# A SIMPLE METHOD FOR MELODIC CLASSIFICATION BASED ON SCALE ANALYSIS

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## 1. INTRODUCTION

One objective of the analysis of modal music is the comparison of melodies, which implies their classification. While conventional methods of analysis are used to enter a modal specificities bounded together, and the number is typically reduced, it is clear that the pertinence of the results is closely related to the amount of data analyzed. We propose a general method, implemented in Python, for the analysis of the scale of melodies and to measure the melodic nearby. We apply it to the analysis of a segmented file and several songs of women from different regions of Tunisia.

For the purpose of this analysis, we have implemented different functions in the python module **Diastema** [1] .

## 2. BACKGROUND

Several works the MIR field have focused on melodic analysis. Part of these works deal with melodies using a symbolic representation (De León et al., 2004; León & Iñesta, 2004; Li & Sleep, 2004; Frieler & Müllensiefen, 2005).

Other studies, such those of Bars Bozkurt (Bozkurt, Bozkurt) focused mainly on makamique analysis. As the special feature of *maqm* is in its intervallic system, which is not taken into consideration by the symbolic data, Bozkurt use different basic detection algorithms to obtain representative frequencies of the melody. These frequencies, retuned into the same octave and converted using Holderian Comma, allowed the representation of histograms of main notes of melodies (template-matching). Ioannidis et al. (2011) present an extension to work Bozkurt using HPCP. The willingness of these approaches is to determine the scales of the main modes of Turkish music or to identify the *maqm* of a music compared to a predetermined scale (theoretical tuning systems). We can consider the we are here in a supervised approach.

The method presented here is different. Our main goal is to analyze and classify melodies in an unsupervised manner. This approach should allow us to address and redefine *makam*-s and modal scales of different art music in a broader context. In addition, it is applicable to non-scholarly traditional music, where melodies do not belong to a pre-established modal theory.

[1] https://github.com/AnasGhrab/diastema

## 3. GENERAL METHODOLOGY

This method consists of an extraction of the fundamental frequencies of each melody, where we use the Predominant Melody Extraction algorithm (Salamon & Gómez, 2012) which is relatively robust for the detection of the melody in a complex context.

A Kernel Density Estimation is then applied to the frequency list to obtain Probability Density Functions (PDF-s) related to dominant frequencies in the melody. The peaks of the PDF gives as the frequencies that represent the scale, which are faced to most known intervals in an epimoric (n+1/n) definition. For that we need first to detect the frequency that could represent the tonic note. We detail below our approch for that.

When comparing melodies from different files, we have to transpose them on a single reference frequency. Then we classify Probability Density Functions by the linear Correlation Coefficient : the classification of PDFs should match a melodic nearby.

## 4. THE DIASTEMA TOOL AND EXAMPLES

### 4.1 First example

Our first example is the analysis of Violin Taksim.

#### *4.1.1 PDF-s of the different segments*

#### *4.1.2 The detection of the tonic frequency-note*

Useing different percentages of the last frequencies :

```
        [1.5%,2%,5%,10%,15%]
P1   :  [318, 318, 318, 318, 318]
P2   :  [318, 318, 318, 318, 347]
P3   :  [318, 343, 318, 318, 318]
P4   :  [316, 316, 316, 318, 318]
P5   :  [318, 318, 318, 318, 318]
```

#### *4.1.3 The global PDF and the scale*

```
[['0.00', '1/1', '+', '0.00'],
 ['36.54', '12/11', '-', '1.25'],
 ['88.39', '9/8*12/11', '-', '0.56'],
 ['114.26', '4/3', '-', '10.68'],
 ['146.52', '4/3', '+', '21.58'],
 ['181.95', '3/2', '+', '5.86'],
 ['209.70', '3/2*10/9', '-', '12.15'],
 ['258.89', '3/2*6/5', '+', '3.62']]
```

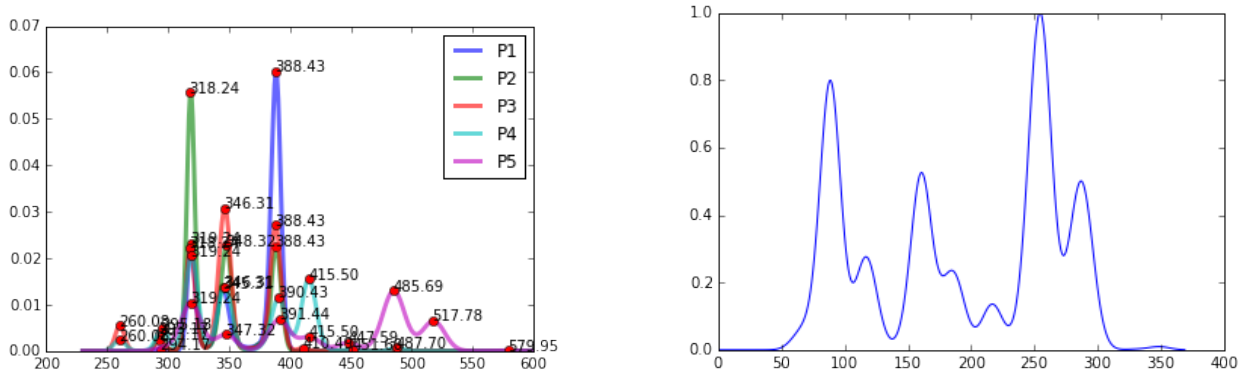


**Figure 1**: PDF-s of the different segments; Global PDF from all segments

### 4.2 Second example

303 audio files of traditionnal women songs from different regions of Tunisia. They are field recordings made between 2007 and 2015 [2] .

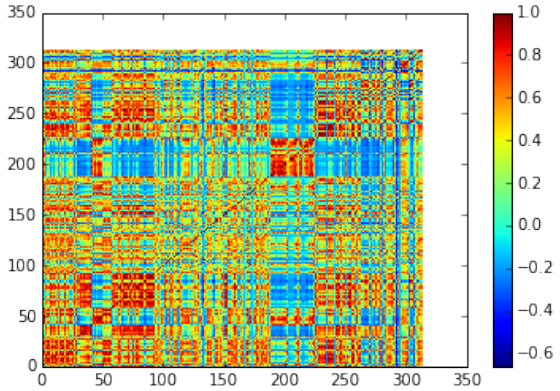

**Figure 2**: Self-similarity matrix

## 5. CONCLUSION

This paper presents a musicologial point of view. Its approach has to be extended with specialists in data-mining and programmers.

## 6. REFERENCES

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[2] See the collection "Chants de femme dans les regions tunisiennes" at the catalogue of the National Sound Archives (http://phonotheque.cmam.tn), hosted by the Centre of Arab and Mediterranean Music (http://www.cmam.tn).

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