

Computer Music: Representations and Models

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Introduction:

Creation of a self-generating music environment initiated by user interaction through the combination of different melodic and rhythmic music styles and different instruments.

Combining different components the user can build a visual and musical environment.

Problem statement

- ▶ The generative model to develop has to present the following characteristics in order to work with the **Computer music system** to be integrated in:
 - It must be able to generate melodies starting from an high level of abstraction user input
 - It must create different styles of music following user preferences
 - It must translate the music created into some notation readable by the system
- ▶ Main musical components needed:
 - Harmony
 - Melody
 - Bass
 - Rhythm

Our solution

- ▶ Music source based on the work of a human composer
- ▶ Subdivision in four different music styles that follow specific compositive rules
- ▶ Generative model based on Markov Chain
- ▶ Match musical styles to graphical elements

Adopted styles

4 ENVIRONMENTS:

► 1. Mountain

- predominant use for melody of constitutive notes of the chords
- use of a more rhythmic style and a more lyric style alternated
- large use of VI-V-I turnarounds, with some modulations

1

rhythmic style. Use of constitutive notes of the chords

42 Am G C

Creation of simple loops similar to each other

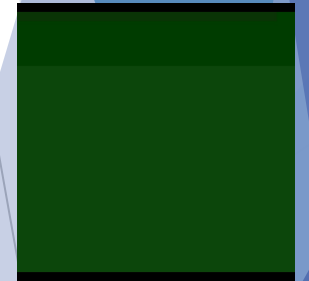
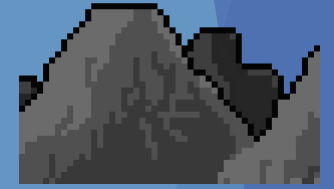
45 Am G C

2

more lyric style

48 B E B B F# B

The image displays three musical staves. The first staff, labeled '1', is in treble clef and shows a rhythmic pattern of eighth and sixteenth notes. Above it are the chords Am, G, and C. The second staff, labeled '45', shows a similar rhythmic pattern with the same chords. The third staff, labeled '2', is in treble clef and shows a more melodic line with notes B, E, B, B, F#, and B. Above it are the chords B, E, B, B, F#, and B. The staves are numbered 42, 45, and 48 respectively.



Adopted styles

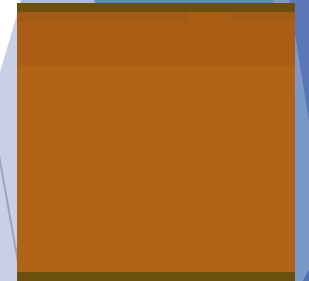
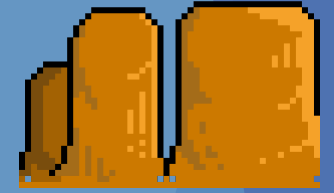
► 2. Desert

- use of harmonic, phrygian, dominant phrygian and double harmonic scales
- large use of fourth turnarounds
- musical syncopations

C example with static harmony and use of double harmonic scale

5

9 F IV I minor turnarounds Cm F F

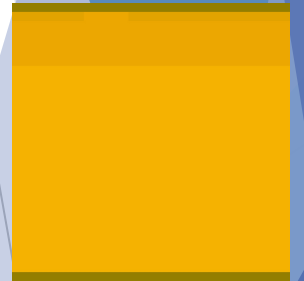
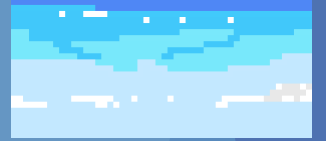


Adopted styles

▶ 3. Seaside

- ▶ lot of emphasis on current harmony notes
- ▶ creation of loops similar to each other, one can be the variation of the other, for example one with the same melody but headless
- ▶ large use of minor harmonies, use of weak cadences
- ▶ Use of static long notes

The image displays three staves of musical notation in treble clef, illustrating the 'Seaside' style. The first staff (measures 13-16) features long notes and slow trends, with harmonies Cm, Ebm, phrigian mode Db, and V-VI of Ab ionic Eb. The second staff (measures 17-18) shows a wavy melodic trend used in a loop with variations like headless or musical syncopes, with harmonies Cm and Bb. The third staff (measures 19-20) continues the wavy melodic trend with harmonies Eb and Bb. Each staff has a small square icon with an upward arrow in the top right corner.



Adopted styles

► 4. City

- use of syncopations and rhythmic lags
- melodic phrases similar to lo-fi music, industrial music, psychedelic
- use of phrygian mode, with recurrent minor harmonies

21 Bm F#m phrygian mode

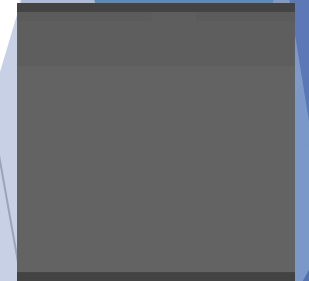
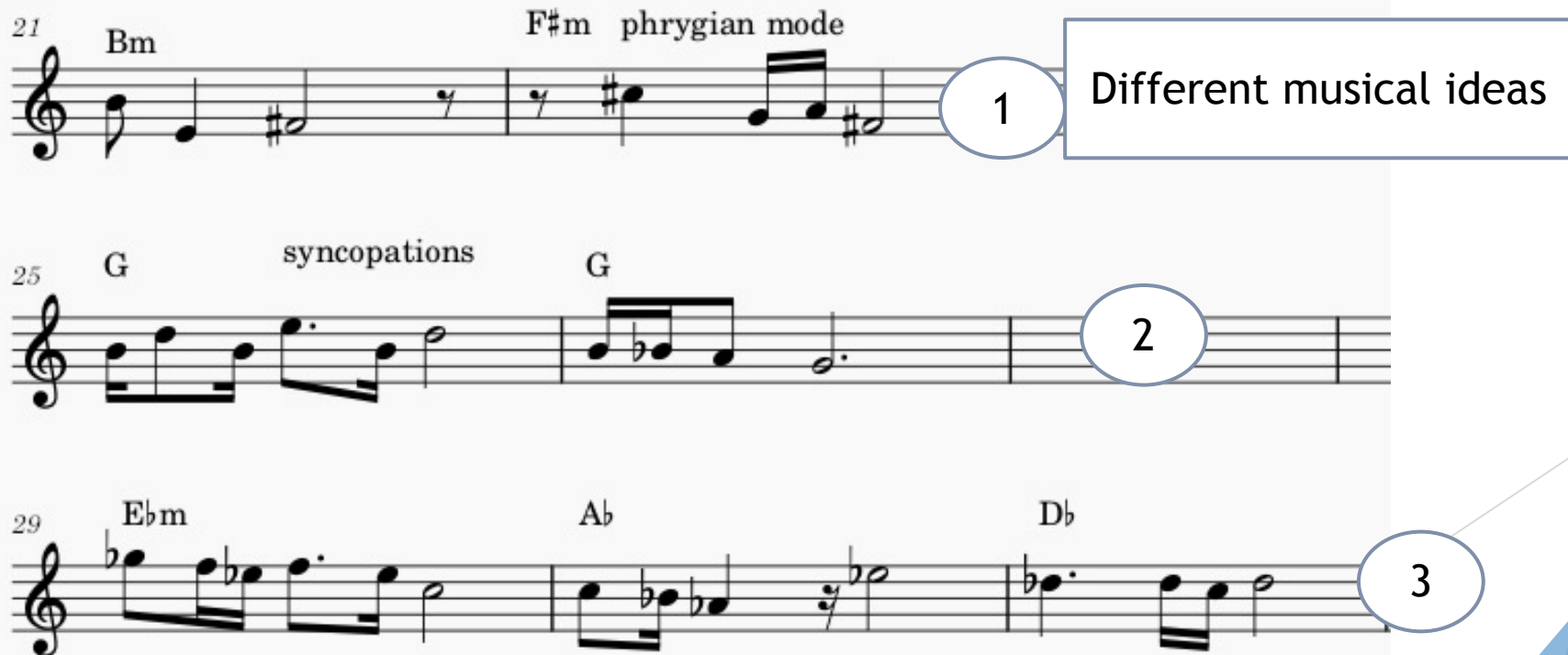
1 Different musical ideas

25 G syncopations G

2

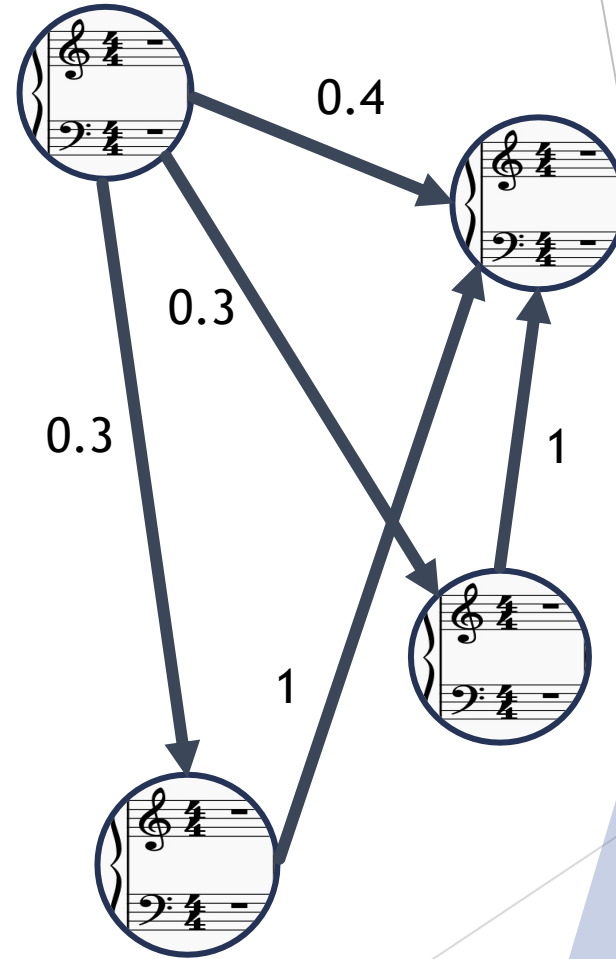
29 Ebm Ab Db

3



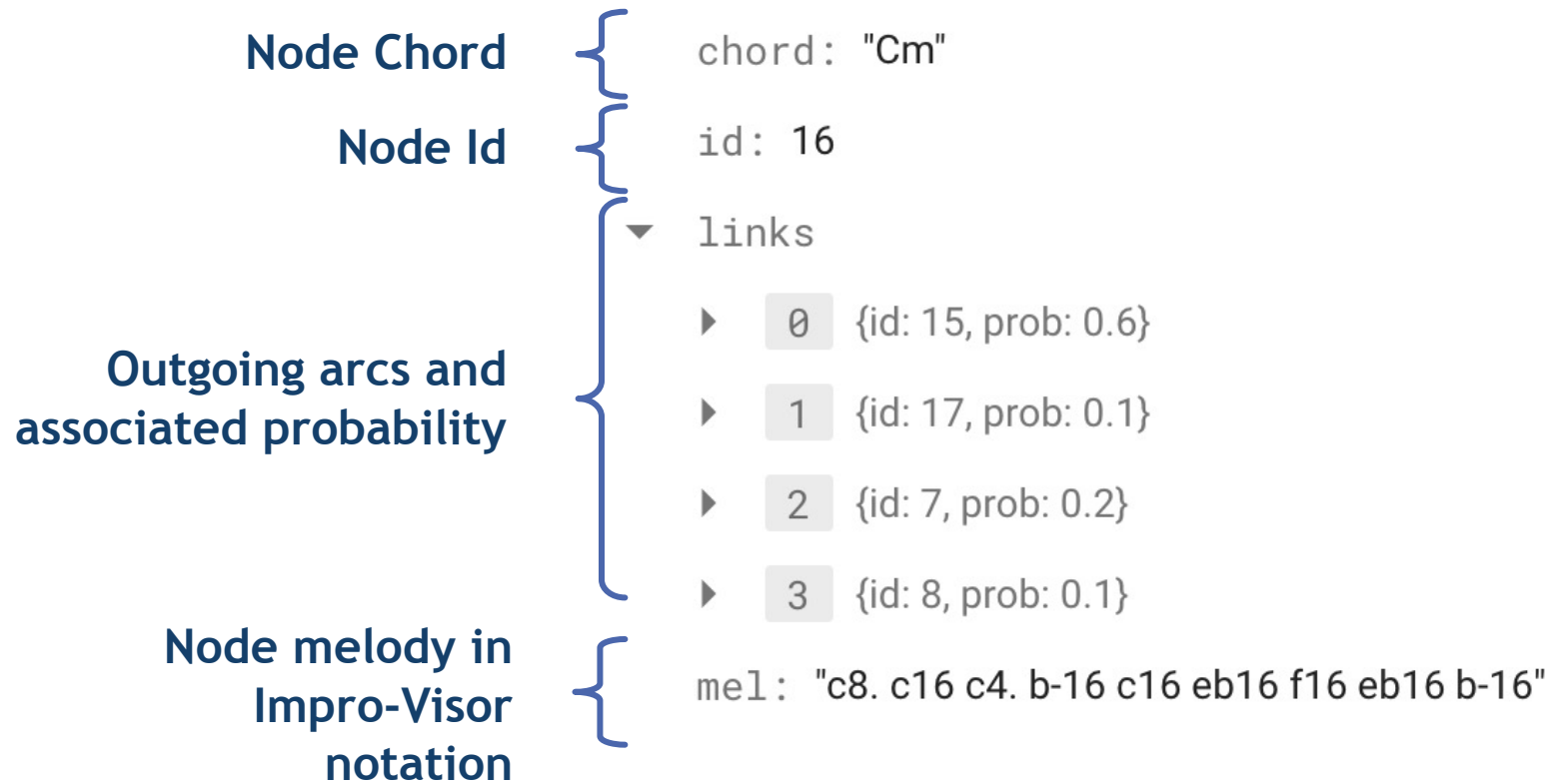
Markov Chain

- ▶ Generative Model
- ▶ Weighted Arcs connect bars and specify the probability of transition between states
- ▶ Stochastic model allows to create melodies
- ▶ Each node is a basic component and contains all the information that constitute one bar



Nodes

- ▶ Musical Nodes represented as database elements



Leadsheet grammar

IMPRO-VISOR LEADSHEET NOTATION

MELODY

NOTE

Lower-case
letter

OCTAVE

+
octave above the
middle one

-
octave below the
middle one

DURATION

1
4/4 note

2
2/4 note

4
1/4 note

8
1/8 note

16
1/16 note

Leadsheet grammar

IMPRO-VISOR LEADSHEET NOTATION

CHORDS

CHORD

upper-case letters

m

minor

EXAMPLE

Chord: Am

Melody: { r16 a4 g#16 f16 g#16 f16 e16 c16 bb-16 a-4 }



Music generation and scheduling

Musical Nodes are composed into a melody through the generation algorithm



Melody is parsed and turned into a list of schedulable musical events



Musical events are played by the selected instrument when scheduled to the Transport Time of the system

Chords: | Am | G | C |

Melody: { c8. c16 a-8 a-4. a-8 a-8\n
b-8 b-8 b-8 b-2 r8\n
c2 r4 e4\n}

Notes Scheduling

duration: "8n." note: "c3" time: "0:0:0"
duration: "16n" note: "c3" time: "0:0:3"
duration: "8n" note: "a2" time: "0:1:0"
duration: "4n." note: "a2" time: "0:1:2"
duration: "8n" note: "a2" time: "0:3:0»
duration: "8n" note: «a2" time: "0:3:2"
duration: "8n" note: "b2" time: "1:0:0"
duration: "8n" note: "b2" time: "1:0:2"
duration: "8n" note: "b2" time: "1:1:0"
duration: "2n" note: "b2" time: "1:1:2"
duration: "2n" note: "c3" time: "2:0:0"
duration: "4n" note: "e3" time: "2:3:0»

Chords Scheduling

duration: "1n"
notes: ["A2", "C3", "E3"]
time: "0:0:0"

duration: "1n"
notes: ["G2", "B2", "D3"]
time: "1:0:0"

duration: "1n"
notes: ["C3", "E3", "G3"]
time: "2:0:0"

Conclusions and Future Development

- ▶ The project implemented aims at two categories of users:
 - The listener who passively enjoys the generated music
 - The composer who can exploit the developed system to project generative musical environment starting from his composition
- ▶ Possible improvements:
 - More nodes in music generation
 - More styles associated with graphical elements
 - Possibility of changing musical database allowing different composers to exploit the same creative concept

THANKS FOR THE ATTENTION



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