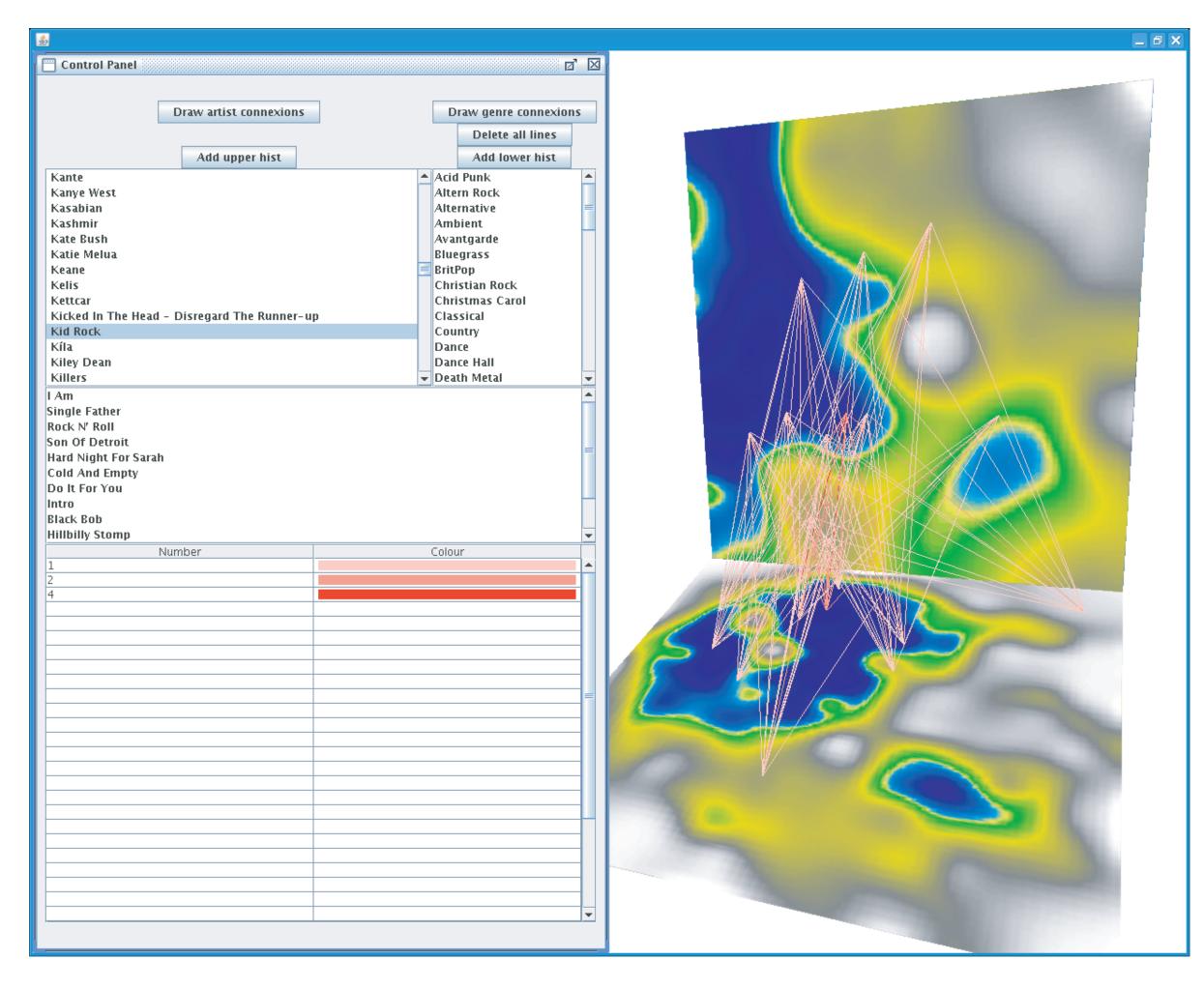
## Multi-Modal Visualisation

Identical instances, ie.e songs, mapped onto multiple clusterings can be linked.

A prototype mock-up was 'engineered' with paper, carton, and sewing cottons.

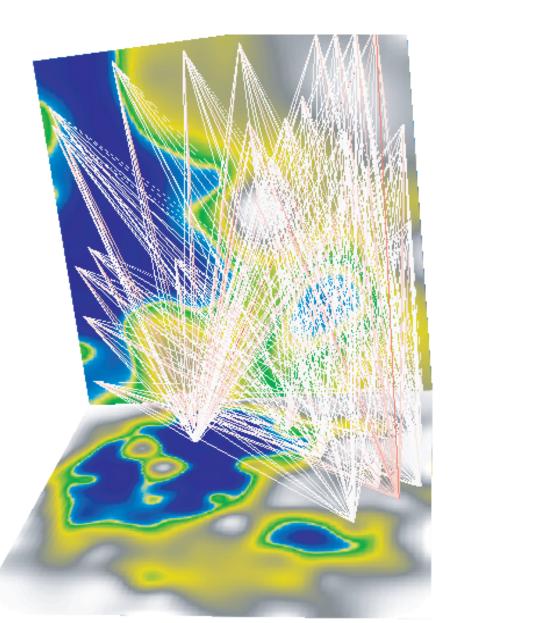




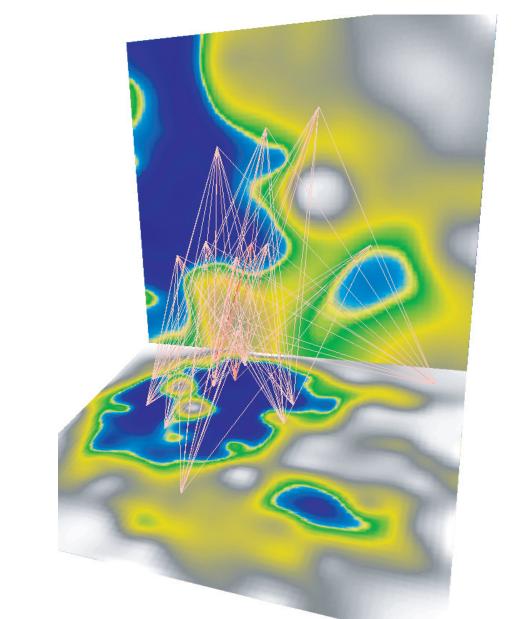


The main user interface of the Java implementation. The two SOMs are displayed on the right part. The 3D display offers the following functionalities: - select particular songs, artist or genres

- rotate the view
- pan and zoom in or out.
- change the colour palette



Connections for the 'Christmas Carol' genre with a much tighter distribution in the audio space.



Connections for the artist 'Kid Rock', the distributions are similar in both feature spaces..

# Multi-Modal Similarity Ranking

SimilarityRetrieval GUI						
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		;				
songWeight —	artistWeight	lyricsWeight —	albumWeight —	genreWeight —		
7	.2	.1	.4	.4		
Recalculate combined Ranking						
valuation legend, bonus for songs from the same:	000/002/005	AlbumCount: 0	ArtistCount: 0	GenreCount: 5		
udioRanking:	ArtistRanking:	LyricsRanking:	AlbumRanking:	GenreRanking:		
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720660 The Verve - Urban Hymns - 04 - The Drugs Don't Work	0.0 ColdplayX & Y08A Message	0.102052 The Facts And We're Voting Yes - 03 - For What Reason	0.029920 TravisSingles15All I Want to Do is Rock			
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726674 214 Were Gonna Get It Right	0.0 ColdplayA Rush Of Blood To The Head01Politik	0.102319exisonfire - Watch Out! - 04 - Side Walk When She Walks	0.030383 Thirteen Senses - The Invitation - 03 - Gone			
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740806 The Verve - Urban Hymns - 01 - Bittersweet Symphony	0.375304 Placebo - Live in Vienna 06-04-01 - 05 - Scared Of Girls	0.104410   ServiceGive Up10We Will Become Silhouettes	0.031530 Good Life - Album of the Year - 01 - Album Of The Year	0.0 Alexisonfire - Watch Out! - 01 - Accide		
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742221 Lostprophets - Start Something - 07 - Hello Again	0.375304 Placebo - Live in Vienna 06-04-01 - 18 - Peeping Tom	0.105012 Queen - Greatest Hits I - 13 - Play The Game	0.032676 JJ72I To Sky10Glimmer	0.0 NOFX - Live At Bizarre 1999 - 25 - 25 - Beer B		
743085 05 Make War (Long Version)	0.375304 (cebo - Live in Vienna 06-04-01 - 08 - Passive Agressive	0.105138 Gorillaz - Demon days - 15 - Demon days	0.033001 Bloc Party - Silent Alarm - 07 - This Modern Love	0.0 Doves - Lost Souls - 05 -		
.743266 Saybia - These Are the Days - 08 - Haunted House	0.3753041ore With Feeling Singles 1996-2004 - 19 - Twenty Years	0.105150 02-funeral_for_a_friend-i_am_the_arsonist	0.033531 Team SleepTeam SleepOur Ride To The Rectory	0.0 Frank Black - Teenager of the Year - 06 - Speedy M		
744798 Death Cab For Cutie - Transatlanticism - 04 - Expo '86	0.375304 Placebo - Live in Vienna 06-04-01 - 07 - 36 Degrees	0.105465 Alexisonfire - Watch Out! - 10 - Get Fighted	0.033603 Nada Surf - Let Go - 03 - Fruit Fly	0.0 ce - The Illusion Of Safety - 09 - Where idols once st		
750172 - Live At Bizarre 1999 - 14 - 14 - Release The Hostages	0.375304 05-Placebo-Follow_The_Cops_Back_Home	0.105502 Offer You Cant Refuse - 08 - A Farewell To A Friendship	0.033603 Nada Surf - Let Go - 08 - Killian's Red	0.0 Placebo - Live in Vienna 06-04-01 - 07 - 36 Degr		
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755890 Blood To The Head10A Rush Of Blood To The Head	0.375304 re With Feeling Singles 1996-2004 - 15 - Special Needs	0.105657 Nirvana - In Utero - 03 - Heart Shaped Box	0.033683 Gorillaz - Demon days - 15 - Demon days	0.0 Melanie CNorthern Star07\		
756302 3 Feet Smaller - Insert Album Title Here - 16 - On & On	0.375304 04-Placebo-Space_Monkey	0.105680 Cutie - The Photo Album - 10 - Debate Exposes Doubt	0.033955 SpartaPorcelain13From Now To Never	0.0 Radio Berlin - Sibling - 06 - 06 The		
.7566361e Age - Lullabies To Paralyze - 14 - Long Slow Goodbye	0.375304 cebo - Sleeping With Ghosts - 04 - Sleeping With Ghosts	0.105813 Alexisonfire - Watch Out! - 01 - Accidents	0.034167 KasabianKasabian12Ovary Stripe	0.0 'ganThe Future Embrace11Pretty, Pretty S		
.756936 Richard Ashcroft - Human Conditions - 04 - Paradise	0.378489 obbie Williams - The Ego Has Landed - 13 - Karma Killer	0.105824 Hight Be Wrong - Live Recordings - 08 - True Love Waits	0.034167 KasabianKasabian06LSF (Lost Souls Forever)	0.0 Lagwagon - Trashed - 03 - Know I		
.761441 The Verve - Urban Hymns - 12 - Velvet Morning	0.378489 Robbie Williams - The Ego Has Landed - 05 - Angels	0.1058633r Cutie - The Photo Album - 02 - A Movie Script Ending	0.034167 KasabianKasabian10Cutt Off	0.0   \q		
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.762162ın Play These Songs With - 03 - Pictures In An Exhibition	0.383051 tars - The Best of 1992 - 2002 - 09 - When You're Gone	0.106209king BenjaminWe're Not Alone Here06Forget It	0.034167 KasabianKasabian04I.D.	0.0 Aqualung - Strange and Beautiful - 07 - Left Be		
.762411 Brujeria - Raza Odiada - 08 - La Ley De Plomo	0.383051 Cranberries - To The Faithful Departed - 07 - The Rebels	0.106213 Nirvana - In Utero - All Apologies	0.034611 Filter - Title of Record - 06 - Take a Picture	0.0 Switchfoot - Learning to Breathe - 06 - Innocence A		

The main user interface of an experimental system to evaluate the impact of different weighting strategies. The largest part of the GUI is occupied by the five different rankings, one for audio, artist, album, lyrics, and genre respectively.

# Experimental and Qualitative Evaluation

Experiments were performetd to assess the quality of the multi-modal clustering, similarity ranking, as well as genre classification.

Genre	AC	$^{ m LC}$	CR	ADR	$ADR \times CR$
Speech	.0822	.0665	.8092	.3417	.2765
Christmas Carols	.0393	.0677	.5800	.7779	.4512
Reggae	.0392	.0413	.9495	.8475	.8047
Grunge	.0382	.0466	.8204	.9974	.8182
Rock	.0372	.0382	.9740	.9300	.9059

We train one map representing the collection
n terms of lyric similarity, one in terms of audio
similarity. Those maps will henceforth be refer-
red to as audio and lyrics map, respectively
Quality measures are given for a selection of
genres, describing the differences in distribu-
ions across maps.

Same Album	Top 5	Top 10	Top 20
Category Subst.	1.84	2.79	3.52
Exclusion	1.91	2.78	3.55
Simple Avg.	<u>2.36</u>	3.41	4.07
Same Artist	Top 5	Top 10	Top 20
Category Subst.	2.43	4.09	5.83
Exclusion	2.41	3.95	5.53
Simple Avg.	2.97	<u>5.11</u>	<u>7.15</u>
Same Genre	Top 5	Top 10	Top 20
Category Subst.	1.55	2.85	<u>5.15</u>
Exclusion	1.64	2.87	4.92
Simple Avg.	<u>1.90</u>	2.91	4.43

At first, the combined distances for each track in the collection to all other songs are computed. Then the first 5, 10 and 20 results are evaluated according to the number of songs belonging to the same artist, genre, and album.

For additional information and publications visit: http://www.ifs.tuwien.ac.at/mir http://www.ifs.tuwien.ac.at/~neumayer