

# Music & the Internet

## MUMT301

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# Plan

- Last class:
  - Music APIs (Last.FM, Musicbrainz, Echonest)
  - Web-based sound generation
  - Web-based recording and sequencing applications
  - Web-based collaborative applications
- Assignment 7 review
- Online music editors
- Online music scores and libraries
- Break
- JavaScript
- Final project proposal presentation guidelines
- Assignment 7

# Assignment 7 review

- <http://www.music.mcgill.ca/~hiebert/A7.html>
- [http://www.music.mcgill.ca/~hecht/assignments/  
assignment7.html](http://www.music.mcgill.ca/~hecht/assignments/assignment7.html)
- <http://www.music.mcgill.ca/~backer/asignment7.html>
- [http://www.music.mcgill.ca/~akdag/assignments/  
assignment7.html](http://www.music.mcgill.ca/~akdag/assignments/assignment7.html)

# Online music editors

- Noteflight
- Scorio
- Flat
- Scorecloud

# Online music scores and libraries

- IMSLP
- Online Digital Musical Document Libraries

# SIMSSA: Single Interface for Music Score Searching and Analysis

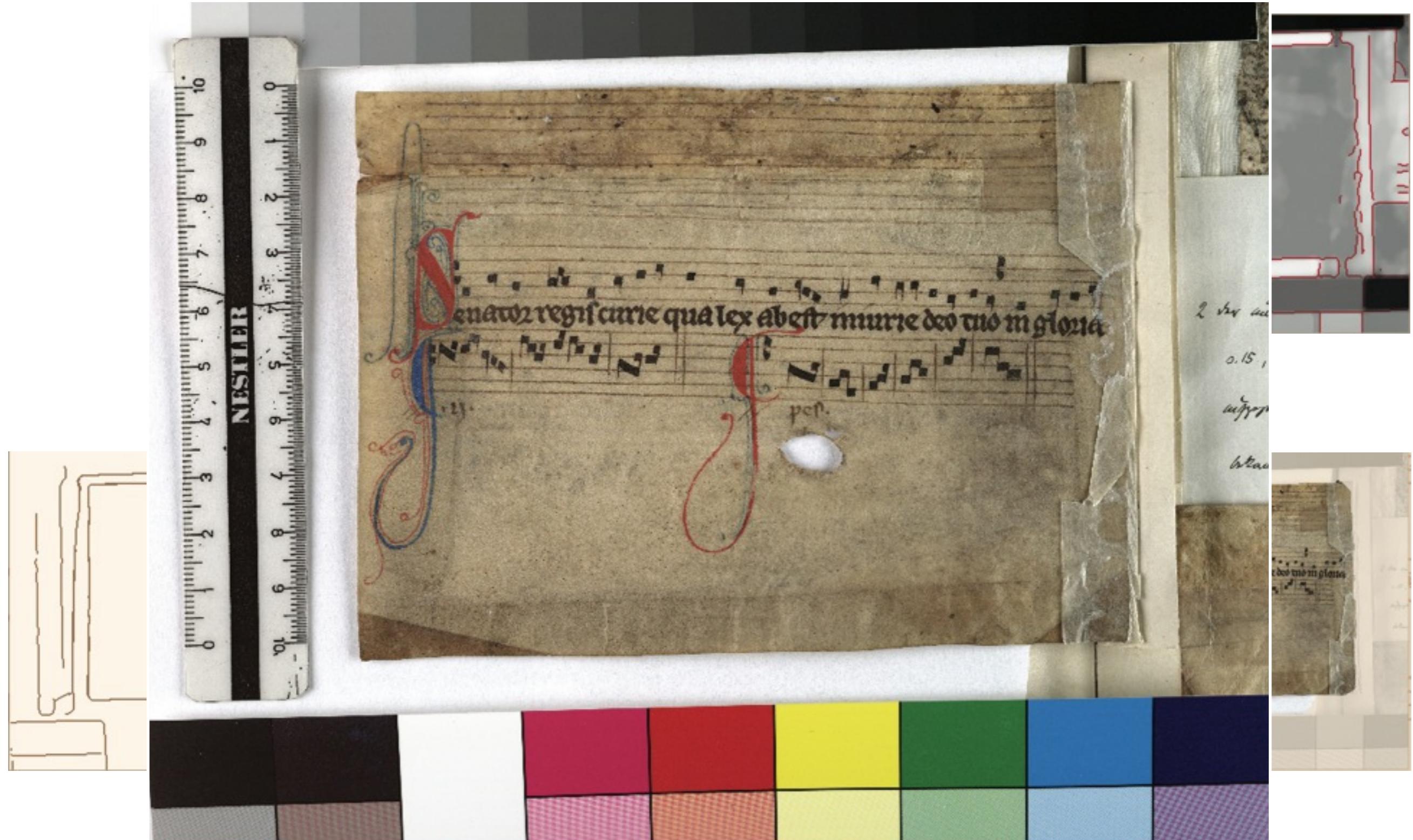
- Prototype for “Google scores” minus Google
- OMR (optical music recognition) is required for full-text search
- Access to digitized scores world-wide from a single website

# SIMSSA technologies

- Web-based optical music recognition (OMR) system with score editor
  - Rodan (Remote Online Document Analysis Network)
  - Gamera + Aruspix (existing OMR software)
  - MuseScore (open-source music editor)
  - Neon.js (open-source neumatic music editor)
  - Crowdsource for error correction
- Web-based user interface to view, search, annotate, and analyze scores
  - Diva.js
  - MEI (Music Encoding Initiative)
  - music21

# Preprocessing for OMR

# I Bte higant deceptibng



# More intelligent cropping

Original



Greyscale



Cropped



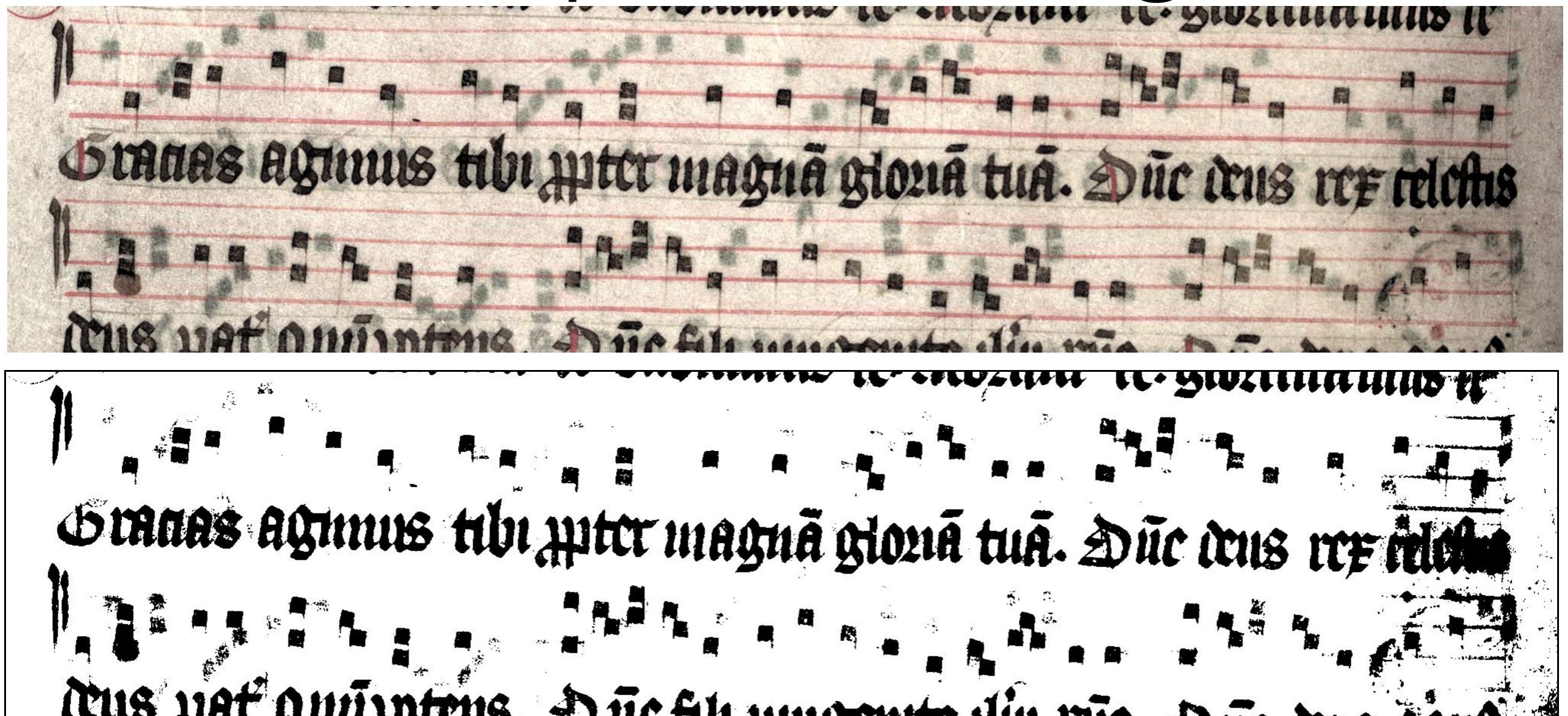
DIAMM: GB-Cantebury Add.128/62r

# Preprocessing



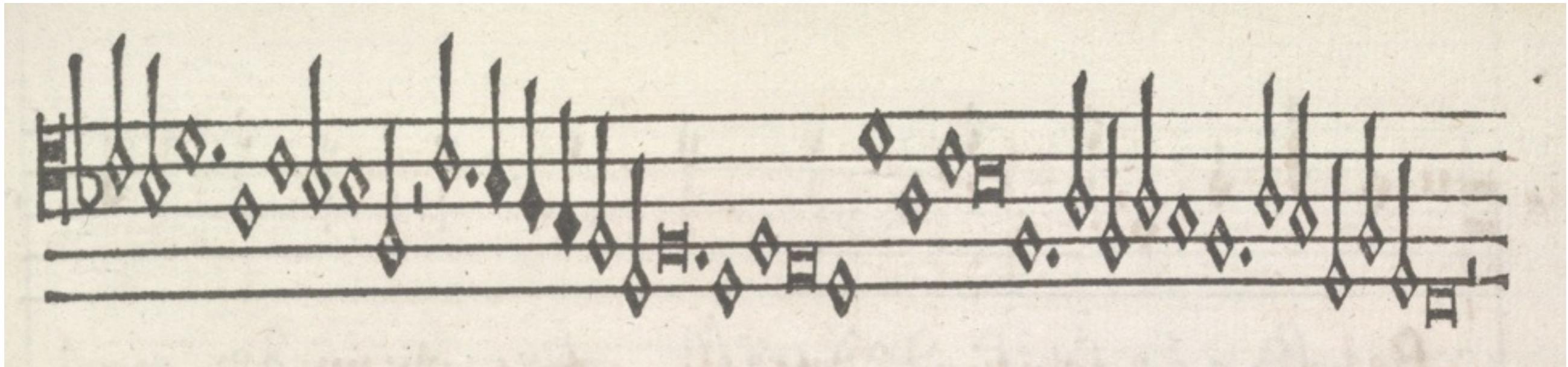
Brightness enhancement

# Preprocessing

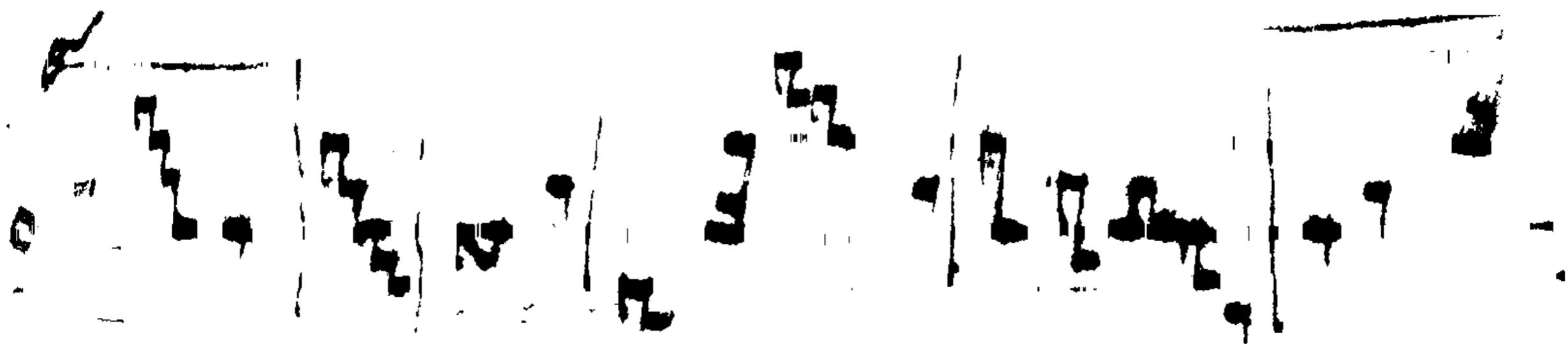


Thresholding

# Staffline Removal

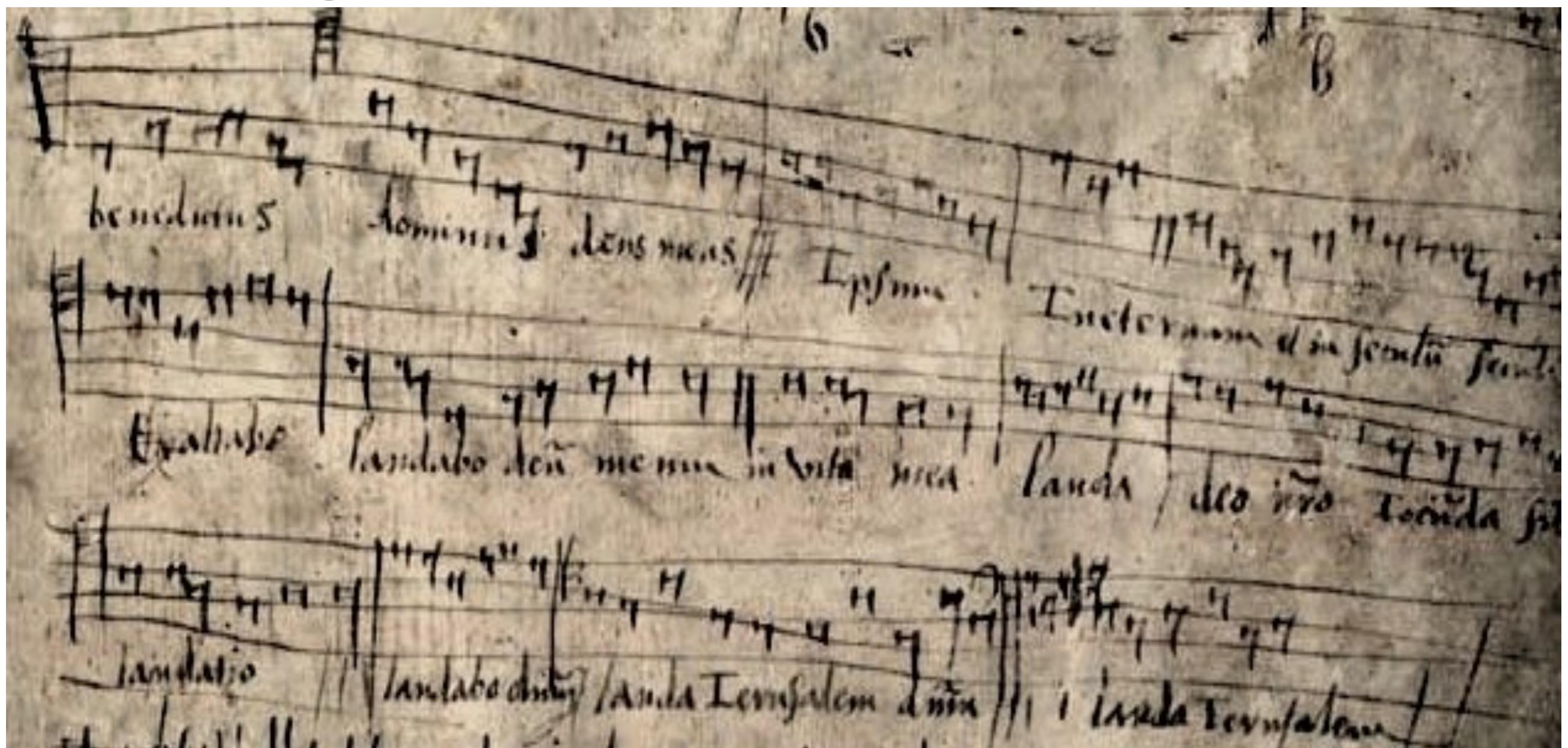


# Staffline Removal



Four-line hand-drawn staff example

# Staffline Removal



Difficult

# Extracting lyrics from Early music



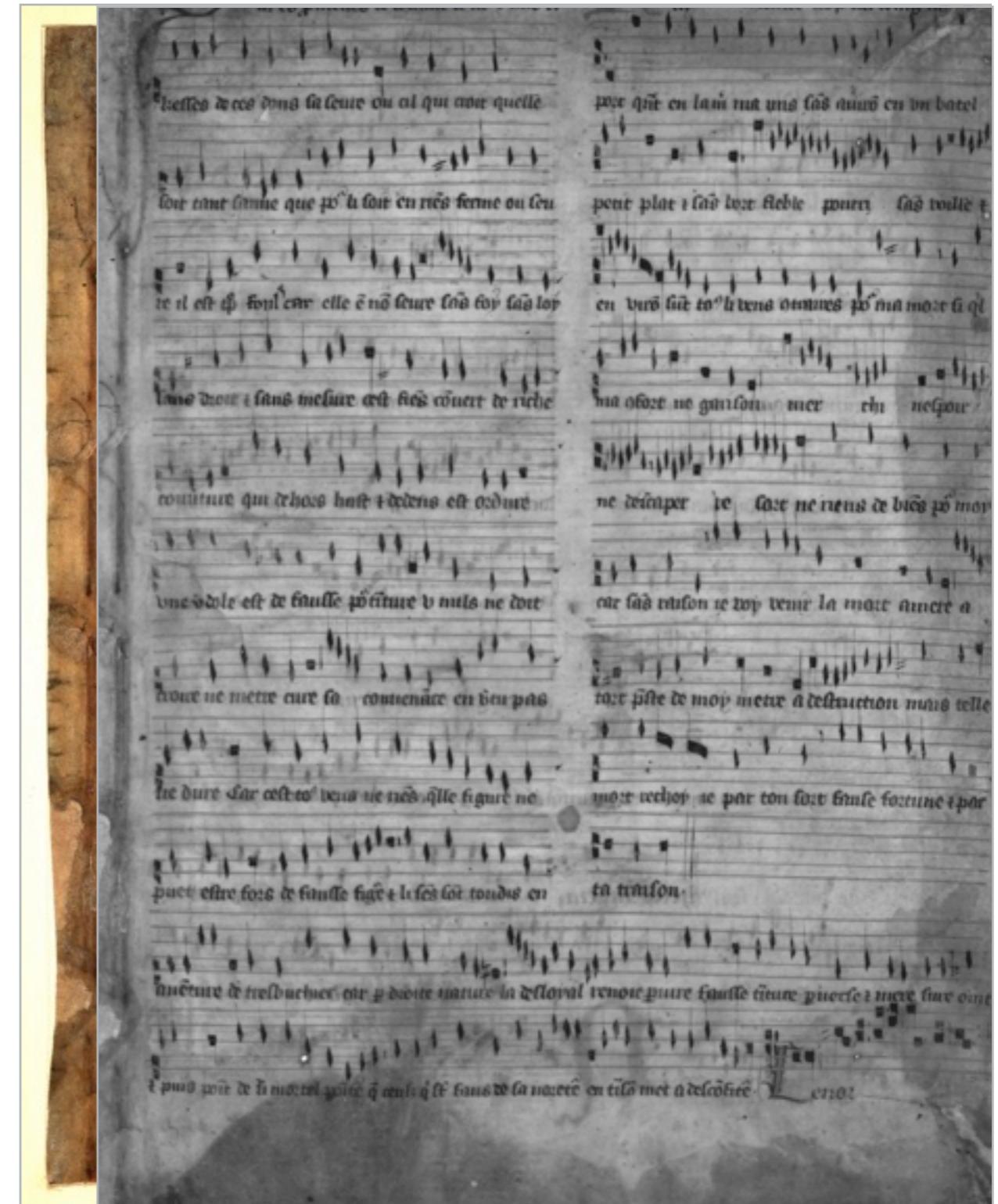
Images Courtesy of

# Extracting lyrics from Early music

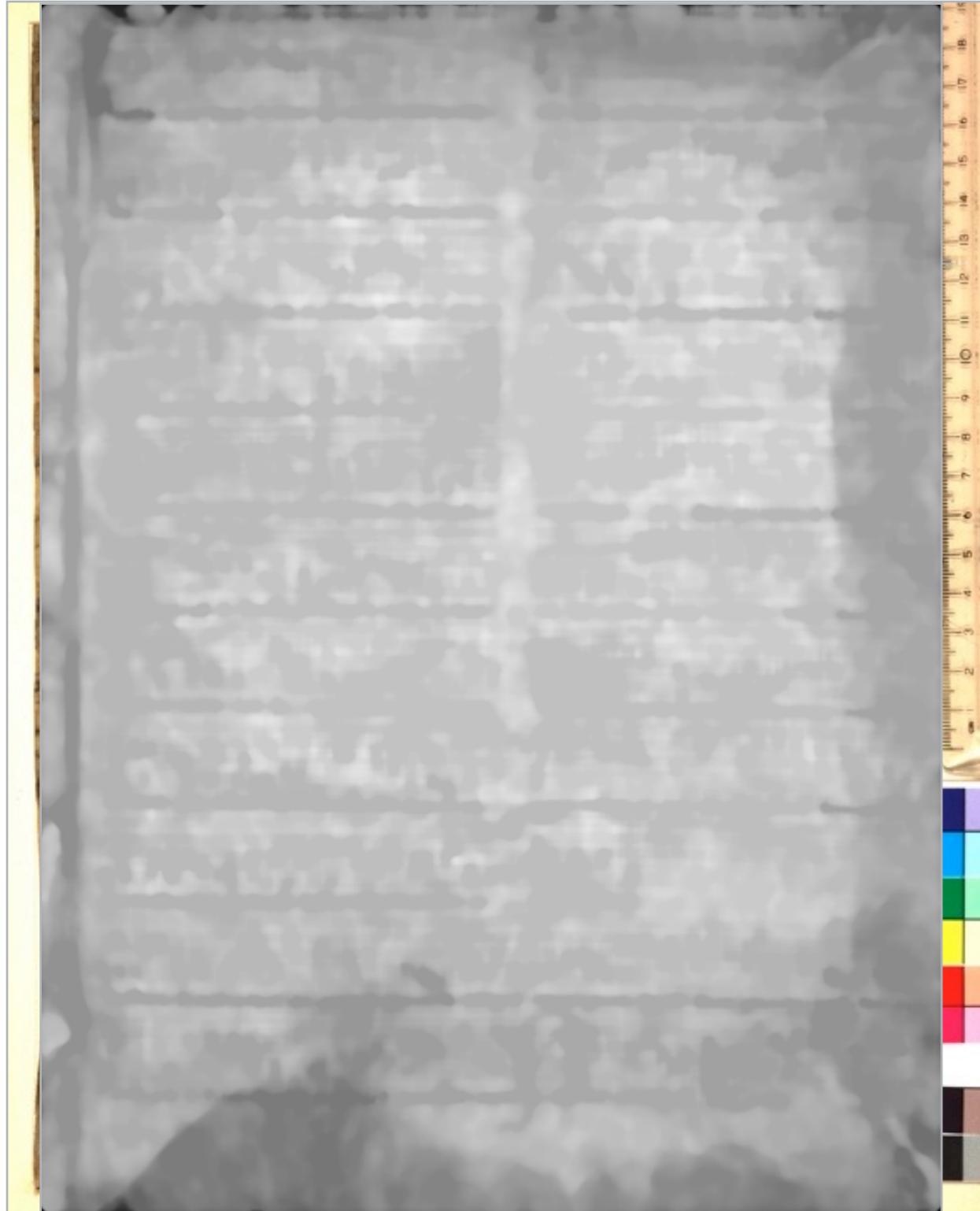
Images Courtesy of



# Preprocessing: Greyscale

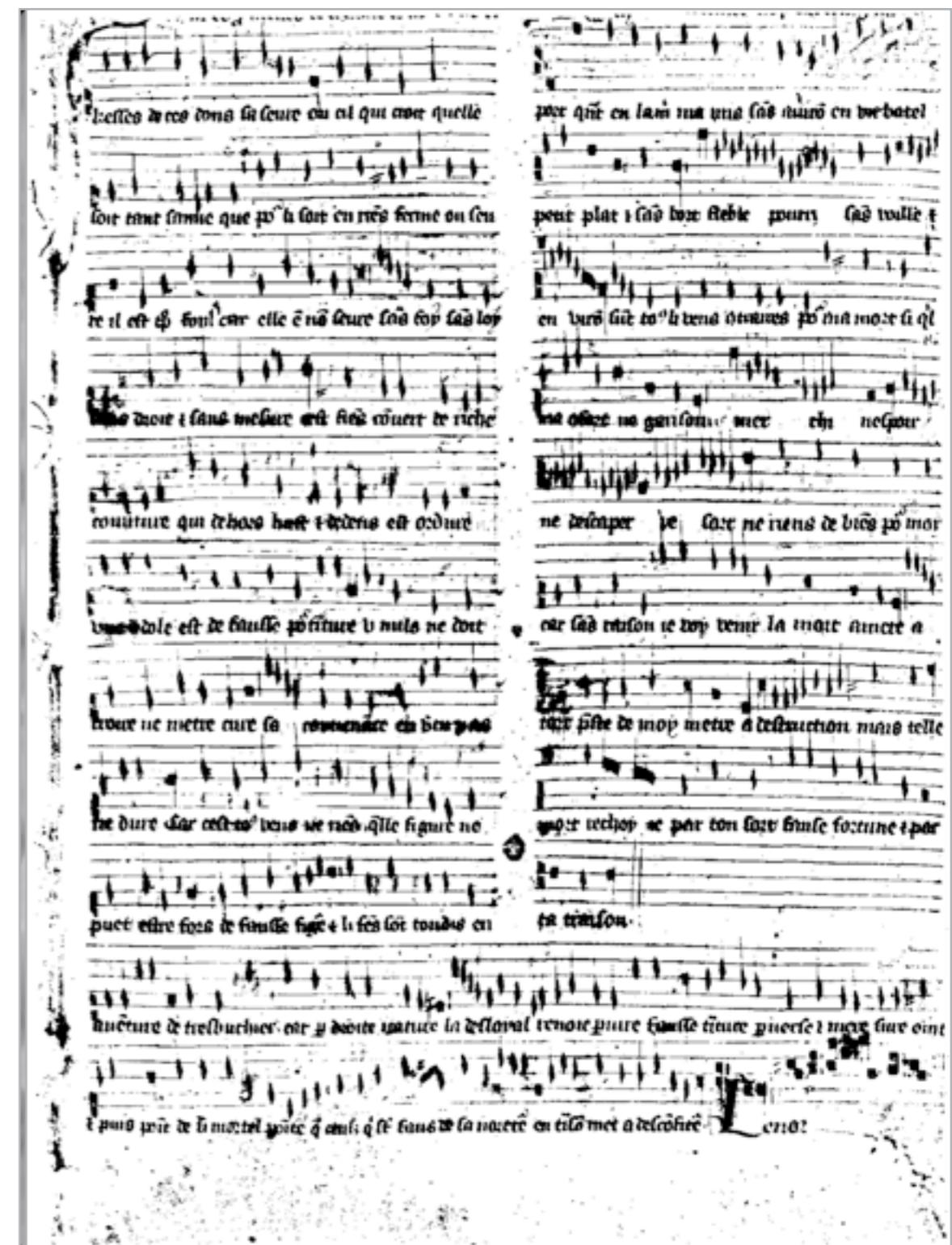


# Preprocessing: BG estimation

A grayscale image of a medieval manuscript page featuring musical notation on four-line staves with lyrics in French. The lyrics are:

blesses de ces dons sa leue ou ai qui amer quelle  
soit tant simme que po' la soit en nies ferme ou leu  
te il est q' son' car elle e' no leue los moy las lor  
lise droit i sans mesme est ries couert de riche  
constitue qui dehors hant t delens est ordure  
une vole est de faulx p'titure v mis ne doit  
troue ne mette cure sa contenante en deu pas  
lie dure lac coste deua ne nies quelle figure ne  
puet estre fors de faulx fage t le ses lot tondus en  
l'enture de tressbutcher sur y droite nature la defforai renoue p'ur faulx titer p'ur le s'ur oint  
e p'ur p'ur de li n'ostrel yole q' eul q' le baus de la n'ret'e en tilo met a descoibree L enor'

# Preprocessing: Binarisation



# Preprocessing: Staff removal

A page from a medieval musical manuscript featuring two staves of music. The music is written in black ink on white paper, with square neumes on four-line red staves. The lyrics are written in French in a Gothic script below the staves.

The lyrics are as follows:

blesses de ces dons la leue ou ai qui croit quelle  
loit tenu simie que po' la foy en mes feme ou seu  
re il est qd son car elle e n'e leue los soy las loy  
me dore i sans meure est foy couert de riche  
couiture qui debors hest i deus est ordure  
quandole est de faulx porteur u nuls ne sont  
trouer ne metre oute sa remonance en bres pas  
ne dure sur ceste leys we ried qd elle figure no  
puet estre foy de faulx figure & li foy lor toutes en  
huncure de tresbueher est y deute quante la destral renoue puer faulx tenue puer & mes foy  
et puer puer de la mortel puer qd sans de la morte en tis met a deschofie enor

# Connected-component analysis

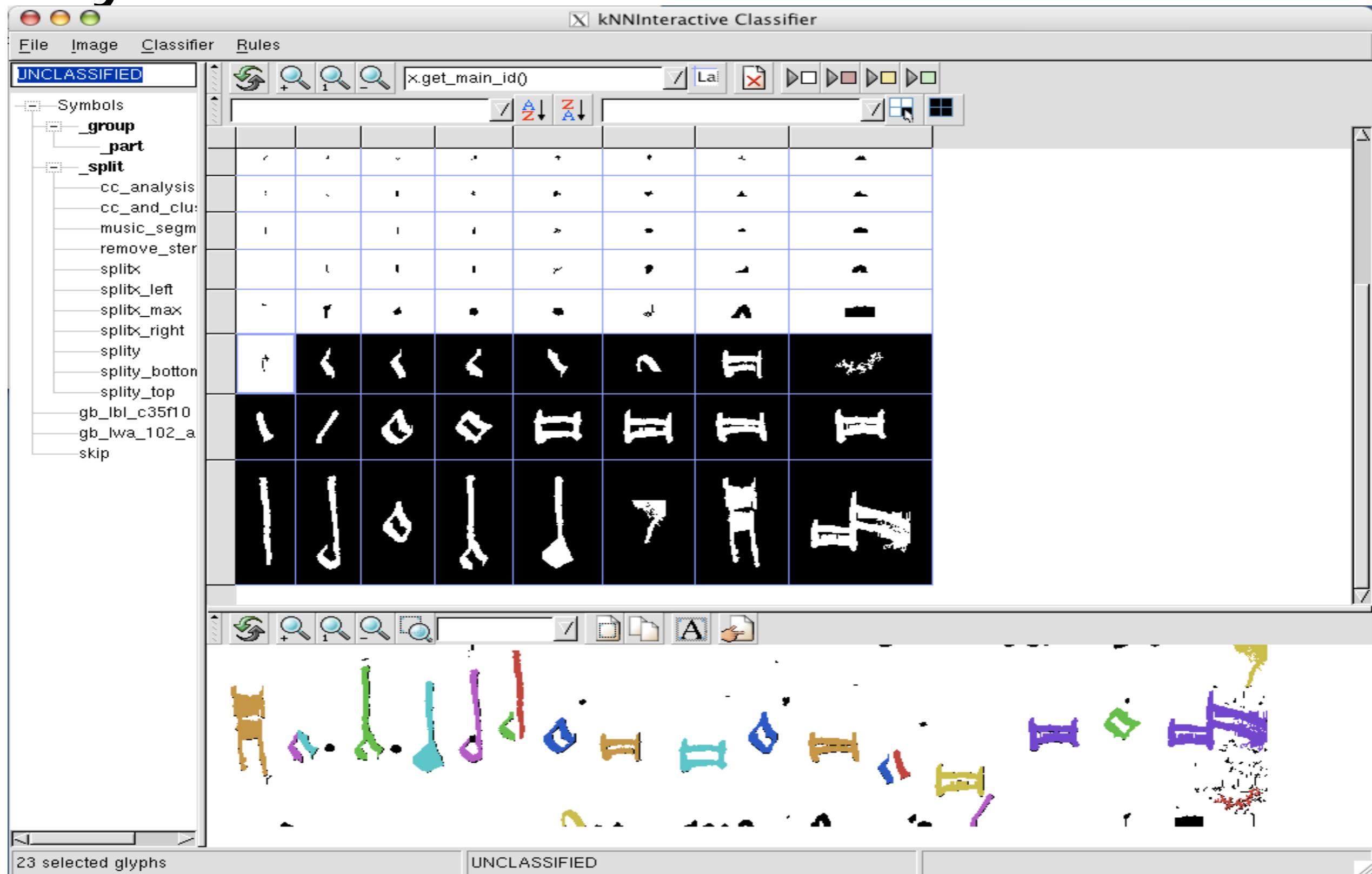


# Lyric extraction

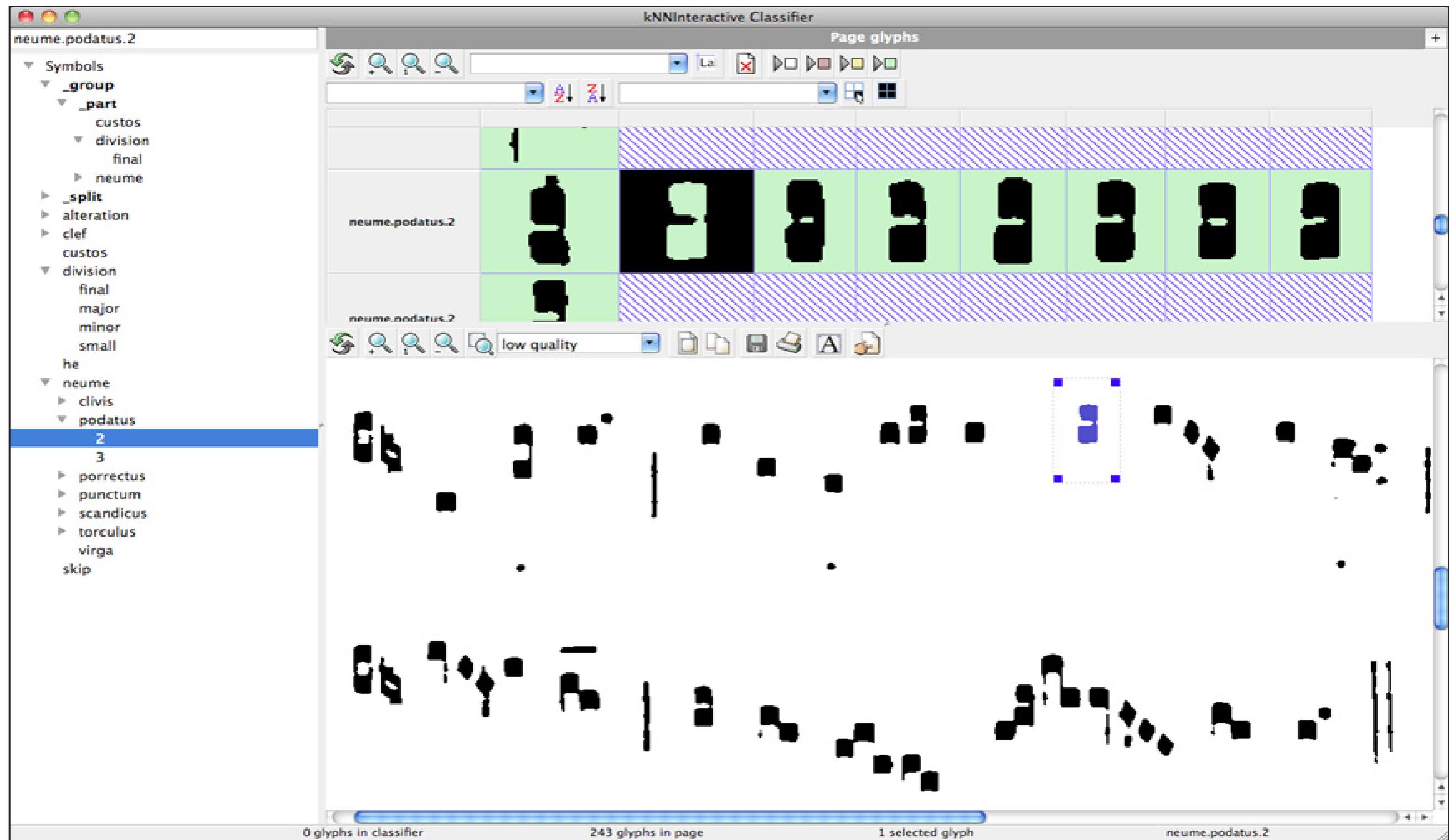
besses de ces dons la leure ou ou qui voit quelle  
 soit tenu simile que po la soit en mes feme ou seu  
 re il est qd foul car elle e na leure los for las loy  
 ma dore i sans meurt est fies couer de riche  
 couture qui debors hest tedenis est ordure  
 une chose est de faulx porteur u nuls ne doit  
 trouer ne mette oute sa rumeur en bres  
 ne dure sur ceste leys we rach qd elle figure no  
 puet estre foy de faulx figure & le foy lor toutes en  
 aueture de trebuchier est y deute iparue la delaval tenore puer faulx tenuer puer le meur leure oint  
 e puer poy de la mortel poy qd amf qd foy de la morte en tis met a deschoie eno?

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 soit tenu simile que po la soit en mes feme ou seu  
 re il est qd foul car elle e na leure los for las loy  
 ma dore i sans meurt est fies couer de riche  
 couture qui debors hest tedenis est ordure  
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 e puer poy de la mortel poy qd amf qd foy de la morte en tis met a deschoie eno?

# Symbol classifier / Gamera



# Symbol classifier / Gamera



# Text recognition: Ocropus

The screenshot shows a desktop environment with two windows open. On the left is a GIMP image viewer window titled "1105.png" showing a scanned page from a liturgical book. The page contains Latin text for the "FEAST OF THE BLESSED SACRAMENT" and "CORPUS CHRISTI". It includes sections for "Double of the First Class with Octave", "AT FIRST VESPERS", and "All as at second Vespers, p. 958, except the following:". Below these are several lines of Latin text. At the bottom, it says "Cant. Magnificat. 6. F. p. 911 or p. 913. Prayer. Deus, qui nobis, p. 943. At Compline and the Little Hours, the psalms of Sunday are said; the Hymn, today and throughout the Octave, is sung in the tone of Christmas, p. 367, with the doxology Jesu tibi sit gloria, Qui natus es de Virgine. All hymns of the same metre end with this doxology throughout the Octave, even on the feasts of Saints, unless the contrary be indicated." and "AT MATINS. Pater. Ave Maria. Credo." On the right is a gedit text editor window titled "1105.html" showing the XML output generated by Ocropus. The XML code uses spans with class="ocr\_line" and title attributes to map the scanned text to specific lines in the original document. The gedit interface includes tabs for "process.bash", "text.py", "genmel.py", and "1105.html". The status bar at the bottom of the gedit window shows file statistics: 1693 x 2747 pixels, 213.9 KB, 37%, 1105 / 2340, 2 x 44 pixels, 7.1 KB, 82%, and 15 / 60.

FEAST OF THE BLESSED SACRAMENT.  
CORPUS CHRISTI.  
*Double of the First Class with Octave.*  
AT FIRST VESPERS.  
*All as at second Vespers, p. 958, except the following:*

quam su-a-vis est, \* Dó- mi-ne, spi-

ri-tus tú- us! qui ut dulcidi-nem tú- am in filii-os de-

monstrá- res, páne su-a-vis simo de cadio

praésti-to, esu-ri- éntes réples bónis, fa-stidi- ó-sos di-

vi- tes dimit-tens in- ánes. E u o u a e.

*Cant. Magnificat. 6. F. p. 911 or p. 913. Prayer. Deus, qui nobis, p. 943. At Compline and the Little Hours, the psalms of Sunday are said; the Hymn, today and throughout the Octave, is sung in the tone of Christmas, p. 367, with the doxology Jesu tibi sit gloria, Qui natus es de Virgine. All hymns of the same metre end with this doxology throughout the Octave, even on the feasts of Saints, unless the contrary be indicated.*

AT MATINS.  
Pater. Ave Maria. Credo.

Omine, lábi- a mé-a apé-ri- es. R. Et os mé- um an-

*the Hymn, today and throughout the Octave, is sung in the tone of Christmas, p. 367, with the doxology Jesu tibi sit glòria, Qui natus es de Virgine. All*

\* The Chant for Matins is taken from the publications of Solesmes.

# Pitch correction: Neon

The screenshot shows a window titled "Auspix - Recognition - untitled (91%)". The window contains a musical score with three staves of neumes. Above the staves, the lyrics are written in Latin: "quam su-á-vis est, \* Dó- mi-ne, spí- ri-tus tú- us! qui ut dulcédi-ném tú- am in fí-li- os de-monstrá- res, páne su-a-vís- simo de caélo". The software interface includes a menu bar with file operations like New, Open, Save, and Undo, and a toolbar below the menu with icons for Neumes and Symbols. The bottom of the window features a toolbar with various musical symbols and a zoom control.

# Web visualizer: Diva.js



Zoom level: 2

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Go



# SIMSSA proof-of-concept projects

- Liber Usualis
- Salzinnes Manuscript
- Cantus Ultimus
- Musiclibs

# MIR: Music Information Retrieval

- Similarity
  - Melody, timbre, rhythm, form, style, tempo, mood, etc.
- Recognition, analysis, classification
  - Instrument, timbre, singer identification
  - Structural analysis
  - Style analysis
    - recommendation system
    - playlist generation
  - Optical music recognition
- Knowledge Representation
  - Standards (metadata, audio file formats, symbolic, song / artist unique IDs)
  - Taxonomy (categorization: genre, tags, mood, etc.)
  - Summarizations
  - Indexing and metadata

# MIR: Music Information Retrieval

- Human-computer interaction and interfaces
  - Usability
  - Multi-modal user interfaces
  - Visualization tools
    - The loudness war
    - Everynoise
    - <http://rama.inescporto.pt/app/>
    - Charting-the-Beatles
  - Mobile applications
- Corpora and databases
  - Digital music libraries and archives
  - Text and web mining
  - Web services and APIs

# MIR: Music Information Retrieval

- Socio-cultural aspects
  - Business models
  - Music and cultural heritage valorization
  - Non-Western music
  - Personalization / privacy
- Intellectual property issues
  - Watermarking
  - Digital rights management
- Evaluations of MIR systems
  - User need and expectations
  - Building test collections (ground truth)
  - Experimental design
  - Metrics and benchmarks
  - [http://www.music-ir.org/mirex/wiki/MIREX\\_HOME](http://www.music-ir.org/mirex/wiki/MIREX_HOME)
    - Annual evaluation campaign for MIR algorithm hosted by UIUC

# MIR: Music Information Retrieval

- Automatic searching, transcription, and annotation
  - Podcastle
- Active Music Listening interfaces
  - Songle
  - API!
  - Songrium

# The End!

# Not quite! Final project proposal presentation guidelines

- Final project proposal (1–2 pages with goals, subgoals, and partial bibliography)
- Powerpoint-style or HTML presentation of what you plan to do
- Include
  - Goal, subgoals, and timeline
  - Partial bibliography
  - References to similar projects/code/music
- 10-minute presentation and 5 minutes of questions
- Final project submission
  - Web-based application with description (1–2 pages)
  - Music project with description (2–3 pages)
  - Research paper (4–6 pages)