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MTG
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Group



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Symbolic analysis of Ottoman-Turkish makam music

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Overview

1. **Introduction**
2. Ottoman-Turkish Makam Music
3. Music Score Collections
4. State-of-the-art in Symbolic Analysis
5. Extensions for Music Generation
6. Conclusion

Introduction

- Music can be represented by various data sources
 - **Music scores**, audio recordings, videos, lyrics, metadata ...
- Music scores are widely used:
 - Musical performances
 - Education
 - Musicological research
 - Archival and preservation etc.
- Music scores show many of the relevant musical components
 - Notes, durations, measures, key, tempo, embellishments etc.
 - These components are easy to access

Introduction

- Analysis on different music traditions is an important research problem
 - Studying and comparing musical characteristics
 - Tackling culture-specific challenges
 - Cross-culture comparisons
 - Gaining attention

Overview

1. Introduction
2. **Ottoman-Turkish Makam Music**
 - **Makam**
 - **Usul**
 - **Music Scores**
3. Music Score Collections
4. State-of-the-art in Symbolic Analysis
5. Extensions for Music Generation
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Ottoman-Turkish Makam Music

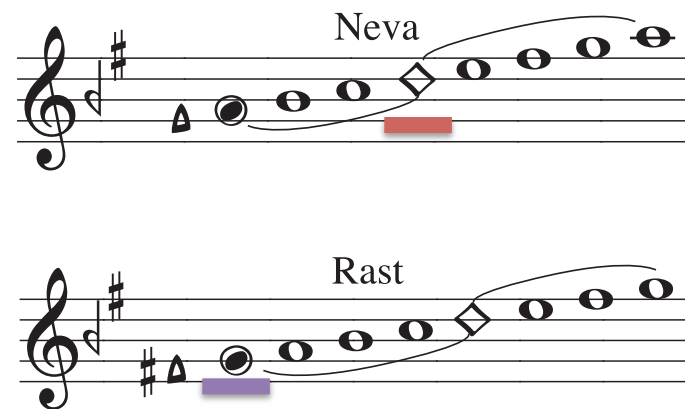
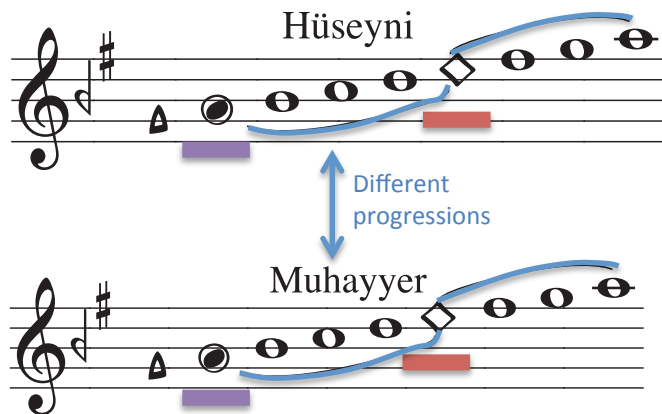
- Performed in a vast geography
- Predominantly an oral tradition
- Arel-Ezgi-Uzdilek is the mainstream musical theory
 - An approximation of 53 tone-equal-tempered (TET) system, where a whole tone is divided into 9 Holderian commas



❖ **IMPORTANT:** Theory does not necessarily correspond to the practice

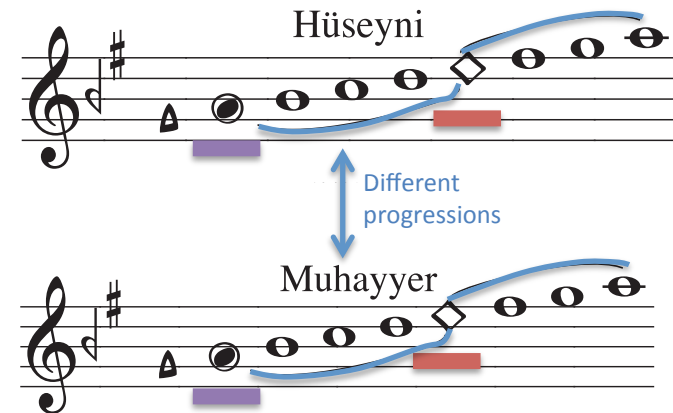
Makams

- Melodic dimension is explained by makams
 - Modal structures
- Each makams has a scale typically formed from **pentachords** and **tetrachords**
- Melodies revolve around a **initial** and a **final** tone



Melodic Progressions

- Melodic progressions are explained with the **seyirs**
- Seyir is dependent on
 - Modal centers
 - Melodic direction(s)
 - Phrases (flavor) & their progressions
 - Intra-phrase movements
 - Intonation of the intervals
 - ...



Usuls

- Metric Structure is explained by usuls.
- Compositions/forms are constructed on metrical grid dictated by the usul
 - Disrupting the usul might also alter the makam “feeling”
- From 2 beats to 128 beats
 - Two different usuls might have the same number of beats or even the same beat sequence (but different tempi)

Aksak

$\text{♩} = 162$

Düm Te Ke Düm Tek Tek

Music Scores

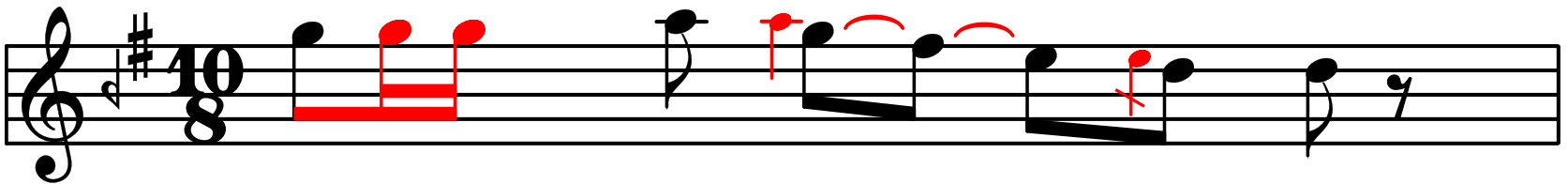
- Adaptation of extended Western notation in 20th century
- Scores notate basic melody lines



- Typically descriptive
- Multiple versions may exist

Music Scores (cont.)

- Performances and scores differ substantially
 - Heterophony
 - Embellishments are not notated
 - Tuning/intonation



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1. Introduction
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3. **Music Score Collections**
 - SymbTr
 - Turkish Makam Symbolic Phrase Dataset
4. State-of-the-art in Symbolic Analysis
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SymbTr Collection

- The largest machine-readable music score collection of Turkish-Ottoman makam music
- 2200 pieces
 - 150 makams, 100 usuls and 50 forms
 - 865000 notes (~80 hours playback time)
- Classical, folk, religious and military genres
- Available in txt, MusicXML, MIDI etc.

<https://github.com/MTG/SymbTr>

Turkish-Makam Symbolic Phrase Dataset

- SymbTr scores are used.
- The dataset consists:
 - 31362 phrases
 - 480 scores of different compositions
 - by 3 experts (overlapping annotations)
- Compositions are selected from:
 - The most common makams
 - Well known composers
 - 17th century to today; uniformly from four main periods

<http://compmusic.upf.edu/node/237>

Turkish-Makam Symbolic Phrase Dataset

Tal'atın Devri Kamerde Hüseyinî Ağırsemâî

Usul: Aksaksemâî
♩ = 120 ⇒ 2 Dk 32 Sn

Beste: Zaharya (1680 - 1750)
Güfte: Nâfîz

mi5: ussak

fa4#4: dilkeshaveran

re5: buselik

do5: cargah_yeni

Tal a tın dev ri ka mer de

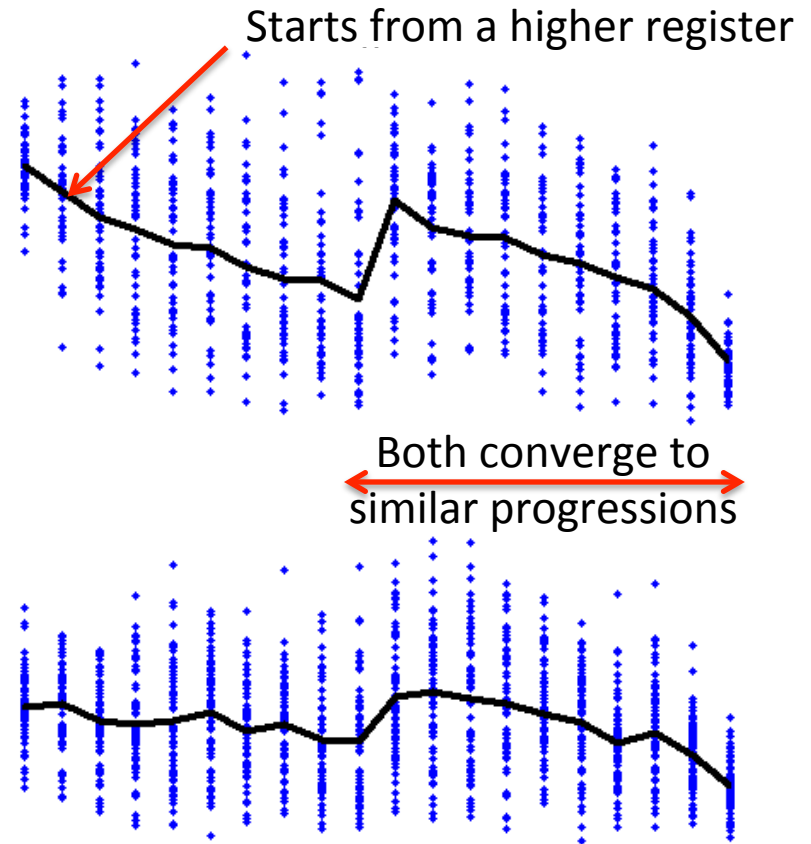
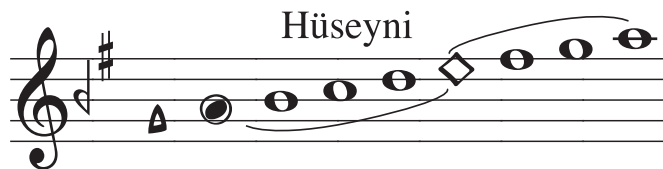
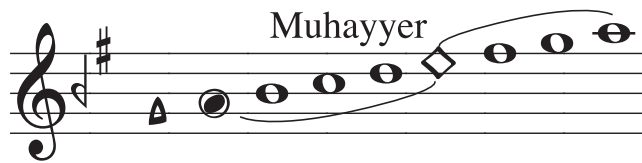
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Overview

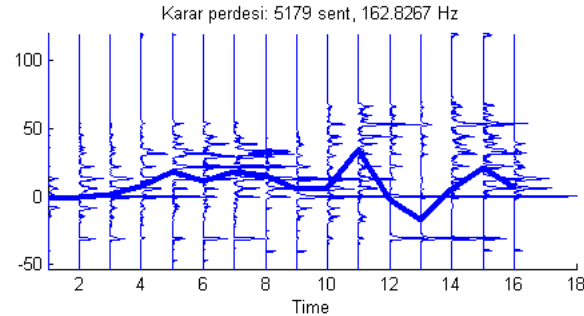
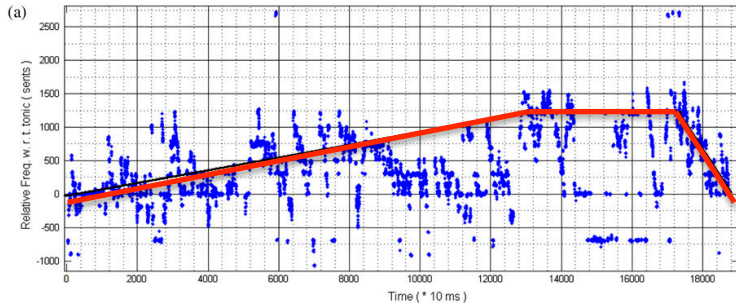
1. Introduction
2. Ottoman-Turkish Makam Music
3. Music Score Collections
4. **State-of-the-art in Symbolic Analysis**
 - Seyir Analysis
 - Phrase Analysis
 - Rhythm Analysis
 - Computational Modeling
5. Extensions for Music Generation
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Seyir Analysis I

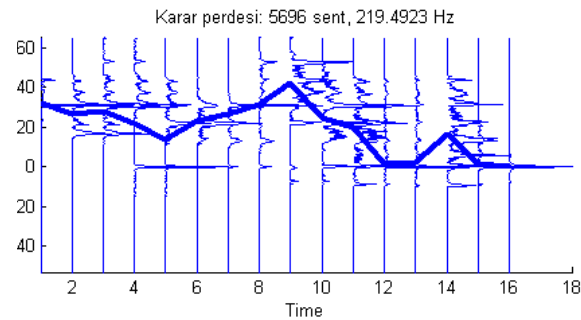
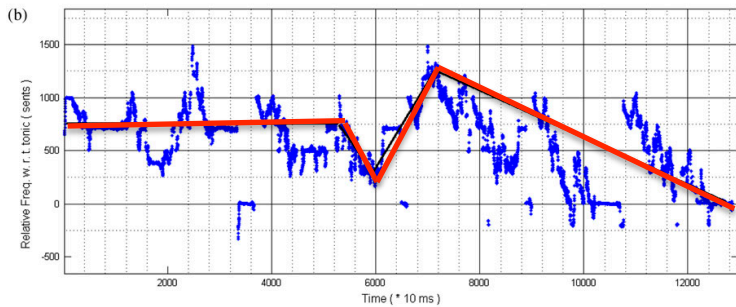


B. Bozkurt, 2012, "Features for Analysis of Makam Music.", Proc. 2nd CompMusic Workshop, 12-13 July, Istanbul.

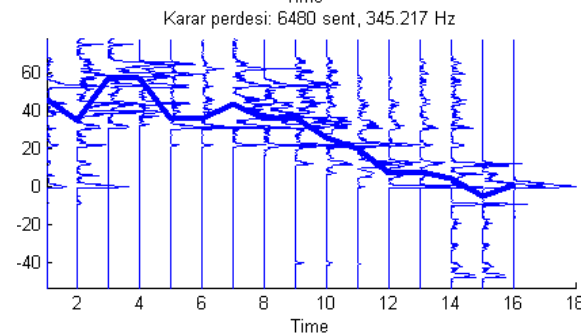
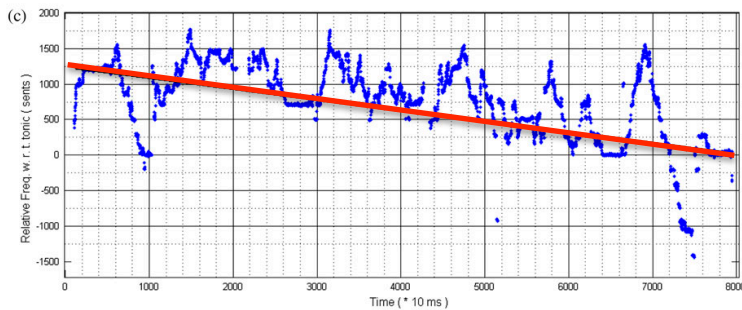
Seyir Analysis - II



Uşşak makam
(ascending)



Hüseyini makam
(ascending,
descending)



Muhayyer makam
(descending)

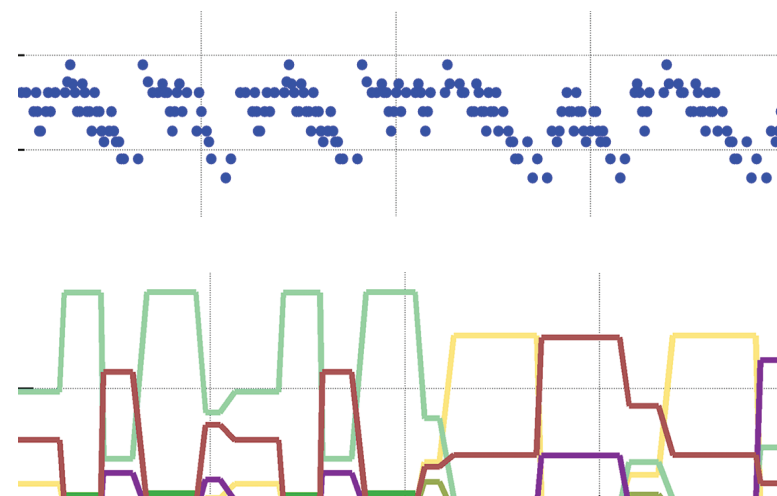
B. Bozkurt, 2012, "Features for Analysis of Makam Music.", Proc. 2nd CompMusic Workshop, 12-13 July, Istanbul.

Phrase characterization

A piece in Segah makam



A piece in Huseyni makam



— Segah

— Hüseyinî

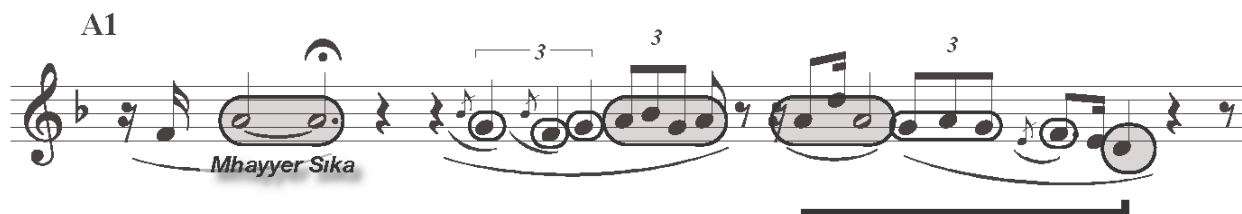
— Uşşak

— Beyatî

B. Bozkurt, B. Karaçalı, 2014, "A computational analysis of Turkish makam music based on a probabilistic characterization of segmented phrases", Accepted for Journal of Mathematics and Music.

Phrase Segmentation in Tunisian maqams

- Low-level and high-level heuristics to make structural segmentations
- Applied to modal ney improvisations in Tunisian maqam music

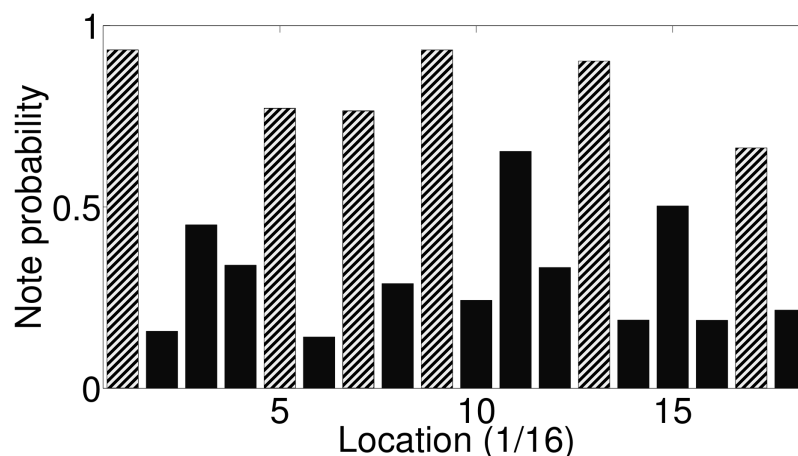


- Compared with segmentations done by human subjects with different cultural and musical backgrounds.

Olivier Lartillot, Mondher Ayari, "Cultural impact in listeners' structural understanding of a Tunisian traditional modal improvisation, studied with the help of computational models", *Journal of Interdisciplinary Music Studies*, 5-1, pp. 85-100, 2011.

Relation Between Surface Rhythm and Usuls

- Worked on the SymbTr-scores of a large number of vocal pieces in short usuls



Aksak Usul

- Relevant point:** *“Rhythmic aspects in Turkish makam music can be considered as the outcome of a generative model”*
- Bayesian models were used to capture the styles

Holzapfel, A. (2015). Relation Between Surface Rhythm and Rhythmic Modes in Turkish Makam Music. *Journal of New Music Research*, 44(1), 25-38.

Computational Modeling of Improvisation in Turkish Folk Music

- Applying the methodology introduced in Conklin's masters thesis to model the melodic progressions
 - Added culture-specific, quarter-tone viewpoints
 - Modeled *uzun hava*, a non-metered improvisational form
- Short-term model has a lower entropy than long-term
 - Individual improvisations have strong melodic patterns
 - A “middle”-term model for each makam can be more predictive

Şentürk, S. (2011). Computational modeling of improvisation in Turkish folk music using variable-length Markov models. Master's thesis, Georgia Institute of Technology, Atlanta.

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 - **Concept**
 - **Material**
 - **Compositional Constraints**
6. Conclusion

Concept

- We can generate melodies hierarchically according to style of Ottoman-Turkish makam music by:
 - Models for melodic progressions as a sequence of flavors for each makam
 - Models for note/motif sequences within each flavor
- Musicians show a high flexibility in performances
 - Generated symbolic music would/should be treated the same
 - Retaining the “feeling” and leaving the rest to the musician

Material

- The theoretical framework & knowledge base is being prepared
 - Makam Ontology: <https://github.com/gopalkoduri/ontologies>
- SymbTr-scores will be used
 - Specifically the Turkish-Makam Symbolic Phrase Dataset
- We can base the methodology on:
 - The findings of existing research on symbolic analysis of makam music
 - The predictive/generative models being developed in Music Informatics Group, UPV/EHU

Compositional Constraints - Makam

- Makam
 - ❖ (Usually) does not change, but modulates
 - Melodic direction (ascending, descending etc.)
 - Theoretically known for each makam
 - Practical implications are shown by Bozkurt
 - Flavors and flavor modulations
 - Can be learned from the phrase dataset
 - For composition transformation we can keep the flavor progressions and their relative durations
 - Intra-flavor movements (notes, motifs)
 - VLMMs, semiotics?

Compositional Constraints: Usul, Composition, Style

- Usul (Bayesian models from Holzapfel)
 - ❖ does not change except certain forms
 - Beat locations
 - Metrical strength
- Composition
 - Mining intra-composition (and intra-makam) motifs (Lartillot)
- Style?
 - Composer
 - Era
 - Genre (folk, classical)

Overview

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5. Possible Extensions for Music Generation
- 6. Conclusion**

Conclusion

- An overview of analysis methodologies applied to symbolic data on Ottoman-Turkish makam tradition
 - Many topics are still uncovered
- Presented basic ideas to extend the state-of-the-art methodologies on symbolic analysis for music generation and transformation
- Models can be further used in relevant tasks:
 - Motif discovery, structural analysis and segmentation, makam recognition etc...
- Future work: performance-informed music generation



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