Kick-Off & Tool Presentations
Fri, 30 Sep 2016, 18:00 - 20:30
2nd Waves Vienna Music Hackday

Successful start last year

Crossover between music & technology

People with many different backgrounds:

- Hobby producer
- Digital creatives
- Hardware tinkerer
- Coder
- Artists
- Researchers
- Musicians
- Audio geeks
- IT specialists
Music Hacking?

music apps  
software  
new instruments  
wearables  
audience interaction  
platforms  
sound installations  
hardware

Anything goes, as long as it is related to music!
Tool Presentations

– Ultrasonic Audio Technologies
– MOD Devices: Step onto the future with MOD Duo
– IRCAM: Sound Music Movement Interaction
– Musimap's human and AI based music recommendation API
– Plux: BITalino – A DiY biosignals (r)evolution
– A Tour of Deezer Developer Tools
– Europeana Sounds: Identifying genres in musical heritage
– GiantSteps: Music Analystisis and Composition APIs
– MusicBricks tools
– Announcement of Challenges and Awards
ULTRASONIC
AUDIO TECHNOLOGIES

By:
Miha
Ciglar

Creating directional sound and contact free tactile feedback through airborne ultrasound
2008

ULTRASONIC
AUDIO TECHNOLOGIES

IŽU

INŠITUT ZA RAZISKOVANJE ZVOČNIH UMETNOSTI INSTITUTE FOR SONIC ARTS RESEARCH
Syntact - contact-free tactile feedback:

The musician feels the frequencies and the temporal features of music and can change them in real time by virtually moulding the tactile signal.
Syntact is a musical interface – It allows direct physical interaction with music

The acoustic energy off all the transducers is accumulated in the focal point where it creates a physical force (a tangible vibration)
Syntact - contact-free tactile feedback:

Visualization of the ultrasonic waves and the focal point with liquid nitrogen
Hyper-directional sound is created by modulating a high frequency carrier. Due to nonlinear interaction of sound waves in air, the modulated ultrasonic signal gets self demodulated and becomes audible while passing through air.
Applications: in-store advertising, museums, galleries
Operation principle

The term Parametric Acoustic Array (PAA) was introduced by P. J. Westervelt in 1963
Acouspade 134AB(S)DUMA-M/S

- Miniaturised amplifier integrated within the emitter housing
- Bluetooth connection
- Motion detection
**Acouspade** AB(S)-134-DUMA-M/S
Acouspade AB(S)-134-DUMA-M/S

-Launch: 1st March 2016
TaPa (Talking Palm)

TaPa is a bracelet containing a directional speaker. The bracelet is a substitute for the mobile phone. A hyper-directional speaker is mounted below the wrist, facing the palm. When you put your hand close to your ear, the sound bounces off the palm and is directed into your ear.
TaPa

-When you want to make a call, just rotate the bracelet around your wrist and lean your palm next to your ear.
- A hyper-directional speaker is mounted bellow the wrist, facing the palm
- The sound enters a cavity formed between the face and the palm, where it is additionally amplifies through acoustic resonances
- The sound does not spread into the environment which preserves silence for others and creates privacy for you
Thank you!
Joseph Larralde
Gabriel Meseguer Brocal

http://ismm.ircam.fr/
RapidMix:

- Rapid Adaptive Prototyping for Industrial Design of Multimodal Interactive eXpressive technology

- wrap together technologies from Europe’s research institutions in an API that will ease the use of bio / gesture sensors with machine-learning, MIR and audio synthesis algorithms for multimodal, interactive, expressive applications

http://rapidmix.goldsmithsdigital.com/
Provided tools:

- **R-IoT sensor**
  Programmable 9 axis sensor board (IMU) sending OSC data over WiFi

- **MuBu (MIR / audio synthesis library for Max)**
  multi-buffer container with associated tools for gesture and sound analysis / synthesis

- **XMM (machine learning library for gesture recognition)**
  C++ library provided as MuBu objects / Python module / Node.js addon
R-IoT WiFi Motion Sensor

9 axis sensor with 3D accelerometers, gyroscopes and magnetometers
R-IoT WiFi Motion Sensor

OSC Wifi Stream at 200 ms
- 3 accelerometers
- 3 gyroscopes
- 3 magnetometers
- Quaternions and Euler Angles

Based on Texas Instrument WiFi module with a 32 bit Cortex ARM processor

Compatible with TI’s Code Composer and with Energia, a port of the Arduino environment
Sensor Analysis

MaxMSP patches to facilitate the R-IoT modules

- Visualization and filtering
- Kick detection
- “Energy” computation

Playing Techniques
- Freefall
- Shaking
- Spinning

Gesture Recognition available in the free MuBu library (Max7)
SOUND MUSIC MOVEMENT INTERACTION
Music & Emotions

Waves Vienna Music HackDay
Vienna, 01/10/2016

Frédéric Notet
CTO
"No musician can compose Music forgetting his influences. All is connected"
THE ALGORITHM - Cross-weighted taxonomy

3 billion data points
2 billion relations
50 million tracks
4.3 million artists
400 complex moods
11.3 thousand keywords
400 genres
100 contexts
Music DNA

1. Musicological System
2. Semantic Intelligence Based On Advanced Lexicology
3. Collaborative Filtering
4. Synaptic Web Mining
5. Metadata Enrichment
6. Collaborative Optimization System
7. Socio-Psychological User Profiling
8. Social Data Mining
9. Behavior & Listening Habits
10. Sensory Inputs
11. Geo-Localization, Contextualization & Movement Detection
12. Electroacoustic Signals
TECHNOLOGY – Rocket science!

COLLABORATIVE FILTERING
DEEP LEARNING
SIGNAL ANALYSIS
SOCIAL AGGREGATION
HUMAN EXPERTISE
ALGORITHM + DATABASE – Matrix for innovative interfaces
Our HTTP based API

- Access metadata for millions of Artists, Albums or Tracks
- Access recommendation for Tracks
- Access audio analyzer for Audio Files
- Access special catalog of “Waves Vienna Festival” Artists
- Access special catalog of “Barack Obama Profile”

HTTPS://DEVELOPERS.MUSIMAP.NET
A JSON formated API

curl "https://api.musimap.net/search/v1/tracks?access_token=jgcWP3lzRcGZ7Mn844vz6Kf7mmRc2eHlvUhxK"

```json
{
    "status": "success",
    "code": 200,
    "stats": {
        "total": 11731,
        "offset": 0,
        "limit": 1
    },
    "tracks": [
        {
            "uid": "FB883E56-EC9A-9E21-3AEA-6665A270A904",
            "name": "La Valse d'Amélie",
            "score": 98.19,
            "album": {
                "uid": "74A4AF2D-0CC4-B44B-7942-76E1906F8F0F",
                "name": "Le Fabuleux Destin d'Amélie Poulain",
                "year": "200104"
            },
            "genre": {
                "uid": "07C7436A-EF77-6207-0036-A35FE5D8CB1",
                "name": "Soundtrack And Movie Theme",
                "bgcolor": "bed6dc"
            },
            "owners": [
                {
                    "uid": "F8028ECC-4DAE-57F6-8403-E993520B2EE8",
                    "nickname": "Yann Tiersen"
                }
            ],
            "references": {
                "deezr": "14406851",
                "spotify": 0,
                "clip": "https://www.youtube.com/watch?v=ygPQ54f0Ac"
            }
        }
    ]
}
```
A moods network to humanize results

Moods are in a hierarchy, describing each human feeling
# Moods Analyzer – Expertise your audio files

## Audio Analysis

**feeling-good.mp3**

**Duration:** 176 seconds

**Key:** D minor

**BPM:** 0

**Meta Data**

<table>
<thead>
<tr>
<th>Title</th>
<th>Feeling Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Album</td>
<td>Complete Jazz Nina Simone</td>
</tr>
<tr>
<td>Artist</td>
<td>Nina Simone</td>
</tr>
<tr>
<td>Genre</td>
<td>Jazz</td>
</tr>
<tr>
<td>Index</td>
<td>2</td>
</tr>
<tr>
<td>Year</td>
<td>1991</td>
</tr>
<tr>
<td>Duration</td>
<td>02:06</td>
</tr>
<tr>
<td>File Size</td>
<td>3.38 MB</td>
</tr>
<tr>
<td>Type</td>
<td>mp3</td>
</tr>
<tr>
<td>Bit Rate</td>
<td>160000</td>
</tr>
</tbody>
</table>

## Complex Analysis

**Melody Flavour:** 0

**Melody’s Flavour:** ...

**Melody Instrument:** 0

**Melody’s Instrument:** ...

**Base Flavour:** 0

**Base Flavour Is:** ...

**Base Instrument:** 0

**Base Instrument Is:** ...

**Intensity:** -1

**Intensity Is:** ...

**Centroid:** 0.627165

**Centroid Is:** ...

**Danceability:** 0.905584

**Danceability Is:** ...

**Derivative:** 0.036098

**Derivative Is:** ...

**General Loudness:** 163.8

**General Loudness Is:** ...

**Complexity:** 7.334021

**Complexity Is:** ...

**Complexity Loudness:** 22.223616

**Complexity’s Loudness Is:** ...
Open Deezer
The gateway to music innovation
Table of contents

/01  Deezer  
/02  Presentation of the API  
/03  Leverage the API  
/04  Showcase
Global Presentation
Available in 180+ countries
Accessing the content through our API
Presentation of the API

Content management

- Artists
- Genres
- Podcasts
- Channels
- Albums
- Playlists
- Flow
- Tracks
- Charts
- Episodes
- Editorial

Explore channels ➔
Immerse yourself in worlds of new music
No authentication is required to use the API

Possibility to choose between different return formats

Check out our API discovery development tool at http://developers.deezer.com!
03

Leverage the API: SDKs, WebApps, widgets...
3 things SDKs are useful for

- Third party auth via oauth2
- Access to account information
- Content streaming (requires an account)
- Automated API Calls
Choose the SDK that fits your needs...

...and bring deezer to all of your devices
Deezer WebApps API

www.deezer.com/app/demo

• Based on JavaScript SDK

• Support for all major browsers: IE7+, FF, Chrome, Opéra

• Same code for both platforms: inside or outside Deezer

• Interactions with Deezer’s player and user’s library
Deezer’s App Studio
Leverage the API

Hacking Fast

• 1. Create your App ID
   MyApps: http://developers.deezer.com/myapps

• 2. Select your SDK
   JS SDK: http://developers.deezer.com/sdk/javascript

• 3. Learn how to hack fast with our API explorer
   API explorer: http://developers.deezer.com/api/explorer

• 4. Guidelines for an immersive experience ;)
   Guidelines: http://developers.deezer.com/guidelines
Showcase
OldRadio - Deezer... in a 1959 radio
House.pl - Custom Players

IF YOU DON'T KNOW WHERE TO GO...

ROAD TRIP SONGS

ESCAPE PLAN
Shuffler.fm – Audio magazine curated by tastemakers

RADIO
Play and read the top emerging songs and artists. Posted on the web’s leading music sites. Learn More

Can’t Do Without You
Caribou
The basement of my childhood house was a lot of things: a

So Many Pros
Snoop Dogg
Marijuana-delivery app Eaze has raised $10 million from investors

American Oxygen
Rihanna
Yakında gıçacak olan sekizinci albümünden üçüncü single’ini da
Identifying genres in musical heritage

- Europeana Project
  - +3500 cultural institutions
  - Over 50 million records
  - Photographs, archival records, art, fashion, tv broadcasts etc.
Identifying genres in musical heritage

- Europeana Sounds
  - +25 content partners
  - Over 300,000 records
  - Pictures/film/recordings/sheet music
Explore 268,522 music recordings, pieces of sheet music and other music items from across Europe.
About Europeana Music

- Largely unknown material
- Not to be found anywhere else (Spotify, Deezer etc.)
- But.. often difficult to navigate
The challenge

- Work on tools and solutions to detect genres in the sound files.
- Data: http://www.ifs.tuwien.ac.at/~schindler/eusounds_challenge/
The awards

- For the best solution of the day we have 500 euros in vouchers.
- If you are interested, we want to further develop today’s prototype into a working tool for production.
GiantSteps Challenge @ Waves Festival
Peter KNEES, Richard VOGGL (JKU Linz)
The GiantSteps Project

The seven-league boots for music creation and performance

Goals

• Improve music creation tools to boost inspiration and creative flow
• Break barriers caused by a lack of technical and musical knowledge
• Empower potential music creators

Approach

• Combining MIR with interfaces and interaction design techniques
• Develop musical expert agents that provide musical suggestions when composing
• Align with user requirements; test in real-world situations, with practitioners
Partners

Department of Computational Perception
Johannes Kepler University Linz
upf.
Music Technology Group

NATIVE INSTRUMENTS

reactable

Red Bull Music Academy
STEIN

GiantSteps is partly funded by the European Community’s Seventh Framework Programme.
GiantSteps Frameworks

• madmom

• Essentia / EssentiaRT~

• Various GiantSteps Assets on GitHub

http://www.giantsteps-project.eu/#/downloads/software
madmom

• Python music processing library
• Signal processing/Music Information Retrieval tools
  – Tempo detection
  – Beat and downbeat tracking
  – Onset detection
  – Chord transcription
  – etc.
• State of the art technology in these areas
• https://github.com/CPJKU/madmom
• C++ music processing library, Python bindings
• EssentiaRT~: Pure Data version for real-time processing
• For audio analysis and audio-based MIR
  – Audio I/O, DSP blocks
  – Statistical characterization of data
  – Large set of spectral, temporal, tonal and high-level music descriptors

• http://essentia.upf.edu
• http://mtg.upf.edu/technologies/EssentiaRT~
Various Assets

- Various tools and libraries developed for music making
  - **RhythmCAT**: Real-time concatenative synthesis for rhythms (VST plugin)
  - **API for rhythm pattern variation** (C++)
  - **DrDrum**: Generative drum machine (Pure Data)
  - **House-Harmonic-Filler**: Harmony expert agent (Pure Data)
  - and many more...

- [https://github.com/GiantSteps](https://github.com/GiantSteps)
Challenge and Award

Best use of GiantSteps APIs

Use one or more of the GiantSteps APIs for music analysis, recommendation, and semantic sound analysis for

- music making and performance,
- new instruments,
- improvising systems,
- virtual band mates,
- real-time visualizations
- ...

Reward: 250€ music store vouchers
#MusicBricks

is a European initiative providing innovative Music (Analysis) Software and Hardware tools as building blocks for hackers

www.musicbricks.net
Freesound API

+200k CC licensed sounds

WebAPI
  - django-rest

Freesound APIv2 Clients:
  - Python,
  - Java,
  - ObjectiveC

https://www.freesound.org/docs/api/
Onset detection

Real-time onset detection/description
Provides **onset** information:
  loudness, timbre, pitch, spectral features
- Onset Detection
  http://essentia.upf.edu
- Melody Extraction
  http://essentia.upf.edu
- PureData and MaxMSP objects
  http://mtg.upf.edu/technologies/EssentiaRT~

- Freesound API
  http://freesound.org/docs/api
Rhythm & Timbre
Analysis from Music

• analyzes audio (segments or songs)
• get analyzed features:
  – Rhythm Pattern
  – Rhythm Histogram
  – Spectral Descriptor (capturing timbre)
Rhythm & Timbre
Analysis from Music

- compute acoustic similarity
- get similar sounding songs by rhythm and/or timbre
- create playlists of a certain style
- detect the genre of a song
- make music recommendations
- etc. etc.

'More like this' - Finding Similar Songs
Rhythm & Timbre

- open source
  - Python
  - Java
  - Matlab

- Download and Tutorials:
  [http://ifs.tuwien.ac.at/mir/musicbricks](http://ifs.tuwien.ac.at/mir/musicbricks)
Music Similarity

Search by Sound: get similar music
Web API

http://ifs.tuwien.ac.at/mir/musicbricks
Music Similarity

Search by Sound: Web API

• REST API (no installation needed!)
• 50,000 songs from freemusicarchive.org pre-analyzed
• add own songs
• get similar songs (by timbre or rhythm)
• super-fast analysis (~ 1-2 sec/full song)

http://ifs.tuwien.ac.at/mir/musicbricks

#MusicBricks
Sonarflow
Visual Music Discovery Apps (iOS + Android)

Discovery from online sources

- Youtube
- last.fm
- iTunes
- Spotify
- 7digital

MusicBricks Transcriber (by Fraunhofer IDMT)

Extract Melody + Bass line from audio

• Predominant melody / bass line (note onset, duration, pitch)
• Key & Chords (e.g., Cm / E / Fm)
• Time signature & beat-grid
• Average tempo (bpm)
• Output formats (MIDI, MusicXML, etc.)
• Executable for Win, Mac & Linux
Real-Time Pitch Detection (by Fraunhofer IDMT)

Realtime analysis of audio samples

• Detect currently sung or played pitches
• Monophonic mode (f0 + pitch)
• Polyphonic mode (pitches)
  • Informed algorithm (provide most likely pitches -> define search range)
• Library incl. sample projects for all platforms (Win, Mac, Lnx, Android, iOS)
Time Stretch & Pitch Shift (by Fraunhofer IDMT)

Stretch or pitch audio samples

- Realtime
- 50% to 200% of tempo
- +/- half Octave
- Library incl. sample projects (Win, Mac, Lnx, Android, iOS)
- Application Example: Songs2See
Goatify

Replace melody with sample

• Predominant melody extraction
• Input sample pitched according to melody
• Original melody muted
#MusicBricks
Music Analysis Tools

available from
www.musicbricks.net
**Other Tools**

- Arduinos + SunFounder Starter Kit
- Raspberry Pi's
- Lilipad Sewing Kit + Textile Fabrics
- FLORA - Wearable electronic platform
- Bitalino body signal kits
- Neurosky Brainwave Kits
- Pico Boards
- Adafruit 12-Key Capacitive Touch Sensor
- KaossPad
- Novation Launchkey MIDI keyboard
- x-OSC Microcontroller
- Bare Conductive Electric Paint
- Flora RGB Smart Neo Pixel
- RFID Wristbands
- PlayStation Portable for Rhythm Hack
- Voice-Changer Boards
- Necomimi Brainwave Cat Ears
- Adafruit NeoPixel RGB
- 3D Printer (MakerBot 2)
- Soldering Station
Challenges

- Best gesture and sound combination (proposed by MOD)
- Best hack on music & emotions (using Musimap API)
- Best hack using body signals
- Best use of GiantSteps APIs for music & sound analysis and recommendation
- Europeana Sounds Music Collection Genre Detection Challenge

Challenges

- Best gesture and sound combination
- Best hack on music & emotions
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Awards

- 1 MOD Duo
- 500 € by Musimap Hardware*
- 250 € vouchers
- 500 € by Europeana

* from MindTecStore and Bitalino

Thanks to our Sponsors and Partners

ultrasonic
ircam
Centre Pompidou
mod
mindtecstore
bitalina
Organized by

Thomas Lidy
Alexander Schindler
Oliver Hödl
Peter Knees
Richard Vogl
Joris Pekel
Wulf Gaebele
Christian Löw
Andreas Rauber
Announcements

- Austrian Heartbeats
  Music Label &
  Music Technology (Startup) Event
  15-17 November 2016 in Tel Aviv
HACKING!

Saturday 9:45 a.m.
Be here in time!

Programme:
– 9:45 - 10:00 Welcome & Ideas Presentation
– 10:00 - 18:00 Hacking
– 18:00 - 18:30 Jury Session
– 18:30 - 20:00 Final Presentations & Awards

Food & Drinks provided!

All Details: http://bit.ly/waveshack
FESTIVAL!

Enjoy the concerts...

... but don’t be late!  Saturday 9:45 a.m.