



## Features defined in theory

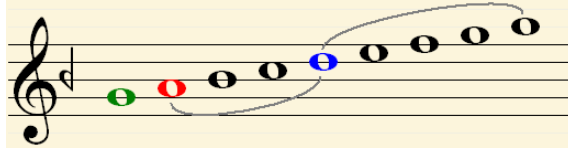
- Scale, intervals and intonation of specific notes in the scale (intervallic structure)

- Overall melodic progression (ascending, descending, etc.) **Seyir**
- Typical phrases, emphasis on certain scale degrees
- Hierarchy of tones and their frequency of occurrence in a piece, tonic, dominant, leading tone, etc.

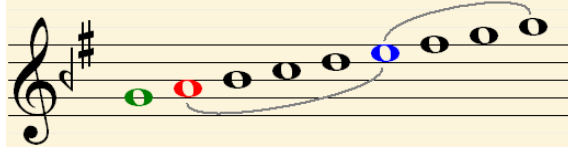
- Melodic range
- Typical modulations, flavours
- Octave relation of notes

## SCALES

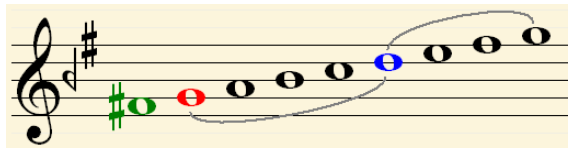
Uşşak-Beyati-İsfahan



Hüseyni – Muhayyer - Gülizar

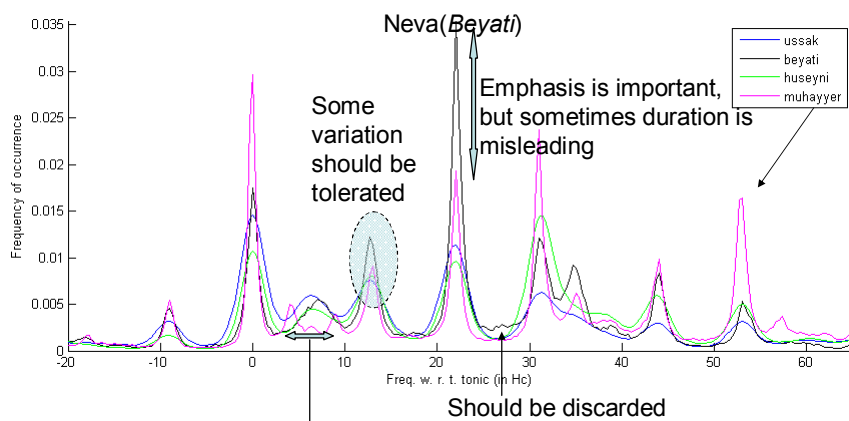


Rast – Pesendide – Rehavi



## Problems encountered in pitch histogram based processing

**Main problem: finding a musicologically meaningful distance measure**



Width can give an idea about dynamic characteristic of a note

But it can also be caused by vibrato

**Open to improvement .....**

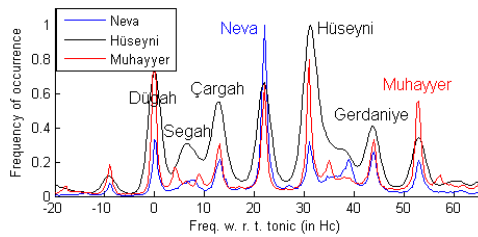
### N-gram based classification

byati	hicaz	hezkr	hsvni	huzzam	krdlz	mahur	mulyr	nlvnt	rast	saba	segah	Ussak	Ref	Rcl
24	0	0	0	0	0	0	1	0	0	0	0	0	byati	61.5
0	112	0	0	0	0	0	0	0	0	0	0	0	hicaz	100
0	0	48	0	0	0	0	0	0	0	0	0	0	hezkr	100
1	0	0	50	0	0	0	0	0	0	0	0	0	hsvni	71.4
0	0	0	0	62	0	0	0	0	0	0	1	0	huzzam	98.4
0	0	0	0	0	49	0	0	0	0	0	0	0	krdlz	100
0	0	0	0	0	0	51	0	0	0	0	0	0	mahur	100
0	0	0	0	0	0	0	35	0	0	0	0	0	mulyr	68.6
0	0	0	0	0	0	0	0	78	1	0	0	0	nlvnt	98.7
0	0	0	1	0	0	0	0	0	76	0	0	0	rast	91.6
0	0	0	1	0	0	0	0	0	0	41	0	0	saba	97.6
0	0	0	1	0	0	0	0	0	0	0	70	0	segah	95.9
0	0	0	0	0	0	0	0	0	0	0	49	0	ussak	57.6
55.8	100	100	64.1	96.9	100	100	63.6	100	91.6	100	95.9	70	Pre.	

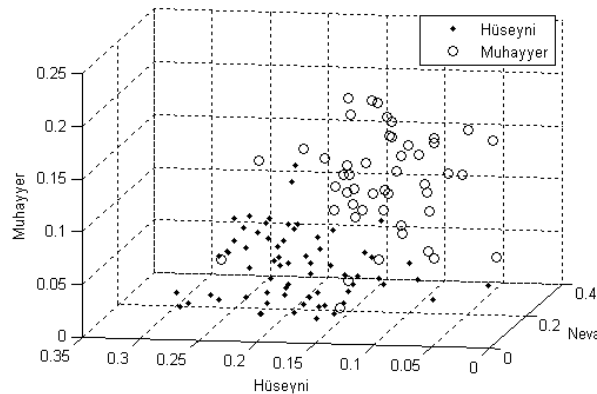
### Classification on audio

	hicaz	rast	segah	kürdili hicazkar	hüzzam	nihavend	hüseyni	uşşak	saba
hicaz	-	-	-	1	-	-	-	1	-
rast	-	-	-	-	-	1	-	1	-
segah	-	-	-	-	-	-	-	-	-
kürdili hicazkar	1	-	-	-	-	-	-	-	-
hüzzam	1	-	-	1	-	-	-	-	-
nihavend	-	1	1	1	-	-	-	-	-
hüseyni	-	-	-	-	-	-	-	-	-
uşşak	-	-	-	-	-	-	-	-	1
saba	-	1	1	1	-	1	-	1	-

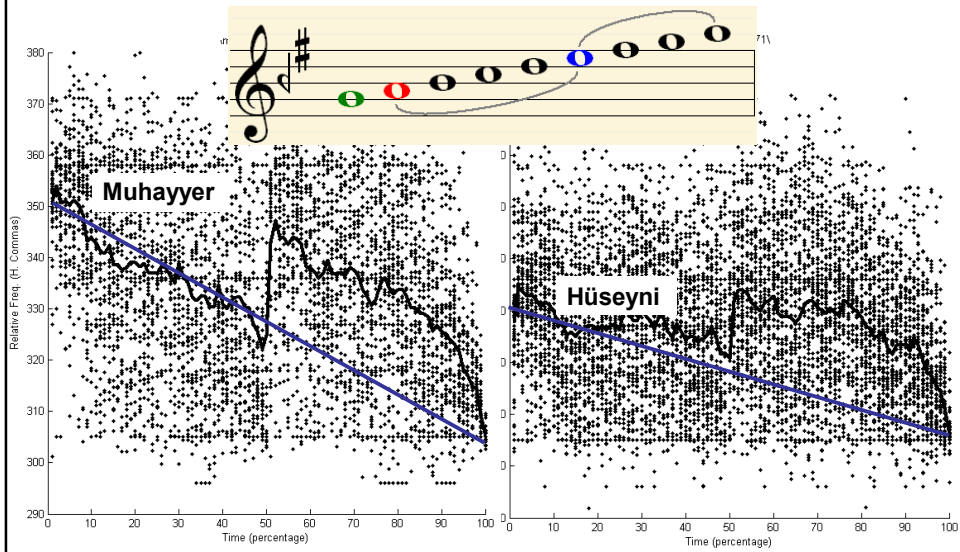
### New features that can be derived from the pitch histogram



### Relative frequencies of notes Neva, Hüseyni and Muhayyer

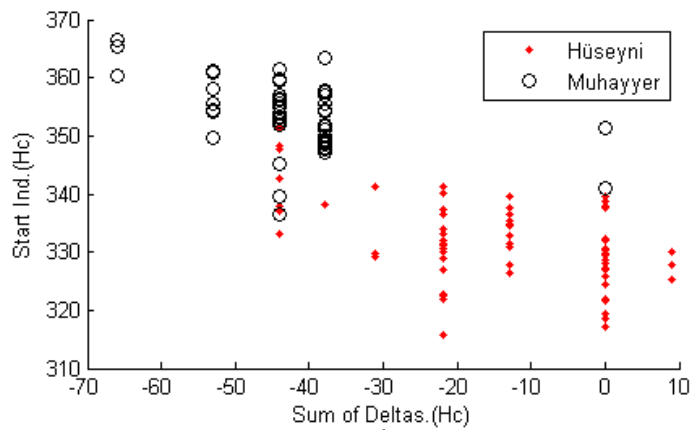


### Measuring melodic progression – Symbolic level



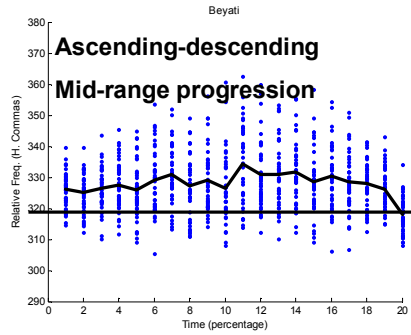
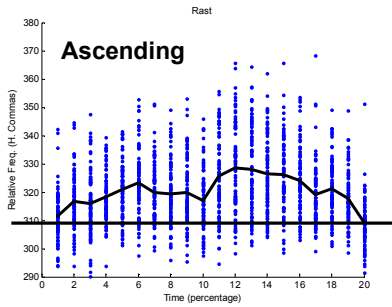
Slope(or delta) appears to be a discriminating feature -> linked also with melodic range and emphasized degrees

### Formulating a low dimensional feature for overall progression

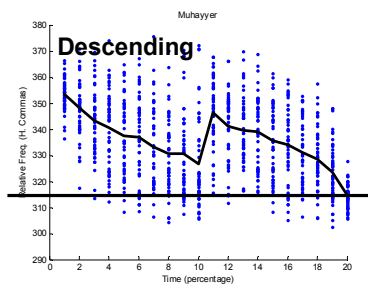


Comparatively difficult on audio data

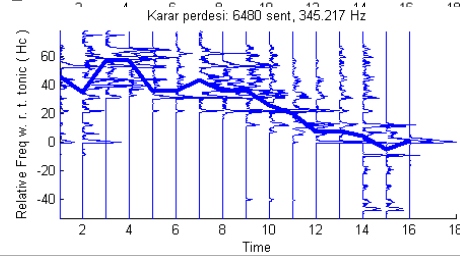
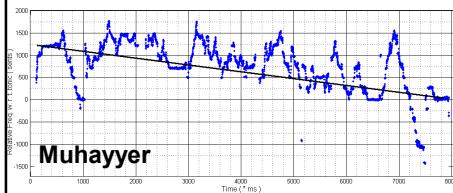
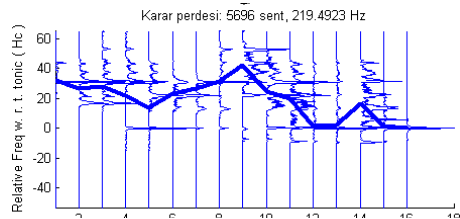
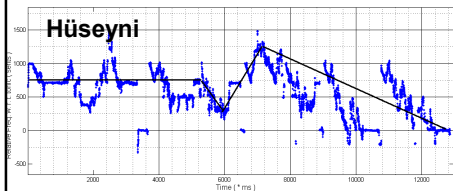
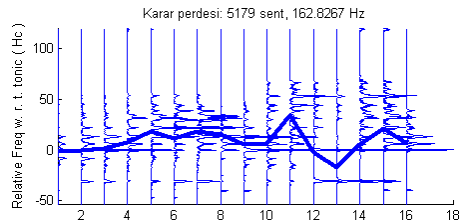
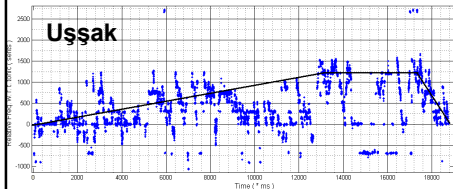
## Three main types of progressions



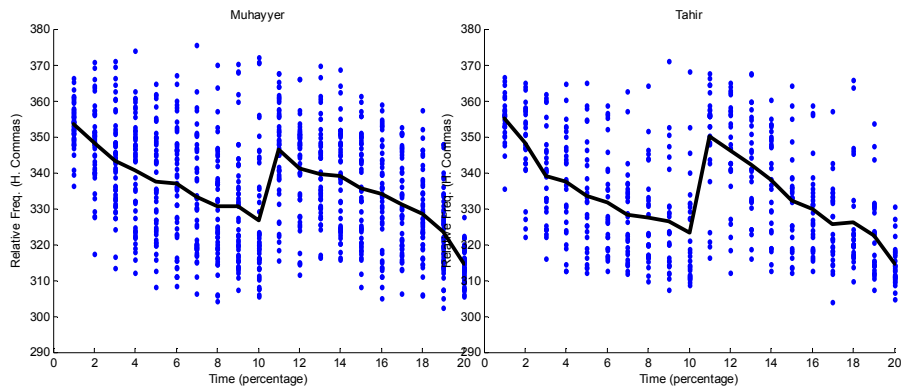
**First time to observe it on actual data**



## Mesasuring progression on audio signals



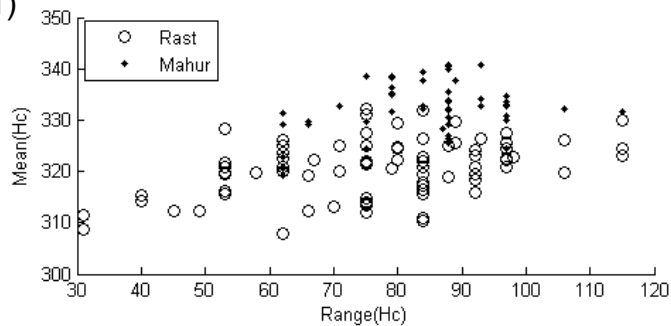
**When scale and overall progression is recognized,  
Confusion would still continue for Muhayyer and Tahir**



Emphasis of (melodies leading to) a certain note may lead to a new makam.

### Melodic range

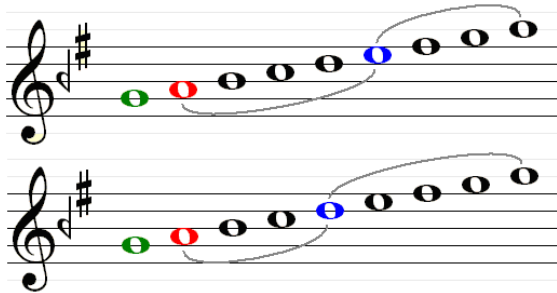
**Example description:** “The makam Rast has an ascending character and is performed mainly within the low register of the scale. The scale extends below the tonic and descends as far as Yegah (D), using the Rast tetrachord” (Aydemir, 2011)



**Range seems to be less discriminative and min-max is not useful either. There needs to be some weighting/filtering to get a more meaningful range information.**

### Open questions

- Is tetrachord/pentachord detection needed?
- Is detection of dominant needed?



### Future goals

- Segmentation into melodies and detection of emphasis notes
- Segmentation into flavors
- Testing all features in a makam recognition task