Supplementary Material for
"Rule Mining for Local Boundary Detection in Melodies"

Peter van Kranenburg

`peter.van.kranenburg@meertens.knaw.nl`

Contents

1 Features

Each feature describes a property of a 5-gram consisting of five consecutive notes from a melody. Feature names ending with {-first, -second, -third, -fourth, -fifth} refer to the first till the fifth note of the 5-gram respectively. The overview is ordered according to the groups as presented in the paper. Some features occur in more than one group. Notably, the features that are based on Narmour's conditions of closure also occur in the elementary pitch and rhythm features.

1.1 Elementary Pitch Features

Scale degree of the pitch. The scale degree of the tonic is 1. Integer. $1 \leq scaledegree \leq 7$.

    1. scaledegreefirst

  2. scaledegreesecond
  3. scaledegreethird
  4. scaledegreefourth
  5. scaledegreefifth

Diatonic pitch. This is the index of the pitch, counting the natural pitches (disregarding any alteration). The tonic in octave 0 has index 0. Integer. $diatonicpitch \geq 0$.

  6. diatonicpitchfirst
  7. diatonicpitchsecond
  8. diatonicpitchthird
  9. diatonicpitchfourth
  10. diatonicpitchfifth

Midi pitch. This is the midi note number of the pitch as defined in the midi standard. Integer.

  11. midipitchfirst
  12. midipitchsecond
  13. midipitchthird
  14. midipitchfourth
  15. midipitchfifth

Interval. The pitch interval in semitones with the preceding note. Integer.

  16. intervalfirst
  17. intervalsecond
  18. intervalthird
  19. intervalfourth
  20. intervalfifth

Center of Gravity. Defined in [8]. Indicates whether the tone has the potential to function as the tonic for the preceding tone. From [8]:

> "Intervals in which the second tone has the functional implication of being the center of gravity [...], were coded as 1; other intervals were coded as 0. Hence, the ascending minor second ($2^4 : 15$), perfect fourth ($2^2 : 3$), and minor sixth ($2^3 : 5$) and the descending major second ($2^3 : 9$), major third ($2^2 : 5$), tritone ($2^5 : 45$), perfect fifth ($2^1 : 3$), and major seventh ($2^3 : 15$) were coded as 1. All the other intervals were coded as 0."

Boolean.

  21. VosCenterGravityfirst
  22. VosCenterGravitysecond
  23. VosCenterGravitythird
  24. VosCenterGravityfourth
  25. VosCenterGravityfifth

Harmony as defined in [8] relates to the degree of dissonance of the pitch interval with the preceding note. From [8]:

> "Harmony was coded as follows: unison = 0; tritone = 1; minor-sixth/major-seventh = 2; major-second/minor-seventh = 3; minor-third/major-sixth = 4; major-third/minor-sixth = 5; perfect-fourth/perfect-fifth = 6; octave = 7."

The first "minor-sixth" should be "minor-second". Integer.

  26. VosHarmonyfirst
  27. VosHarmonysecond
  28. VosHarmonythird

29. VosHarmonyfourth
30. VosHarmonyfifth

The pitch contour relative to the previous note. Lower: '-', equal: '=', higher: '+'.

31. contourfirst
32. contoursecond
33. contourthird
34. contourfourth
35. contourfifth

Whether the pitch contour of the first three notes changes direction or not. Lateral movement is considered a distinct direction. Related to Narmour's sixth condition of closure [3, p. 11]. Boolean.

36. registraldirectionchange

The next feature is a more strict measure of change of direction. It is only True if the first interval is ascending and the second interval is descending or vice versa. In all other cases (also including lateral movement) the value is False. Boolean.

37. contourreversal

Whether the second note is preceded by a large interval (≥ 6 semitones) AND the third note is preceded by a small interval (≤ 4 semitones). Related to Narmour's fifth condition of closure [3, p. 11]. Boolean.

38. largetosmall

Whether the first two intervals are both ascending or both descending. Boolean.

39. isascending
40. isdescending

The difference between the highest and the lowest of the five notes in semitones. Integer.

41. ambitus

Whether the diatonic interval preceding the second note is a leap OR the diatonic interval preceding the third note is a leap. Any interval larger than a third is considered a leap. Boolean.

42. containsleap

Contour of several of the preceding features. For the pitch intervals, a distinction is made between the size and direction of the interval. The intervals are the intervals preceding the notes of the 5-gram. Less: '-', equal: '=', greater: '+'.

43. intervalsizefirstsecond
44. intervalsizesecondthird
45. intervalsizethirdfourth
46. intervalsizefourthfifth
47. intervaldirfirstsecond
48. intervaldirsecondthird
49. intervaldirthirdfourth
50. intervaldirfourthfifth
51. diatonicpitchfirstsecond
52. diatonicpitchsecondthird
53. diatonicpitchthirdfourth
54. diatonicpitchfourthfifth
55. VosHarmonyfirstsecond
56. VosHarmonysecondthird
57. VosHarmonythirdfourth
58. VosHarmonyfourthfifth

1.2   Elementary Rhythm Features

The 'numerator' and 'denominator' of the current meter at the first note of the 5-gram. Integer.

    59. meternumerator
    60. meterdenominator

The duration of the beat as determined by the meter-model of music21. Float.

    61. beatduration

The number of beats in one measure as determined by the meter-model of music21. Integer.

    62. beatcount

The metric weight (beatstrength) of the onset time note as computed by the meter-model of music21. This is determined by the meter and the position of the note within the measure. Float.

    63. beatstrengthfirst
    64. beatstrengthsecond
    65. beatstrengththird
    66. beatstrengthfourth
    67. beatstrengthfifth

The inter-onset-interval of the note in units of the duration of the beat. This is the time span from the onset of the note to the onset of the next note. Float.

    68. IOIbeatfractionfirst
    69. IOIbeatfractionsecond
    70. IOIbeatfractionthird
    71. IOIbeatfractionfourth
    72. IOIbeatfractionfifth

Whether the third note is longer than the second note, and the second note is longer than the first note. Boolean.

    73. durationcummulation

Whether the note starts on the beat or not. Boolean.

    74. onthebeatfirst
    75. onthebeatsecond
    76. onthebeatthird
    77. onthebeatfourth
    78. onthebeatfifth

Whether the offset of the third note is the at same position in the measure as the onset of the very first note of the melody. Boolean.

    79. completesmeasuresong

Whether the time-span between the onset of the first note of the melody and the onset of the third note of the 5-gram is dividable by the length of the beat. Boolean.

    80. completesbeatsong

First order contour of the beatstrength and the Inter Onset Interval. {less than, equal, greater than}.

    81. beatstrengthfirstsecond
    82. beatstrengthsecondthird
    83. beatstrengththirdfourth
    84. beatstrengthfourthfifth
    85. IOIbeatfractionfirstsecond

86. IOIbeatfractionsecondthird
87. IOIbeatfractionthirdfourth
88. IOIbeatfractionfourthfifth

1.3   Elementary Lyric Features

The following features are related to the lyric syllable that goes with a note. In the case of a melisma, the syllable is attached to the final note of the melisma. The reason is that we are interested in detecting the contribution of lyric properties to melodic closure: we want to recognise the final note of a phrase. The other notes in a melisma get value False for all of the features. For labeling non-content words, detection of rhyme, and determining the word stress, the methods as described in [7] are used.

Whether the syllable that goes with the note is stressed or not. Boolean.

89. wordstressfirst
90. wordstresssecond
91. wordstressthird
92. wordstressfourth
93. wordstressfifth

Whether the word that ends at the note rhymes with any other word in the lyrics. Only for content words. Boolean.

94. rhymesfirst
95. rhymessecond
96. rhymesthird
97. rhymesfourth
98. rhymesfifth

The time span between the onset of the third note of the 5-gram and the closest preceding note in the melody at which a rhyme word ends. Measured in number of notes (Integer), and number of beats (Float).

99. rhyme_noteoffset
100. rhyme_beatoffset

Whether the word that goes with the note is a content word or not. Content word: True, non-content word: False. Boolean.

101. noncontentwordfirst
102. noncontentwordsecond
103. noncontentwordthird
104. noncontentwordfourth
105. noncontentwordfifth

Whether a word ends at the note. Also True for words of one syllable. Boolean.

106. wordendfirst
107. wordendsecond
108. wordendthird
109. wordendfourth
110. wordendfifth

The position of the note in a melisma. First note: 'start', middle notes: 'in', final note or syllabic: 'end'.

111. melismastatefirst
112. melismastatesecond
113. melismastatethird

114. melismastatefourth
115. melismastatefifth

Contour of the word stress. Lower: '-', equal: '=', higher: '+'.

116. wordstressfirstsecond
117. wordstresssecondthird
118. wordstressthirdfourth
119. wordstressfourthfifth

1.4   Features from Previous Models

Information content of the note as computed by the IDyOM model [4]. Float.

120. informationcontentfirst
121. informationcontentsecond
122. informationcontentthird
123. informationcontentfourth
124. informationcontentfifth

The following features are related to the six conditions of closure as stated by Narmour [3, p. 11]:

"1. a rest, an onset of another structure, or a repetition interrupts an implied patterning;
2. metric emphasis is strong;
3. consonance resolves dissonance;
4. duration moves cumulatively (short note to long note);
5. intervallic motion moves from large interval to small interval;
6. registral direction changes (up to down, down to up, lateral to up, lateral to down, up to lateral, or down to lateral)."

For condition 1, no features are included because the rests are related to the ground truth (see Section 3.1.2 in the paper). For condition 3, no features are included because there is no information on harmony included in the data. The features are also included in the groups of elementary pitch and rhythm features.

36. registraldirectionchange
37. contourreversal
38. largetosmall
63. beatstrengthfirst
64. beatstrengthsecond
65. beatstrengththird
66. beatstrengthfourth
67. beatstrengthfifth
73. durationcummulation
43. intervalsizefirstsecond
44. intervalsizesecondthird
45. intervalsizethirdfourth
46. intervalsizefourthfifth
47. intervaldirfirstsecond
48. intervaldirsecondthird
49. intervaldirthirdfourth
50. intervaldirfourthfifth

the values for pitch proximity and pitch reversal as defined in [5]. Float.

125. pitchproximityfirst

126. pitchproximitysecond
127. pitchproximitythird
128. pitchproximityfourth
129. pitchproximityfifth
130. pitchreversalfirst
131. pitchreversalsecond
132. pitchreversalthird
133. pitchreversalfourth
134. pitchreversalfifth

Whether the Grouper algorithm [6] classifies the note as a phrase end. Boolean.

135. grouperfirst
136. groupersecond
137. grouperthird
138. grouperfourth
139. grouperfifth

The sum of the values for the quantised GTTM GPRs 2a, 2b, 3a, and 3d, as defined in [2]. Float.

140. gprsumfirst
141. gprsumsecond
142. gprsumthird
143. gprsumfourth
144. gprsumfifth

The Local Boundary Strength as computed by the LBDM [1]. Float.

145. lbdmfirst
146. lbdmsecond
147. lbdmthird
148. lbdmfourth
149. lbdmfifth

The contour of the information content. Lower: '-', equal: '=', higher: '+'.

150. informationcontentfirstsecond
151. informationcontentsecondthird
152. informationcontentthirdfourth
153. informationcontentfourthfifth

1.5   Features related to the Ground Truth

Whether the offset of the third note is the at same position in the measure as the onset of the first note of the phrase. Boolean.

154. completesmeasurephrase

Whether the time-span between the onset of the first note of the phrase and the onset of the third note of the 5-gram is dividable by the length of the beat. Boolean.

155. completesbeatphrase

The distance between the third note of the 5-gram and the beginning of the phrase, both as number of notes (Integer), and as number of beats (Float).

156. noteoffset
157. beatoffset

Whether the note is followed by a rest. Boolean.

2 Discovered Rule Sets

2.1 MTC – Elementary Pitch and Rhythm (El. NoLyr)

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Rule 0:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (IOIbeatfractionthird >= 1.25) and
  (meternumerator >= 4) and
  (IOIbeatfractionfirst <= 0.666667)
  => class=boundary (739.0/54.0)
Rule 1:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (IOIbeatfractionthird >= 1) and
  (IOIbeatfractionsecondthird = +) and
  (beatstrengthfourth >= 1)
  => class=boundary (705.0/88.0)
Rule 2:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (IOIbeatfractionthird >= 1.25) and
  (IOIbeatfractionfifth <= 1.5) and
  (VosHarmonyfourth >= 4) and
  (intervalsecond <= 0) and
  (diatonicpitchthird <= 30)
  => class=boundary (272.0/15.0)
Rule 3:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (beatstrengthfirst <= 0.5) and
  (IOIbeatfractionthird >= 1.333333) and
  (meternumerator >= 4) and
  (beatstrengthsecond <= 0.25)
  => class=boundary (136.0/14.0)
Rule 4:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (intervalfifth >= 0) and
  (IOIbeatfractionfifth <= 0.333333) and
  (midipitchfourth <= 67) and
  (beatduration >= 1.5)
  => class=boundary (102.0/12.0)
Rule 5:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (intervaldirthirdfourth = +) and
  (intervalfifth >= 0) and
  (diatonicpitchthirdfourth = =)
  => class=boundary (436.0/92.0)
Rule 6:
  (IOIbeatfractionthirdfourth = -) and
  (intervaldirthirdfourth = +) and
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  (IOIbeatfractionthird >= 1.666667) and
  (completesbeatsong = False)
  => class=boundary (206.0/17.0)
Rule 7:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (contourthird = -) and
  (intervalfifth >= 0) and
  (contourfirst = -) and
  (VosHarmonythird <= 3)
  => class=boundary (128.0/20.0)
Rule 8:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (IOIbeatfractionfifth <= 0.5) and
  (intervalfifth >= 2) and
  (midipitchfourth <= 68) and
  (VosHarmonyfirst <= 4)
  => class=boundary (87.0/10.0)
Rule 9:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (IOIbeatfractionfifth <= 0.5) and
  (IOIbeatfractionsecondthird = +) and
  (intervaldirthirdfourth = +) and
  (VosCenterGravitysecond = True)
  => class=boundary (113.0/19.0)
Rule 10:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (IOIbeatfractionthird >= 1.333333) and
  (IOIbeatfractionfirst <= 1) and
  (diatonicpitchthirdfourth = =)
  => class=boundary (154.0/47.0)
Rule 11:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (beatstrengthfirst <= 0.5) and
  (IOIbeatfractionsecondthird = +) and
  (contourfirst = +)
  => class=boundary (124.0/42.0)
Rule 12:
  (IOIbeatfractionthirdfourth = -) and
  (IOIbeatfractionthird >= 0.833333) and
  (beatstrengththird <= 0.5) and
  (intervalthird <= 0) and
  (IOIbeatfractionsecondthird = +) and
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  (beatstrengthfourth >= 0.5)
  => class=boundary (293.0/77.0)
Rule 13:
  (IOIbeatfractionthirdfourth = -) and
  (IOIbeatfractionthird >= 0.833333) and
  (intervalthird <= 1) and
  (beatstrengthfifth >= 1) and
  (IOIbeatfractionfirst <= 1) and
  (VosHarmonyfourth >= 6)
  => class=boundary (99.0/18.0)
Rule 14:
  (IOIbeatfractionthirdfourth = -) and
  (IOIbeatfractionthird >= 1.666667) and
  (IOIbeatfractionfifth <= 0.75) and
  (intervalfourth >= 0)
  => class=boundary (230.0/80.0)
Rule 15:
  (IOIbeatfractionthirdfourth = -) and
  (IOIbeatfractionthird >= 0.833333) and
  (completesmeasuresong = True) and
  (IOIbeatfractionsecond <= 0.666667) and
  (contoursecond = -) and
  (VosHarmonythird <= 2) and
  (intervalfourth >= 0)
  => class=boundary (37.0/6.0)
Rule 16:
  (IOIbeatfractionthirdfourth = -) and
  (IOIbeatfractionthird >= 1.25) and
  (beatcount <= 2) and
  (intervalfifth >= 0) and
  (diatonicpitchfifth <= 32)
  => class=boundary (214.0/65.0)
Rule 17:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (contourfirst = -) and
  (intervalfourth <= -4)
  => class=boundary (75.0/29.0)
Rule 18:
  (IOIbeatfractionthirdfourth = -) and
  (IOIbeatfractionthird >= 1) and
  (beatstrengththird <= 0.5) and
  (intervalthird <= 0) and
  (onthebeatfifth = True) and
  (IOIbeatfractionfifth <= 0.666667)
  => class=boundary (138.0/49.0)
Rule 19:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (IOIbeatfractionfifth <= 0.666667) and
  (intervalthird <= 1) and
  (IOIbeatfractionfirst <= 0.333333) and
  (beatstrengthfifth >= 1) and
  (VosHarmonysecond >= 3)
  => class=boundary (78.0/22.0)
Rule 20:
  (IOIbeatfractionthirdfourth = -) and
  (IOIbeatfractionthird >= 2.5) and
  (intervalfourth >= 0) and
  (IOIbeatfractionsecond <= 2)
  => class=boundary (86.0/14.0)
Rule 21:
  (IOIbeatfractionthirdfourth = -) and
  (IOIbeatfractionthird >= 1) and
  (completesmeasuresong = True) and
  (intervalthird <= 1) and
  (diatonicpitchfirst >= 33) and
  (IOIbeatfractionfirstsecond = +)
  => class=boundary (73.0/21.0)
Rule 22:
  (IOIbeatfractionthirdfourth = -) and
  (completesmeasuresong = True) and
  (IOIbeatfractionfifth <= 0.75) and
  (intervalthird <= 1) and
  (VosHarmonyfourth <= 0) and
  (intervalfirst <= 1)
  => class=boundary (180.0/84.0)
Rule 23:
  (IOIbeatfractionsecondthird = +) and
  (VosHarmonyfourth >= 4) and
  (IOIbeatfractionthird >= 2.5)
  => class=boundary (59.0/17.0)
Rule 24:
  (IOIbeatfractionthird >= 0.666667) and
  (completesmeasuresong = True) and
  (IOIbeatfractionfifth <= 0.75) and
  (intervaldirthirdfourth = +) and
  (contoursecond = -) and
  (intervalfifth >= -1)
  => class=boundary (198.0/79.0)
Rule 25:
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (diatonicpitchsecondthird = -) and
  (contourfirst = -) and
  (midipitchsecond <= 66) and
  (IOIbeatfractionthirdfourth = =) and
  (intervalfourth >= 7)
  => class=boundary (46.0/9.0)
Rule 26:
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (onthebeatthird = True) and
  (IOIbeatfractionfifth <= 0.75) and
  (beatcount <= 2) and
  (VosHarmonyfirst <= 3) and
  (scaledegreesecond <= 3)
  => class=boundary (187.0/75.0)
Rule 27:
  (completesmeasuresong = True) and
  (beatstrengththirdfourth = -) and
  (IOIbeatfractionfourthfifth = =) and
  (intervaldirthirdfourth = +) and
  (contourfirst = -)
  => class=boundary (177.0/81.0)
Rule 28:
  (IOIbeatfractionthird >= 0.666667) and
  (completesmeasuresong = True) and
  (IOIbeatfractionfifth <= 0.75) and
  (intervalthird <= 0) and
  (VosHarmonyfourth >= 4) and
  (midipitchsecond >= 72)
  => class=boundary (118.0/55.0)
Rule 29:
  (IOIbeatfractionthird >= 1.25) and
  (beatstrengththird <= 0.5) and
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(IOIbeatfractionfifth <= 1.5) and
(VosHarmonyfourth >= 4) and
(VosHarmonyfirst <= 3)
=> class=boundary (114.0/48.0)
Rule 30:
(IOIbeatfractionthird >= 0.666667) and
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(IOIbeatfractionfifth <= 0.75) and
(beatstrengththird <= 0.5) and
(IOIbeatfractionsecondthird = +) and
(intervaldirthirdfourth = +) and
(VosHarmonyfirst <= 3) and
(intervalsecond <= -2)
=> class=boundary (143.0/67.0)
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2.2 MTC – All Features (All)

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Rule 0:
(grouperthird = True) and
(rhymesthird = True) and
(lbdmthird >= 0.280929)
=> class=boundary (2413.0/149.0)
Rule 1:
(grouperthird = True) and
(wordendthird = True) and
(informationcontentfourth >= 7.252784) and
(contourthird = -) and
(lbdmfifth <= 0.159635)
=> class=boundary (641.0/33.0)
Rule 2:
(grouperthird = True) and
(wordendthird = True) and
(completesmeasuresong = True) and
(IOIbeatfractionthirdfourth = -) and
(rhyme_noteoffset >= 4)
=> class=boundary (761.0/74.0)
Rule 3:
(grouperthird = True) and
(rhymesthird = True) and
(completesmeasuresong = True)
=> class=boundary (399.0/75.0)
Rule 4:
(grouperthird = True) and
(wordendthird = True) and
(lbdmthird >= 0.201473) and
(informationcontentfourth >= 8.011659)
=> class=boundary (302.0/51.0)
Rule 5:
(rhymesthird = True) and
(beatstrengththird >= 0.5) and
(rhyme_noteoffset >= 4) and
(lbdmthird >= 0.151685) and
(intervaldirthirdfourth = +) and
(VosHarmonyfirstsecond = -)
=> class=boundary (101.0/13.0)
Rule 6:
(rhymesthird = True) and
(beatstrengththird >= 0.5) and
(rhyme_noteoffset >= 4) and
(lbdmthird >= 0.152494) and
(intervalthird <= 0) and
(noncontentwordfifth = True)
=> class=boundary (120.0/27.0)
Rule 7:
(rhymesthird = True) and
(beatstrengththird >= 0.5) and
(rhyme_noteoffset >= 4) and
(wordendsecond = False) and
(lbdmthird >= 0.0777) and
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(IOIbeatfractionsecondthird = -)
=> class=boundary (146.0/26.0)
Rule 8:
(rhymesthird = True) and
(beatstrengththird >= 0.5) and
(wordendsecond = False) and
(noncontentwordfourth = True) and
(midipitchthird <= 68) and
(IOIbeatfractionfifth <= 0.666667)
=> class=boundary (154.0/30.0)
Rule 9:
(grouperthird = True) and
(wordendthird = True) and
(wordendsecond = False) and
(completesmeasuresong = True)
=> class=boundary (222.0/58.0)
Rule 10:
(rhymesthird = True) and
(beatstrengththird >= 0.5) and
(rhyme_noteoffset >= 5) and
(beatstrengththird <= 0.5) and
(gprsumthird >= 0.0625) and
(lbdmthird >= 0.175048) and
(noncontentwordfourth = True)
=> class=boundary (62.0/7.0)
Rule 11:
(rhymesthird = True) and
(beatstrengththird >= 0.5) and
(rhyme_noteoffset >= 4) and
(IOIbeatfractionfifth <= 0.75) and
(beatstrengththird <= 0.5) and
(wordstressfifth = True) and
(gprsumthird >= 0.0625) and
(intervalfirst <= -2) and
(meterdenominator >= 4)
=> class=boundary (43.0/2.0)
Rule 12:
(rhymesthird = True) and
(onthebeatthird = True) and
(grouperthird = True) and
(wordendfirst = False)
=> class=boundary (68.0/22.0)
Rule 13:
(rhymesthird = True) and
(completesmeasuresong = True) and
(rhyme_beatoffset >= 2.25) and
(lbdmfifth <= 0.043461) and
(beatstrengthfourth <= 0.25)
=> class=boundary (111.0/30.0)
Rule 14:
(rhymesthird = True) and
(beatstrengththird >= 0.5) and
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  (rhyme_noteoffset >= 4) and
  (informationcontentthird <= 1.824062) and
  (pitchproximityfirst <= 1) and
  (informationcontentfourth >= 3.827067)
  => class=boundary (87.0/36.0)
Rule 15:
  (rhymesthird = True) and
  (completesmeasuresong = True) and
  (noncontentwordfourth = True) and
  (lbdmthird >= 0.045752) and
  (midipitchfourth <= 62)
  => class=boundary (46.0/12.0)
Rule 16:
  (rhymesthird = True) and
  (onthebeatthird = True) and
  (grouperthird = True) and
  (beatstrengthfirst >= 1)
  => class=boundary (20.0/7.0)
Rule 17:
  (rhymesthird = True) and
  (completesmeasuresong = True) and
  (rhyme_beatoffset >= 2.333333) and
  (lbdmfifth <= 0.226475) and
  (intervaldirfourthfifth = +) and
  (lbdmfirst >= 0.054977)
  => class=boundary (88.0/31.0)
Rule 18:
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  (IOIbeatfractionthirdfourth = -) and
  (wordendsecond = False) and
  (wordstressfourth = True) and
  (rhyme_noteoffset >= 6) and
  (rhyme_noteoffset <= 9) and
  (lbdmfifth <= 0.181148) and
  (informationcontentsecond <= 3.571858)
  => class=boundary (136.0/42.0)
Rule 19:
  (grouperthird = True) and
  (wordendthird = True) and
  (IOIbeatfractionthirdfourth = -) and
  (beatstrengththird <= 0.5) and
  (wordstressthirdfourth = +)
  => class=boundary (47.0/13.0)
Rule 20:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (wordstressfourth = True) and
  (grouperthird = True)
  => class=boundary (119.0/40.0)
Rule 21:
  (rhymesthird = True) and
  (IOIbeatfractionthird >= 0.666667) and
  (lbdmthird >= 0.26002) and
  (informationcontentfourth >= 6.399741) and
  (wordendfifth = True)
  => class=boundary (131.0/64.0)
```

2.3 EFSC – Elementary Pitch and Rhythm (El. NoLyr)

```
Rule 0:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (contourthird = -) and
  (beatstrengthfirst <= 0.5) and
  (IOIbeatfractionthird >= 1.333333) and
  (IOIbeatfractionfifth <= 1)
  => class=boundary (1284.0/41.0)
Rule 1:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (contourthird = -) and
  (intervalfifth >= 0) and
  (scaledegreefourth <= 5) and
  (meternumerator >= 4) and
  (beatstrengthfifth >= 0.25)
  => class=boundary (316.0/32.0)
Rule 2:
  (completesmeasuresong = True) and
  (IOIbeatfractionsecondthird = +) and
  (IOIbeatfractionfourthfifth = =) and
  (IOIbeatfractionthird >= 1.5) and
  (contoursecond = -)
  => class=boundary (446.0/44.0)
Rule 3:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (contourthird = -) and
  (intervaldirthirdfourth = +) and
  (intervalfifth >= 0) and
  (beatcount <= 2) and
```

```
  (VosCenterGravitysecond = True)
  => class=boundary (100.0/7.0)
Rule 4:
  (completesmeasuresong = True) and
  (IOIbeatfractionsecondthird = +) and
  (IOIbeatfractionfifth <= 1) and
  (IOIbeatfractionthird >= 1.333333) and
  (beatstrengthfourthfifth = -)
  => class=boundary (318.0/36.0)
Rule 5:
  (completesmeasuresong = True) and
  (IOIbeatfractionsecondthird = +) and
  (IOIbeatfractionfirstsecond = =) and
  (VosHarmonyfourth >= 6) and
  (intervalfifth >= 4)
  => class=boundary (113.0/14.0)
Rule 6:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (intervalfifth >= 0) and
  (beatstrengthfirst <= 0.5) and
  (beatstrengthfifth >= 0.5) and
  (beatstrengthfourth <= 0.25) and
  (scaledegreefourth <= 2)
  => class=boundary (68.0/5.0)
Rule 7:
  (completesmeasuresong = True) and
  (IOIbeatfractionsecondthird = +) and
  (IOIbeatfractionfifth <= 1) and
  (IOIbeatfractionthird >= 1.333333) and
  (beatstrengthfirst <= 0.5) and
```

```
  (beatcount <= 2)
  => class=boundary (90.0/5.0)
Rule 8:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (VosHarmonyfourth >= 4) and
  (contourfirst = -) and
  (scaledegreefourth <= 1)
  => class=boundary (96.0/11.0)
Rule 9:
  (completesmeasuresong = True) and
  (IOIbeatfractionsecondthird = +) and
  (IOIbeatfractionfourthfifth = =) and
  (intervaldirthirdfourth = +) and
  (beatstrengthfifth >= 1) and
  (VosHarmonysecond >= 2) and
  (intervalfourth <= 1)
  => class=boundary (53.0/4.0)
Rule 10:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfourthfifth = =) and
  (contourfirst = -) and
  (intervaldirthirdfourth = +) and
  (VosCenterGravitythird = True)
  => class=boundary (304.0/67.0)
Rule 11:
  (completesmeasuresong = True) and
  (IOIbeatfractionsecondthird = +) and
  (IOIbeatfractionfifth <= 1) and
  (contourfirst = -) and
  (intervalfifth >= -1) and
  (scaledegreefirst >= 4) and
  (intervaldirsecondthird = =)
  => class=boundary (133.0/24.0)
Rule 12:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (intervalthird <= -2) and
  (contourfirst = -) and
  (beatstrengthfirstsecond = +)
  => class=boundary (97.0/15.0)
Rule 13:
  (completesmeasuresong = True) and
  (IOIbeatfractionsecondthird = +) and
  (IOIbeatfractionfifth <= 1) and
  (VosHarmonyfirst <= 3) and
  (intervalfourth >= 0) and
  (VosHarmonyfirst >= 2)
  => class=boundary (577.0/215.0)
Rule 14:
  (completesmeasuresong = True) and
  (IOIbeatfractionsecondthird = +) and
  (IOIbeatfractionfourthfifth = =) and
  (midipitchthird <= 69) and
  (VosHarmonyfirst <= 3) and
  (VosHarmonyfourth >= 5)
  => class=boundary (90.0/22.0)
Rule 15:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfourthfifth = =) and
  (VosHarmonyfourth >= 4) and
```

```
  (beatstrengthfirst <= 0.25) and
  (IOIbeatfractionsecondthird = -) and
  (meternumerator >= 4)
  => class=boundary (55.0/1.0)
Rule 16:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfourthfifth = =) and
  (contourthird = -) and
  (IOIbeatfractionfirstsecond = +) and
  (beatstrengthfourth <= 0.25) and
  (IOIbeatfractionthird >= 0.666667)
  => class=boundary (65.0/16.0)
Rule 17:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfourthfifth = =) and
  (VosHarmonyfourth >= 4) and
  (IOIbeatfractionfirst <= 0.666667) and
  (contoursecond = -) and
  (midipitchthird <= 66) and
  (VosCenterGravityfifth = False)
  => class=boundary (47.0/8.0)
Rule 18:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfourthfifth = =) and
  (contoursecond = -) and
  (VosHarmonyfourth <= 0) and
  (scaledegreesecond >= 5) and
  (beatstrengthfourth <= 0.25)
  => class=boundary (54.0/2.0)
Rule 19:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (intervalthird <= 1) and
  (intervalfifth >= 0) and
  (intervaldirsecondthird = +) and
  (IOIbeatfractionfirst <= 0.5) and
  (scaledegreefirst >= 4)
  => class=boundary (63.0/8.0)
Rule 20:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfifth <= 0.75) and
  (contourthird = -) and
  (beatstrengthsecond >= 1) and
  (beatstrengthfourth <= 0.25) and
  (contourreversal = False)
  => class=boundary (89.0/17.0)
Rule 21:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (intervalfifth >= 0) and
  (VosHarmonyfourth >= 4) and
  (contourfirst = -) and
  (IOIbeatfractionfirstsecond = =) and
  (midipitchsecond <= 69)
  => class=boundary (38.0/6.0)
Rule 22:
  (completesmeasuresong = True) and
  (IOIbeatfractionthirdfourth = -) and
  (intervalfifth >= 0) and
  (scaledegreesecond >= 3) and
```

```
    (intervaldirthirdfourth = +) and
    (beatstrengthsecond >= 1)
    => class=boundary (77.0/27.0)
Rule 23:
    (completesmeasuresong = True) and
    (beatstrengththird >= 0.5) and
    (IOIbeatfractionfourthfifth = =) and
    (VosHarmonyfourth >= 4) and
    (contourfirst = -) and
    (intervaldirsecondthird = =) and
    (beatstrengthfifth >= 1)
    => class=boundary (74.0/22.0)
Rule 24:
    (completesmeasuresong = True) and
    (beatstrengththird >= 0.5) and
    (IOIbeatfractionfifth <= 0.75) and
    (VosHarmonyfourth >= 4) and
    (midipitchsecond >= 71) and
    (beatstrengthfourth >= 0.5) and
    (scaledegreefifth <= 3) and
    (diatonicpitchfirst >= 31)
    => class=boundary (52.0/9.0)
Rule 25:
    (completesmeasuresong = True) and
    (beatstrengththird >= 0.5) and
    (IOIbeatfractionfifth <= 0.75) and
    (beatcount <= 2) and
    (beatstrengthfirst <= 0.25) and
    (beatstrengthfourthfifth = +)
    => class=boundary (170.0/54.0)
Rule 26:
    (completesmeasuresong = True) and
    (IOIbeatfractionsecondthird = +) and
    (IOIbeatfractionfifth <= 1.5) and
    (VosHarmonyfirstsecond = +) and
    (ambitus <= 1)
    => class=boundary (160.0/59.0)
Rule 27:
    (completesmeasuresong = True) and
    (IOIbeatfractionsecondthird = +) and
    (VosHarmonyfourth >= 4) and
    (IOIbeatfractionfirstsecond = =) and
    (beatstrengthfourth >= 1)
    => class=boundary (77.0/29.0)
Rule 28:
    (completesmeasuresong = True) and
    (beatstrengththird >= 0.5) and
    (IOIbeatfractionfourthfifth = =) and
    (VosHarmonyfirst <= 3) and
    (diatonicpitchfourth <= 28) and
    (ambitus <= 1) and
    (VosHarmonyfirstsecond = +)
    => class=boundary (45.0/13.0)
Rule 29:
    (completesmeasuresong = True) and
    (beatstrengththird >= 0.5) and
    (IOIbeatfractionfourthfifth = =) and
    (VosHarmonyfirst <= 4) and
    (diatonicpitchthird <= 30) and
```

```
    (diatonicpitchsecond >= 30) and
    (beatstrengthsecond <= 0.25) and
    (VosHarmonyfirstsecond = +) and
    (diatonicpitchthird >= 30) and
    (scaledegreefourth >= 3)
    => class=boundary (45.0/8.0)
Rule 30:
    (completesmeasuresong = True) and
    (beatstrengththird >= 0.5) and
    (IOIbeatfractionfourthfifth = =) and
    (VosHarmonyfirst <= 4) and
    (VosHarmonyfourth >= 5) and
    (scaledegreefirst <= 4) and
    (ambitus <= 2)
    => class=boundary (170.0/67.0)
Rule 31:
    (completesmeasuresong = True) and
    (beatstrengththird >= 0.5) and
    (IOIbeatfractionfifth <= 0.75) and
    (intervalthird <= -2) and
    (beatcount <= 2) and
    (scaledegreethird >= 5)
    => class=boundary (68.0/28.0)
Rule 32:
    (completesmeasuresong = True) and
    (IOIbeatfractionthirdfourth = -) and
    (intervalthird <= -2) and
    (scaledegreefourth <= 1)
    => class=boundary (77.0/31.0)
Rule 33:
    (completesmeasuresong = True) and
    (beatstrengththird >= 0.5) and
    (VosHarmonyfourth >= 4) and
    (intervalfourth <= -4) and
    (diatonicpitchfourth <= 25) and
    (onthebeatfourth = False)
    => class=boundary (65.0/19.0)
Rule 34:
    (IOIbeatfractionsecondthird = +) and
    (IOIbeatfractionthird >= 1.5) and
    (beatstrengththird <= 0.5) and
    (intervalfourth >= 0)
    => class=boundary (379.0/122.0)
Rule 35:
    (completesmeasuresong = True) and
    (IOIbeatfractionthird >= 0.666667) and
    (IOIbeatfractionfifth <= 1.5) and
    (contourfirst = -) and
    (VosHarmonyfourth >= 4) and
    (beatstrengthfirst <= 0.25)
    => class=boundary (133.0/47.0)
Rule 36:
    (completesmeasuresong = True) and
    (beatstrengththird >= 0.5) and
    (IOIbeatfractionfourthfifth = =) and
    (midipitchfirst >= 68) and
    (scaledegreefourth <= 3) and
    (scaledegreefourth >= 3) and
    (VosHarmonyfirst <= 2)
    => class=boundary (126.0/60.0)
```

2.4 EFSC – All Features (NoLyr)

```
Rule 0:
  (grouperthird = True) and
  (completesmeasuresong = True) and
  (lbdmthird >= 0.3675)
  => class=boundary (2823.0/130.0)
Rule 1:
  (completesmeasuresong = True) and
  (grouperthird = True) and
  (IOIbeatfractionthirdfourth = -)
  => class=boundary (849.0/136.0)
Rule 2:
  (completesmeasuresong = True) and
  (pitchproximityfourth >= 3) and
  (grouperthird = True) and
  (contourfirst = -)
  => class=boundary (180.0/29.0)
Rule 3:
  (completesmeasuresong = True) and
  (grouperthird = True) and
  (IOIbeatfractionsecondthird = +) and
  (pitchproximityfirst <= 3) and
  (IOIbeatfractionfifth <= 1)
  => class=boundary (143.0/29.0)
Rule 4:
  (completesmeasuresong = True) and
  (grouperthird = True) and
  (lbdmthird >= 0.134601) and
  (informationcontentthirdfourth = +) and
  (pitchproximitysecond <= 2)
  => class=boundary (44.0/12.0)
Rule 5:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfourthfifth = =) and
  (contourthird = -) and
  (contourfirst = -) and
  (intervalfifth >= 0) and
  (beatstrengthfifth >= 1)
  => class=boundary (214.0/49.0)
Rule 6:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfourthfifth = =) and
  (intervaldirthirdfourth = +) and
  (isdescending = True) and
  (contourfourth = =)
  => class=boundary (93.0/20.0)
Rule 7:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (lbdmfifth <= 0.175) and
  (contourthird = -) and
  (beatcount <= 2) and
  (lbdmsecond >= 0.09373) and
  (gprsumsecond >= 0.375)
  => class=boundary (156.0/29.0)
Rule 8:
  (completesmeasuresong = True) and
  (lbdmthird >= 0.125) and
  (lbdmfifth <= 0.11896) and
  (beatstrengththird >= 0.5) and
  (intervalfifth >= 0) and
  (beatcount <= 2) and
  (pitchproximityfourth >= 4)
```

```
  => class=boundary (99.0/27.0)
Rule 9:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (lbdmfifth <= 0.405343) and
  (pitchproximityfirst <= 3) and
  (pitchproximityfourth >= 3) and
  (diatonicpitchthird <= 30) and
  (lbdmthird >= 0.175) and
  (intervalfifth >= 2)
  => class=boundary (138.0/39.0)
Rule 10:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (pitchproximityfirst <= 3) and
  (grouperthird = True) and
  (lbdmfifth <= 0.053061) and
  (intervalthird <= 1) and
  (lbdmfirst >= 0.009545)
  => class=boundary (49.0/7.0)
Rule 11:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (lbdmfifth <= 0.338097) and
  (pitchproximityfirst <= 3) and
  (intervaldirthirdfourth = +) and
  (lbdmthird >= 0.210598) and
  (VosCenterGravitythird = True) and
  (diatonicpitchthird <= 28) and
  (lbdmsecond >= 0.046053) and
  (lbdmfirst <= 0.227273) and
  (IOIbeatfractionfifth >= 0.333333)
  => class=boundary (51.0/8.0)
Rule 12:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (lbdmfifth <= 0.405343) and
  (contourthird = -) and
  (informationcontentfirst <= 2.304833) and
  (beatstrengthfirst <= 0.25) and
  (lbdmfirst >= 0.078509)
  => class=boundary (65.0/15.0)
Rule 13:
  (grouperthird = True) and
  (informationcontentfourth >= 9.936357)
  => class=boundary (602.0/102.0)
Rule 14:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (lbdmfifth <= 0.338097) and
  (pitchproximityfirst <= 3) and
  (pitchproximityfourth >= 3) and
  (diatonicpitchthird <= 30) and
  (scaledegreethird >= 3) and
  (IOIbeatfractionfirst <= 0.75) and
  (lbdmfourth <= 0.05403)
  => class=boundary (128.0/45.0)
Rule 15:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfourthfifth = =) and
  (intervaldirthirdfourth = +) and
  (diatonicpitchfirstsecond = -) and
  (informationcontentthirdfourth = +) and
```

```
(VosCenterGravityfifth = False)
=> class=boundary (111.0/43.0)
Rule 16:
  (completesmeasuresong = True) and
  (lbdmthird >= 0.125) and
  (lbdmfifth <= 0.207617) and
  (beatstrengththird >= 0.5) and
  (intervalfifth >= 0) and
  (beatstrengthfourthfifth = -) and
  (lbdmsecond <= 0.068445) and
  (ambitus >= 1) and
  (scaledegreesecond >= 3)
=> class=boundary (84.0/28.0)
Rule 17:
  (completesmeasuresong = True) and
  (lbdmfifth <= 0.329891) and
  (beatstrengththird >= 0.5) and
  (pitchreversalfirst >= 0) and
  (beatstrengthfirst <= 0.25) and
  (beatstrengthfifth >= 1) and
  (IOIbeatfractionsecond >= 2)
=> class=boundary (93.0/17.0)
Rule 18:
  (completesmeasuresong = True) and
  (beatstrengththird >= 0.5) and
  (pitchproximityfirst <= 3) and
  (beatcount <= 2) and
```

```
(gprsumfirst >= 0.6875) and
(lbdmfifth <= 0.05)
=> class=boundary (70.0/27.0)
Rule 19:
  (completesmeasuresong = True) and
  (grouperthird = True) and
  (midipitchfifth >= 71) and
  (lbdmsecond >= 0.03227) and
  (intervalfirst <= 0)
=> class=boundary (51.0/13.0)
Rule 20:
  (completesmeasuresong = True) and
  (lbdmfifth <= 0.479864) and
  (beatstrengththird >= 0.5) and
  (pitchproximityfirst <= 3) and
  (pitchproximityfourth >= 4) and
  (lbdmsecond >= 0.070175) and
  (containsleap = False) and
  (lbdmfifth >= 0.089286)
=> class=boundary (65.0/20.0)
Rule 21:
  (completesmeasuresong = True) and
  (lbdmfifth <= 0.359573) and
  (beatstrengththird >= 0.5) and
  (pitchreversalfirst >= 0) and
  (intervalthird <= -2) and
  (scaledegreesecond >= 6) and
  (gprsumfifth >= 0.3)
=> class=boundary (95.0/44.0)
```

2.5   CHOR – Elementary Pitch and Rhythm (El. NoLyr)

```
Rule 0:
  (completesmeasuresong = True) and
  (intervaldirthirdfourth = +) and
  (IOIbeatfractionfourthfifth = =) and
  (IOIbeatfractionfirstsecond = +) and
  (beatstrengththirdfourth = -)
=> class=boundary (257.0/10.0)
Rule 1:
  (completesmeasuresong = True) and
  (IOIbeatfractionthird >= 2) and
  (IOIbeatfractionfourthfifth = =) and
  (beatstrengthsecond <= 0.25)
=> class=boundary (368.0/4.0)
Rule 2:
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (contourfourth = +) and
  (contourfirst = -)
=> class=boundary (255.0/42.0)
Rule 3:
  (completesmeasuresong = True) and
  (VosHarmonyfourth <= 0) and
  (IOIbeatfractionfifth <= 1) and
  (beatstrengthfourth <= 0.25)
=> class=boundary (320.0/79.0)
Rule 4:
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (IOIbeatfractionfirstsecond = +) and
  (diatonicpitchthird <= 30) and
```

```
(contoursecond = -)
=> class=boundary (47.0/3.0)
Rule 5:
  (completesmeasuresong = True) and
  (intervalfourth >= 0) and
  (beatstrengththird >= 0.5) and
  (IOIbeatfractionfourthfifth = =) and
  (VosHarmonyfifth <= 0) and
  (VosCenterGravityfourth = False)
=> class=boundary (40.0/3.0)
Rule 6:
  (IOIbeatfractionthird >= 2) and
  (intervaldirthirdfourth = +) and
  (beatstrengthfirstsecond = +) and
  (beatcount >= 4)
=> class=boundary (137.0/5.0)
Rule 7:
  (IOIbeatfractionthird >= 2) and
  (intervaldirthirdfourth = +) and
  (VosHarmonyfourth >= 4)
=> class=boundary (50.0/6.0)
Rule 8:
  (completesmeasuresong = True) and
  (VosHarmonyfourth >= 4) and
  (intervaldirfirstsecond = -) and
  (intervalthird <= 1)
=> class=boundary (144.0/67.0)
Rule 9:
  (IOIbeatfractionthird >= 3) and
  (IOIbeatfractionfourthfifth = =)
```

```
                                               Rule 11:
  => class=boundary (40.0/4.0)                   (completesmeasuresong = True) and
Rule 10:                                         (beatstrengththirdfourth = -) and
  (IOIbeatfractionthird >= 3) and                (IOIbeatfractionfirstsecond = +) and
  (intervalfourth >= 0)                          (beatstrengthsecond >= 0.5)
  => class=boundary (21.0/6.0)                   => class=boundary (73.0/20.0)
```

2.6   CHOR – All Features (NoLyr)

```
Rule 0:                                            (pitchproximityfirst <= 4) and
  (grouperthird = True) and                        (beatstrengthfifth >= 1) and
  (completesmeasuresong = True) and                (gprsumsecond <= 0)
  (IOIbeatfractionfourthfifth = =) and             => class=boundary (312.0/84.0)
  (lbdmthird >= 0.165828) and                    Rule 5:
  (intervalthird <= 2)                             (completesmeasuresong = True) and
  => class=boundary (548.0/6.0)                    (grouperthird = True) and
Rule 1:                                            (IOIbeatfractionfourthfifth = =) and
  (completesmeasuresong = True) and                (diatonicpitchfirstsecond = -)
  (intervaldirthirdfourth = +) and                 => class=boundary (41.0/16.0)
  (grouperthird = True)                          Rule 6:
  => class=boundary (287.0/22.0)                   (IOIbeatfractionthird >= 2) and
Rule 2:                                            (intervaldirthirdfourth = +) and
  (completesmeasuresong = True) and                (beatstrengthfirstsecond = +)
  (beatstrengththirdfourth = -) and                => class=boundary (129.0/16.0)
  (IOIbeatfractionfirstsecond = +) and           Rule 7:
  (beatstrengthsecond >= 0.5)                      (completesmeasuresong = True) and
  => class=boundary (259.0/27.0)                   (beatstrengthsecondthird = +) and
Rule 3:                                            (groupersecond = True) and
  (grouperthird = True) and                        (intervalfifth >= -1)
  (intervalfourth >= 0) and                        => class=boundary (44.0/8.0)
  (lbdmthird >= 0.412654)                        Rule 8:
  => class=boundary (86.0/6.0)                     (beatstrengththird >= 0.5) and
Rule 4:                                            (grouperthird = True) and
  (completesmeasuresong = True) and                (gprsumsecond <= 0) and
  (beatstrengthsecondthird = +) and                (informationcontentfourth >= 6.187956) and
  (IOIbeatfractionfifth <= 1) and                  (VosHarmonyfifth <= 4)
  (intervalfourth >= 0) and                        => class=boundary (67.0/20.0)
```

3   Examples

This section presents 50 random examples for each data set, indicating the predicted class label of the 5-grams. A true positive is indicated with blue notes (only the fist three of the 5-gram are colored) and the index number of the rule. A false positive is indicated with red notes and the index of the rule, and a false negative is indicated with red notes and the label "Miss". True negatives are not indicated. The rule sets from the previous section have been used for classification. The ground truth phrase endings are indicated with fermatas.

3.1 MTC – Elementary Pitch and Rhythm (El. NoLyr)

NLB070040_01

Een boer en een boer en een e - de - le.boer en een boer al uit de lan - den_ Een boer en een boer en een
Miss rule_2

e - de - le.boer en een boer al uit de lan - den_ Die had er zijn wa - gen.met hout be - laan_ Die hij zou uit - ver-
Miss rule_10 Miss

ko - pen_gaan En op de mar - rekt.daar kwam er hij te lan - de_ En op de mar - rekt.daar kwam er hij te lan - de._
Miss Miss

NLB070744_01

Mijn tamboerijn.klinkt heel de dag, Op het rinklen.van de maat Heb ik gezon - gen_en gedanst.Langs markt en plein of
Miss rule_11 rule_13 rule_5

straat Men gaf niet veel, want menigeen.Zag mij minachtend.aan; En sprak: Zeg deerne.kunt gij niet Als ik uit werken.gaan.
rule_15 rule_11 rule_15

NLB071438_01

Lui - lak_bed-dezak,_ sta om ne-gen_u-ren.op. Negen.uur om hal-lef.tien dan is de luilak.nog niet te zien.
rule_1 rule_1

NLB073226_01

Jaap sta stil, Jaap sta stil, Hoor nu wat ik je zeg - gen.wil. En waar-om.zou ik stil - le.staan, Ik heb van m'n le-ven.geen
rule_1 rule_1 Miss Miss

kwaad gedaan._ Ik zei d'r van Jaap, ik zei d'r van Jaap, Ik zei d'r van Jaapje_sta stil. Hoe - ra,_ hoe-ra_ voor
Miss Miss rule_16 Miss

Jaap - je,_ Dat was een aar - dig_ knaap - je._ Ik zei d'r van Jaap, ik zei d'r van Jaap, Ik zei d'r van Jaap sta stil.
Miss Miss

NLB073672_03

Mijn doch-ter_ die is ern-stig_ ziek Vanaf.haar slaap - ka - mer.komt zij niet Zij heeft er zo -
Miss rule_16 Miss

waar_ een klein kind - je_ ont - van-gen_ en zij weet er van geen scho - ne.jonk-man-ne__
rule_5

NLB073833_01

Su - ker-jont-jen.lich tÃ³ slie-pen.Moai de hÃ³ - le.op 'e dis Tuf ter-noai.dÃ³ rup - te.Tryntjen.'k Leauw, dot ik in kuÃ©-ke_
Miss rule_5 Miss rule_5

mis! Lyt - je.rÃºn, Lyt - je_rÃºn Troai kear rewm om Folkerts.schÃºn Lyt - je.rÃºn, Lyt - je_rÃºn Troai kear rewm om Folkerts.schÃºn.
Miss rule_7 Miss

NLB074213_01

Er was een boer met zo'n groot ge - tal___ vier zwa - re_ koe - ien_ op de stal Hij heeft z'al aan de
rule_0 rule_0

sla-ger.verkocht_ en naar de sla - ger_ toe - gebracht_het geld er-voor_ ont-vang - en.met ver - lang - en._
Miss Miss

NLB074247_01

Daar was een meis - je_ die was zwaar be - laan_ die met haar e - zel.naar de markt zou gaan
rule_1 rule_1 rule_14

maar gro - te_ tijd wat vond zij op haar we - gen_ een val - se_ gre - na - dier.die kwam haar te - gen._
rule_20

NLB074457_01

Vrienden.ik zal je een kluchtje.verha-len.Luister.uit wat een ra-re.grap Van een lo - ze.schippersvent_ op zijn schip was hij bekend_
Miss rule_1 rule_1 rule_1
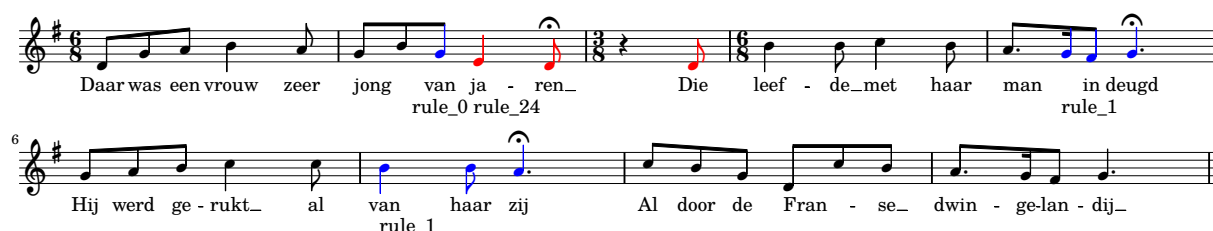
Hij kan er zei-len.ja bij de nacht ja zo goed als op den dag Hij kan er zei-len.ja bij de nacht ja zo goed als op den dag
Miss rule_1 Miss

NLB074525_01

Hoe kan er soms toch een braaf hartje lij-den, Hoe wonder is God toch in zijn bestuur. Zo als de zaak dat wij hier gaan ver -
rule_0   rule_0   rule_0

klaren, Onlangs geschied bij de Franse karossiers. Oscar een bra-ve koopmans zoon ge-heten, Viel in het lot en moest worden sol -
rule_0   rule_0   rule_0

daat.   Had maar ééÃ©n broe-der die voor priester stu - deer-de. Bleef gans al - leen met zij - ne moe-der op   aard.
rule_0

NLB075005_01

Daar was een vrouw zeer   jong van ja - ren   Die   leef - de met haar   man   in deugd
rule_0 rule_24   rule_1

Hij werd ge - rukt   al   van haar zij   Al door de Fran - se dwin - ge-lan - dij
rule_1

NLB075090_01

En ons Mie - ke had e-ne vrij - er. Hanne-ke hoep, Hanne-ke hoep. En ons Mie - ke had e-ne vrij - er. Hanne-ke hoep, Hanne - ke
Miss   rule_26   Miss   rule_22

hoep. En ons Mie - ke had e-ne vrij - er. En dat was enen hon-ger - lij - der. Hanne-ke hoep en Hanne-ke hoep, en Hanne-ke hoep.
Miss   Miss

NLB075231_01

Ik ben laatst maal op e - nen keer Naar mijn schoonlief ge - gaan. Ik deed bij haar mijn klachten teer maar ik vond geen troost bij
rule_5   rule_0   rule_5   rule_0

haar.   Of ik schoon praatt' of niet   Of dat ik klaag al mijn verdriet. Hoe kan het zijn hoe kan het zijn   Schoon-
rule_16   Miss   rule_0

lief dat gij er mij laat in pijn.   Hoe kan het zijn hoe kan het zijn   Schoonlief dat gij er mij laat in pijn.
rule_14   rule_0

NLB075412_01

Luistert,oud en jong van ja - ren. Die nog leeft in de-ze.tijd 't geen ik u wil o-penba-ren.Van een groot mis-da-digheid._
Miss   rule_12   Miss

NLB075452_01

Er liep een meis-je.langs de straat Al met een mand vol ei-e-ren.Dieholle-die,.die holle-da,.Dieholle-die,.die-holle-da._
rule_2   rule_5   rule_2

NLB075575_01

De we ver.dat is e - ne_ aar-di-ge.kloot Hij schoot zien vrouw met de schietspoel.dood Tra-la - la - la-la - la - la____ La-
rule_22   Miss   rule_0

la - la - la - la - la - Wat helpt nu mij-ne.droef - heid____   Zij is haar le - ven_ kwijt
rule_0   rule_0

NLB075678_02

Is dat dan geen non-de-dju_   Ja, dÃ¨ is e-ne_non-de-dju_ De non-de-dju_en een pa-ra-plu._   O, die
rule_1   Miss   Miss rule_16

sjeu - ne,_   o   die sjeu - ne_   O, die sjeu - ne_ pa - ra - plu._
rule_16   Miss   rule_16

NLB075825_01

Er kwam er eens een e - de - le.heer Die bij een schooi-ster.kwam ver - ke - ren.Hij kwam klop-pen aan de deur Sprak er
                                    Miss   Miss   Miss

met een droef getreur:.Juffrouw.'k kom u   een woord-je vra - gen. Sta ik bij u in be - ha - gen?.Neen, gij een
                rule_30   rule_14   rule_12   rule_12   rule_27

heer zo hoog van staat Die mij zo ver te bo ven.gaat. Neen, gij een heer zo hoog van staat Die mij zo ver te bo ven.gaat. Ik zal u om -
            Miss   rule_27   Miss   Miss

hangen.met di - a-mant.Gij zijt de schoonste.van het land Ik zal u om - hangen.met di - a-mant.Gij zijt de schoonste.van het land
            Miss   Miss   Miss

NLB076591_01

Al - tijd.in de wind al - tijd.in de wind, Zo liep ik naar dat schipperskind.Al - tijd.in de wind al - tijd.in de wind, Zo liep ik naar dat
            rule_26   rule_26   rule_26   Miss

schipperskind.Hoe - zee,_ hoe - za,_ weer een an-der,.weer een an-der,.Hoe - zee,_ hoe - za,_ weer een an-der ja   ja.
            Miss   Miss
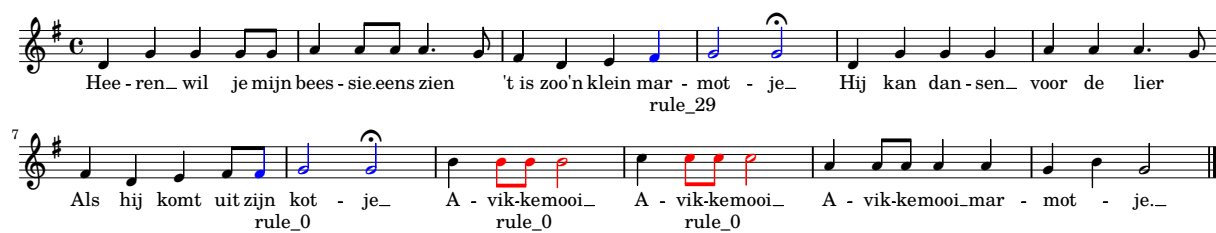
NLB111748_01

A - men,.a - men_wij zijn hier te - za - men.Om te drin-ken.een glaas-je wijn De   bruid die moet be - ta - len.Ge -
            Miss   rule_5   Miss   rule_12

dronken.moet er   zijn Dat is eenmaal.ge - dron-ken.Dat is een - maal.Hans. Dat is tweemaal.ge - dron-ken.Dat is twee - maal_
rule_5   Miss   rule_5   Miss   rule_5

Hans. Dat is driemaal_ge - dron-ken.Dat is drie - maal_ Hans. Van li derom,.la derom,_ lo - rom.Van vi - va_ la France.
            Miss   rule_13   Miss
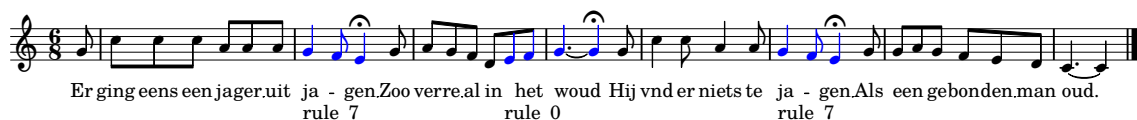
NLB112489_01

Hee - ren_ wil je mijn bees - sie.eens zien   't is zoo'n klein mar - mot - je_   Hij kan dan - sen_ voor de   lier

rule_29
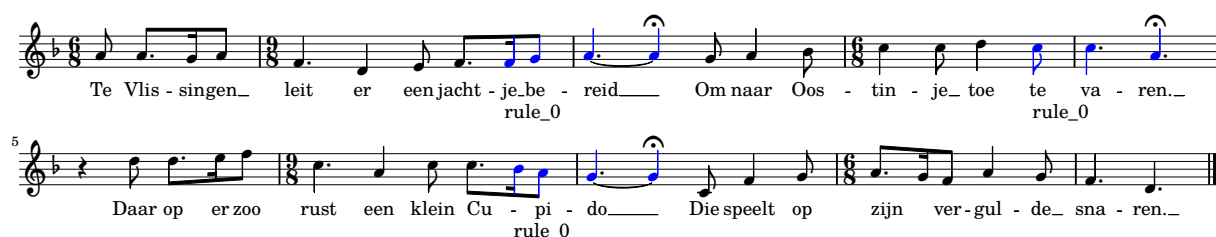
Als hij komt uit zijn kot - je_   A - vik-kemooi_   A - vik-kemooi_   A - vik-kemooi_mar - mot - je._

rule_0   rule_0   rule_0

NLB112521_01

Er ging eens een jager,uit ja - gen.Zoo verre.al in het woud Hij vnd er niets te ja - gen.Als een gebonden,man oud.

rule_7   rule_0   rule_7
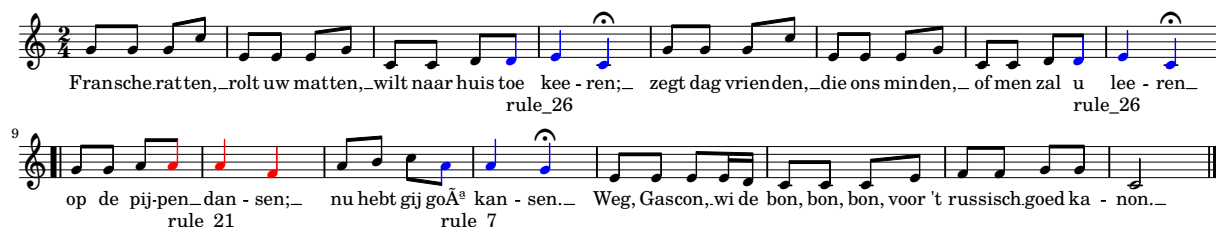
NLB113195_01

Te Vlis - singen_   leit   er   een jacht - je_be - reid____   Om naar Oos - tin - je_ toe te va - ren._

rule_0   rule_0

Daar op   er zoo   rust een klein Cu - pi - do____ Die speelt op   zijn ver - gul - de_ sna - ren._

rule_0

NLB123212_01

Fransche.rat ten,_rolt uw matten,_wilt naar huis toe   kee - ren;_ zegt dag vrienden,_die ons minden,_ of men zal u   lee - ren_

rule_26   rule_26

op de pij-pen_ dan - sen;_   nu hebt gij goÃª kan - sen._   Weg, Gascon,.wi de bon, bon, bon, voor 't russisch.goed ka - non._

rule_21   rule_7

NLB123265_01

Ge - kwetst.ben   ik van bin - nen,_ deur - wond.mijn hert zoo   zeer,   van   u - wer_ gantscher.min - nen,_ ge -

Miss   rule_1   Miss

kwetst.zoo lang zoo meer.   Waer   ik my wend, waer ik my keer,   'k en kan ge - rus-ten.dach noch nach - te;_

rule_20   Miss   rule_20

waer ik my wend, waer ik my keer, gy zijt al - leen_____ in mijn ge - dach - te._

Miss   rule_28   rule_0

NLB123278_01
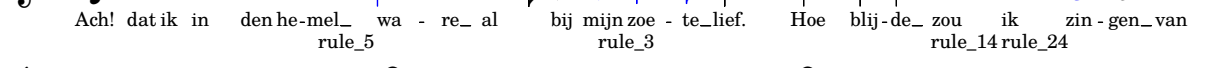
Schoon lief, hoe ligt gy hier en slaept in uwen eersten droome?. Wil opstaen en den mei ontfaÃªn,. hy staet hier al   zoo schoone.
rule_9   Miss   rule_10   rule_8

NLB124565_01

Ach! dat ik in   den he-mel_   wa - re_ al   bij mijn zoe - te_lief.   Hoe blij-de_ zou ik   zin - gen_ van
rule_5   rule_3   rule_14 rule_24

Je - sus,_mij - ne_   minne, minne, min, van   Je - sus_mij - ne_   minne, minne, min en mijn brui-degom is   er - in._
Miss   rule_8

NLB124585_01

Wat zullen on-ze pa-trio-tjes e - ten,. als zij in 't leger_zijn?   Een kieksje aan 't spit ge - ste - ken,. dat zullen on-ze pa-trio-tjes
Miss   rule_3   rule_5

e - ten. Ka-pitein,. lui-tenant,. vaan le-rig,. sergeant,. tamboer,. korporaal,. pa-tri-otjes al-temaal,. kame-ra - den,. kame-ra - den._
rule_7   rule_22   Miss   rule_15   rule_9

NLB124615_01

Achter rozen daletje. zoo staat er een boompje,. waar op zal zingen de nachte - gaal._
Miss

NLB124681_01

We-duwvrouwtjes_al - te - ma - le,. stelt uw' droefheid_aan den kant.   Ik zal u wat gaan ver - ha - len_ge-schied in het
Miss   rule_1   Miss

Vlaan-der - land,._   van een' we - duwvrouw,_he - las!_   die haar man ge - stor-ven_ was   ze - ven_ we - ken_ en drie
rule_1   rule_1   Miss   Miss

da - gen.. Hoort eens hoe al - daar kwam vra - gen_een schoenma - ker_naar lo - gist,_   die kwam rei - zen_van Pa - rijs._
Miss   rule_1

NLB124761_01

Mietje Wantj' is altijd ziek, geheel de week en 's zondags niet. 's Zondags staat zij aan haar deur om te verwachten haar serviteur,
rule_1 rule_1 rule_1 rule_1

serviteur met twee roo kaken. Maatje, wilt gij mijn broek vermaken? Roekedoekdoek roekedoekdoek, kus de bil-le van As-sebroek.
Miss Miss rule_1 rule_1

NLB126399_01

Arm en nedrig is mijn hutje, Maar de rust en tee-derheid Woont er in; bij el-ken voetstap, Teekent zich tevredenheid. Blijft de
rule_14 rule_3 rule_2 rule_3

lief-de bij ons wonen, Die ons niet dan bloemen biedt, Dan be-nij ik zelfs den vorsten Hunnen troon of glo-rie niet.
rule_0 rule_0 rule_0

NLB127020_01

De vrijheid was mijn grootst ge - noe - gen, Zij was mij meer dan schatten waard; Mij naar eens an-ders wil te
Miss rule_5 Miss

voe - gen. Steeds al-toos met mijn woes - ten aard. Niets kon mij aan een plaats ver - bin - den, Ik ging dan
Miss Miss

hier, dan der-waarts heen. Maar nooit kon ik 't ge-noe-gen vin - den, Want al-toos was ik maar al - leen.
rule_14 Miss

NLB127106_01

Waandlaar! ziet gij in de da-len, Aan den oe-ver van den vliet, 't Hemelsch blau - we
Miss rule_1

bloem-pje pra-len? O vergeet dat bloem-pje niet, O vergeet dat bloem-pje niet.
Miss Miss rule_29

NLB127126_01

De ka bels.los, de zeilen.op, Dat gaat er op een va-ren;_   Al wa-ren.wij Sin - jeurs.aan wal, Ons hart leï® in de ba-ren:_ Een
            rule_5   rule_7   rule_5   rule_5

Hollandsch.kind, dat is bekend,.Die vindt in Zee zijn e - lement,_ jo - ho,.joho,_ jo - ho,.joho!.Die vindt in Zee zijn   e - lement!_
            rule_13   rule_13   rule_11   rule_8

NLB133423_01

Gul - de.ty - den!_ als men de gemeenten.zag   sich verbly - den_ op den sin - te_Martens.dag,   als de kin-ders_
            rule_1   rule_8   rule_1

al - le.soort van lek - kernien,_   geld en spy - ze.voor   de   sie - ke.en arm' lien.   Wierd op den dag van he - den_
            rule_1   rule_1   rule_1   rule_1

aen een ie - der.toe - be - reyd,_   als geschenken_ter ge - den - ken_   van Marti - nus.mild - saemheyd._
            rule_14   rule_1
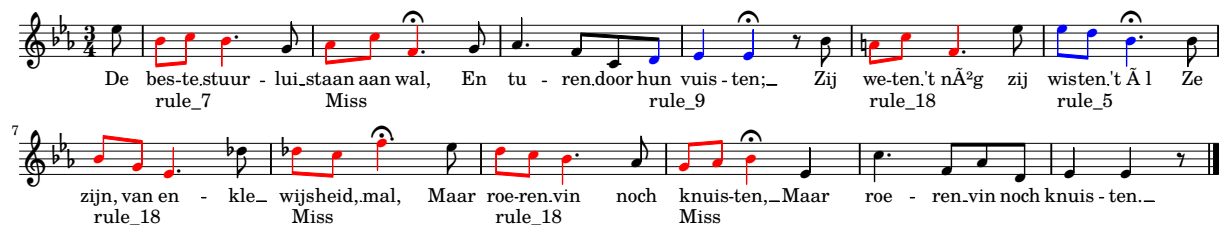
NLB134063_01

Dat Mel po-me-na_ de-ze.droeve_dood be -   schreyt.Dezer.tyd, Dat Melpo-me - na_ de-ze.droe-ve_dood be - schreyt._ Maer
            Miss   rule_26   rule_9

Cli - o.moet be-schry-ven_het kloek en vroom be - dry - ven_Van d'heer ad-mi - rael.Bart vermaerd,_Zeer vroom van   aerd.
            rule_26

NLB139369_01

De bes-te.stuur - lui_staan aan wal, En tu - ren.door hun vuis - ten;_ Zij we-ten.'t nÃ²g   zij wisten.'t Ã l   Ze
            rule_7   Miss   rule_9   rule_18   rule_5

zijn, van en - kle_ wijsheid,.mal, Maar roe-ren.vin   noch knuis-ten,_Maar   roe - ren_vin noch knuis - ten._
            rule_18   Miss   rule_18   Miss

NLB139503_01

Schild wachtje,.wend je hoofd zoo niet,   't Is Oranje,.'t blijft Oranje,.'t Is Oranje,.'t blijft Oranje!.Of je nu schik hebt of verdriet,
rule_1   Miss   rule_1

Toch is 't Oran-je,_ dat je ziet!   't Is Oranje,.'t blijft Oranje,_'t Is Oranje,.'t blijft Oranje!_'t Is O - ran-je_ bo - ven!_
rule_0   Miss

NLB140078_01

Hebde.van de ze-ven,.de ze-ven,.de ze ven,.Hebde.van de ze-vensprong.niet gehoord?.Ze zeggen.dat ik niet dansen.en kan, ik kan
rule_24   rule_16   Miss

dansen_als een e-del-man,_ Dat is Ã©Ã©n, dat is twee, dat is drie! Dat is vier, dat is vijf, dat is zes, Dat is zeven!_
rule_1   rule_1   rule_1   rule_1   rule_1   rule_1   rule_1

NLB140223_01
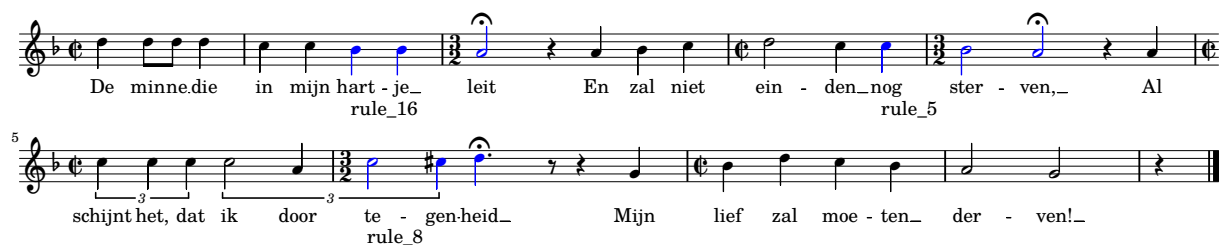
Ik was eens, laatst, aan mij-ne.deur ge-ze - ten,.het was op eenen.vroegen.morgen stond,_een herde - rin-neke.dat daar pas -
rule_27   rule_11   rule_27

seer - de,_dat met haar schaapkens.naar de wei-de_ gong.   Haar tee-re_ le - den_ en haar schoon-he - den,.die heb ben_
rule_8   Miss

gansch mijn jong hart door-wond._   En ik die kon haar schoonheid.niet ver - ge - ten..'k Wil haar gaan zoeken_al waar ik haar
rule_17   rule_27   rule_11

vond.   En ik die kon haar schoonheid.niet ver - ge - ten..'k Wil haar gaan zoe-ken_al waar ik haar vond.
rule_27

NLB140425_01

De minne.die in mijn hart - je_ leit   En zal niet ein - den_nog ster - ven,_ Al
rule_16   rule_5

schijnt het, dat ik door te - gen-heid_   Mijn lief zal moe - ten_ der - ven!_
rule_8

NLB142316_01

Den bezem, den bezem, Wat doen we der mee, Wat doen we der mee, We vegen der mee, We vegen der mee, Den vloer, den vloer.
Miss   Miss   Miss   rule_16

NLB142734_02
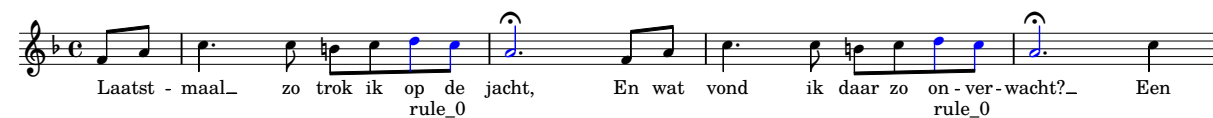
Den Maandag, den Maandag en ik wensch dat 't altijd. Maandag wa-re en dat ik, dat ik, bij mijn, bij mijn Cornelia_wa - re._
rule_2   rule_12   rule_12

NLB144099_01

O dag, o lang gewens-te dag, En waar menig mens naar wen-se mag Onze skepies die komen_ bin - nen._
rule_30   Miss rule_27

NLB146403_01

Laatst-maal_ zo trok ik op de jacht, En wat vond ik daar zo on-ver-wacht?_ Een
rule_0   rule_0

scho-ne_her - derin_ die ik daar zit-ten vond 't Was in het vroe-ge_van de mor - gen-stond_
rule_24   rule_12

NLB146739_01

Ka-rel min-de_Ro-za_te-der, met het vuur den jong'ling ei-gen. Ro-za min-de_Kar rel we-der, maar hun plicht gebood het
rule_21   rule_21   rule_5   rule_21   rule_21   rule_21

zwijgen. Bei-der stand was on - gelijk,_Ka-rel_ arm en Ro-za_rijk. Bei-der stand was on-gelijk,_Ka-rel arm en Ro-za_rijk.
rule_24   rule_14   rule_9   rule_24   rule_14   rule_21

NLB166916_01

When Bri-tain_ rst   at heav'ns com - mand_   a - rose_____ from out the a - zu-re.main,   a -
                                    rule_8   rule_0

ro-se,_a-ro-se_from out the a - zu-re.main,   This was the charter,_ the charter.of the land,   And guardian_an - gels_
                    rule_6   rule_13   rule_0

sug this strain: Rule Bri tannia,_ Bri - tan-nia.rule the waves, For Bri-tons_ ne - ver_ will be slaves.
        rule_6   rule_7

NLB167459_01

Bo-na_nox,   Bist a rechter.Ochs: Bona.no-te_ Liebe.Lot-te_Bonn' nuit Pfui pfui Goodnight,,goonight.Heut muss man so
    rule_1   rule_14   rule_14   Miss rule_20   rule_30   Miss   Miss

weit Gute.Nacht, Gute.nacht Marschin's.Bett, Gibt's kracht! Gute.Nacht! Schlaf sei g'sund, Und werd recht ku - gel-rund!_
    Miss   Miss   rule_2

NLB170262_01

A - me - rika,_A - me - ri ka,_ driemaal.in het rond, van je hop-sa-sa._
                rule_12   rule_5

3.2   EFSC – Elementary Pitch and Rhythm (El. NoLyr)

deut0616

rule_33   rule_9   rule_17

deut0625

Miss   Miss   Miss   Miss   rule_10   Miss   rule_10

deut0654

deut0675

deut0681

deut0686

deut0687

deut0695

deut0790

deut0959

deut0976

deut1106
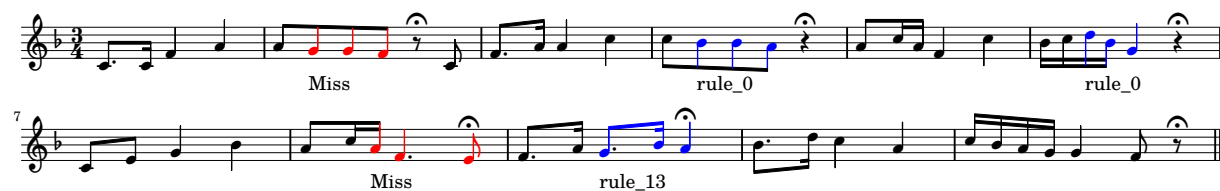
deut1112

deut1114

deut1116

deut1125

deut1157

deut1165

deut1171

deut1176

deut1217

deut1221

deut1225

deut1287

deut1288

deut1297

deut1368

deut1409

deut1417

deut1433

deut1447

deut1450

deut1479

deut1490

deut1522

deut1538

deut1555

deut1557

deut1676

deut1719

deut1726

deut1784

deut1804

deut1921

deut1923


deut2075

deut2118

**deut2143**

deut2164

deut2241

3.3   CHOR – Elementary Pitch and Rhythm (El. NoLyr)

chor014-sop

chor017-sop

chor019-sop

chor024-sop

chor030-sop

chor033-sop

chor035-sop
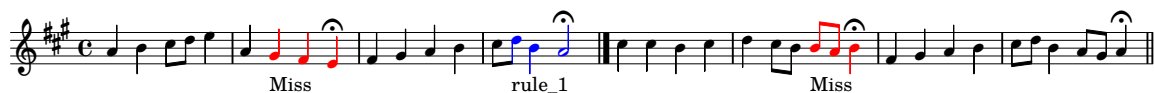
chor041-sop

chor042-sop

chor043-sop

chor046-sop

chor048-sop

chor059-sop

chor064-sop

chor065-sop

chor066-sop

chor068-sop

chor074-sop

chor075-sop

chor094-sop

chor106-sop

chor116-sop

chor120-sop

chor122-sop

chor147-sop

chor152-sop

chor159-sop

chor164-sop

chor173-sop

chor174-sop

chor180-sop
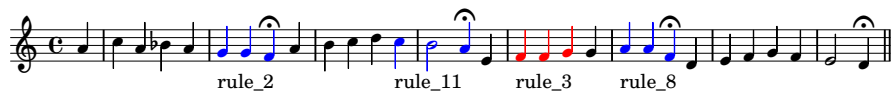
chor184-sop

chor199-sop

chor210-sop

chor224-sop

chor238-sop

chor264-sop

chor268-sop

chor273-sop

chor278-sop

chor283-sop

chor284-sop

chor287-sop

chor323-sop

chor339-sop

chor341-sop
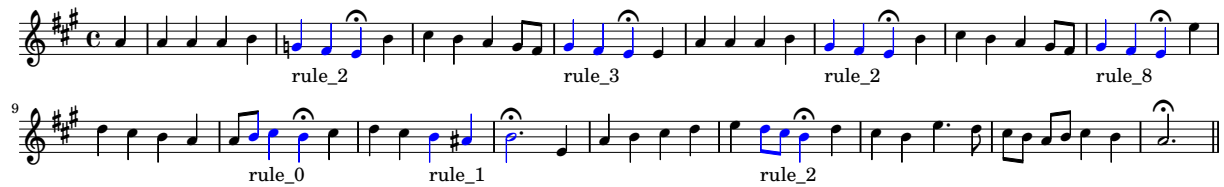
chor343-sop

chor348-sop

chor362-sop

chor369-sop


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