

Datasets for Music Information Research in Indian Art Music

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Getting Started on Computational Musicology and Music Information Research: An Indian Art Music Perspective

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Indian Art Music:
A Computational Perspective



Edited by Preeti Rao, Hema A. Murthy and S. R. M. Prasanna

<https://play.google.com/store/books/details?id=g-2rEAAAQBAJ&pli=1>



Saraga: Open Datasets for Research on Indian Art Music

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A. Srinivasamurthy, S. Gulati, R. Caro Repetto, X. Serra, "Saraga: Open Datasets for Research on Indian Art Music," *Empirical Musicology Review* (Special Issue on Open Science in Musicology), vol. 16, no. 1, pp. 85-98, 2021

Agenda

- Getting Started
 - Why should we get started?
- Music Concepts, Parallels
 - Objects in Indian Art Music
 - MIR tasks
- Datasets for MIR on Indian Art Music
 - Fundamental Principles
 - Building datasets
 - Accessing datasets
 - Using datasets
- Examples and Applications
 - Time to Get Started!
- Opportunities/Resources

Show of Hands!

- Music Training
 - Indian Music
 - Western Music
 - Music Production
 - Sheet Music Literates ?
- Avid Music Listeners
- Signal processing and/or Machine Learning

Music Technology

Music Technology enhances our experience with music by **building tools and technologies** to learn, teach, compose, produce, perform, record, playback, consume, analyze, understand, appreciate, store and archive music

Music Technology

Music Technology enhances our experience with music by building tools and technologies to learn, teach, compose, produce, perform, record, **playback, consume, analyze, understand, appreciate, store and archive music**

Music Information Research (MIR)

Music Technology

Music Technology enhances our experience with music by building tools and technologies to **learn, teach, compose, produce, perform, record, playback, consume, analyze, understand, appreciate**, store and archive music

Computational Musicology

Computational Musicology

- Scholarly analysis of music – multidisciplinary
- Facets: learning, teaching, performance, listening, appreciation, aesthetics
- Perspectives: Historical, cultural, cognitive
- Computational tools for Musicology

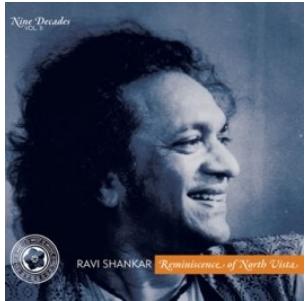
Data-driven computational musicology

- Music-corpora level statistical analysis
 - Melody, rhythm and harmony
- Supplement and complement manual analyses
 - Scale to large corpora
 - Verify common-knowledge
 - Derive additional insights

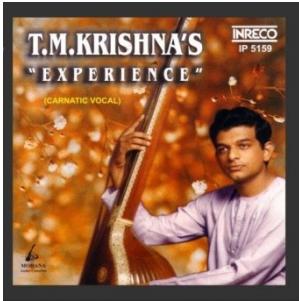
Opportunities (Challenges!?)

- Multicultural world
 - Each within its sociocultural context
- Lots of data
 - but copyrighted, unlabeled and sub-optimally organized
- Subjectivity
 - In creation, consumption and analysis
 - Music Similarity
- Interdisciplinary
 - Involve the community

Culture aware technologies



Hindustani



Carnatic



Turkish-makam



Arab-Andalusian



Beijing Opera

- CompMusic: Culture aware Music Information Research
 - Bring music knowledge into methods
 - Musical concepts to engineering formulations
 - Involve music communities

<http://compmusic.upf.edu/>

Indian Art Music



Carnatic Music

Vignesh Ishwar in concert at Arkay Convention Center, Chennai, India



Hindustani Music



<https://musicboxnews.files.wordpress.com/2011/09/darbar-festival-20081.jpg>

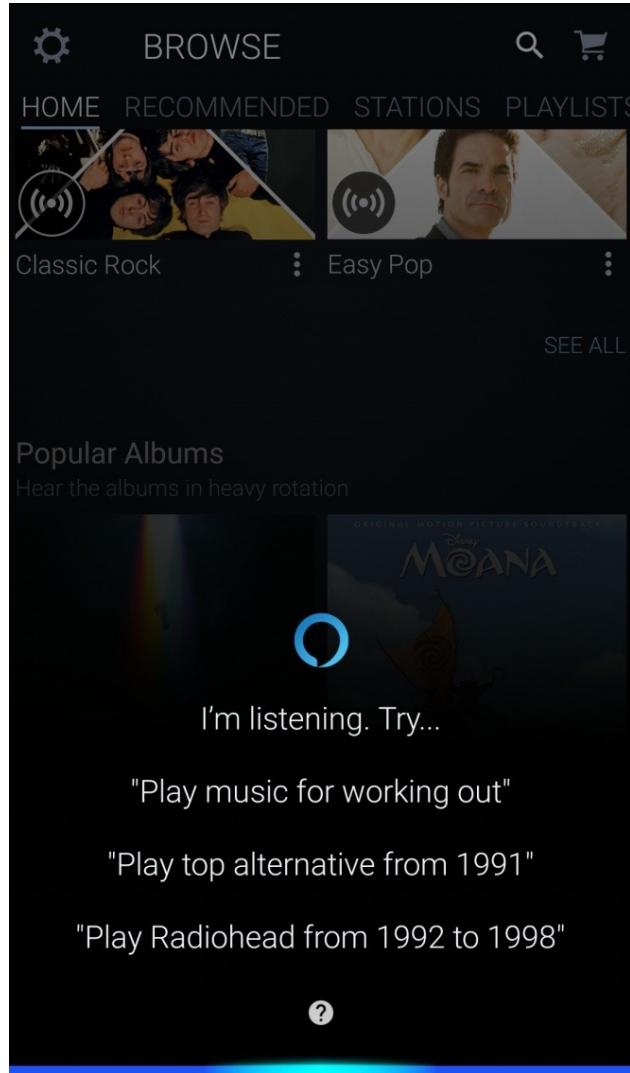
Indian Art Music

- Carnatic and Hindustani music
 - Some common concepts and terminology
 - Differences in practice
- Carnatic Music
 - Southern parts of the Indian sub-continent
- Hindustani music
 - Northern parts of the Indian sub-continent
- Centuries of evolution
 - Sophisticated melodic and rhythmic structures

Why Indian art music ?

- Music
 - Predominantly oral traditions
 - Sophisticated and structured, scope for improvisation
 - Wide variety of instruments and variations
 - In practice, continues to evolve
- Community
 - A large dedicated audience
 - Significant musical literature
- Unique challenges

Data: Organizing music collections



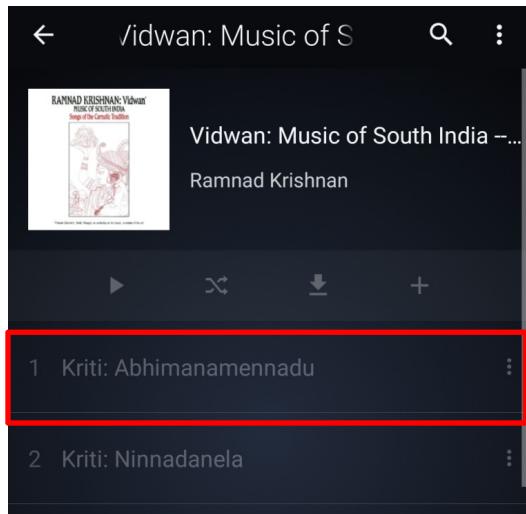
Artist -> Album -> Title 

Play a slow kriti in mohana raga and mishra
chapu tala

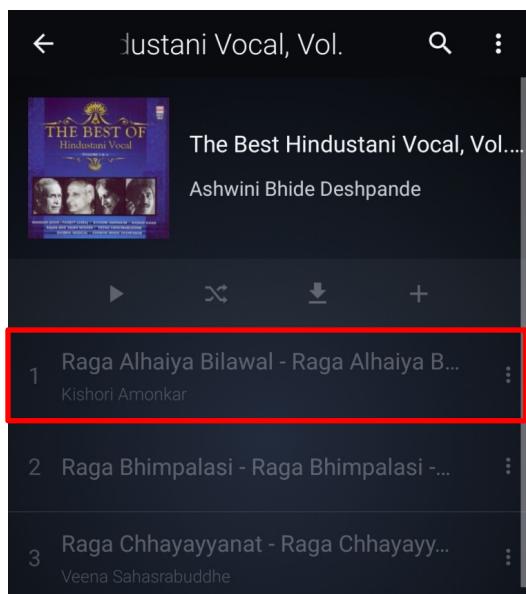
Make a playlist of drut teental bandish that
contain improvisatory sections

Get other songs that have similar rhythmic
passages

Editorial metadata – partially available



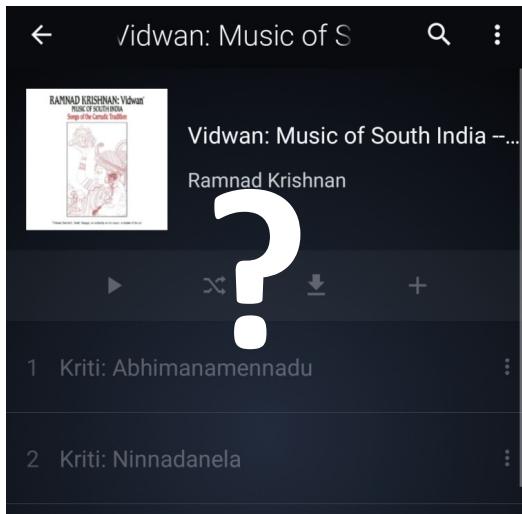
Play a slow **kriti** in **mohana raga** and
mishra chapu tala



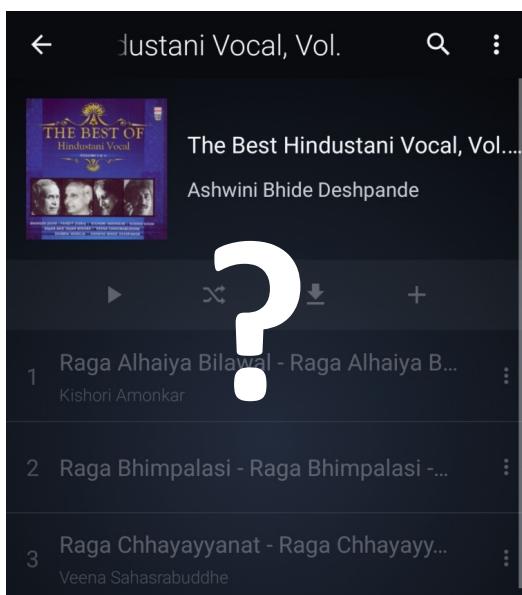
Make a playlist of drut **teental bandish** that
contain improvisatory sections

Get other songs that have similar rhythmic
passages

Content based descriptors and similarity



Play a **slow** kriti in mohana raga and mishra chapu tala



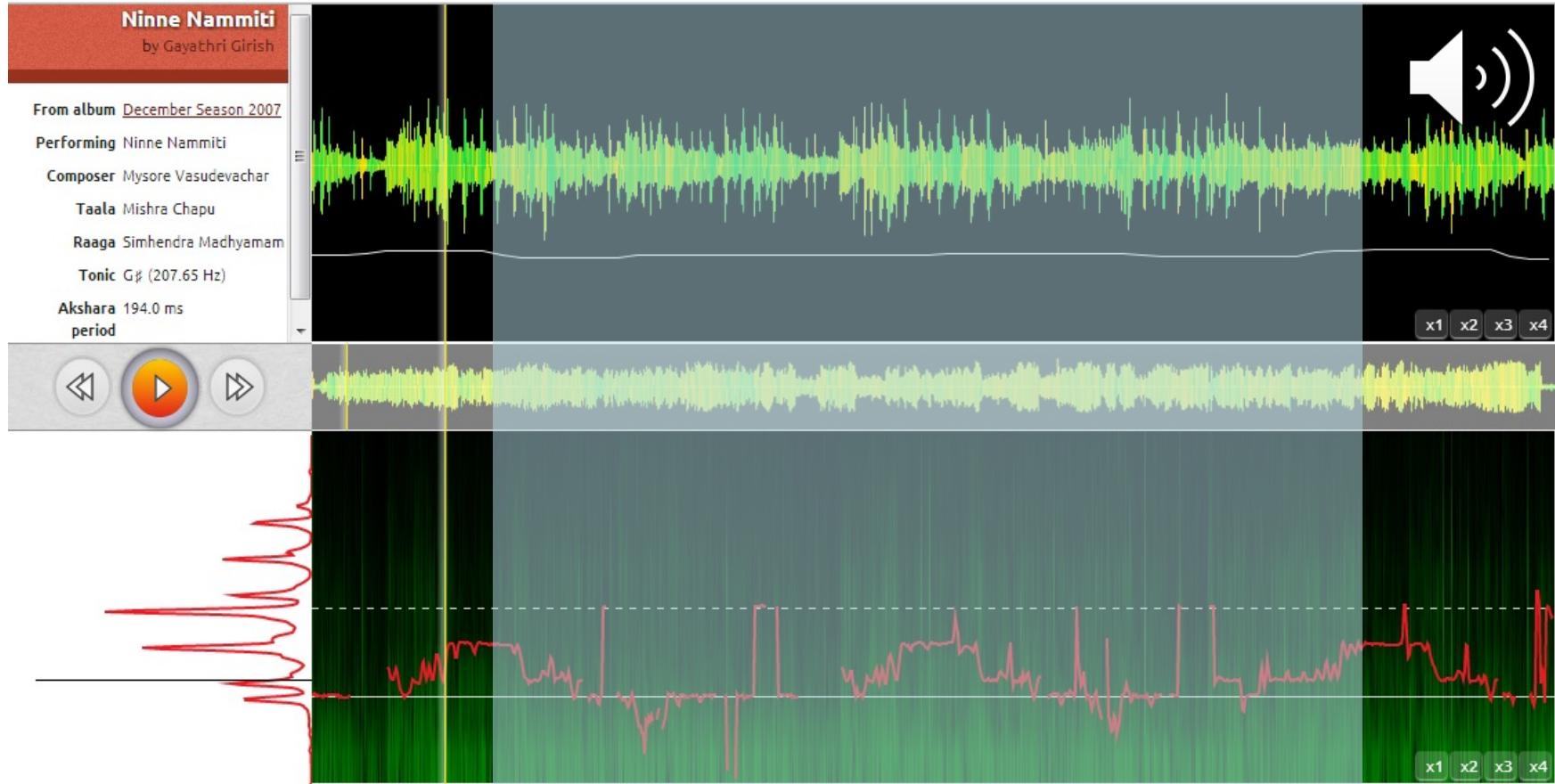
Make a playlist of drut teental bandish that contain **improvisatory sections**

Get other songs that have **similar rhythmic passages**

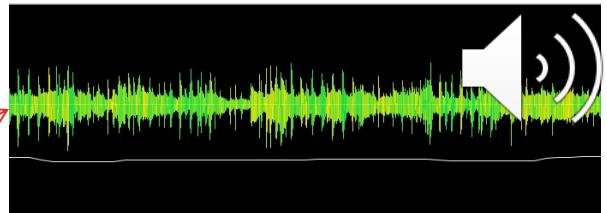
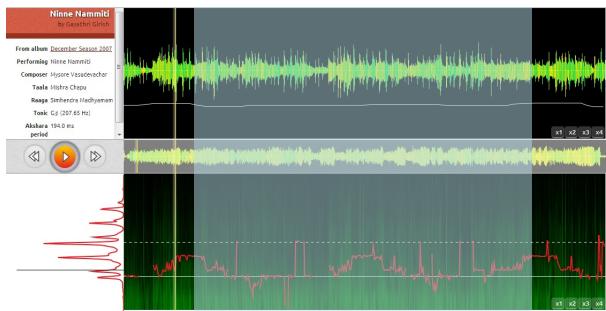
Enriched Interaction with Music

- Editorial metadata and **content based descriptors**
- Large collections – enriched with musically relevant metadata and organized using “similarity measures”
- Indian Art Music
 - Melody: Descriptors related to the rāga
 - Rhythm: Descriptors related to the tāla

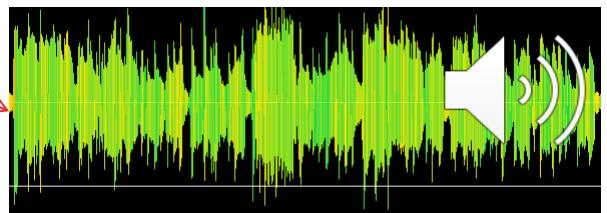
Similarity: in the future...



From Ninne Nammiti, December Season 2007, Gayathri Girish

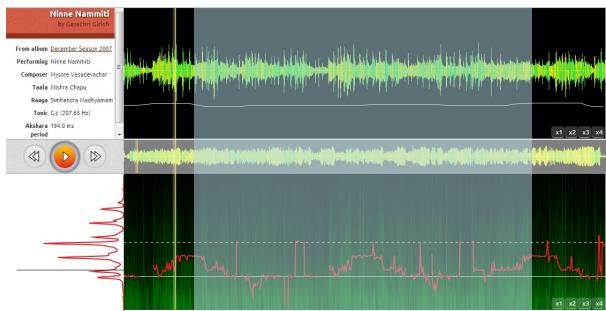


From Ninne Nammiti, Paddhatti - K V Narayanaswamy & N Ramani, by K V Narayanaswamy & N Ramani, 2003

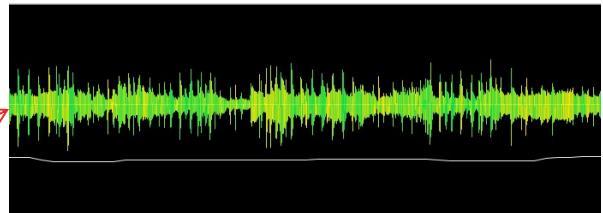


From Ninne Nammi Nanu,
December Season 2003, O.S.
Thyagarajan

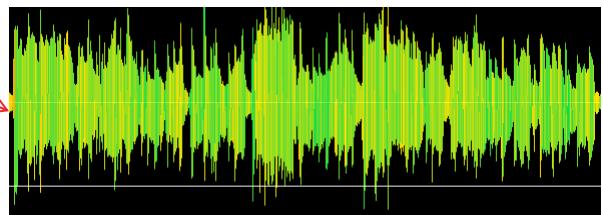
Similarity ?



?

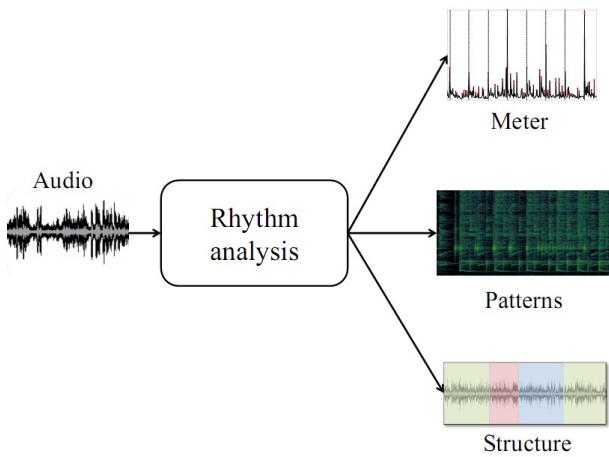
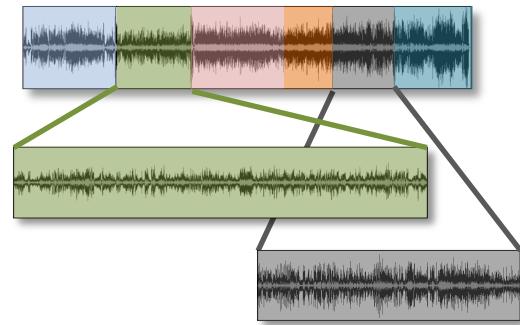
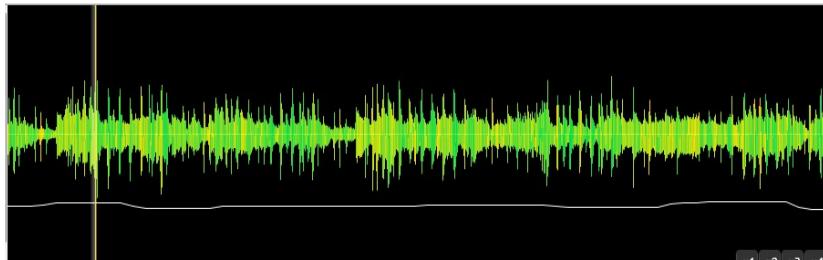


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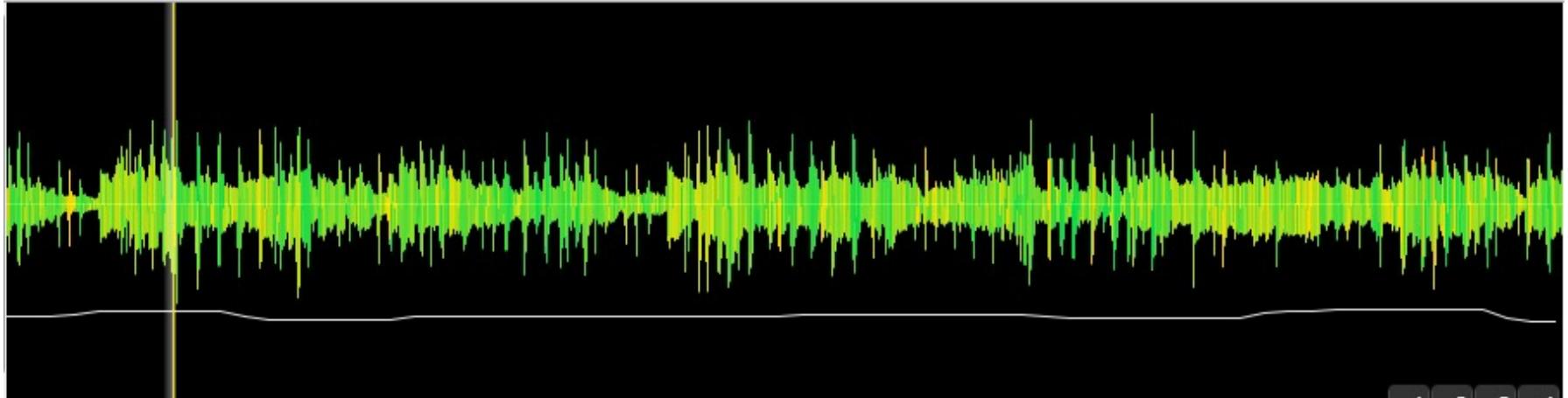
Music Objects and MIR Tasks



Representation
 Segmentation
 Similarity
 Motifs Discovery
 Pattern Characterization

Music Objects

- Audio
 - Waveform: time sequence of amplitudes



Music Objects

Scores

- Prescriptive/Descriptive

Pallavi

G , R ,	S , , ,	N S R G	R R S N I
ja . la .	jā . . .	kshi . . .	nin . . . I
S R S S	N P - N S R - P ,	N , S , R	
ne da . . bā . .	. si . .	
G R S N	S R - P N	S R G P	G N P ,
chā . . la	. ma . .	. ru . .	. lu .
S N S G	R - S N P P G , R ,	S , R	
kon na . . di rā . .	

```

id: ravikiran2024p
vol: 2
page: 24
varnam: Jalajaakshi
raag: hamsadhwani
taal: adi
tempo: madhyalaya

// G3 - R2 - / S - - -/ N3, S R2 G3/ R2 R2 S N3,/
S R2 S S/ N3, P, N3, S/ R2 P, - N3,/ - S - R2/

// G3 R2 S N3,/ S R2 P, N3,/ S R2 G3 P/ G3 N3 P -/
S' N3' S' G3'/ R2' S' N3 P/ P G3 - R2/ - S - R2/

```



The image shows two staves of a musical score. The top staff is for Clarinet, the middle for Viola, and the bottom for Piano. Measure 94 starts with a dynamic *f*. Measure 98 begins with a dynamic *p*.

Music Objects

- Audio
- Scores
- Lyrics

Kuşâde taliim hem bahtım uygun,
Aman sâkî bana hiç durma mey sun.
Gamım yok, zevk u şevkim hadden efvun,
Aman sâkî bana hiç durma mey sun

Music Objects

- Audio
- Scores
- Lyrics
- Commentary/Critique

#14

by drshrikaanth » 20 Aug 2006, 03:47

Here is a review of a concert of the Grande Dame of HM- Gangubai Hangal. It is always invigorating to read about maestros. And in this particular review, touching as well. What a spirit!

<http://www.hindu.com/fr/2006/08/18/stor...170300.htm>

en kaDan paNi seidu kiDappadE was a line Rangaramanuja Iyengar quoted in his books (*kRti maNimAlai*). Gangubai is a living example of it. I once saw her interview and was struck by her unassuming nature. The child in her is remarkable. She reminds one so much of D.K.Pattammal who too has that beatific smile and child-like simplicity.

0 x 

<https://www.rasikas.org/forums/viewtopic.php?f=13&t=916>

Music Objects

- Audio
- Scores
- Lyrics
- Commentary/Critique
- Metadata and social information

1 Sgt. Pepper's Lonely Hearts Club Band

lead vocals: [Paul McCartney](#) (The Beatles)

producer: [George Martin](#)

has remixes: [Sgt. Pepper's Lonely Hearts Club Band \(1999 remix\)](#) by [The Beatles](#) and [Sgt. Pepper's Lonely Hearts Club Band \(2017 stereo remix\)](#) by [The Beatles](#)

mash-ups: [Razor Smile](#) by [Go Home Productions](#), [Sgt. Pepper Jerks It Out](#) by [G3RSt](#) and [Sgt. Pepper's Paradise \(The Beatles vs. Guns N' Roses\)](#) ([Best of Bootie 2005 DJ-mix](#)) by [Jimmie Jammes](#)

sampled by: [Kowalski \(GHP Bootleg Breaks remix\)](#) by [Primal Scream](#), [Strawberry Fields Forever \(Love version\)](#) by [The Beatles](#) and [The Sounds of Science](#) by [Beastie Boys](#)

recording of: [Sgt. Pepper's Lonely Hearts Club Band](#)

writer: [John Lennon](#) (The Beatles) and [Paul McCartney](#) (The Beatles)

publisher: [Northern Songs Ltd.](#) (1967)

is the basis for: [Cpl. Kipper's Barnsley Trades Club Turn](#)

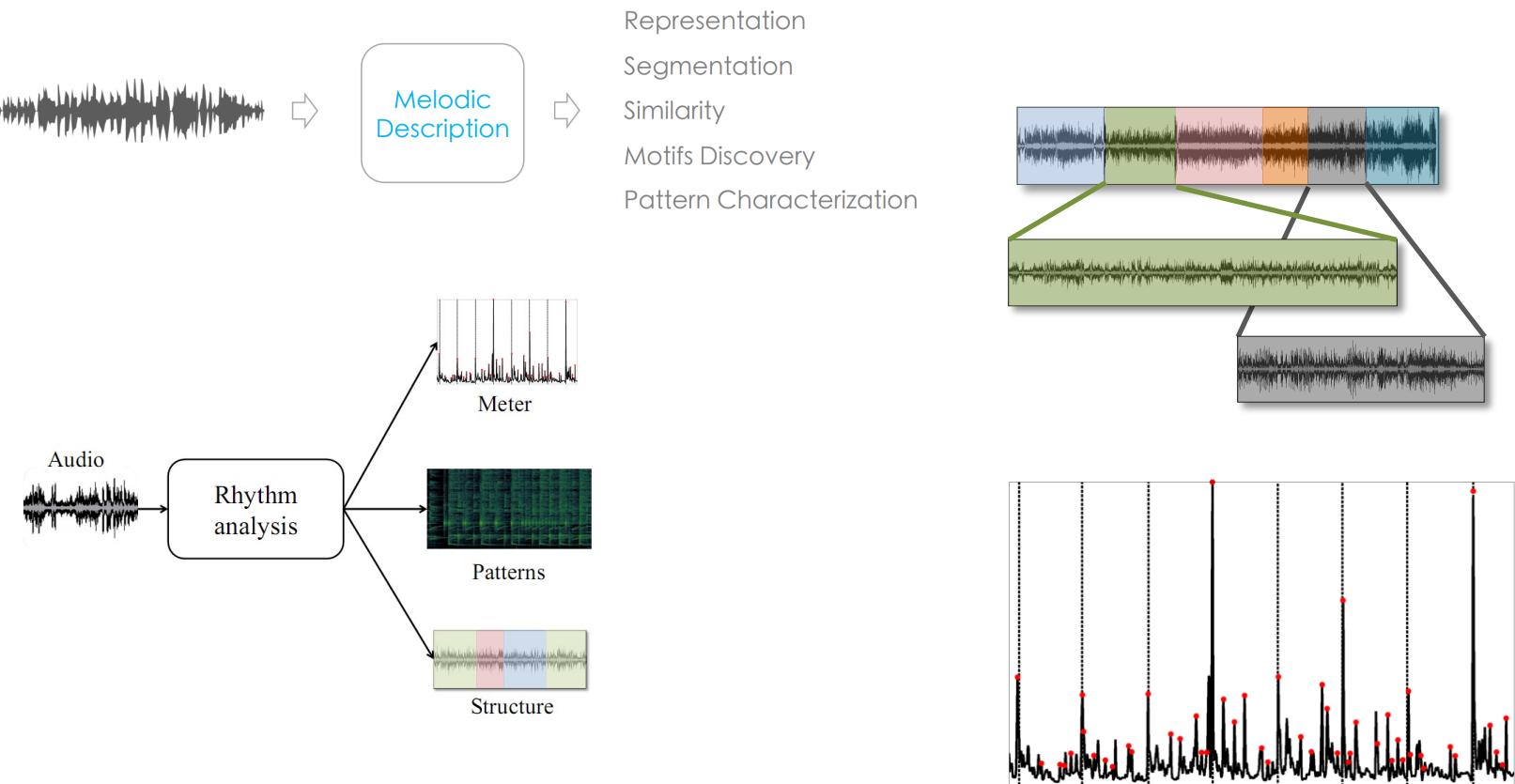
later translated parody versions: [Sergent pépère](#)

later parody versions: [Sgt. Hetfield's Motorbreath Pub Band](#)

later parody versions: [Such Impressive Loving Smart Close Friends](#)

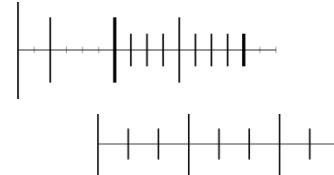
★★★★★ 2:02

MIR Problems



Content description

Similarity

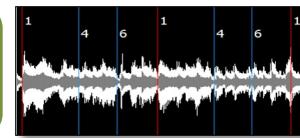


Pattern analysis

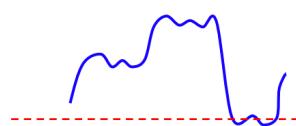
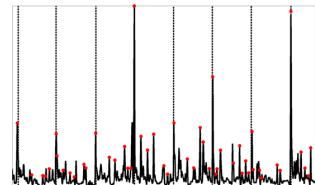
Segmentation



Meter/Melody



Onset/Pitch



Complex

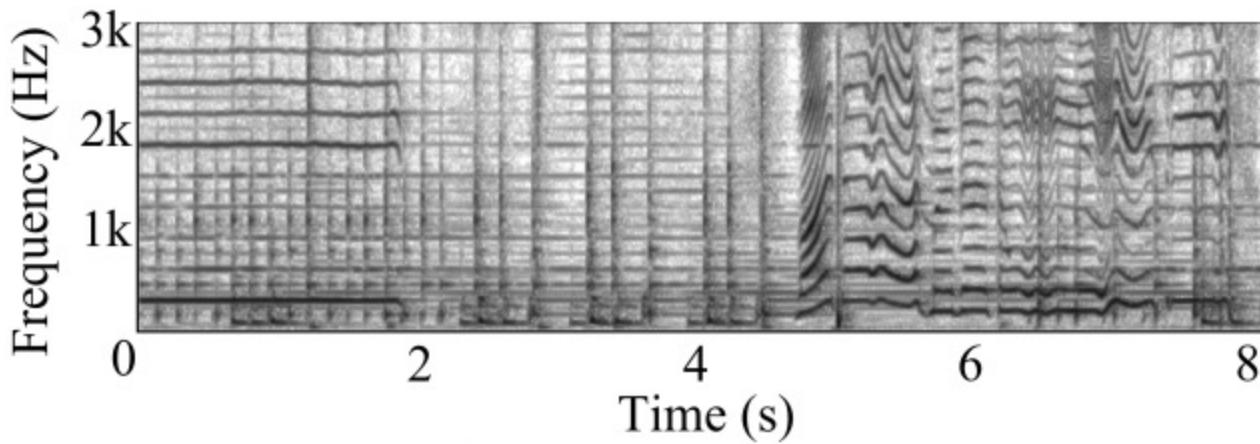


Simple

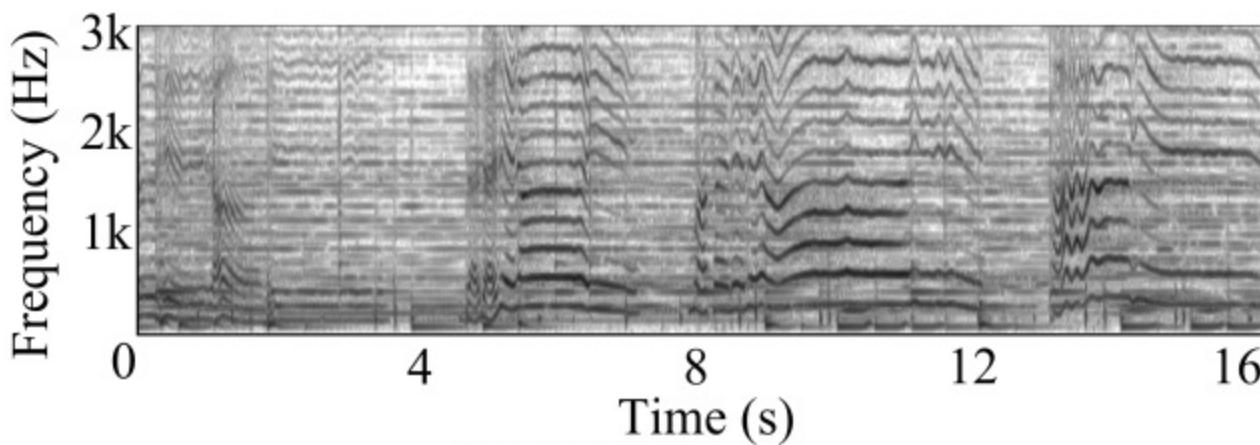
Music Representations

- Representations help to interpret, transmit and archive music
- Representations can vary with content, and can be lossy!
 - Represent some/all elements of music
- Symbolic representations
 - Music Scores, Piano rolls, MIDI
 - Prescriptive or descriptive
- Acoustic representations
 - Waveforms
 - Spectrograms
 - compressed audio (MP3, e.g.)
 - Features from audio – descriptors

Characteristics of Indian Art Music

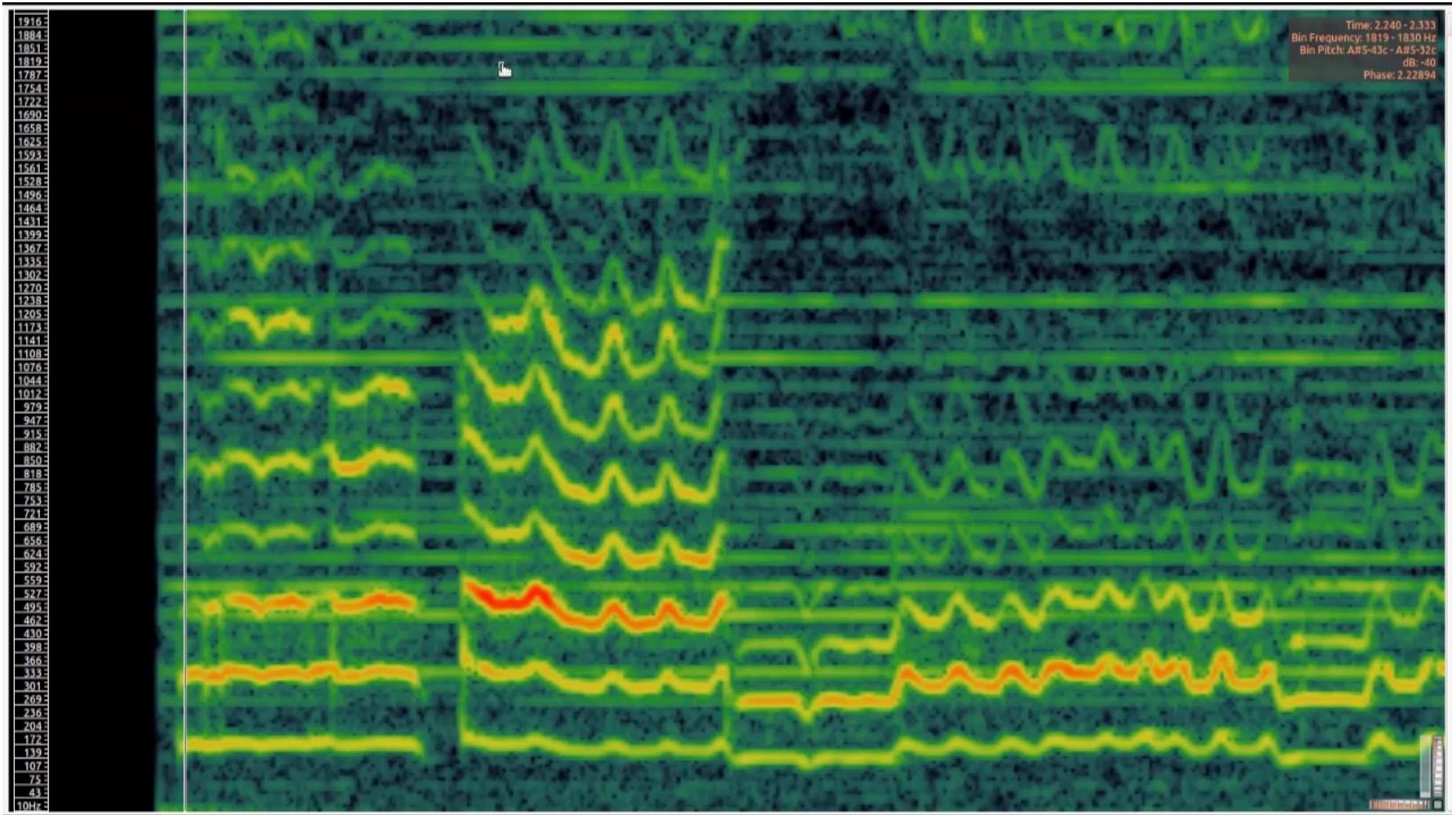


(a) Carnatic music

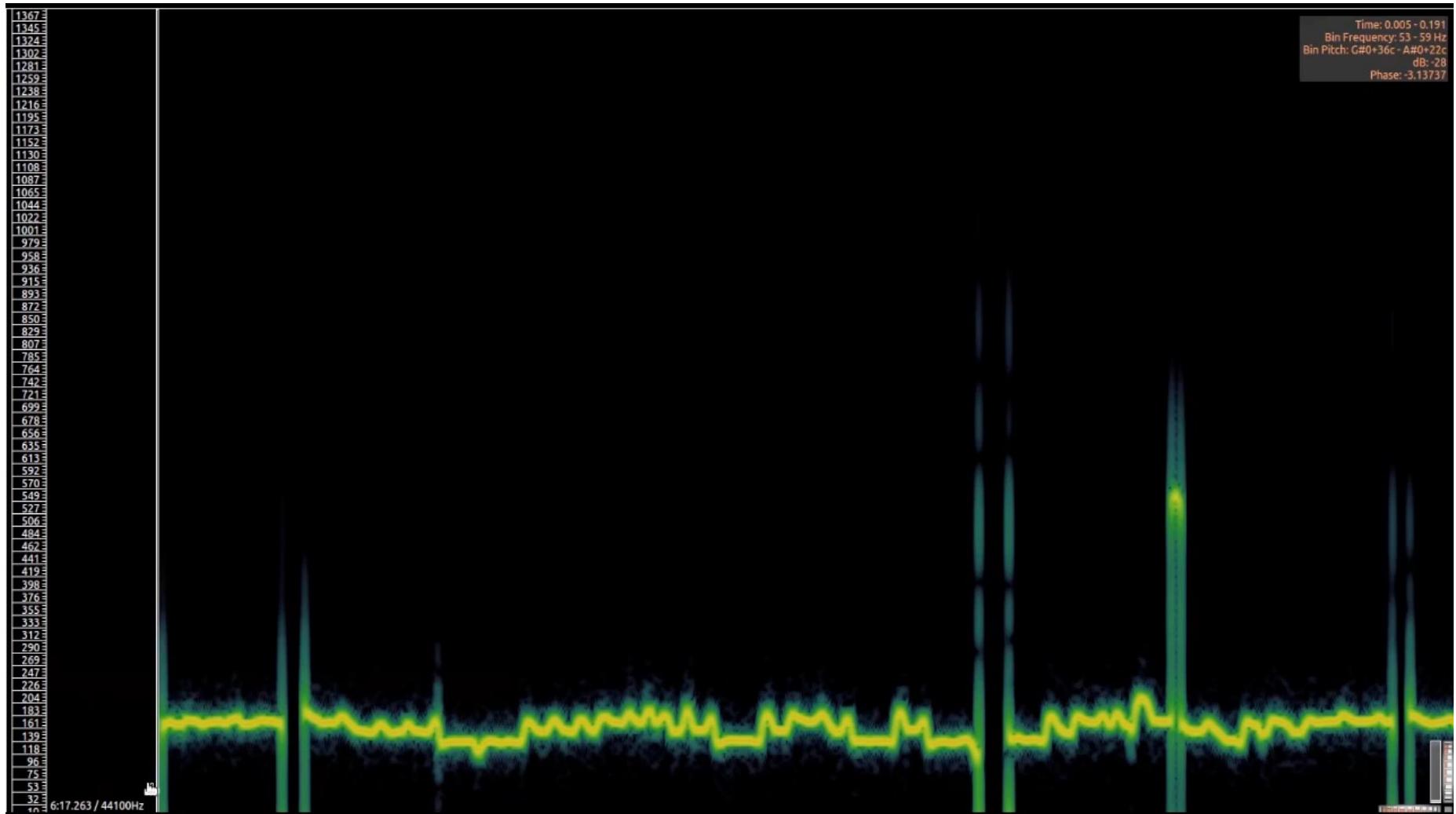


(b) Hindustani music

Example: Melody Extraction

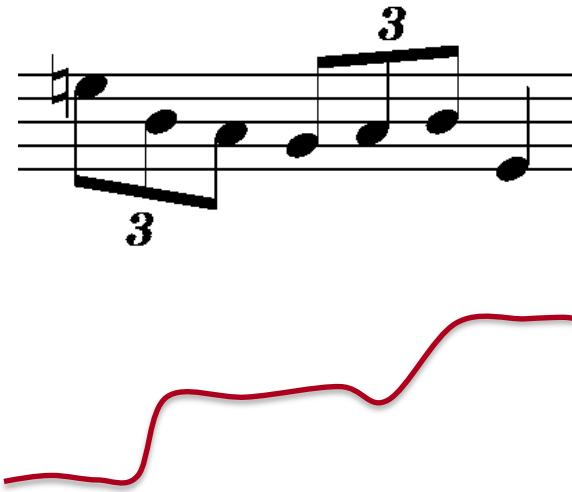


Example: Melody Extraction

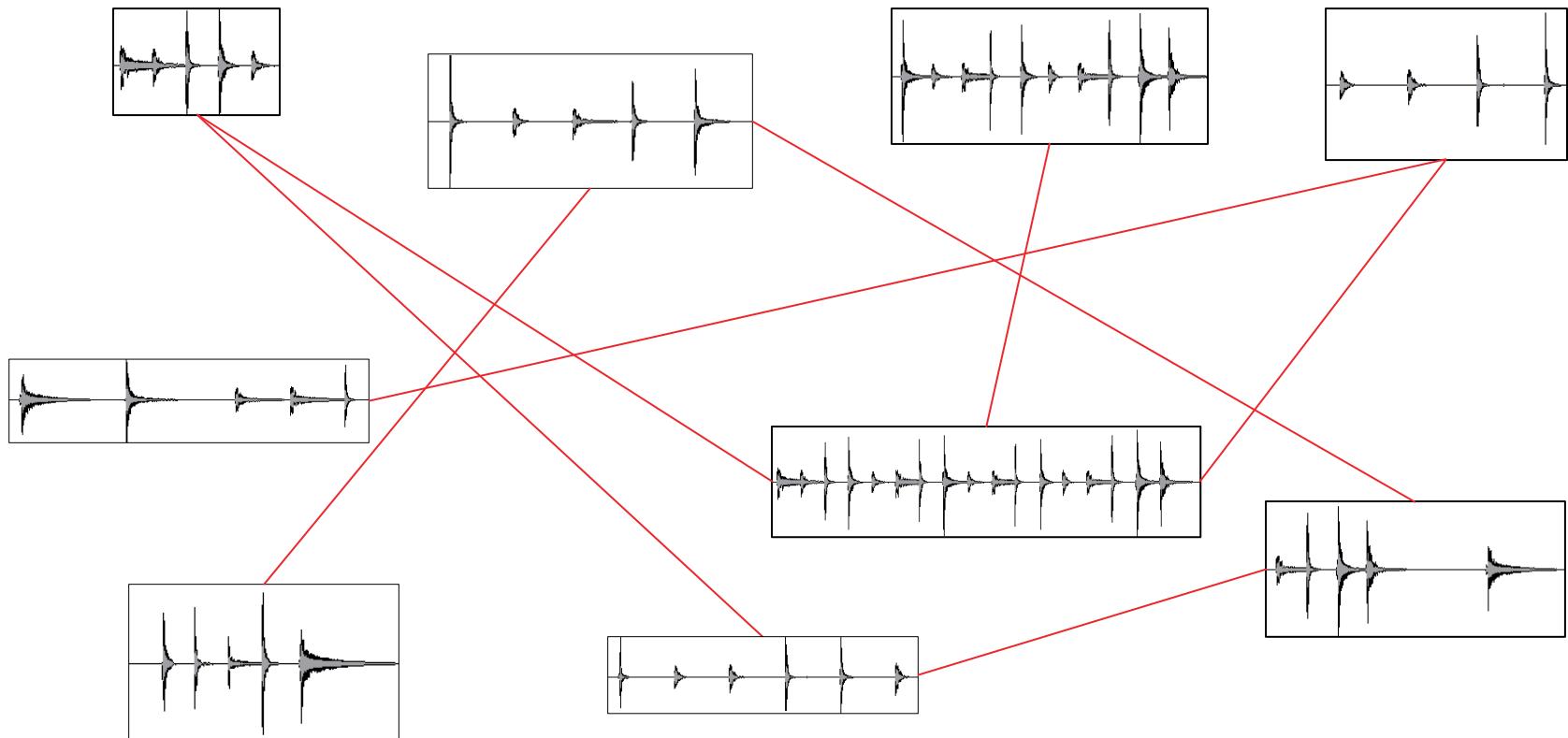


Melodic motifs/phrases

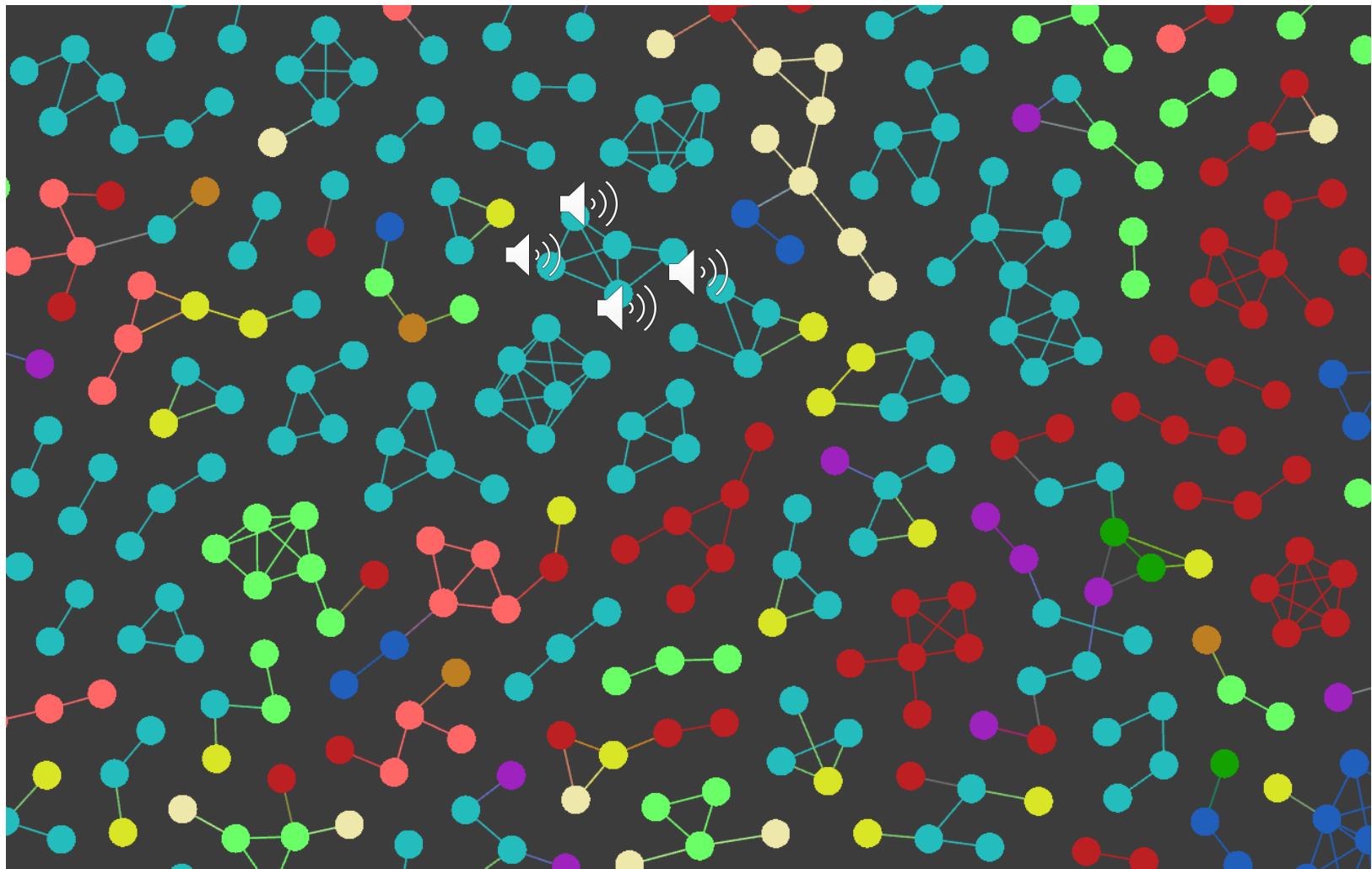
- Short segments of melody
 - Sequence of notes
 - Pitch contours
- Characteristic melodic phrases
 - Repeated within and across music pieces
 - Characteristic of a raga



Pattern extraction and analysis



Melodic motif discovery

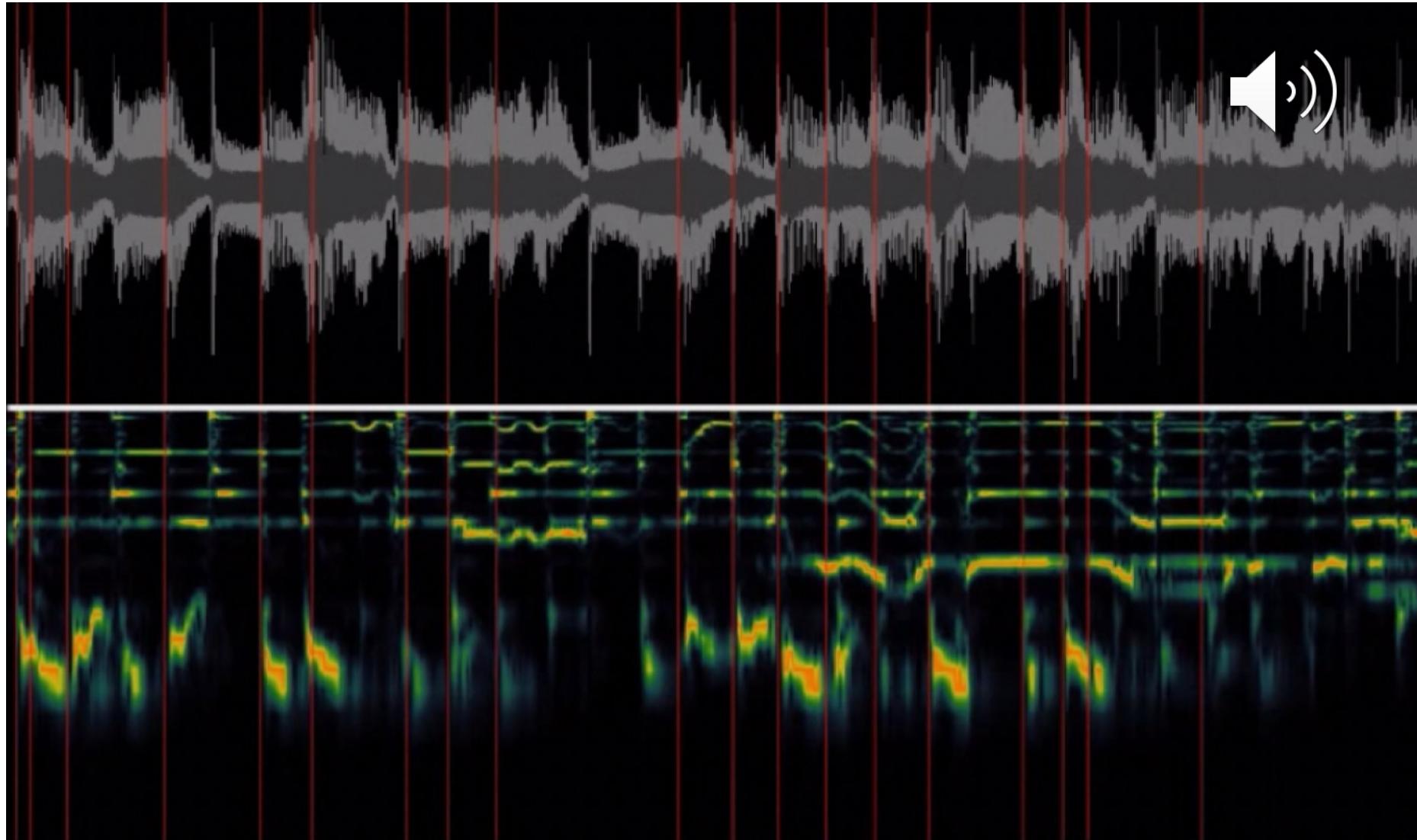


https://dunya.compmusic.upf.edu/pattern_network/

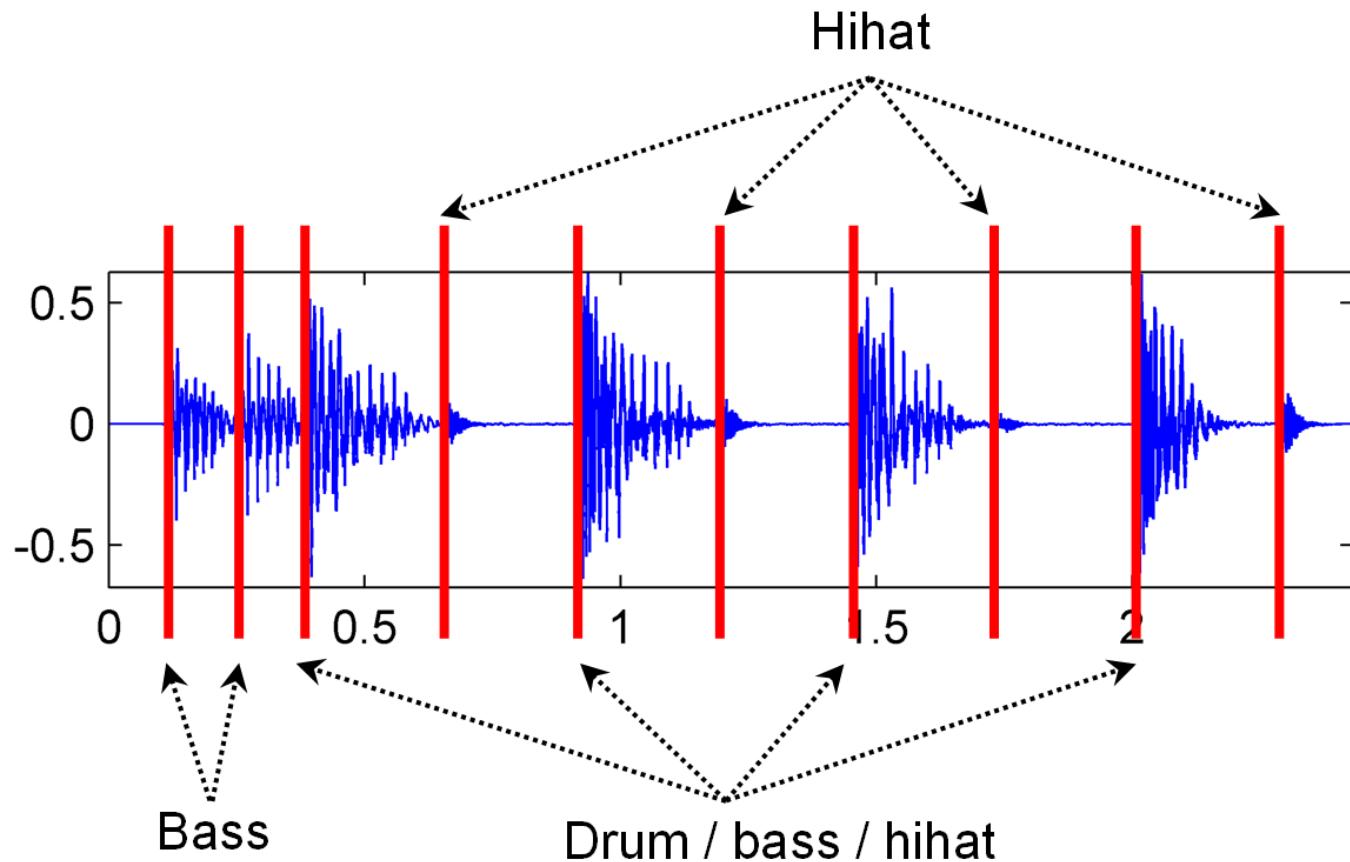
Onsets and Tempo

- Onset: Note event
 - Basic events in time
 - Grouped to form beats, bar . . .
- Tempo
 - Median Inter-onset interval: good estimate of tempo
 - Possibly time-varying: local averages

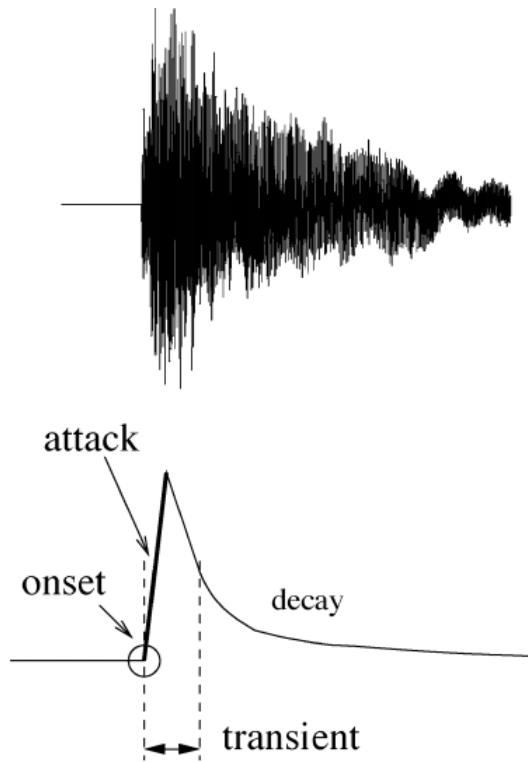
Onsets



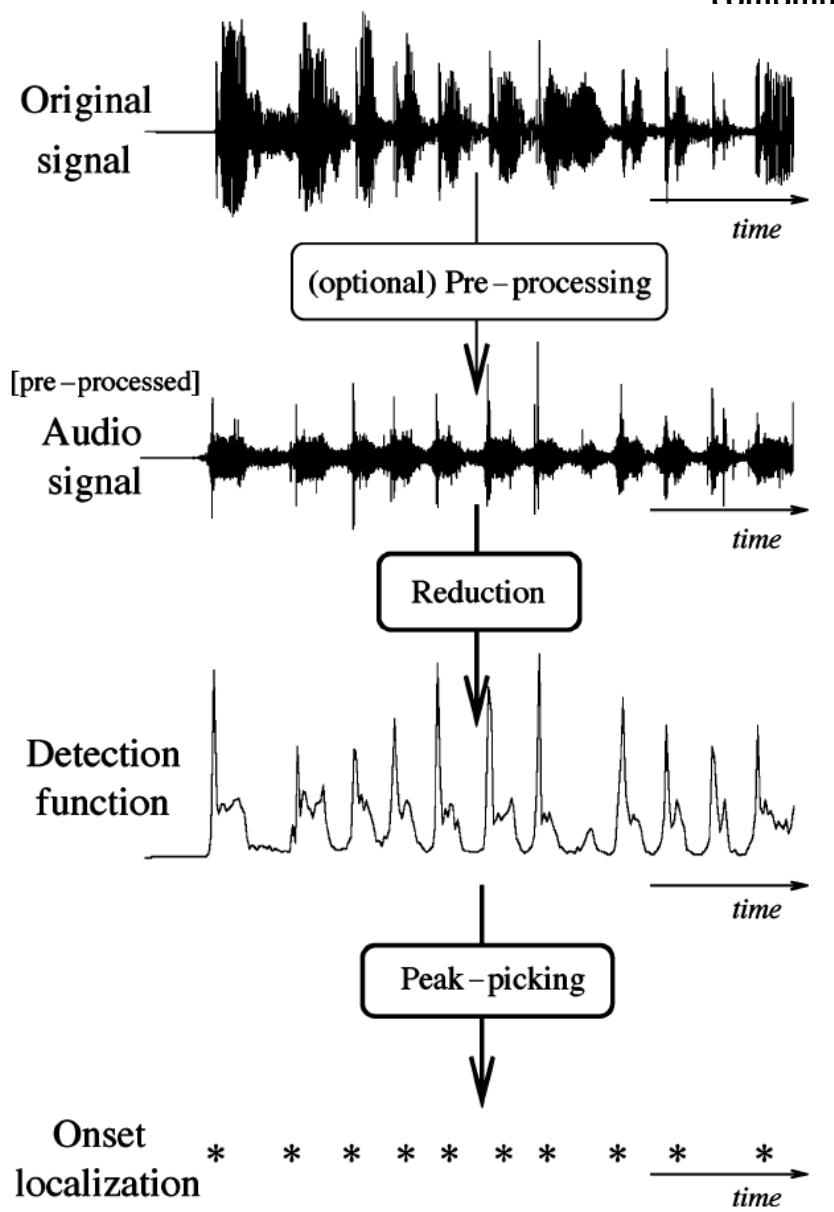
Onsets



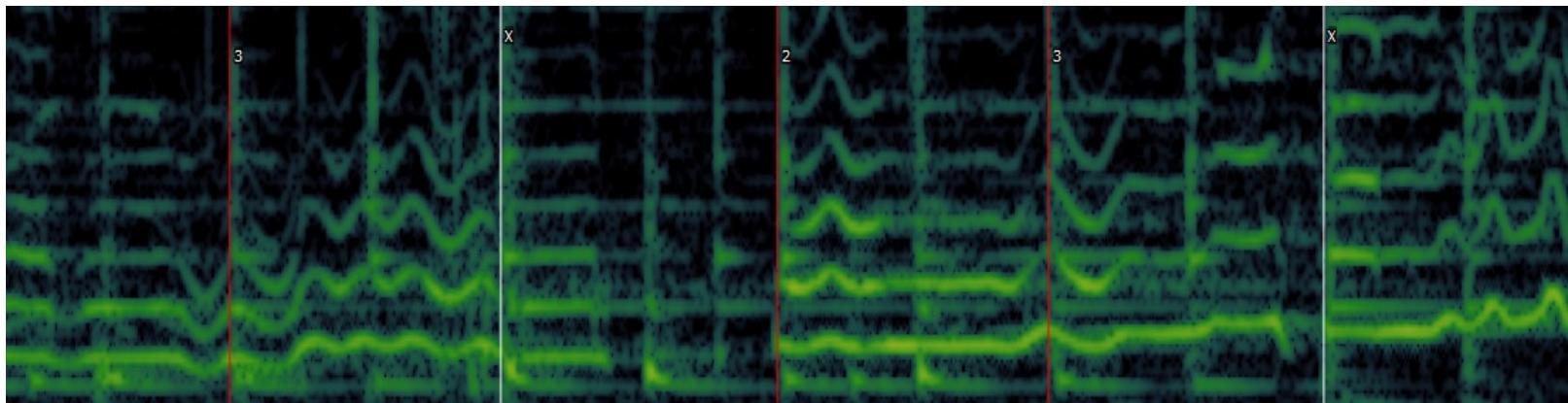
Onset detection



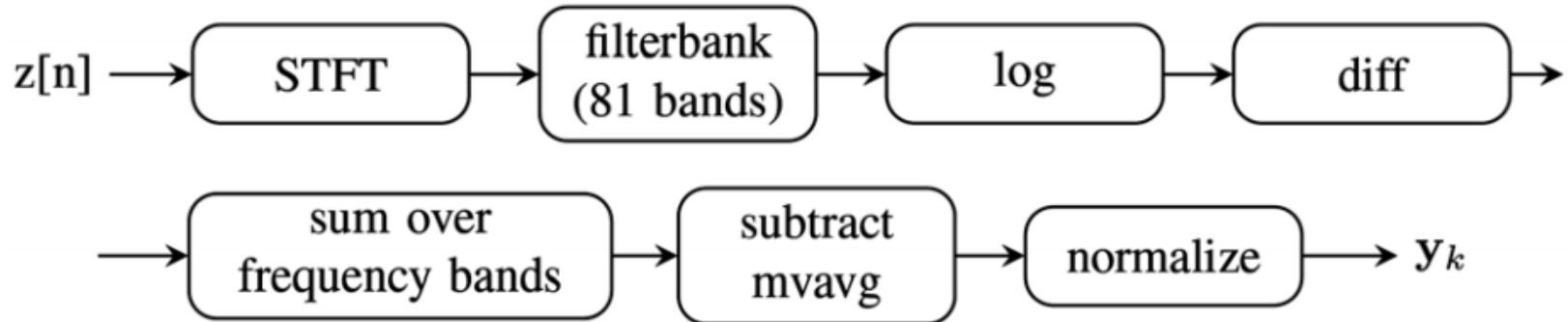
- Temporal and spectral features
- Band-wise spectral flux
 - Spectral magnitude change



Onset features



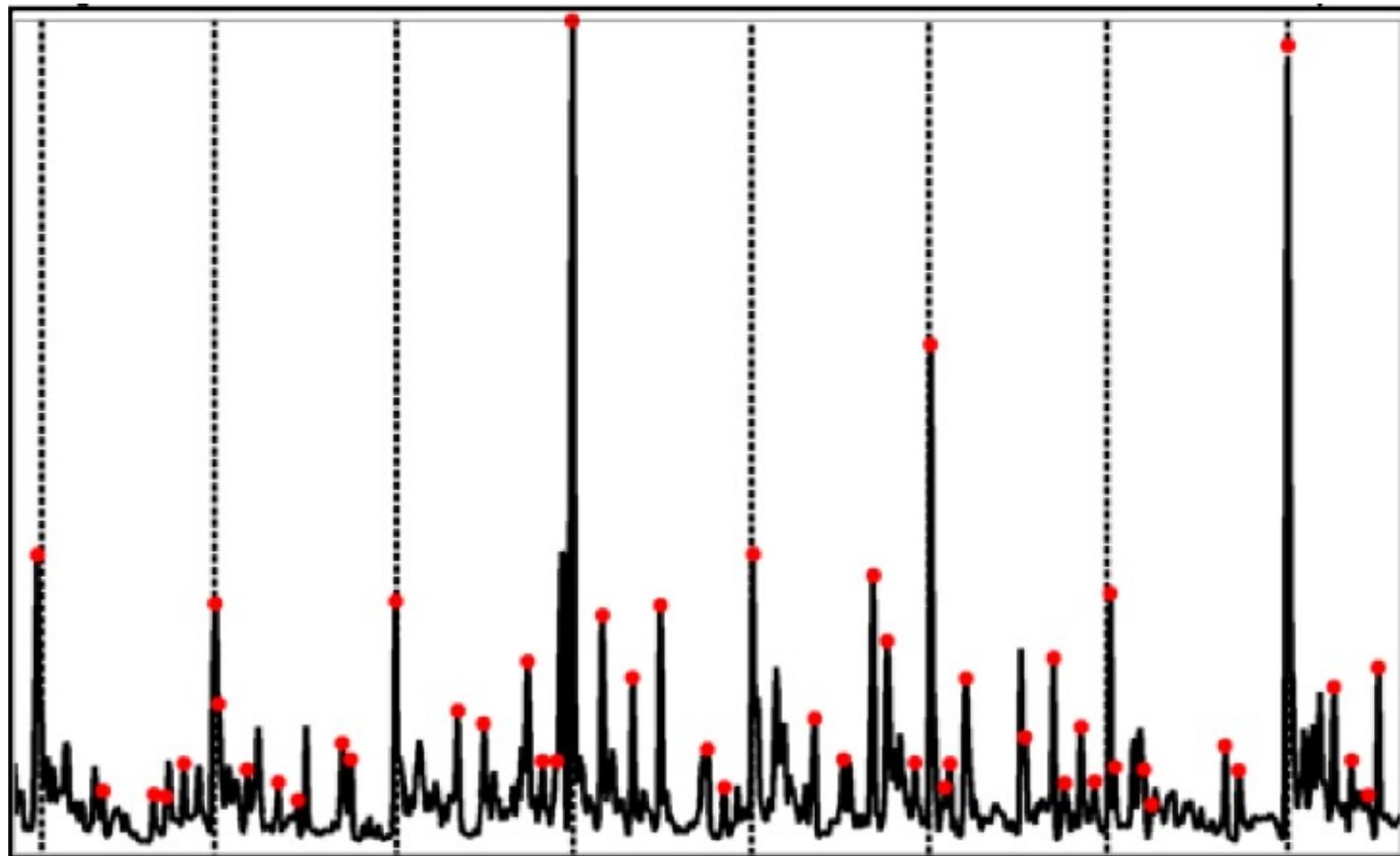
- Spectral flux



J. Bello et al., "A tutorial on onset detection in music signals." *IEEE Transactions on Speech and Audio Processing*, 13(5), 2005: 1035-1047.

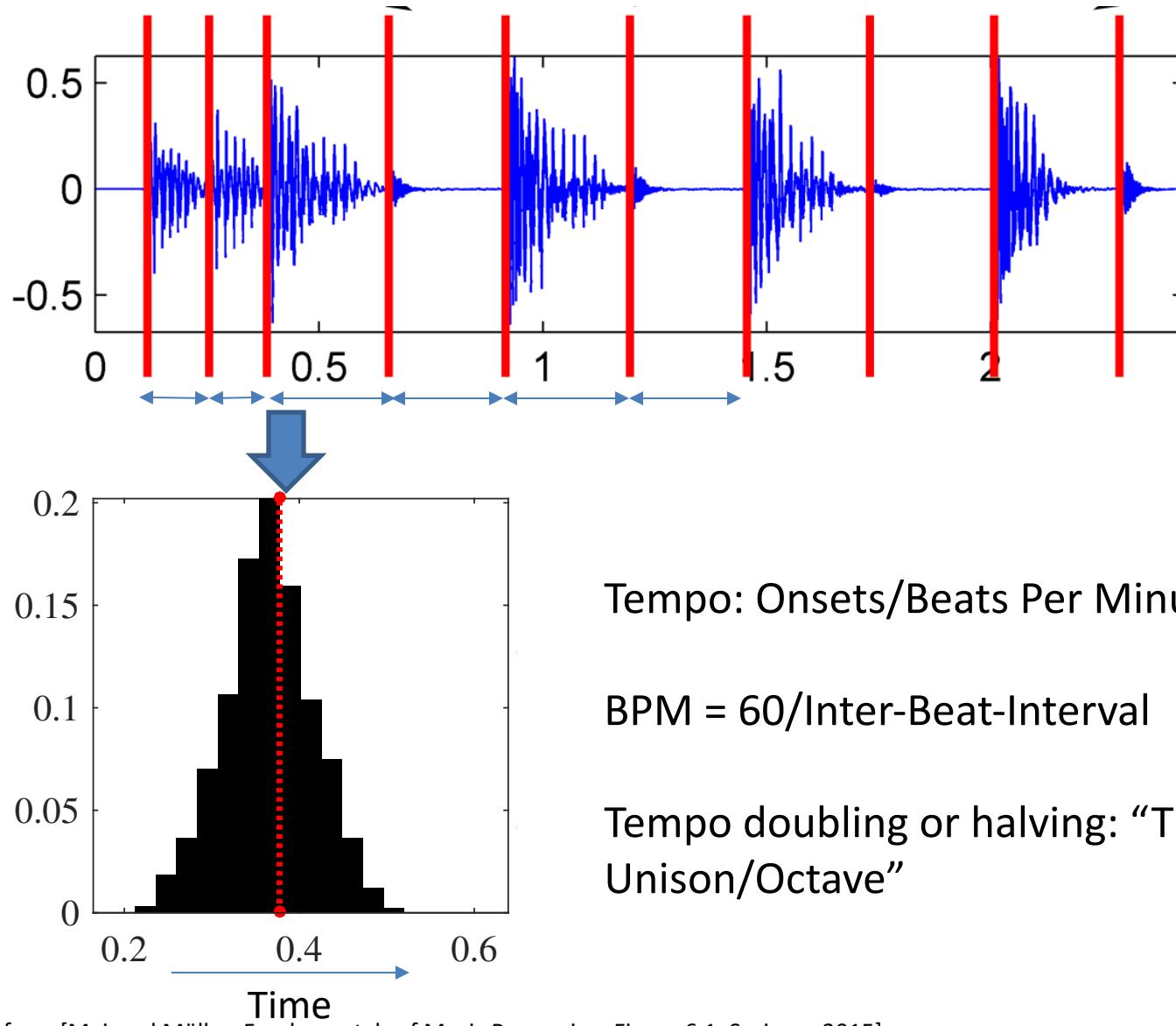
F. Krebs, S. Bock, and G. Widmer , "Rhythmic pattern modeling for Beat and Downbeat Tracking in Musical Audio," Proc. of the 14th International Society for Music Information Retrieval Conference (ISMIR), Curitiba, Brazil, 2013.

Onset Detection Function



Onset detection function

Onset Interval Histogram: Tempo



Tempogram: Basics

- Fourier Analysis of the Onset Detection Function

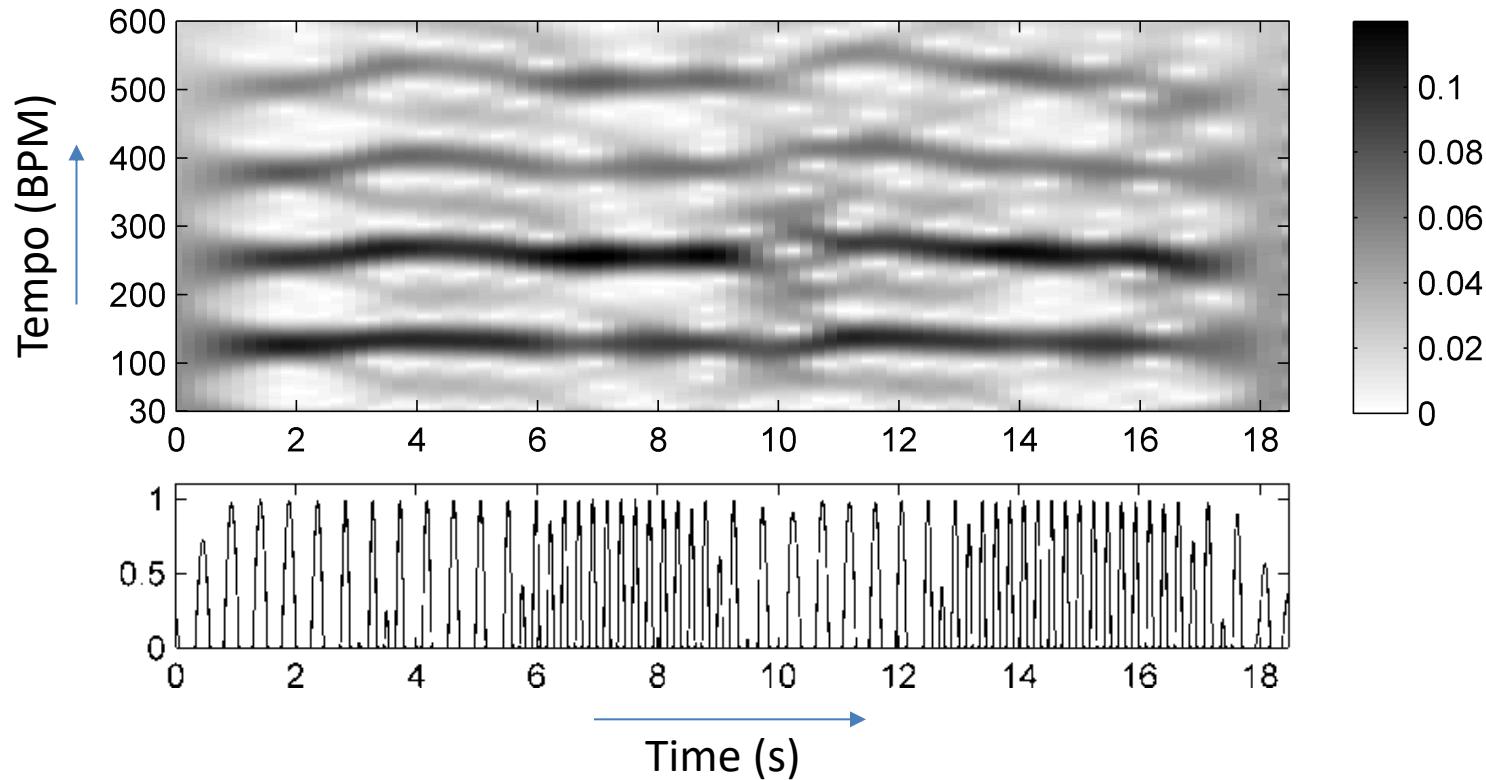
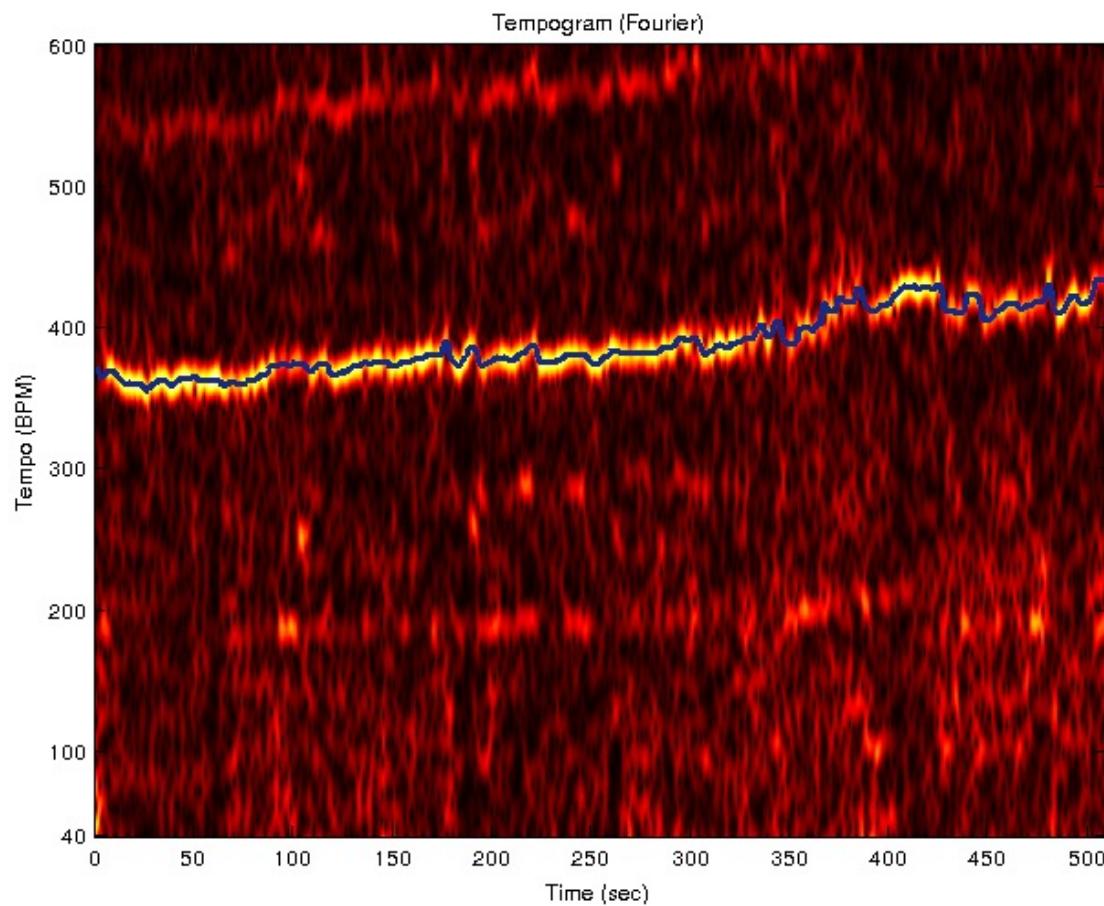


Figure taken from [Meinard Müller, Fundamentals of Music Processing, Figure 6.20, Springer 2015]

Tempogram

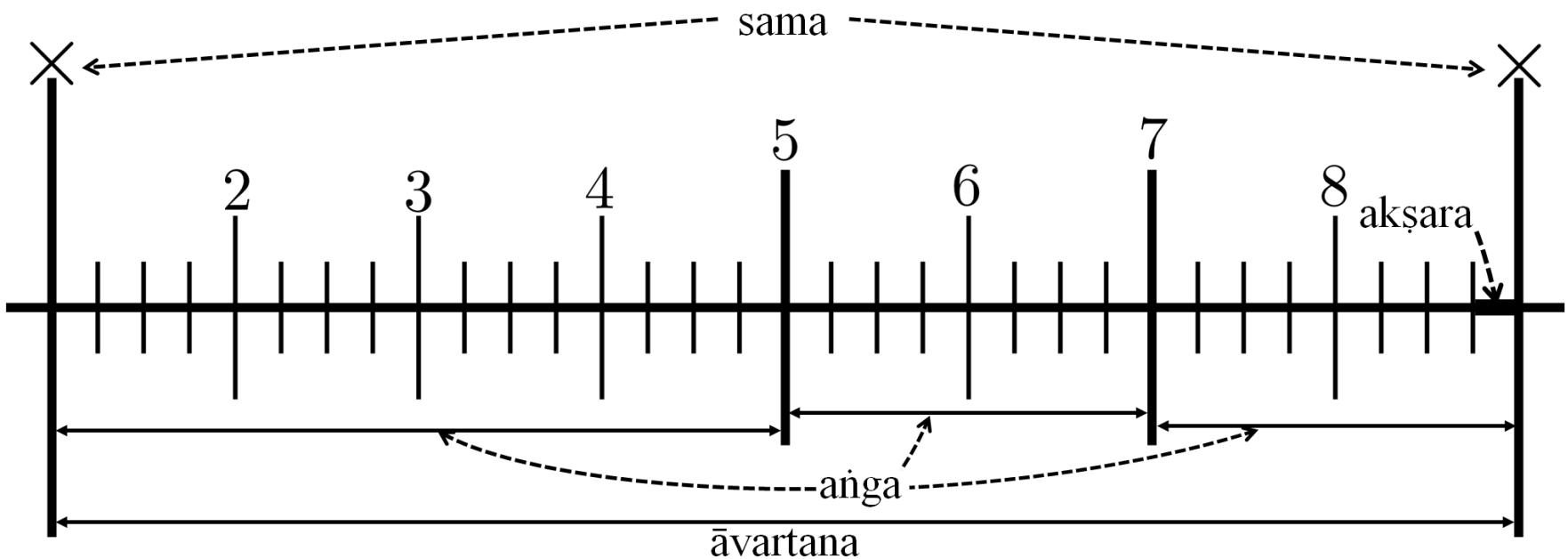
- Tracking time-varying tempo



Tāla in Carnatic music

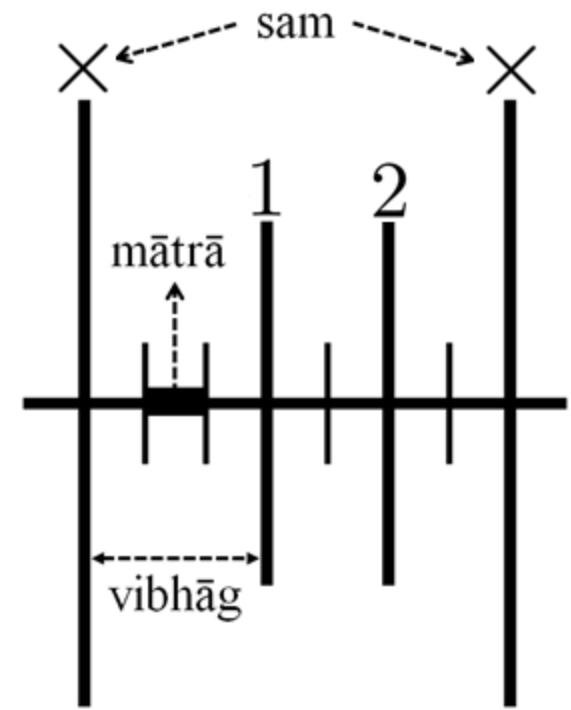
- Time cycles

- Broad structure for rendition and repetition of melodic and rhythmic phrases, motifs, and improvisations
- Akṣara, “beats”, sama (downbeat), aṅga (section)



Tāl in Hindustani music

- Metrical time cycles
 - Broad structure for rendition and repetition of melodic and rhythmic phrases, motifs, and improvisations
 - *mātrā* (beat), *sam* (downbeat), *vibhāg* (section)
- Tempo classes (lay)
 - Wide range of tempi
 - Slow (vilābit): 10-60 *mātrā* per minute (MPM)
 - Medium (madhya): 60-150 MPM
 - Fast (drut): >150 MPM

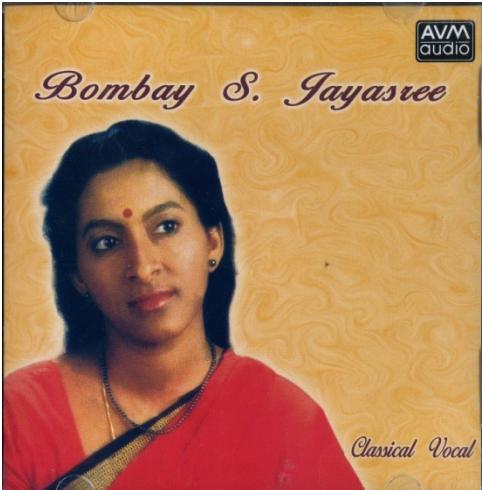


Musical parallels in Rhythm and Meter

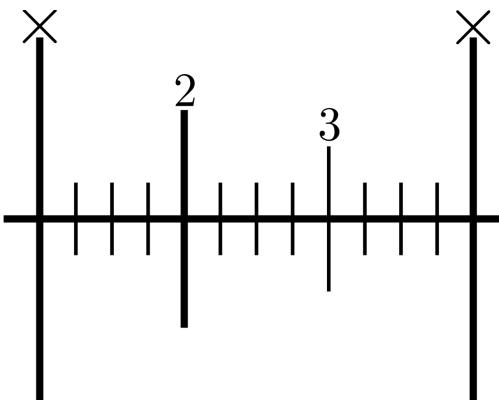
- Tempo estimation
- Beat Tracking
- Meter Inference
- Meter Tracking

Eurogenetic music	Carnatic Music	Hindustani Music
tatum	akṣara	mātrā or sub-mātrā
tactus/beat	beat or aṅga	mātrā or vibhāg
measure/bar (downbeat)	āvartana (sama)	āvart (sam)

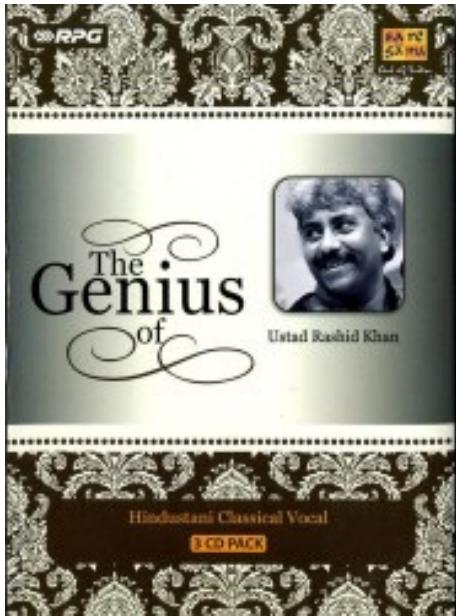
Tāla tracking – Carnatic music



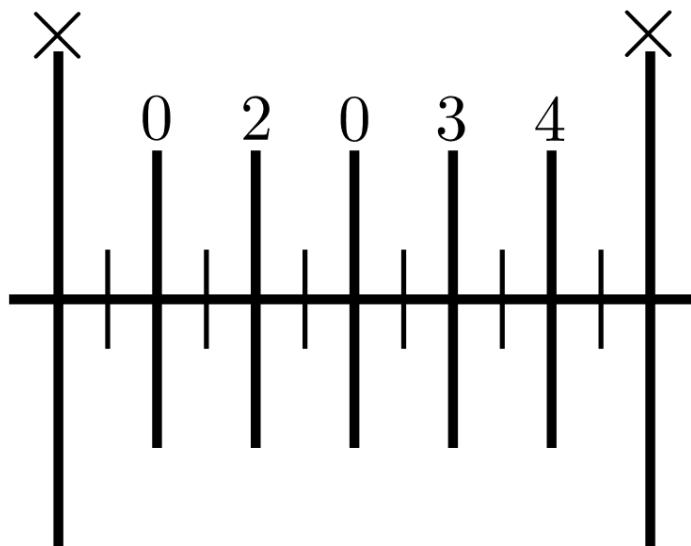
Artist: Bombay Jayasree (vocal)
Release: Classical Vocal
Composition: Śaṅkari nīvē
Composer: Subbaraya Sastry
Rāga: Bēgada
Tāla: Rūpaka (Cycle of 12 akṣara)



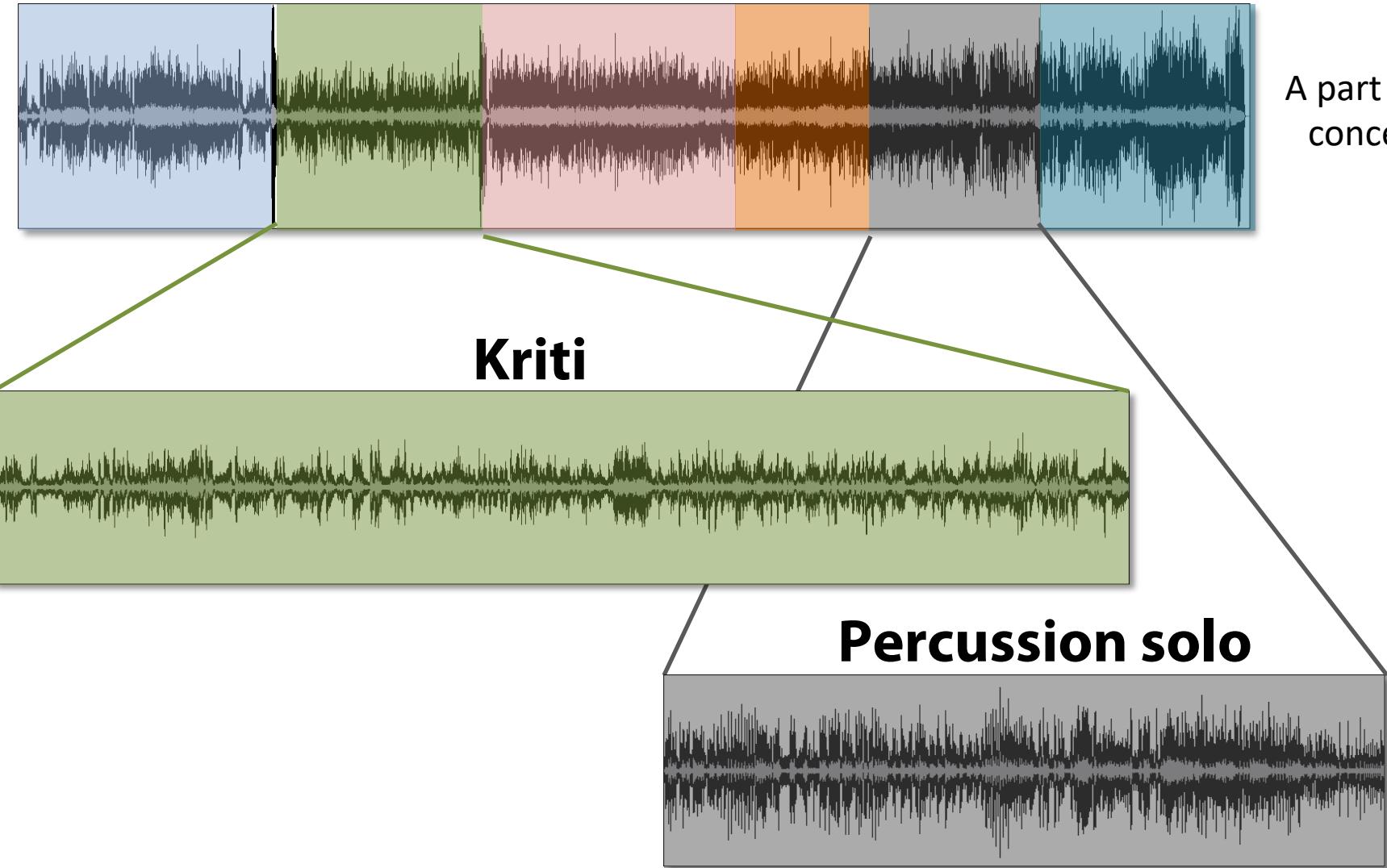
Tāl tracking – Hindustani music



Artist: Rashid Khan (vocal)
Release: The Genius Of Ustad
Rashid Khan
Composition: Rasiya Maara Ama Laara
Rāga: Ahir Bhairav
Tāla: Ektāl (Cycle of 12 mātrās)



Structural segmentation: Concert



Datasets for MIR in Indian Art Music



computation models
for the discovery of the World's Music

UNIVERSITAT POMPEU FABRA 

English 

COMPANION WEBPAGE FOR THE PHD THESIS OF AJAY SRINIVASAMURTHY

A DATA-DRIVEN BAYESIAN APPROACH TO AUTOMATIC RHYTHM ANALYSIS OF INDIAN ART MUSIC

Ajay Srinivasamurthy

(Last updated: 13 Nov 2016. Please click on the headings to expand.)

The dissertation document can be obtained from <http://mtg.upf.edu/node/3593>

► EXAMPLES

► DATASETS

► PUBLICATIONS

► CODE

► RESULTS

(The page <http://www.ajaysrinivasamurthy.in/phd-thesis> redirects to this page)

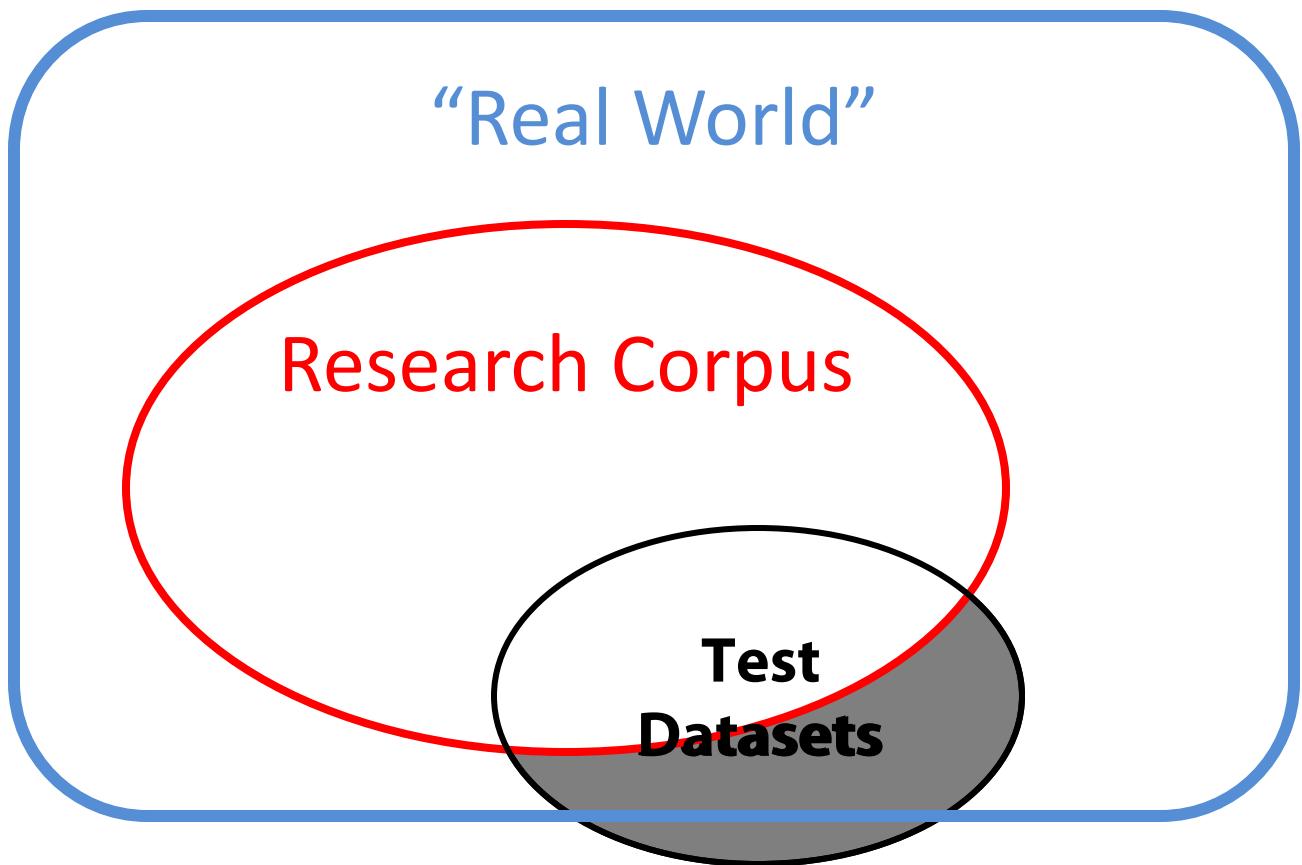
LATEST BLOGS

Technology and Multiculturality 17/04/2016 [Article published in the daily newspaper 'El Vanguardia' on 17th 2016. English translation of the original text written in catalan.] The violin, typewriter or mobile are examples of technological devices that were born in certain contexts... Two evenings of Chinese traditional music 27/01/2016 Last December (2015) Barcelona's Conservatori Municipal de Música hosted two evenings of Chinese traditional music: the first one dedicated to the silk and bamboo music genre and the second one to jingju (Beijing opera). For this... Nila Sangita - An evening of Indian Classical Music and Dance

Building datasets

- Building research corpora and test datasets
 - Essential for data-driven MIR
 - A research problem in itself !
 - Involve communities
 - Musicians, music students, musicologists, listeners
 - Engineers, scientists and technologists
 - Music producers, record labels
 - Address subjectivity

Corpora for data driven research



Approach

- Systematic approach to building MIR corpora
 - Purpose
 - Coverage
 - Completeness
 - Quality
 - Reusability
- Based on reliable references

FAIR principles

- Machine-actionability
- Findable
 - Metadata allows for easy discovery
- Accessible
 - Data accessible through easily searchable metadata
- Interoperable
 - Accessed data easily integrated into other systems
- Reusable
 - Optimize reusability of data

<https://www.go-fair.org/fair-principles/>

Additionally . . .

- Code – Open source
- Data – Easily accessible





Computational models for the discovery of the World's Music


UNIVERSITAT
POMPEU FABRA


COMPARISON WEBPAGE FOR THE PHD THESIS OF AJAY SRINIVASAMURTHY

This page is the companion webpage for the PhD thesis titled **A DATA-DRIVEN BAYESIAN APPROACH TO AUTOMATIC RHYTHM ANALYSIS OF INDIAN ART MUSIC**

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English ▾ 

EXAMPLES

DATASETS

PUBLICATIONS

CODE

RESULTS

LATEST BLOGS

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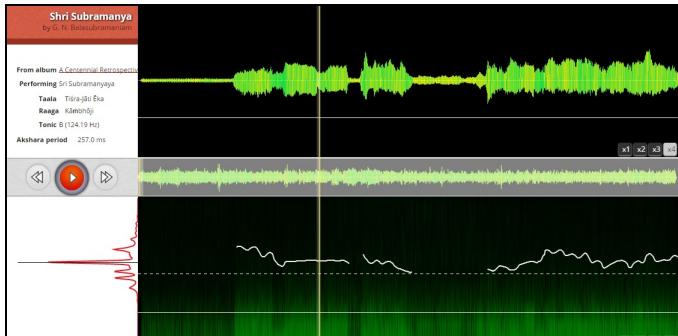
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Availability of corpus and datasets

- Dunya Browser



- Dunya API

```
import compmusic.dunya as dn
import compmusic.dunya.carnatic as dncar
dn.set_token("9450e2b376d6b20a1f86191257b389e5ba0897a4")

artistList = dncar.get_artists()
for aIndex, artist in enumerate(artistList):
    artistInfo = dncar.get_artist(artist[u'mbid'])
    artInstList.append(artistInfo['instruments'])
print len(artistInfo[u'concerts']), aIndex, len(artistList)
```

- Audio

- Commercial audio: easily available
- Open audio collection

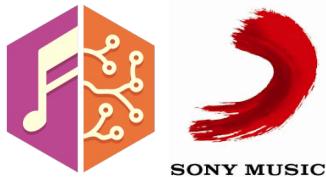
- Extracted features and software: Open licenses

- Editorial metadata: MusicBrainz
- Annotations: publicly available
- Archived on Zenodo



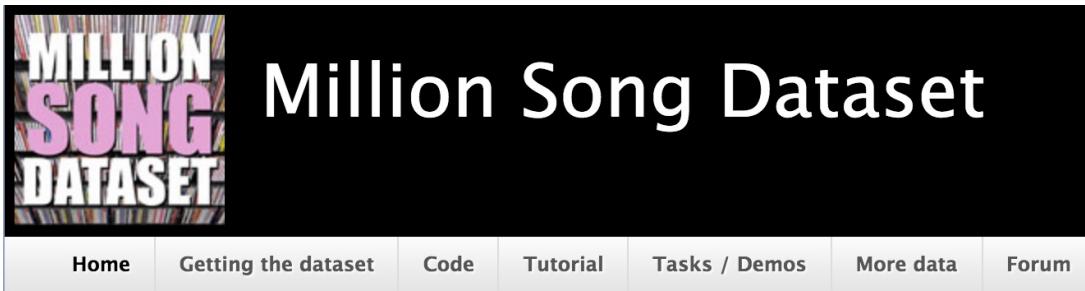
Data

- Music Audio
- Music Scores
- Lyrics
- Metadata
- Music Community



Datasets for MIR

- <https://www.audiocontentanalysis.org/data-sets/>
- Million Song Dataset



The screenshot shows the homepage of the Million Song Dataset. At the top left is the logo 'MILLION SONG DATASET' with a background of vertical bars. To the right, the text 'Million Song Dataset' is displayed in large white letters. Below the header is a navigation bar with links: Home, Getting the dataset, Code, Tutorial, Tasks / Demos, More data, and Forum. Underneath the navigation bar, the text 'Home » Home' is shown. A large 'Welcome!' heading is centered. Below it, a paragraph explains that the dataset is a freely-available collection of audio features and metadata for a million contemporary popular music tracks. It also lists the purposes of the dataset, which include encouraging research on algorithms, providing a reference dataset for evaluation, serving as a shortcut alternative to creating a large dataset with APIs, and helping new researchers get started in the MIR field.

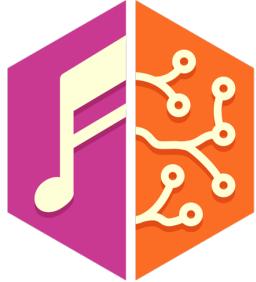
The **Million Song Dataset** is a freely-available collection of audio features and metadata for a million contemporary popular music tracks.

Its purposes are:

- To encourage research on algorithms that scale to commercial sizes
- To provide a reference dataset for evaluating research
- As a shortcut alternative to creating a large dataset with APIs (e.g. The Echo Nest's)
- To help new researchers get started in the MIR field

<https://labrosa.ee.columbia.edu/millionsong/>

MusicBrainz and AcousticBrainz



<https://musicbrainz.org>



MusicBrainz

[Log In](#) [Create Account](#)

[About Us](#) [Products](#) [Search](#) [Documentation](#)

Welcome to MusicBrainz!

MusicBrainz is an open music encyclopedia that collects music metadata and makes it available to the public.

MusicBrainz aims to be:

1. **The ultimate source of music information** by allowing anyone to contribute and releasing the data under open licenses.
2. **The universal lingua franca for music** by providing a reliable and unambiguous form of **music identification**, enabling both people and machines to have meaningful conversations about music.

Like Wikipedia, MusicBrainz is maintained by a global community of users and we want everyone — including you — to [participate and contribute](#).

[More Information](#) — [FAQs](#) — [Contact Us](#)

MusicBrainz is operated by the [MetaBrainz Foundation](#), a California based 501(c)(3) tax-exempt non-profit corporation dedicated to keeping MusicBrainz [free and open source](#).



[About](#) ▾

[Downloads](#)

[API/Data](#)

[Datasets](#) ▾



Welcome to AcousticBrainz!

The AcousticBrainz project aims to crowd source acoustic information for all music in the world and to make it available to the public. This acoustic information describes the acoustic characteristics of music and includes low-level spectral information and information for genres, moods, keys, scales and much more. The goal of AcousticBrainz is to provide music technology researchers and open source hackers with a massive database of information about music. We hope that this database will spur the development of new music technology research and allow music hackers to create new and interesting recommendation engines.

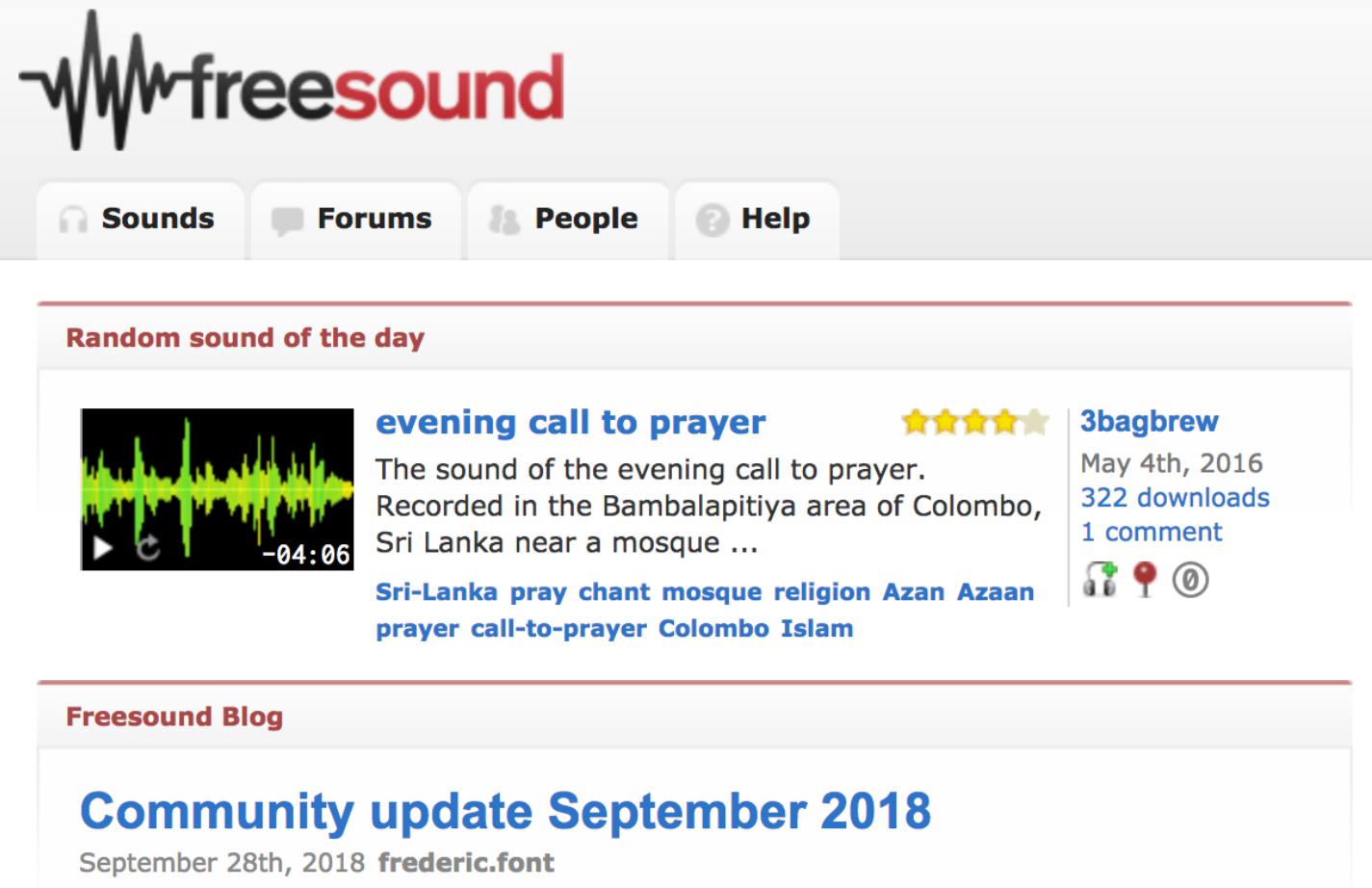
AcousticBrainz is a joint effort between [Music Technology Group](#) at [Universitat Pompeu Fabra](#) in Barcelona and the [MusicBrainz](#) project. AcousticBrainz was originally envisioned by Xavier Serra, the founder and head of the MTG. At the heart of this project lies the [Essentia toolkit](#) from the MTG – this open source toolkit enables the automatic analysis of music. The output from Essentia is collected by the AcousticBrainz project and made available to the public.



AcousticBrainz

<https://acousticbrainz.org>

Creative Commons Sounds



The screenshot shows the homepage of the freesound website. At the top, there's a navigation bar with four buttons: 'Sounds', 'Forums', 'People', and 'Help'. Below the navigation bar, a red banner reads 'Random sound of the day'. Underneath this, there's a preview of a sound file titled 'evening call to prayer'. The preview includes a waveform image, a play button, a volume icon, and a timestamp '-04:06'. To the right of the preview, the title 'evening call to prayer' is shown in blue, followed by a yellow star rating icon. Below the title is a brief description: 'The sound of the evening call to prayer. Recorded in the Bambalapitiya area of Colombo, Sri Lanka near a mosque ...'. Further down, there's a list of tags: 'Sri-Lanka pray chant mosque religion Azan Azaan prayer call-to-prayer Colombo Islam'. To the right of the sound preview, there's a user profile for '3bagbrew' with a blue background. It shows the user's name, the date 'May 4th, 2016', '322 downloads', and '1 comment'. Below the profile are three small icons: a green headphones icon, a red download icon, and a grey comment icon.

Freesound Blog

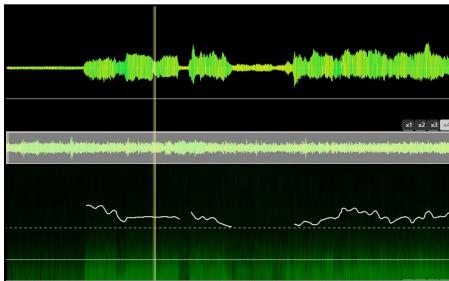
Community update September 2018

September 28th, 2018 [frederic.font](#)

Hi again... ...and welcome back to our community update post! This month we don't have any major user-ready features to show, but there are a number of things we've been doing in the background which will allow nice new stuff ... Continue reading → [Read Full Entry](#)

<https://freesound.org>

CompMusic Carnatic corpus



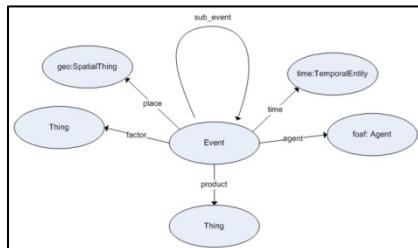
Recording: audio,
annotated and
derived features



Metadata: artists, raga,
tala, composer, ...

	TOPICS	POSTS	LAST POST
General Discussions Miscellaneous topics on Carnatic music	3897	70284	by ksr 13 Sep 2014 23:14
Raga & Alapana All about Ragas	652	9826	by kal 10 Sep 2014 13:29
Tala & Laya Laya related	208	2849	by msakella 10 Aug 2014 19:49
Anniversaries and obituaries Remembering musicians of the recent past	17	823	by satyabalu 13 Sep 2014 19:23
Technical Discussions Ideas and innovations in Indian classical music	243	5058	by shankaran 10 Sep 2014 09:44
Event Announcements Concerts and other events related to CM.	1093	6665	by rshankar 13 Sep 2014 21:35
Kutcheri Reviews & Recordings Review the latest concerts,	6304	56871	by makhavishnu 13 Sep 2014 23:36
Album Reviews Place to review music albums that you have heard.	80	339	by musicmantra 23 Jun 2014 14:44

Community: Forums
and discussion
(rasikas.org)



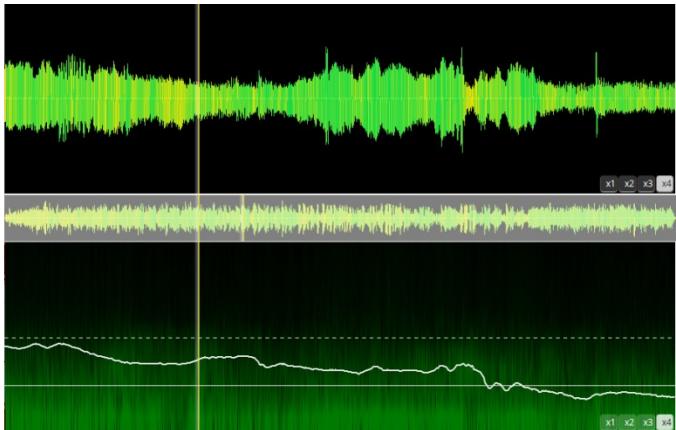
Ontology of the music
concepts

G	,	R	,	S	,	,	,
ja	.	la	.	jā	.	.	.
S	R	S	S	N	P	-	N
ne	da	.
G	R	S	N	S	R	-	N
chā	.	la	.	.	.	ma	.
Ś	N	Ś	Ṅ	Ṅ	Ṅ	-	Ṅ
kon	.	.	.	na	.	.	

Lyrics and scores

Contextual Information

CompMusic Hindustani corpus



Recording: audio, annotated and derived features



Kareem Naam and At Ghumar Aayi Badariya
 ~ Recording by Bhimsen Joshi

Releases Tags Fingerprints Details Edit

Appears on releases

#	Title	Length	Release Title	Release Artist	Date	Country	Label	Catalog#
1.3	Kareem Naam and At Ghumar Aayi Badariya	19:00	Raagadhiraj	Bhimsen Joshi	2001	IN	Saregama	CDNF 150399

Relationships

lead vocals: Bhimsen Joshi (1960)
 recording of: At Ghumar Aayi Badariya (1960)
 kareema naam tero (1960)

Metadata: artists, rāga, tāla, composer, ...

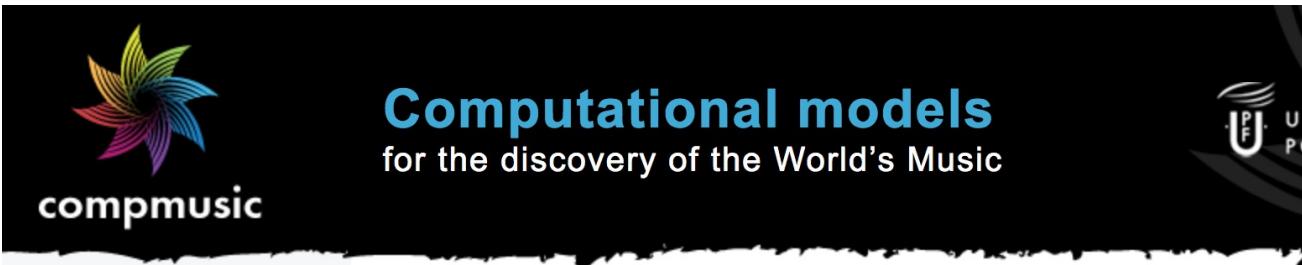
नि	-	प	-	ग	म	रे	रे	सा	-	रे	सा
तू	s	है	s	में	s	म	द	शा	s	द	र
x	o		2		o		3		4		
सा	-	-	रे	म	रे	प	-	-	निनि	पम	प
बा	s	s	r	s	n	जा	s	s	m	ss	उ
x	o		2		o		3		4		
सा	-	-	प	नि	प	प	निप	मप	निप	ग	म
दी	s	s	n	s	s	जा	ss	ss	न	s	s
x	o		2			o			8		

Lyrics and scores



Contextual Information

CompMusic datasets



HOME

DESCRIPTION

TEAM

PUBLICATIONS

CORPORA

SOFTWARE

EVENTS

BLOG

NEWS

RESOURCES

GET INVOLVED



LATEST NEWS

European Research Music Conference in Barcelona
24/06/2018 - 09:29
The European Research Music Conference took place at the Universitat Pompeu...

MOOC on North Indian Classical Music by the MTG on the Kadenze platform
16/03/2018 - 15:38

Computational models for the discovery of the World's Music

DATASETS

This page lists the datasets (most of them available in [Zenodo](#)) created to carry out a number of experiments done as a part of CompMusic. They complement the [Corpora](#) of the five music traditions studied. Please visit the respective pages for more details.

INDIAN ART MUSIC

INDIAN MUSIC TONIC DATASET

This dataset comprises 597 commercially available audio music recordings of Indian art music (Hindustani and Carnatic music), each manually annotated with the tonic of the lead artist. This dataset is used as the test corpus for the development of tonic identification approaches. <http://compmusic.upf.edu/iam-tonic-dataset>

CARNATIC VARNAM DATASET

Carnatic varnam dataset is a collection of 28 solo vocal recordings, recorded for our research on intonation analysis of Carnatic ragas. The collection consists of audio recordings, time aligned tala cycle annotations and swara notations in a machine readable format. <http://compmusic.upf.edu/carnatic-varnam-dataset>

CARNATIC MUSIC RHYTHM DATASET

The Carnatic Music Rhythm Dataset is a sub-collection of 176 excerpts (16.6 hours) in four taalas of Carnatic music with audio, associated tala related metadata and time aligned markers indicating the progression through the tala cycles. It is useful as a test corpus for many automatic rhythm analysis tasks in Carnatic music. A subset with 118 two minute long excerpts (about 4 hours) is also available with equivalent content. <http://compmusic.upf.edu/carnatic-rhythm-dataset>

<https://compmusic.upf.edu/datasets>

Indian Music Tonic Dataset

This dataset comprises 597 commercially available audio music recordings of Indian art music (Hindustani and Carnatic music), each manually annotated with the tonic of the lead artist. This dataset is used as the test corpus for the development of tonic identification approaches. <http://compmusic.upf.edu/iam-tonic-dataset>

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Hindustani Music Rhythm Dataset

The Hindustani Music Rhythm Dataset is a sub-collection of 151 (5 hours) in four taals of Hindustani music with audio, associated taal related metadata and time aligned markers indicating the progression through the taal cycles. The dataset is useful as a test corpus for many automatic rhythm analysis tasks in Hindustani music.
<http://compmusic.upf.edu/hindustani-rhythm-dataset>

Mridangam Stroke Dataset

The Mridangam Stroke dataset is a collection of 7162 audio examples of individual strokes of the Mridangam in various tonics. The dataset comprises of 10 different strokes played on Mridangams with 6 different tonic values. The dataset can be used for training models for each Mridangam stroke. <http://compmusic.upf.edu/mridangam-stroke-dataset>

Mridangam Tani-avarthanam Dataset

The Mridangam Tani-avarthanam dataset is a transcribed collection of two tani-avarthanams played by the renowned Mridangam maestro Padmavibhushan Umayalpuram K. Sivaraman. The audio was recorded at IIT Madras, India and annotated by professional Carnatic percussionists. It consists of about 24 min of audio and 8800 strokes. <http://compmusic.upf.edu/mridangam-tani-dataset>

Tabla Solo Dataset

The Tabla Solo Dataset is a transcribed collection of Tabla solo audio recordings spanning compositions from six different Gharanas of Tabla, played by Pt. Arvind Mulgaonkar. The dataset consists of audio and time aligned bol transcriptions. <http://compmusic.upf.edu/tabla-solo-dataset>

Carnatic Music Rhythm Dataset

- Time-aligned beat and downbeats along with tāla related metadata
- Largest rhythm annotated Carnatic music corpus
- Spans four popular tālas

Tāla	#beats	#Akṣara per cycle	#Pieces	Total Duration hours (min)	$\overline{T_f}$	#Ann.	#Sama
Ādi	8	32	50	4.21 (252.78)	4m51s	22793	2882
Rūpaka	3	12	50	4.45 (267.45)	4m37s	22668	7582
Miśra chāpu	7	14	48	5.70 (342.13)	6m35s	54309	7795
Khaṇḍa chāpu	5	10	28	2.24 (134.62)	4m25s	21382	4387
Total			176	16.61 (996.98)	5m4s	121602	22646

<https://compmusic.upf.edu/carnatic-rhythm-dataset>

Tempo distribution in the dataset

Tāla	$\bar{\tau}_s \pm \sigma_s$	$\bar{\tau}_o \pm \sigma_o$	$[\tau_{s,\min}, \tau_{s,\max}]$
Ādi	5.34 ± 0.723	0.167 ± 0.023	[2.88, 7.07]
Rūpaka	2.13 ± 0.239	0.178 ± 0.020	[1.21, 3.10]
Miśra chāpu	2.67 ± 0.358	0.191 ± 0.026	[1.63, 3.65]
Khaṇḍa chāpu	1.85 ± 0.284	0.185 ± 0.028	[0.91, 2.87]

- Mean cycle and akṣara duration in the dataset
 - Computed over the median for each music piece
 - Typical tempi used in concerts
- Range of cycle duration
 - Depends on the length of the tala

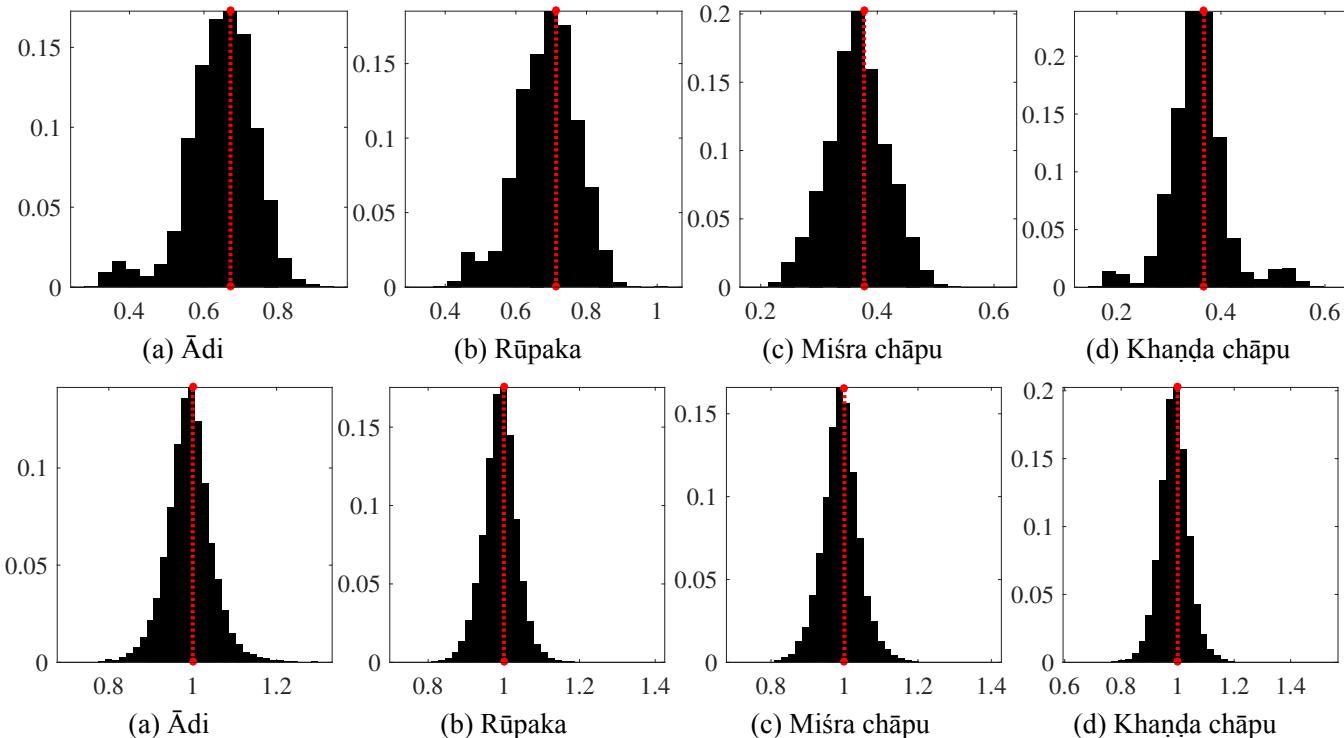
Tempo distribution in the dataset

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Khaṇḍa chāpu	1.85 ± 0.284	0.185 ± 0.028	[0.91, 2.87]

- Basic akṣara pulse does not show much variance across different talas in the dataset
- Range and cycle durations depend on the length of the cycle

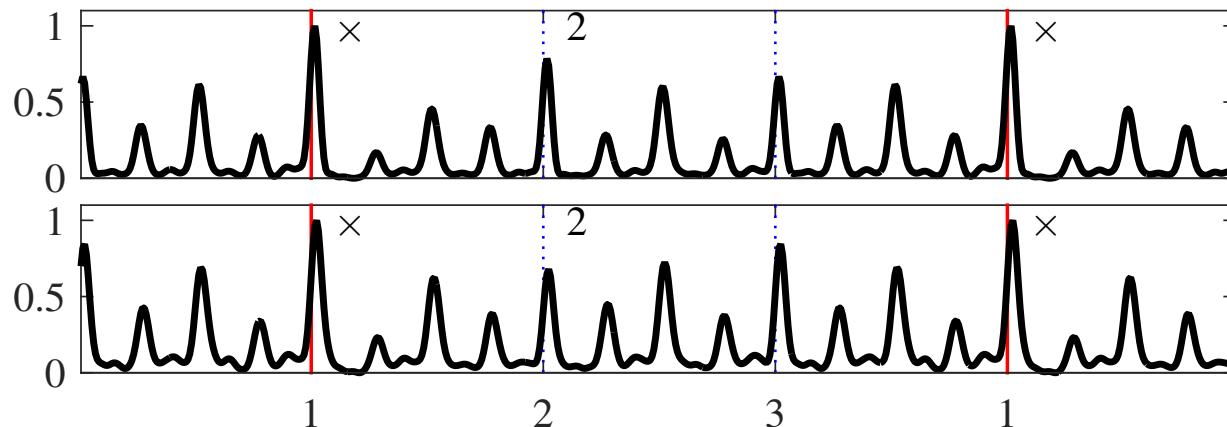
Time varying tempo: Inter-beat interval (IBI)

- Beat duration is time-varying across music pieces
 - ~20% maximum deviation in median beat duration

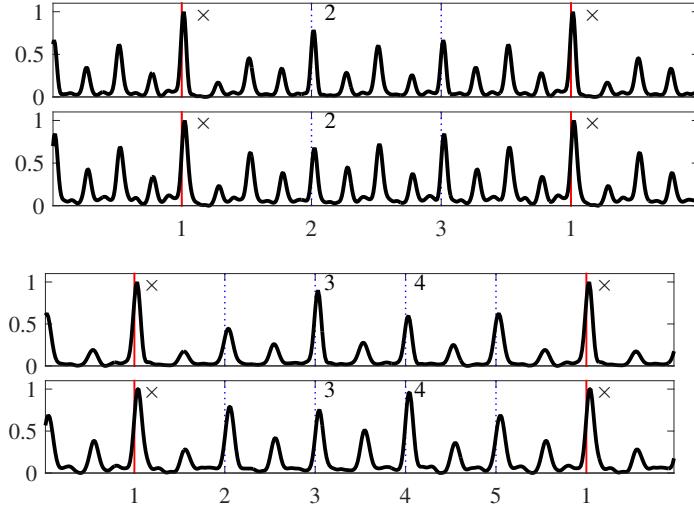
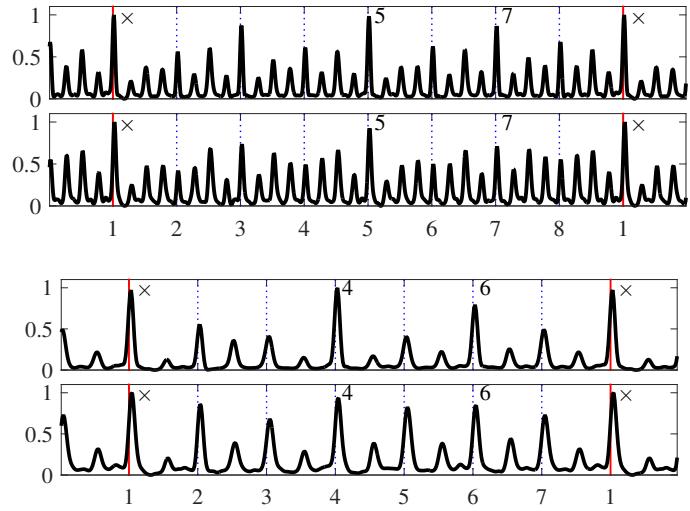


Canonical cycle-length rhythm patterns

- Average patterns
 - Use beat and sama annotations
 - Split spectral flux sequence into cycle length sequences
 - Average over the complete dataset
 - Top pane: >250 Hz; Bottom Pane: <250 Hz



Carnatic Music: Cycle-length patterns



- Three levels: aksara, beats and sama
- Less stress in after sama (recovery ?)
- Common-knowledge: verified by a professional musician
- Many different patterns can be played: these are averaged patterns

Saraga - Open access Indian music corpora



- Largest annotated open data collections for IAM
 - Shared under Creative Commons Licenses
- Audio and editorial metadata
 - Uniquely identified with a MBID
- Manual and automatic annotations
 - Melody, Rhythm, Structure

A. Srinivasamurthy, S. Gulati, R. Caro, X. Serra, "Saraga: Open Datasets for Research on Indian Art Music", Empirical Musicology Review, vol. 16, no. 1, pp. 85-98, 2021.

<https://mtg.github.io/saraga/>

Saraga: Basic stats

Content	Hindustani	Carnatic
Total releases	36	26
Total recordings	108	249
Total recordings in multi-track	-	168
Total artists (lead+accompanying)	36	64
Compositions	113	202
Unique rāga	61	96
Unique tāla	9	10
Total duration	43.6 hours	52.7 hours

Saraga: Basic stats

Content	Hindustani	Carnatic
Total releases	36	26
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Compositions	113	202
Unique rāga	61	96
Unique tāla	9	10
Total duration	43.6 hours	52.7 hours

Saraga: Content

- Recordings from concerts
- Audio (under creative commons licenses)
 - Part of Carnatic collection in multitrack
- Editorial Metadata (Publicly available)
 - Name, compositions, composer, artists + role, raga, tala and form

Saraga: Content

- Annotations (Publicly available)
 - Manual Annotations: Sections, Sama, Tempo, Characteristic melodic phrases
 - Automatic Annotations: Predominant melody, tonic

Saraga: Organization

- Tenets
 - Easy access for human and machine consumption
 - Open data and code
 - Reproducibility
 - Easy adoption by research and listener communities
 - Enable community contribution
- Grouped by music culture
 - A music recording and all associated metadata

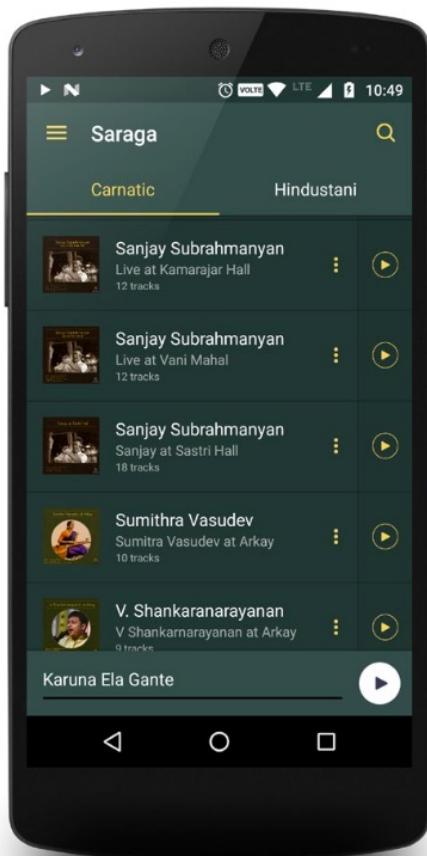
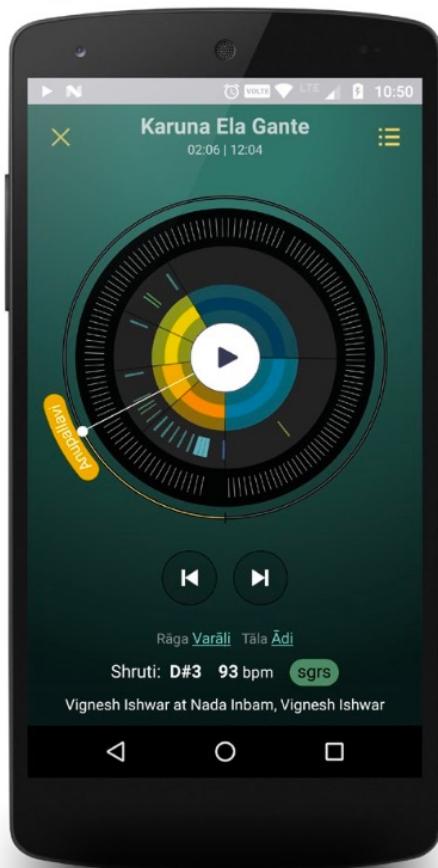
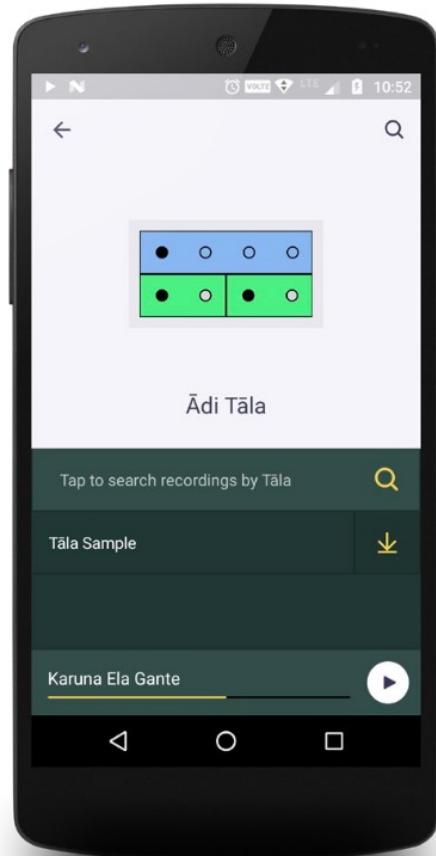
Saraga: Access

- Open source API (PyCompMusic) to access content
- Fetch metadata, source and derived files
- Version-control through a publicly available repository
 - Snapshots of dataset for different tasks
 - Checksum for audio files
 - Community contribution – help it grow and sustain!

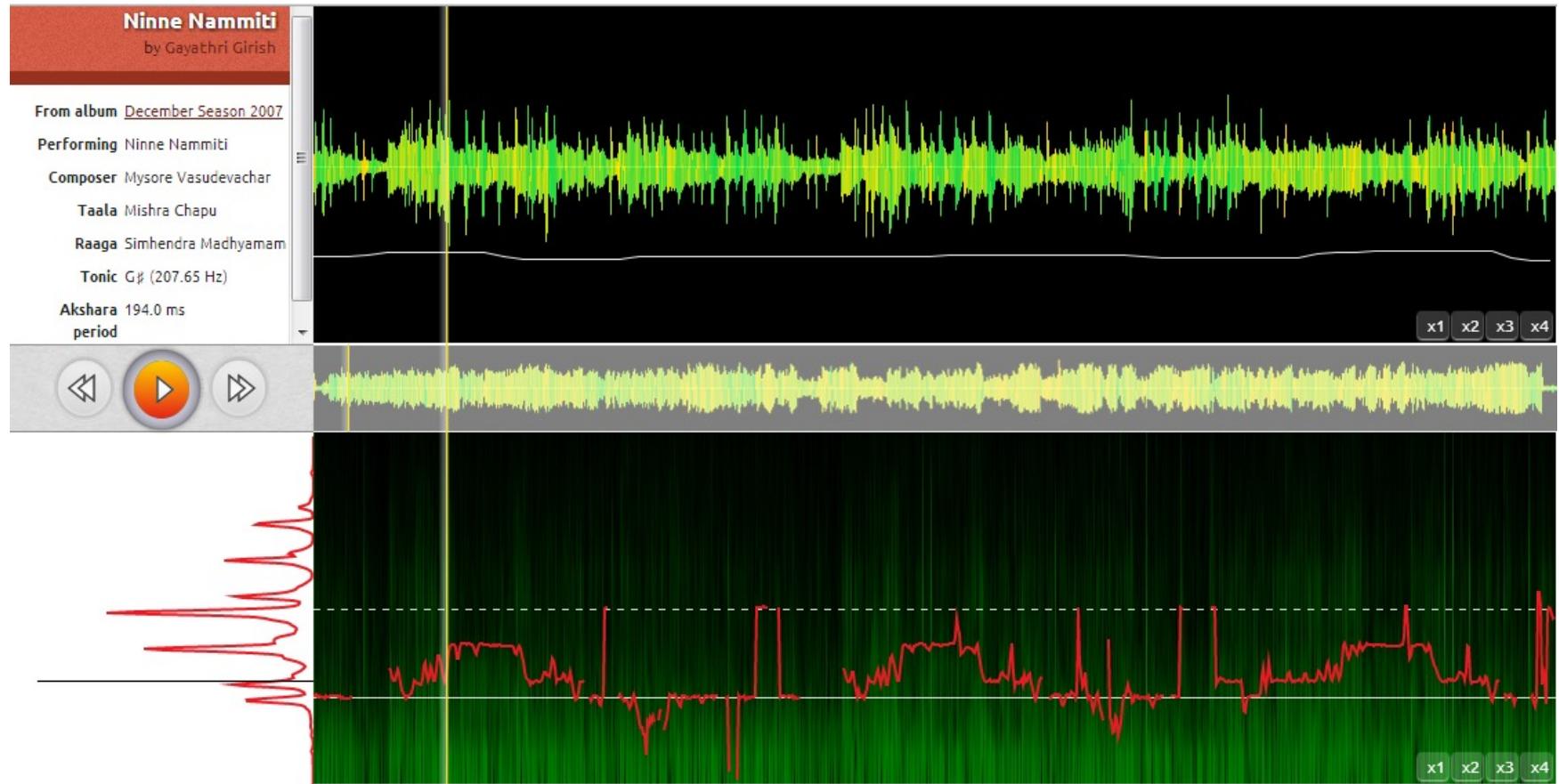
Saraga: MIR Applications

- MIR tasks
 - Melody extraction, source separation, automatic rhythm annotation, structural segmentation,
- Musical Bridges
 - Music Understanding and Appreciation
 - Interactive visualizations synchronized with recordings
- The Saraga app
 - Enriched listening with the Saraga collections
 - Visualize metadata

Saraga: App

A

B

C


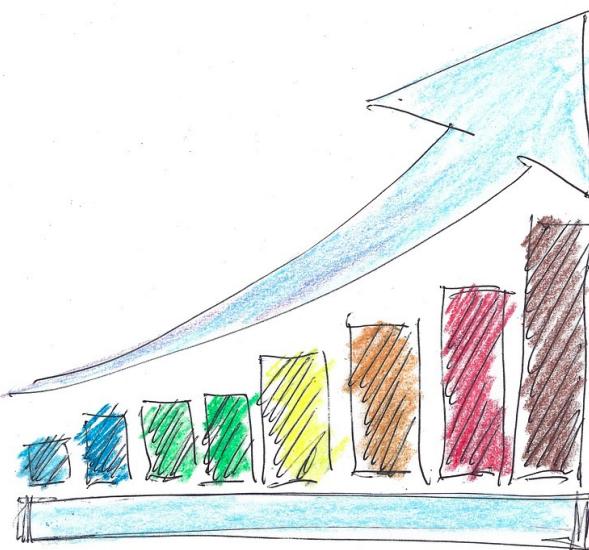
Dunya: Enriched music listening

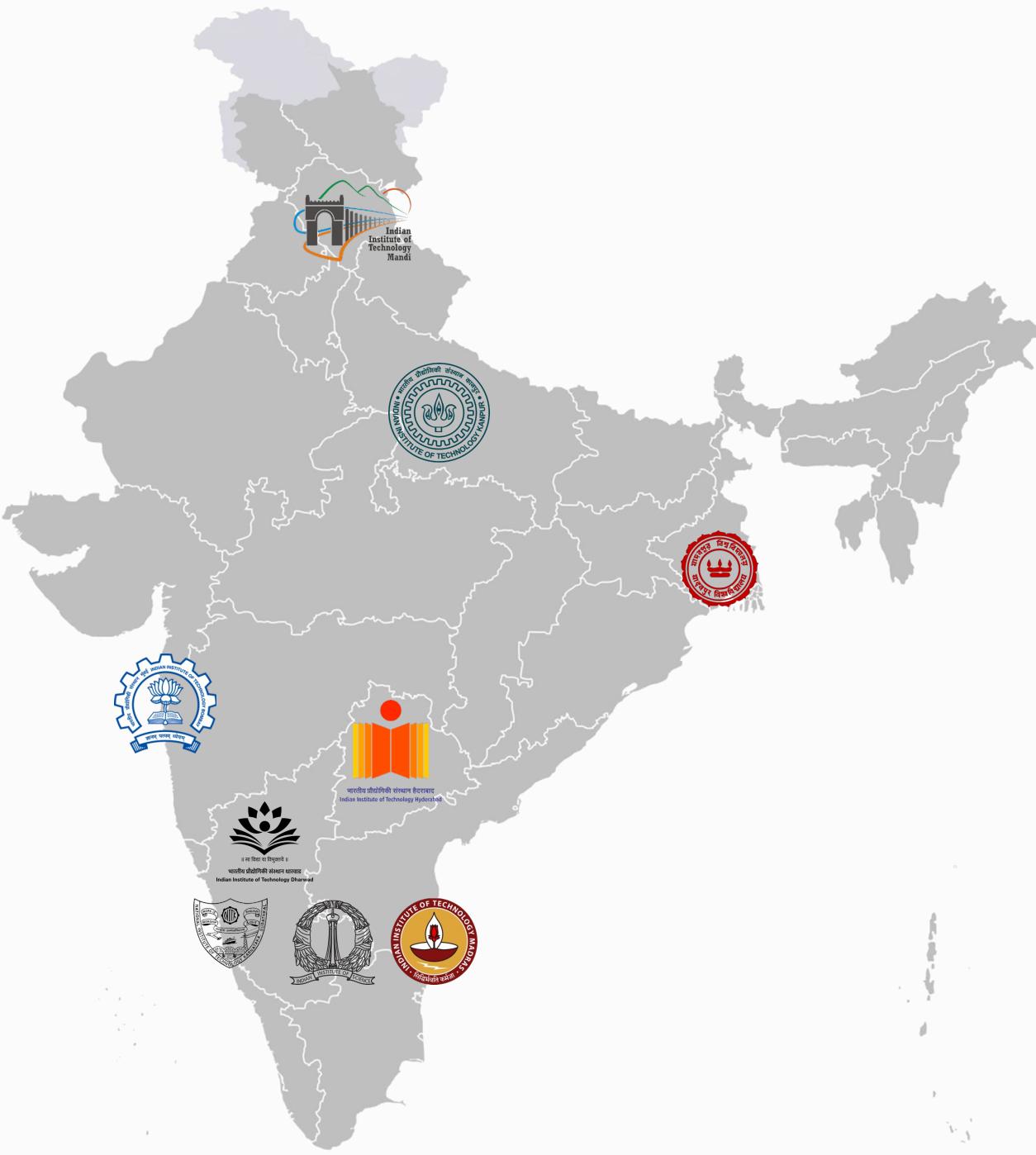


Current Opportunity

- Application for enhanced discovery and listening of Indian art music
 - Curated Collections
 - Listening → Enriched listening → Guided listening → Discovery → Interactives
- Combine audio, text and symbolic representations
- Get in touch if you are interested!

Opportunities in India





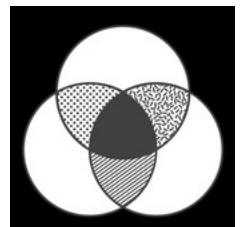
Industry



Community

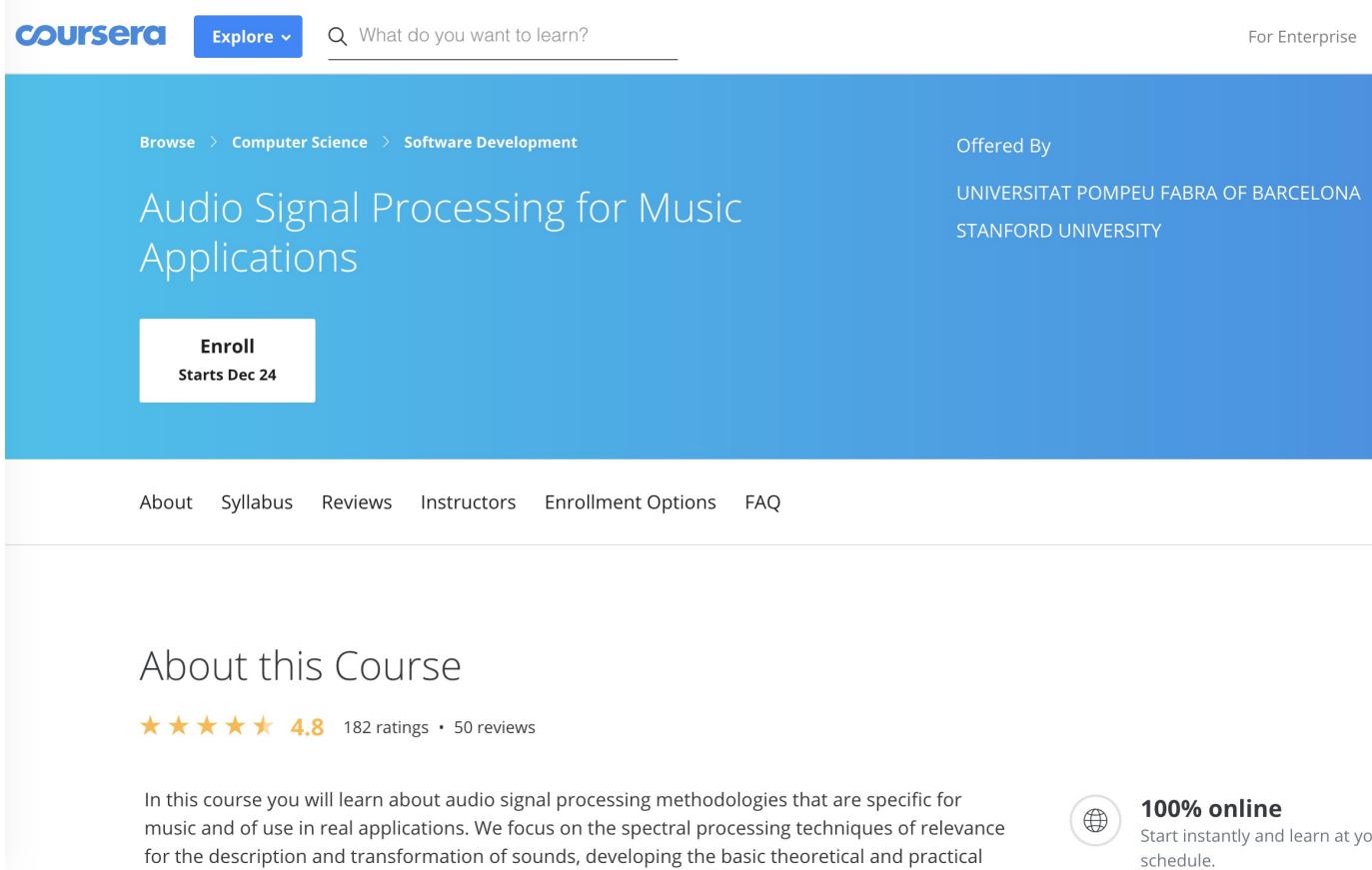
- ISMIR mailing list
 - <https://groups.google.com/a/ismir.net/forum/#!forum/community>
- CompMusic mailing list
 - <https://groups.google.com/a/llista.upf.edu/forum/#!forum/compmusic-friends>
- SMC Network
 - <http://www.smcnetwork.org/>
 - Roadmap: <http://www.smcnetwork.org/index.html#roadmap>
- Music Tech Community India
 - <https://musictechcommunityindia.wordpress.com>

ISMIR



Learn

■ Audio Signal Processing for Music Applications on Coursera

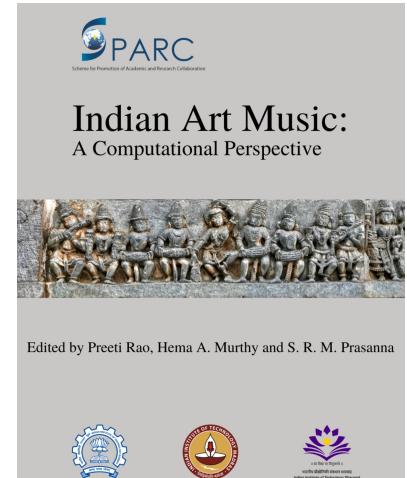


The screenshot shows the Coursera course page for 'Audio Signal Processing for Music Applications'. At the top, there's a navigation bar with the Coursera logo, a search bar containing 'What do you want to learn?', and a 'For Enterprise' link. Below the navigation is a breadcrumb trail: 'Browse > Computer Science > Software Development'. The main title 'Audio Signal Processing for Music Applications' is displayed prominently, along with the offerers: 'Offered By UNIVERSITAT POMPEU FABRA OF BARCELONA STANFORD UNIVERSITY'. A large 'Enroll' button is visible, with the text 'Starts Dec 24' underneath it. At the bottom of the main section, there are links for 'About', 'Syllabus', 'Reviews', 'Instructors', 'Enrollment Options', and 'FAQ'. Below this, the 'About this Course' section includes a rating of '4.8' based on '182 ratings • 50 reviews'. The course description states: 'In this course you will learn about audio signal processing methodologies that are specific for music and of use in real applications. We focus on the spectral processing techniques of relevance for the description and transformation of sounds, developing the basic theoretical and practical'. To the right, there's a circular icon with a globe and the text '100% online Start instantly and learn at your schedule.'

<https://www.coursera.org/learn/audio-signal-processing>

Learn

- ISMIR proceedings and tutorials
 - <https://dblp.uni-trier.de/db/conf/ismir/index.html>
- Audio signal processing books
 - https://ccrma.stanford.edu/~jos/pasp/Book_Series_Overview.html
- Meinard Müller, Fundamentals of Music Processing, Springer 2015
 - <http://www.music-processing.de/>
- Resources on Indian Art Music
 - <https://compmusic.upf.edu/>
 - SPARC Monograph - Indian Art Music: A Computational Perspective
 - <https://play.google.com/store/books/details?id=g-2rEAAAQBAJ&pli=1>



Build and Contribute

Music hackdays and hackathons

<https://www.musichackday.org>

HAMR@ISMIR (Hacking audio music research)

<https://labrosa.ee.columbia.edu/hamr>



<http://essentia.upf.edu>



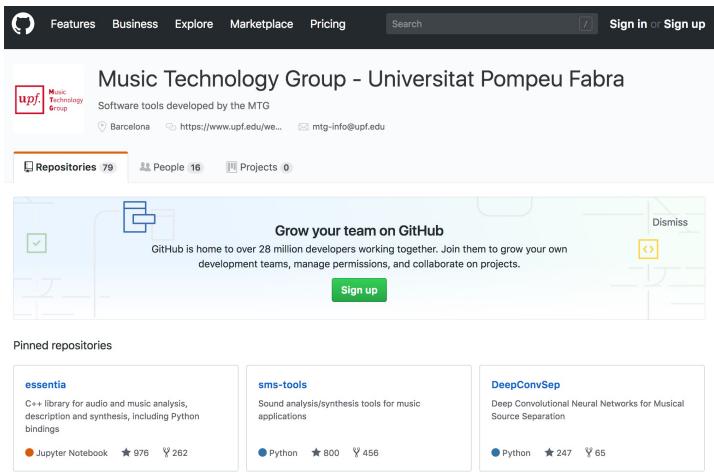
AcousticBrainz
<https://acousticbrainz.org>



<https://freesound.org>



<https://musicbrainz.org>



The screenshot shows the GitHub profile page for the MTG group. At the top, there's a header with the group's name, 'upf Music Technology Group', and a link to their website. Below the header, there are sections for 'Repositories' (79), 'People' (16), and 'Projects' (0). A prominent 'Sign up' button is located in the top right corner. The main content area features a large image of a circuit board with sound waves overlaid, followed by a section titled 'Pinned repositories' which lists three projects: 'essentia' (C++ library for audio and music analysis), 'sms-tools' (Sound analysis/synthesis tools for music applications), and 'DeepConvSep' (Deep Convolutional Neural Networks for Musical Source Separation).

<https://github.com/MTG>

MIREX: MIR Evaluation eXchange



mirex by year

- MIREX 2018
- MIREX 2017
- MIREX 2016
- MIREX 2015
- MIREX 2014
- MIREX 2013
- MIREX 2012
- MIREX 2011
- MIREX 2010
- MIREX 2009
- MIREX 2008
- MIREX 2007
- MIREX 2006
- MIREX 2005

results by year

- MIREX 2018 Results
- MIREX 2017 Results
- MIREX 2016 Results
- MIREX 2015 Results
- MIREX 2014 Results
- MIREX 2013 Results
- MIREX 2012 Results

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- 4 MIREX 2018 Submission Instructions
- 5 MIREX 2018 Evaluation
 - 5.1 Note to New Participants
 - 5.2 Runtime Limits
 - 5.3 Note to All Participants
 - 5.4 Software Dependency Requests
- 6 Getting Involved in MIREX 2018
 - 6.1 Mailing List Participation
 - 6.2 Wiki Participation
- 7 MIREX 2005 - 2017 Wikis

Welcome to MIREX 2018

This is the main page for the eleventh running of the Music Information Retrieval Evaluation eXchange (MIREX 2018). The International Music Information Retrieval Systems Evaluation Laboratory (IMIRSEL) at [School of Information Sciences](#), University of Illinois at Urbana-Champaign ([UIUC](#)) is the principal organizer of MIREX 2018.

The MIREX 2018 community will hold its annual meeting as part of [The 19th International Society for Music Information Retrieval Conference](#), ISMIR 2018, which will be held in Paris, France, September 23-27, 2018.

J. Stephen Downie
Director, IMIRSEL

https://www.music-ir.org/mirex/wiki/MIREX_HOME

Meet

- ISMIR conferences
 - <https://www.ismir.net/conferences/>
 - 2022: Bengaluru, India
 - 2023: Milan, Italy
 - 2024: San Francisco, USA
- Music Tech Community India
 - <https://musictechcommunity.org/>

Upcoming Events

Audio Developer Conference

- ADCx 2024 + Music Hack Day
 - <https://audio.dev/adcx-india-24/>
 - Jan 5-7, Bengaluru, India



Datasets for Music Information Research in Indian Art Music

Ajay Srinivasamurthy

19 Dec 2023

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