SYNTHESIS OF TURKISH MAKAM MUSIC SCORES USING AN ADAPTIVE TUNING APPROACH

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Outline

1. Introduction
2. Turkish Makam Music
3. Methodology
4. Applications
5. Conclusion
Introduction

- **Score synthesis** is one of an important feature
  - Provides real-time aural feedback on how the notated music would sound like.

- Most of the synthesis tools render the audio devoid of the performance added expression.
  - Scores of many music cultures do not explicitly include important information related to performance aspects.
    - Timing, dynamics, *tuning, temperament* and etc.
Introduction

- Notation editors are currently designed for Eurogenetic music
  - 12 tone-equal-tempered (TET) tuning system
  - *Limited support* for intermediate tones and microtonal intervals

- May negatively impact the music creation process
  - *It might even lead to loss of some variations in the expression and understanding of the music culture in the long term*
Introduction

- Adaptive Synthesis - Allows the user to synthesize the melody in a music score
  - according to a given tuning system
  - according to the tuning extracted from audio recordings

- Tuning and temperament dimensions in music score synthesis, specifically for Turkish makam music
  - Consists of diverse tunings and microtonal intervals, which vary with respect to the makam (melodic structure), geographical region and artists

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Outline

1. Introduction
2. Turkish Makam Music
   - Makam and Karar (tonic)
   - Mainstream Theory, Arel-Ezgi-Uzdilek (AEU)
   - SymbTr Score Collection
3. Methodology
4. Applications
5. Conclusion
2. Turkish Makam Music
   Makam and Karar (tonic)

- Melodic dimension explained by *makams*
  - Melodies revolve around some melodic centers
  - Final tone ≈ Tonic

- No definite tuning reference (e.g. A4 = 440Hz)
- Diverse tuning & intonation
- Allows a high degree of expressivity
2. Turkish Makam Music
Mainstream theory, Arel-Ezgi-Uzdilek (AEU)

• **IMPORTANT**: Theories does not necessarily correspond to the practice

• Arel-Ezgi-Uzdilek is the mainstream musical theory
  – 24 notes in an octave
  – A whole tone is divided into 9 Holderian commas (Hc)
  – Approximation of 53 tone-equal tempered (TET) system
    • $1 \text{ Hc} \approx 22.6$ cents.
2. Turkish Makam Music

SymbTr Score Collection v2.4.3

- The largest and most representative machine-readable score collection of Turkish makam music (2200 music scores)
- Available in different formats

Outline

1. Introduction
2. Turkish Makam Music
3. Methodology
   - Predominant melody extraction
   - Tonic identification
   - Tuning analysis and adaptation
   - Score synthesis
4. Applications
5. Conclusion
3. Methodology

Audio Recording

Predominant Melody Extraction

Tonic Frequency Identification

Pitch Distribution

Tuning adaptation & Synthesis

Machine Readable Score

Machine Readable Score

Machine Readable Score

Machine Readable Score
3. Methodology

Audio Recording  →  Predominant Melody Extraction
3. Methodology

Predominant Melody Extraction

3. Methodology

Predominant Melody Extraction

https://github.com/sertansenturk/predominantmelodymakam

3. Methodology

Audio Recording → Predominant Melody Extraction

Pitch Distribution
3. Methodology

Pitch Distribution Computation

https://github.com/altugkarakurt/morty


3. Methodology

- Audio Recording
- Predominant Melody Extraction
- Pitch Distribution
- Tonic Frequency Identification
3. Methodology

Tonic Identification

https://github.com/hsercanatli/tonicidentifier_makam

3. Methodology

Audio Recording

Predominant Melody Extraction

Tonic Frequency Identification

Machine Readable Score

Pitch Distribution

<x notedefault-x="102.19" default-y="35.00">
  <pitch>
    <step>F</step>
    <octave>4</octave>
  </pitch>
  <duration>2</duration>
  <voice>1</voice>
  <type>quarter</type>
  <stem>up</stem>
  <lyric number="1">began</lyric>
  <text>Eru</text>
</note>
3. Methodology
Tuning analysis and adaptation

Makam information, notes & scale comes from music score

Pitch Distribution

Tonic Frequency Identification

Tuning Adapter

https://github.com/miracatici/notemodel
3. Methodology
Synthesis

Machine Readable Score

https://github.com/hsercanatli/symbtrsynthesis
Outline

1. Introduction
2. Motivation
3. Turkish Makam Music
4. Methodology
5. Applications
   - Dunya & Dunya-web
   - Dunya-desktop
   - Application: Dunya-desktop Adaptive Synthesis Extension
6. Conclusion
5. Applications
Dunya & Dunya-web

- Carnatic
- Hindustani
- Makam
- Jingju
- Andalusian

Dunya.compmusic.upf.edu

>22000
~7000
2200
>190 gb

API
5. Applications

Dunya-desktop

https://github.com/MTG/dunya-desktop
5. Applications
Dunya-desktop Adaptive Synthesis Extension

https://github.com/MTG/dunya-desktop/tree/adaptive-synthesis
5. Applications
Dunya-desktop Adaptive Synthesis Extension - Dataset

• 5 Makams (Hicaz, Nihavent, Uşşak Rast and Hüzzam)
  – Covers 25% of SymbTr Score collection
• 10 “good-quality” recordings for each makam
  – 50 tuning presets
• Includes;
  – Metadata
  – Predominant melody
  – Pitch distribution
  – Note models

https://github.com/MTG/otmm_tuning_intonation_dataset
Conclusion

- Presented a methodology for score synthesis
- Developed a desktop application

**Future works**
- Conduct user studies
- Improve the synthesis methodology with score-informed tuning & intonation analysis

Thank you!

Companion page: compmusic.upf.edu/node/339