

Adaptive Selection/Composition of Music

Seminar at the Media Computing Group WS 05/06 Markus Kohls , Yang Yang Advisor : Jan Buchholz



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2. Selection of Music
 3. Composition of Music
 4. Discussion



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Introduction

Composition

Discussion

Selection

Music in Everyday Life



- Influence mood
- Deliver messages
- Improve sales figures
- Development of Digital Music
 → Problems





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Requirements



- Automatically select favourite songs
- Automatic composition of music
- Composition of unique ad-hoc music for individuals
- Silent Notification of people in Shared Spaces



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Existing Applications for Automatic Selection

Business Music System (BMS)

- Automatic selection and mixing of music
- Automatic day time volume changes
- Adjustable music volume balance



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Composition

Discussion

Selection

http://www.nch.com.au/bms/

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Existing Applications for Automatic Composition



- Based on Constraint Programming
- Creates 4-voiced music pieces automatically
- Derived from a research paper

File Configure Pitch Chord Sequence Soprano Atto Tenor Bass Ambitus Instrument Volume • off Plano AccBass • hard AccBass Harpsichord • hard AccBass Harpsichord Choir Clarinet Flute Rockorgan Obore Sawwave Upper g1 g1	COMPOZE			
Ambitus Instrument Volume off Pano AccBass hard AccBass Harpsichord 20 Choir Choir 20 Carinet 60 Hute Rockorgan Churchorgan Oboe Sawrwave 91	File Configure Pitch Chord Sequence Soprano Alto Tenor Bass			
	Ambitus off hard soft 20 Lower A Upper g1	Instrument Piano AccBass Harpsichord Choir Clarinet Flute Rockorgan Churchorgan Oboe Sawwave	Volume 50	



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Discussion

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Requirements



- Find a song which is closest to user's favor from thousands of songs
- Share music with people having the same taste
- Mix different styles of music to satisfy people



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Music information retrieval(MIR)



- Began in the 1950's
- Music information retrieval by
 - Metadata-based: title, artist's name, music style...
 - Content-based: melody, rhythm, genre...



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The Content-Based Music Retrieval (CBMR)

- Query music based on the content of music:
 pitch, melody, tempo, etc.
- Retrieval according to a part of music
- Based on large music database



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- Discover a music by melody style

allows users to query similar style music by an example of music

 Query a mixed style music which user wish to hear allows users to query music by system predefined taxonomic style



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Define a music style

Style: Descriptions of characterization and discrimination

- Characterization
 - The common patterns of a given collection
- Discrimination

Comparison among collections.

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User selects songs from randomly generated songs

Discover the common characteristics of the selected group Discover the common characteristics of the unselected group

Find the discrimination of the two groups

Ranking Function evaluated all music in library



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Retrieval by Relevance Feedback



- A music retrieval method based on user's preferences
- Applying TreeQ to user's preferences
- Relevance feedback method is used to improve the performance



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Retrieval by Relevance Feedback



How to find out the user's preferences

- The musical preferences of user are very ambiguous
 Elements of music influence the user's reaction to a song
- Based on user's feedback to find out preferences
- Using Relevance Feedback method refine the result



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MusicFX

- Operational since November 1997
- Music from digital radio stations
- A group preference arbitration system
- Three components
 - Preference database
 - Group preference arbitration algorithm
 - Environmental "triggers"





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MusicFX



Every user submits an electronic form User login to MusicFX by swiping badges

> Using the database find out the user's preference A Group Preference Arbitration Algorithm calculate group preference value Output the songs which are suitable for most of people



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MusicFX



Environmental "Triggers"

Five events trigger the group preference arbitration algorithm:

- Member Entrance
- Member Exit
- Individual Preference Update
- System Parameter Adjustment
- Maximum Station Play Time Elapsed

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Flytrap



- What music do people listen to?
- Five components
 - Radio frequency ID badge
 - RealJukebox
 - Database
 - A Flytrap agent
 - Virtual DJ

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Flytrap



Random selection policy "Virtual DJ":

Has the power to override and prioritize the outcome of the user's vote based on its own "good taste"

- Never play two tracks by the same artist
- Maintain loose genre coherence across tracks



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Soundpryer



- Mobile music-sharing tool
- Sharing by streaming MP3
- Listen to what the other stereos close-by are playing.
- Application of peer-to-peer software architecture



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Soundpryer



Four combinations of mode and the source of music

- manual/local
- manual/remote
- automatic/local
- automatic/remote



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Composition of Music



There are different approaches to music composition depending on goal:

- Genetic Algorithm approach used for music composition
- Gesture/Context based approach, using the environment as an impression for Automatic song composition
- Notification or informational Tasks accomplished by adapting Music

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Genetic Algorithm Approach



- Genetic Algorithms widely used in scientific community
- Biological role model: Nature's survival of the fittest
- A number of lifeforms or chromosomes is generated
- According to a certain measurement (often called "fitness") selection of the best lifeforms for the new generation



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Genetic Algorithm Approach



Properties of the Chromosomes

- 1 main melody
- 4 precomposed backings
- Length (only 4 bars with time signature 4/4)



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Genetic Algorithm Iterations



Creating Start Population of 20 Chromosomes User rates every Song (Fitness value) -

Applying GA Operations (mutations, recombinations)

A new generation of 20 Chromosomes is generated ^{__}

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A Generate and Sense Approach

- also based on Genetic Algorithm
- Physiological Sensors were used
- Training Phase
 - User evaluates song
 - physiological data is measured and analysed
 - map it to attributes
- Main Phase
 - Fitness Function based on physiological input data

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Introduction

Composition

Discussion

Selection

Sonic City

- AACHEN Introduction Selection Composition Discussion
- Mapping Urban Environment and Motion on to Music
- Sensor Input:
 - Body-related (Heart rate, speed)
 - Environment-related (temperature, light level)
- Data Output:
 - Samples and Sounds from or near to City Soundscape
 - Foreground and Background Sounds
- Preferences: User vs Environment, Random vs Determined

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Sonic City: Mapping Strategy



Input

High Level

Descriptions (e.g. "inside")

Outpu

Structural composition variables

_ow Level

Sensor Data

Spectral Values, Triggering of short musical events



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Sonic City: Prototype Video



ACCEPTION Introduction Selection Discussion



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Seamless User Notification



- Silent Notification of Individuals or Groups
- Example application: stores, banks
- What needs to be created?
 - Creation of main songs, which sound complete
 - Creation of Notification sounds or patterns, which integrate smoothly into the main songs

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Seamless User Notification



- Usage of a special audio framework for rooms
- On notify event: Mixing notification sounds or patterns into the main song
- Direction of notify event can be recognized by using only a certain group of speakers



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Navigation via Adapted Music



- Navigating the user by adapting music.
- Lab Prototype:
 - A 3D World with multiple navigation tasks was created
 - One group used the Ontrack-system, which navigates by adapting the balance to indicate the right direction
 - Second group navigated via normal birds-eye map

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Navigation via Adapted Music



- Evaluation:
 - Both groups were able to reach their destination in about the same time
 - Navigation via sound was considered less exhausting
- Probable applications: Tourist guide service, Child monitoring system



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3. Composition of Music

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MusicFX and Flytrap

- Using metadata to define the music style
- Mixing the style to satisfy the most of people's music habits
- Developed random selection policy to provide a new kind of music for users
- Different:
 - Fill out a survey
 - Observation

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Retrieval based on Melody Style or Relevance Feedback

- Find out the style of music by analysing the content of music
- Retrieves songs to satify the individual user
- Require large database or users' feedback to get a result
- Unsuitable for a group of people

Soundpryer

select music by choose the co-located peers

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Automated Composition of Music:

- Approaches often rely on precomposed songs, patterns or rules
- Projects often try to use users mood or emotional state directly or indirectly on to composed music
- Genetic Algorithm approaches take much time
- The projects are still very experimental

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Notification and informational Music Composition:

- Already many possible real life applications today
- Information transfer via audio is limited
- Both approaches are very intuitive, so also less exhausting when used
- Often as good as non-audio solutions



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