

# Music & the Internet

## MUMT301

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# Plan

- Last class:
  - Web-based sound generation
  - Web-based recording and sequencing applications
  - Web-based collaborative applications
- Assignment 7 review
- Final project proposal guidelines and round
- Online music editors
- Online music scores and libraries
- The End
- In-class final project proposal help

# Assignment 7 review

- Tommy
- Jackson
- Ishani
- Sam
- Jacob
- Julie
- Zoe

# Final project proposal

The final project proposal consists on:

1. The submission of a **project proposal report**.

- You will describe your **goal** for the project, dividing it into **sub-goals**, and arranging them into a **timeline**.
- You must also present **references**. These may be **bibliographical**, **code** examples, **music** examples, **software** applications, or any kind of **creative** or **intellectual work** that you think is relevant for the development your project.
- The report should be 2 pages long at the most, 11 pt, single-spaced.

# Final project proposal presentation guidelines

## 2. The presentation of your project proposal.

- You will present your project in class by means of a powerpoint-style slide show or an HTML webpage.
- You will describe your **goals** and **sub-goals**, and will present the **references** you consider relevant for doing your project.
- The presentation will be **15 minutes** (10-minute presentation, 5-minute round for questions). Rehearse and time your presentation accurately, since no extra time will be given.

I will send the presentation order before this coming Thursday.

The final project submission is due on Tuesday 19 December, by midnight.

# Online music editors

- Scorio
- Noteflight
- Scorecloud
- Flat
- Verovio (music notation engraving library)

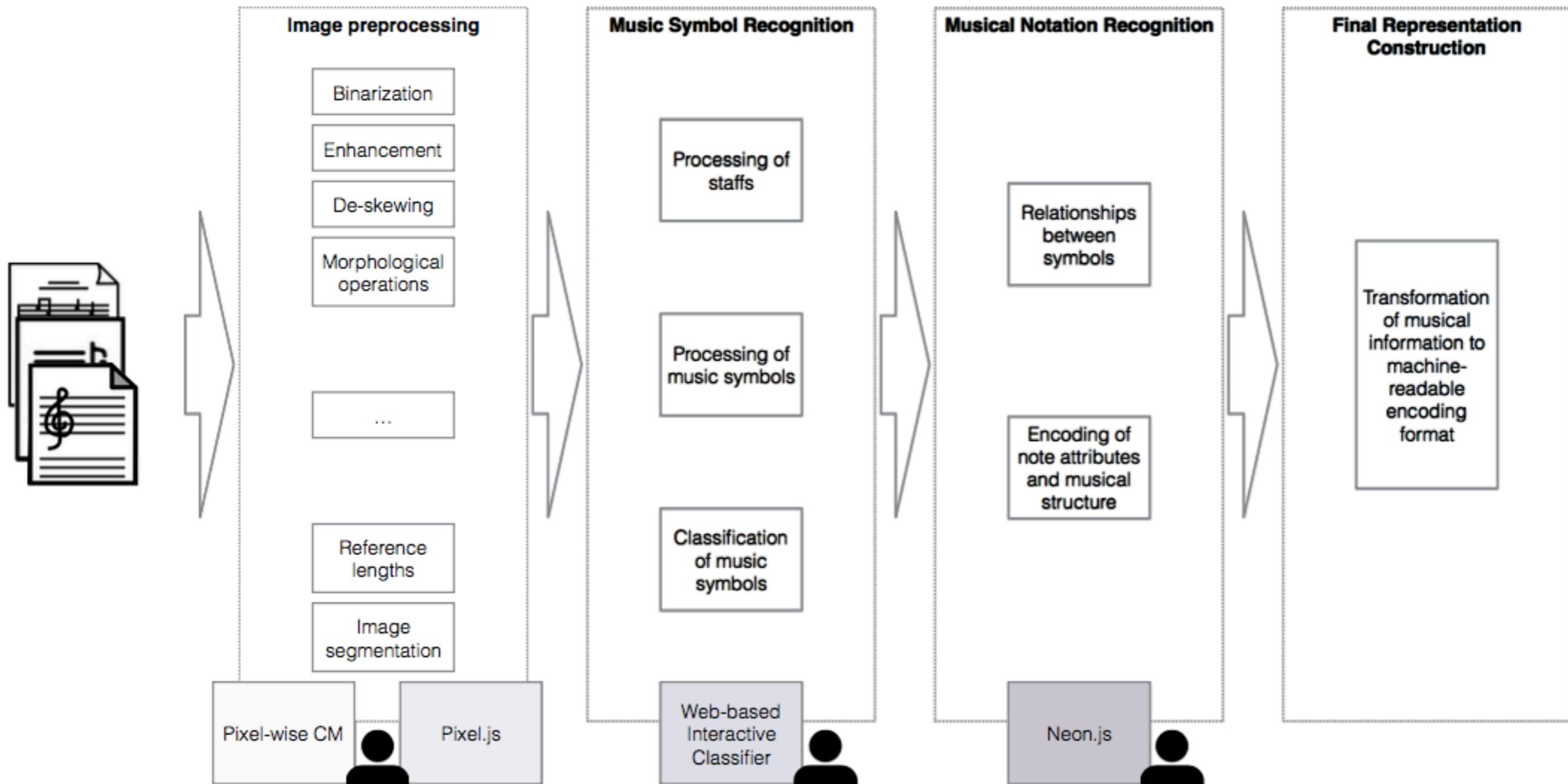
# Online music scores and libraries

- IMSLP
- Online Digital Musical Document Libraries

# SIMSSA: Single Interface for Music Score Searching and Analysis

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

# SIMSSA technologies

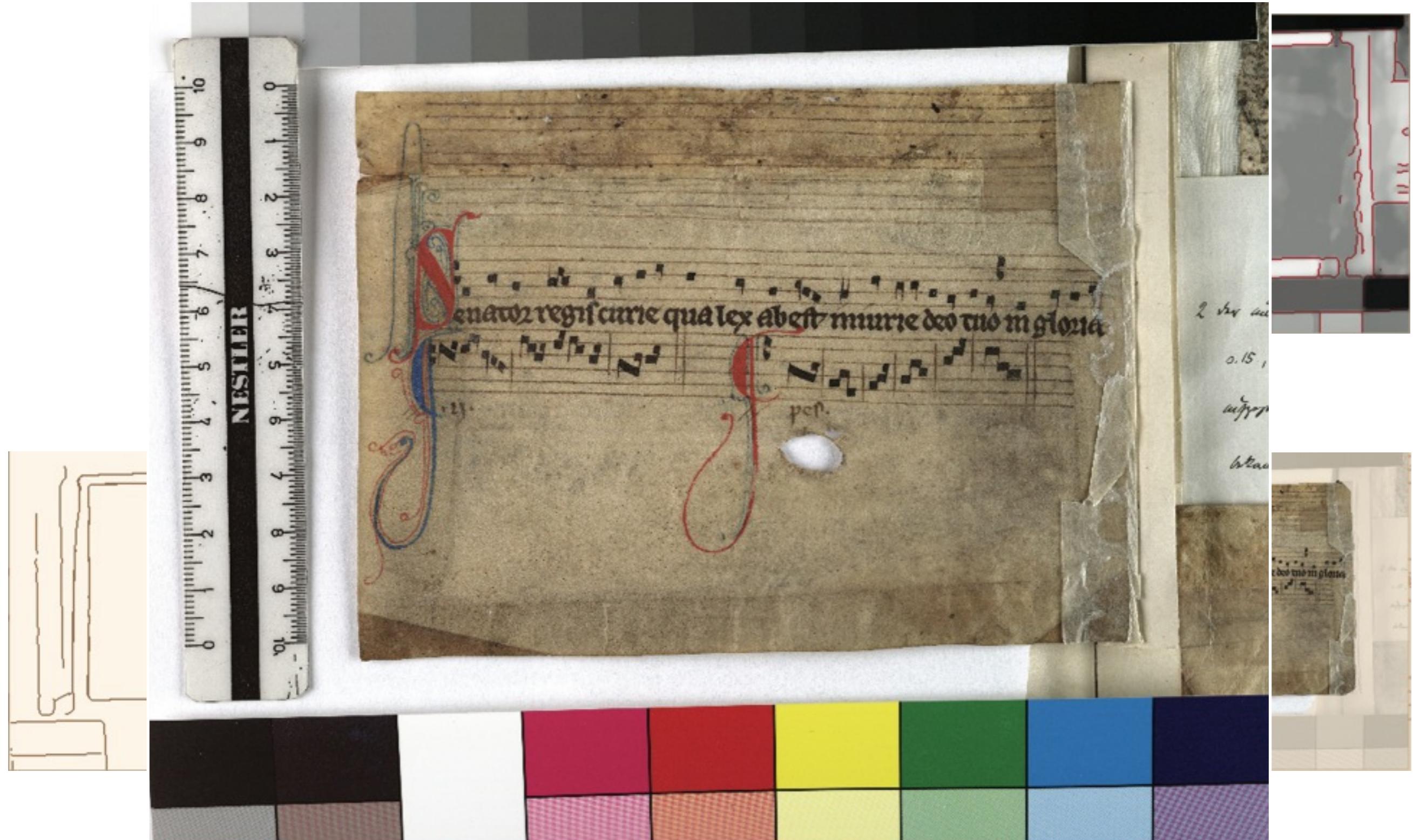


# SIMSSA technologies

- Web-based optical music recognition (OMR) system with score editor
  - Rodan (Remote Online Document Analysis Network)
  - Gamera and Aruspix for image preprocessing and music symbol recognition
  - Neon.js (web-based neume 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

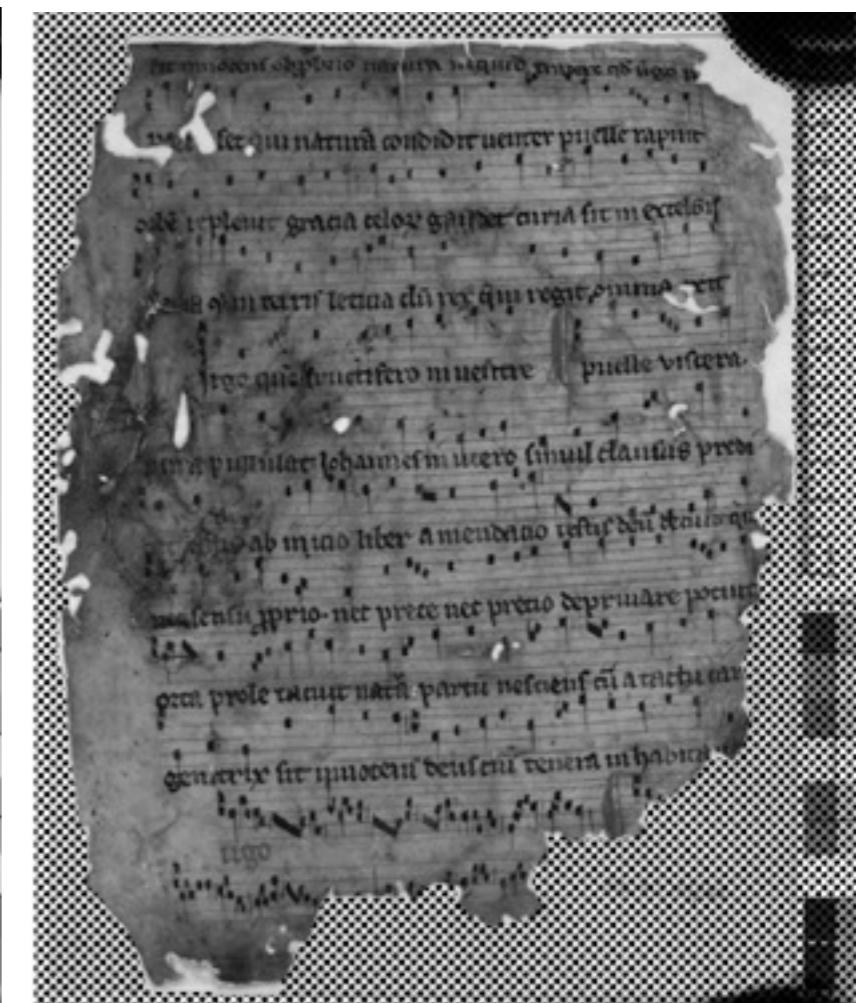
Original



Greyscale



Cropped



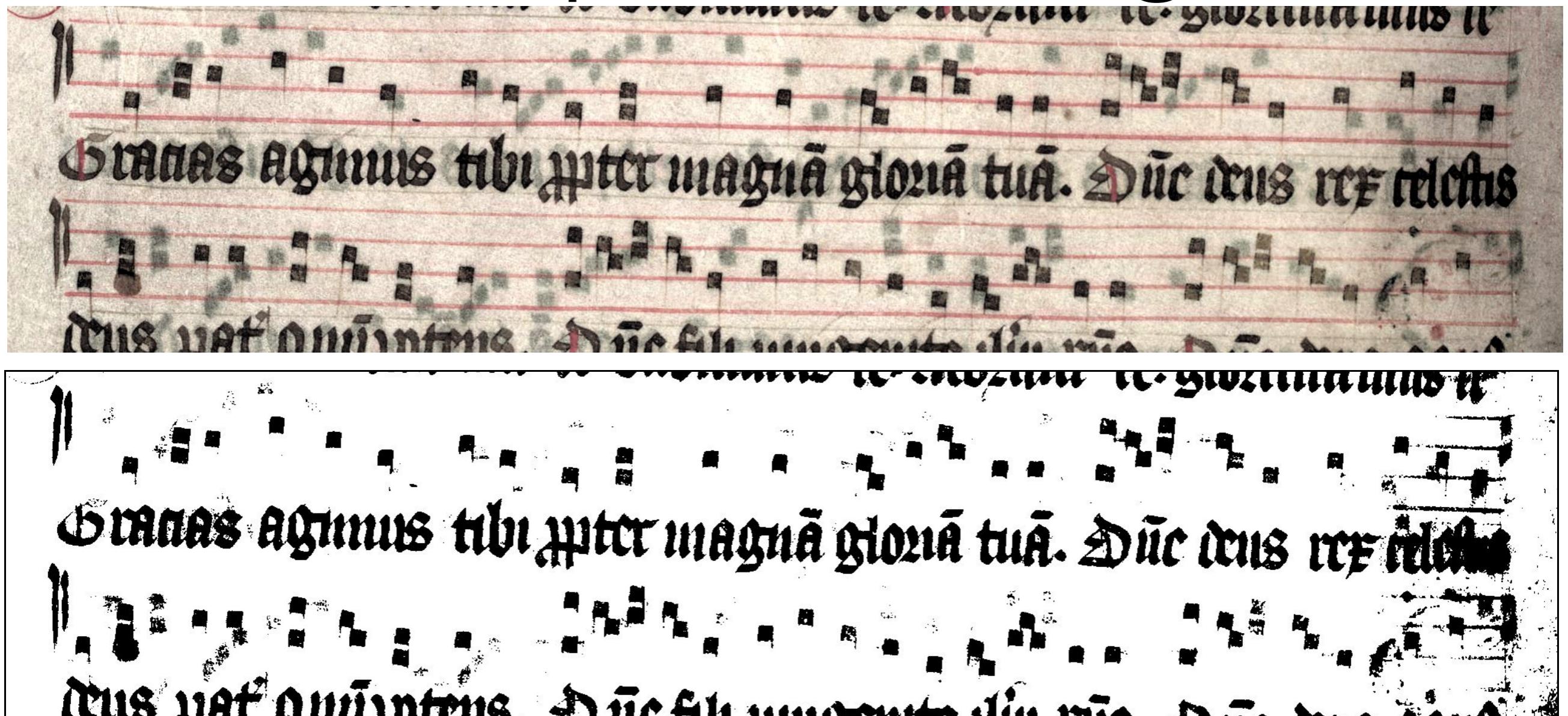
DIAMM: GB-Cantebury Add.128/62r

# Preprocessing



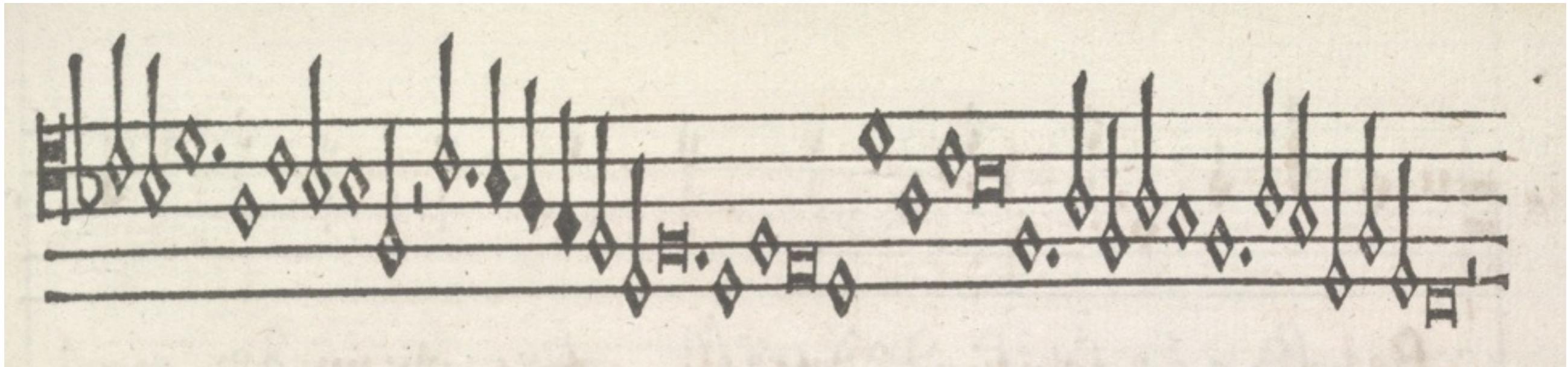
Brightness enhancement

# Preprocessing

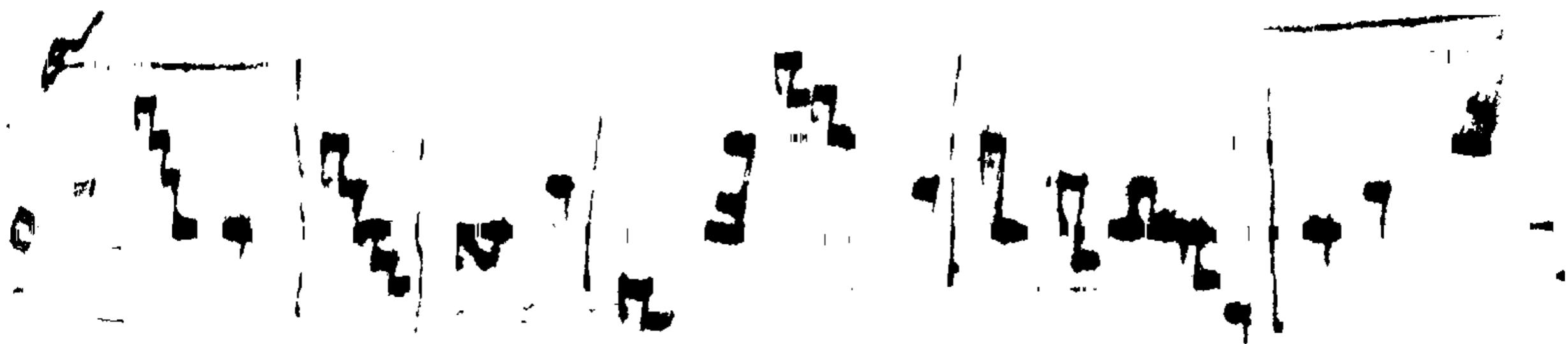


Thresholding

# Staffline Removal

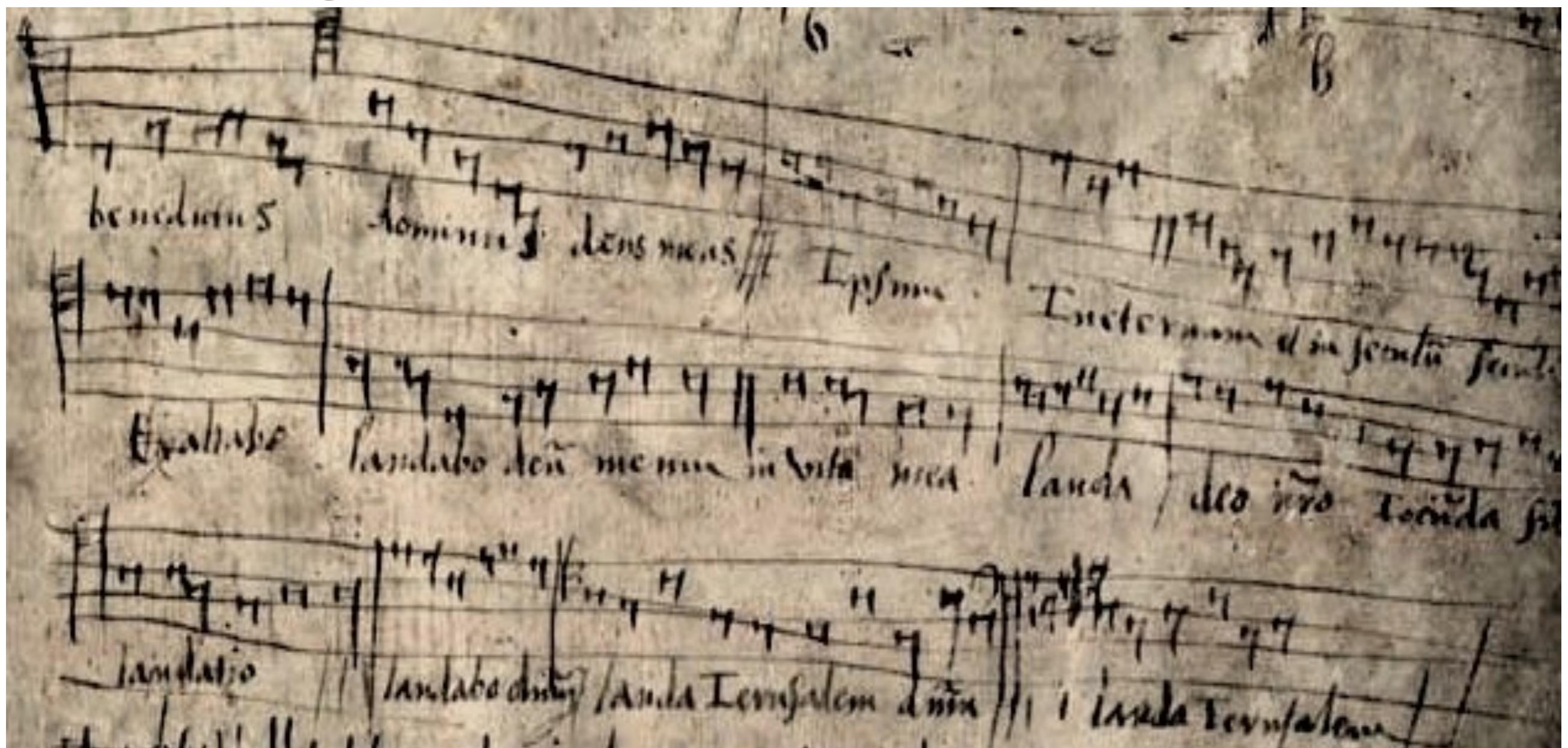


# Staffline Removal



Four-line hand-drawn staff example

# Staffline Removal



Difficult

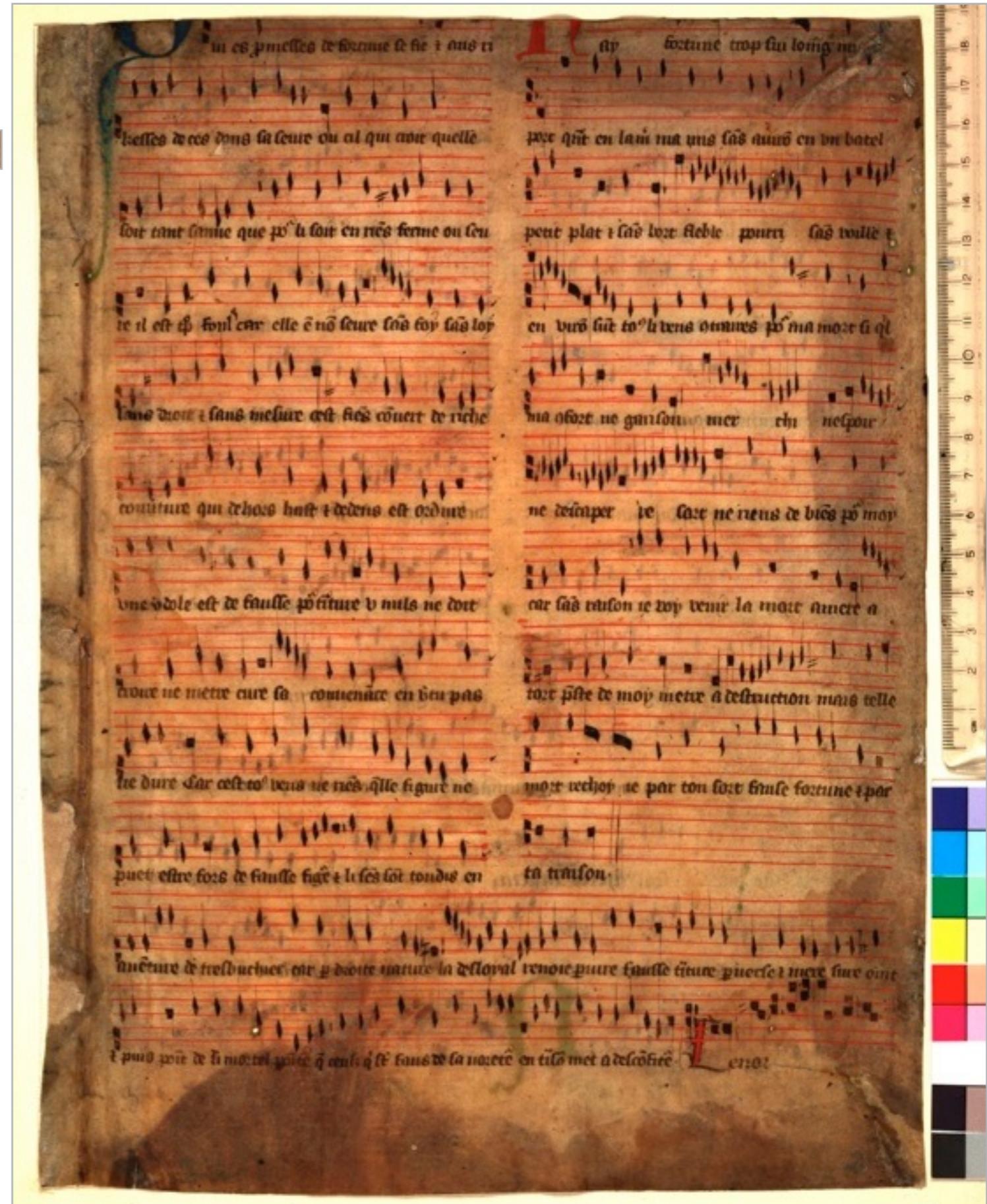
# Extracting lyrics from Early music



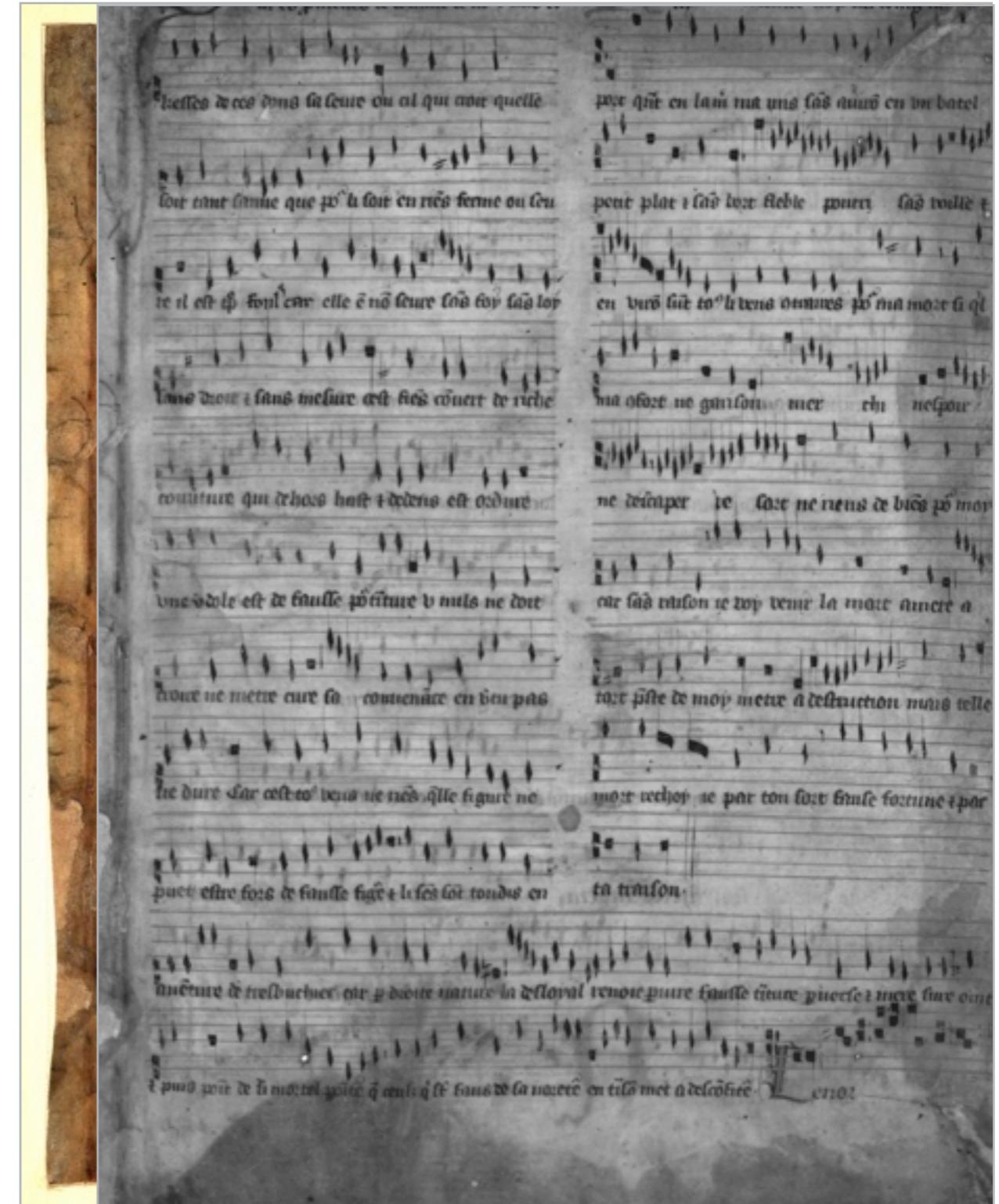
Images Courtesy of

# Extracting lyrics from Early music

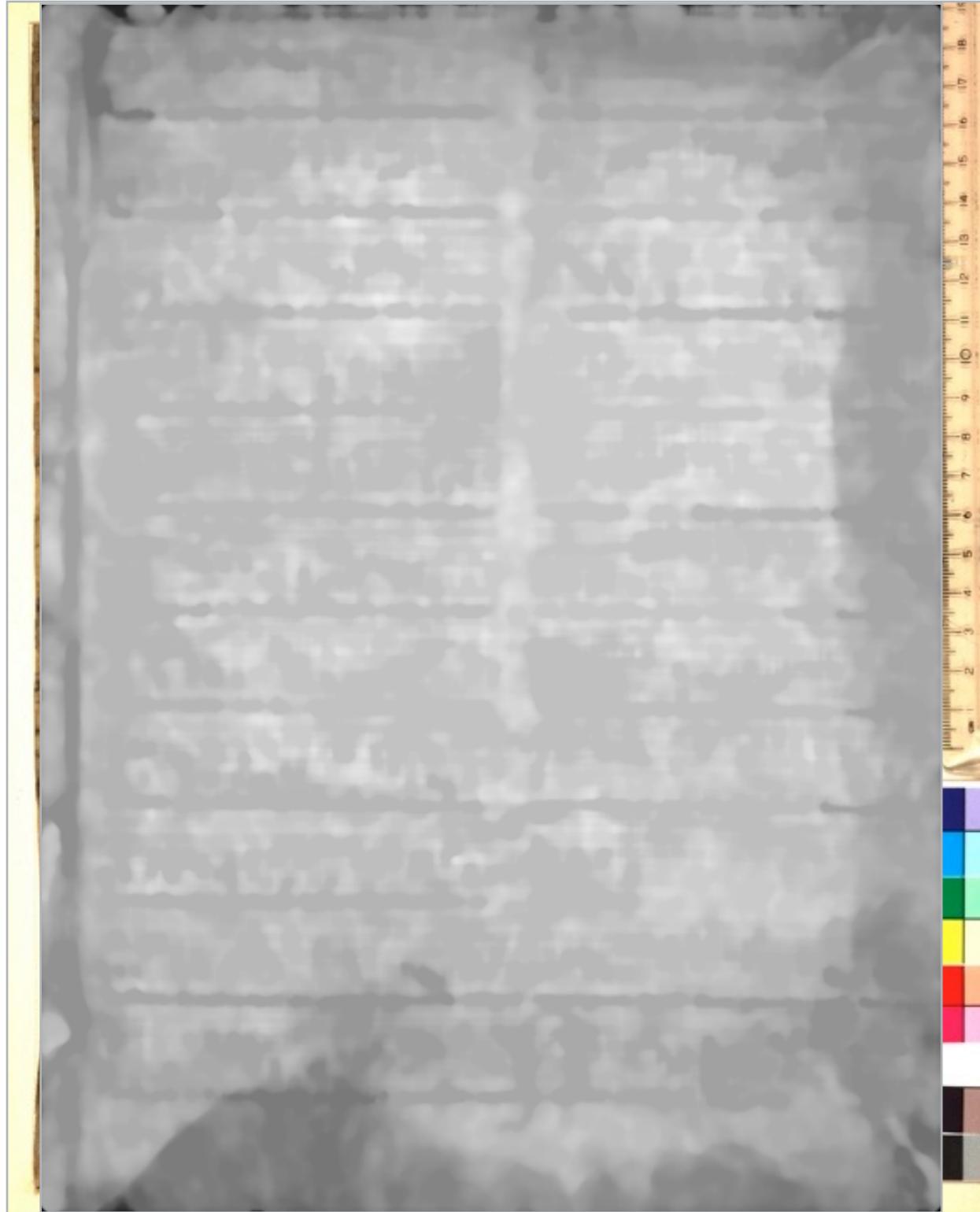
Images Courtesy of



# Preprocessing: Greyscale



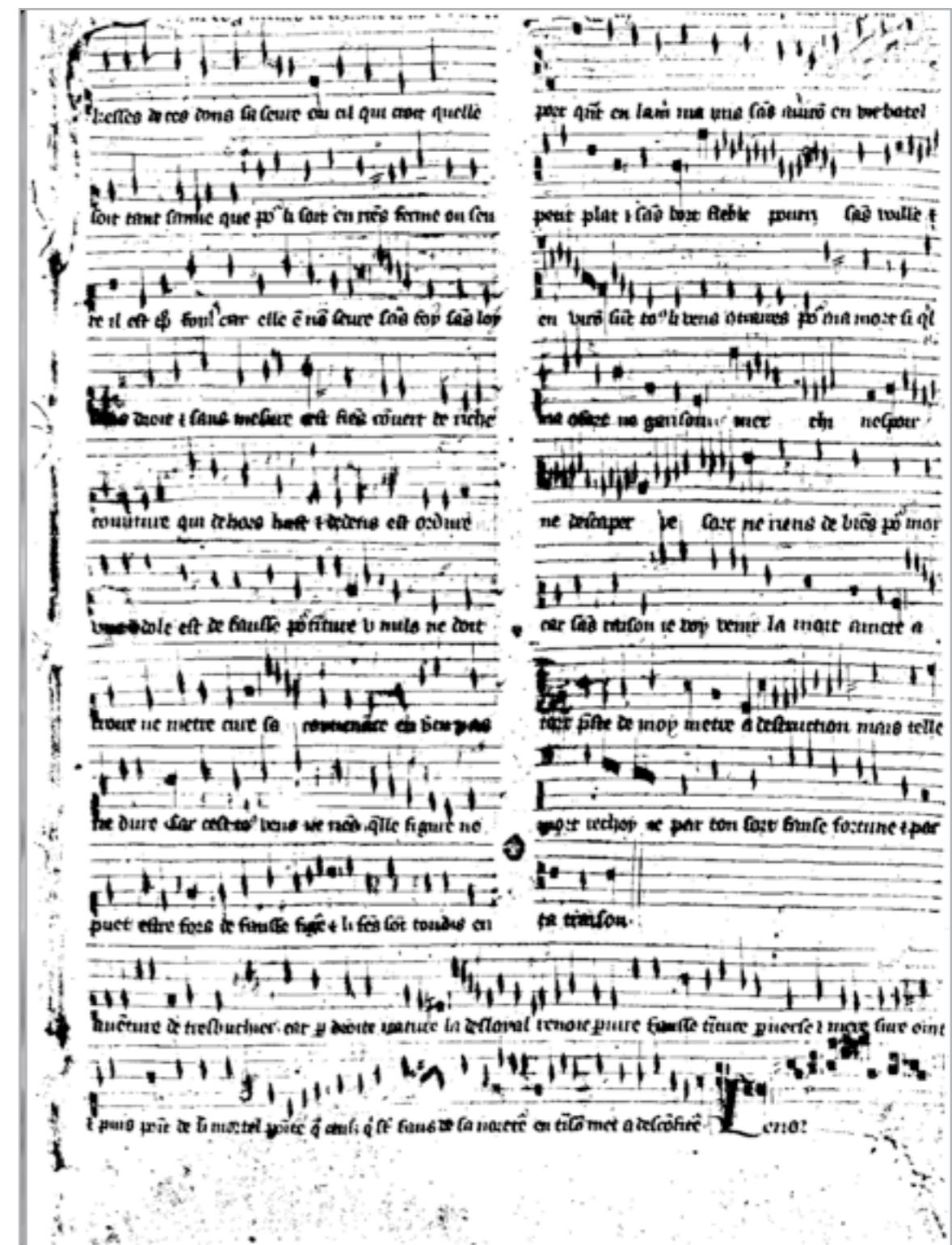
# Preprocessing: BG estimation



helles de ces dons la leue ou ai qui auer quelle  
loit tant simme que po' le soit en nes ferme ou leu  
te il est q' fol' car elle e' nō leue los moy las lor  
lise droit i sans mesur est ries couert de riche  
constance qui dehors hast t'delens est ordure  
une vole est de faulx p'titure v mis ne doit  
droit ne mette cure sa contenante en deu pas  
lie dure l'ar coste deua ne nes quelle figure ne  
puet estre fors de faulx fage t le ses soi tondus en  
l'autre de tressbutcher sur y droite nature la delorai renoue pture faulx t mere sine oint  
t plus p're de li noutre yole q' eul q' le bonz de la nartre en tilo met a descoibree L enor

A grayscale image of a medieval manuscript page featuring musical notation on four-line staves. Below each staff, there is French Gothic script lyrics. The text is as follows:

# 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 four-line red staves. The lyrics are written in a Gothic script below the staves.

The lyrics are as follows:

blesse 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 our la remenace 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 deschoie L 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 leus we rach qd elle figure no  
 puet estre fies de faulx figure & le fes lor toutes en  
 aueture de trebuchier est y deute iparue la delorat tenore purr faulx tenuer guefle l meur leure oint  
 e purr purr de la mortel iparue qd amf qd fens de la morte en tis met a deschoie eno?

besses de ces dons la leure ou ou qui voit quelle      poq que ou lam ma una los muo en bres  
 soit tenu simile que po la soit en mes feme ou seu      peat plat i los box fleble pourt los voulle t  
 re il est qd foul car elle e na leure los for las loy      en vres but to la brea broues po dura mose si q  
 ma dore i sans meurt est fies couer de riche      ma oree ne gantons met chi nespou  
 couture qui debors hest tedenis est ordure      ne dresper pe lart ne riens de vres po mor  
 une chose est de faulx porteur u nuls ne doit      car los rason le moy tenir la mort amere a  
 trouer ne mette oute sa rumeur en bres      rach pise de moy mette a destruction nuls telle  
 ne dure sur ceste leus we rach qd elle figure no      apur recop se pur con tate bres fortune tpar  
 puet estre fies de faulx figure & le fes lor toutes en      aueture de trebuchier est y deute iparue la delorat tenore purr faulx tenuer guefle l meur leure oint  
 e purr purr de la mortel iparue qd amf qd fens de la morte en tis met a deschoie eno?

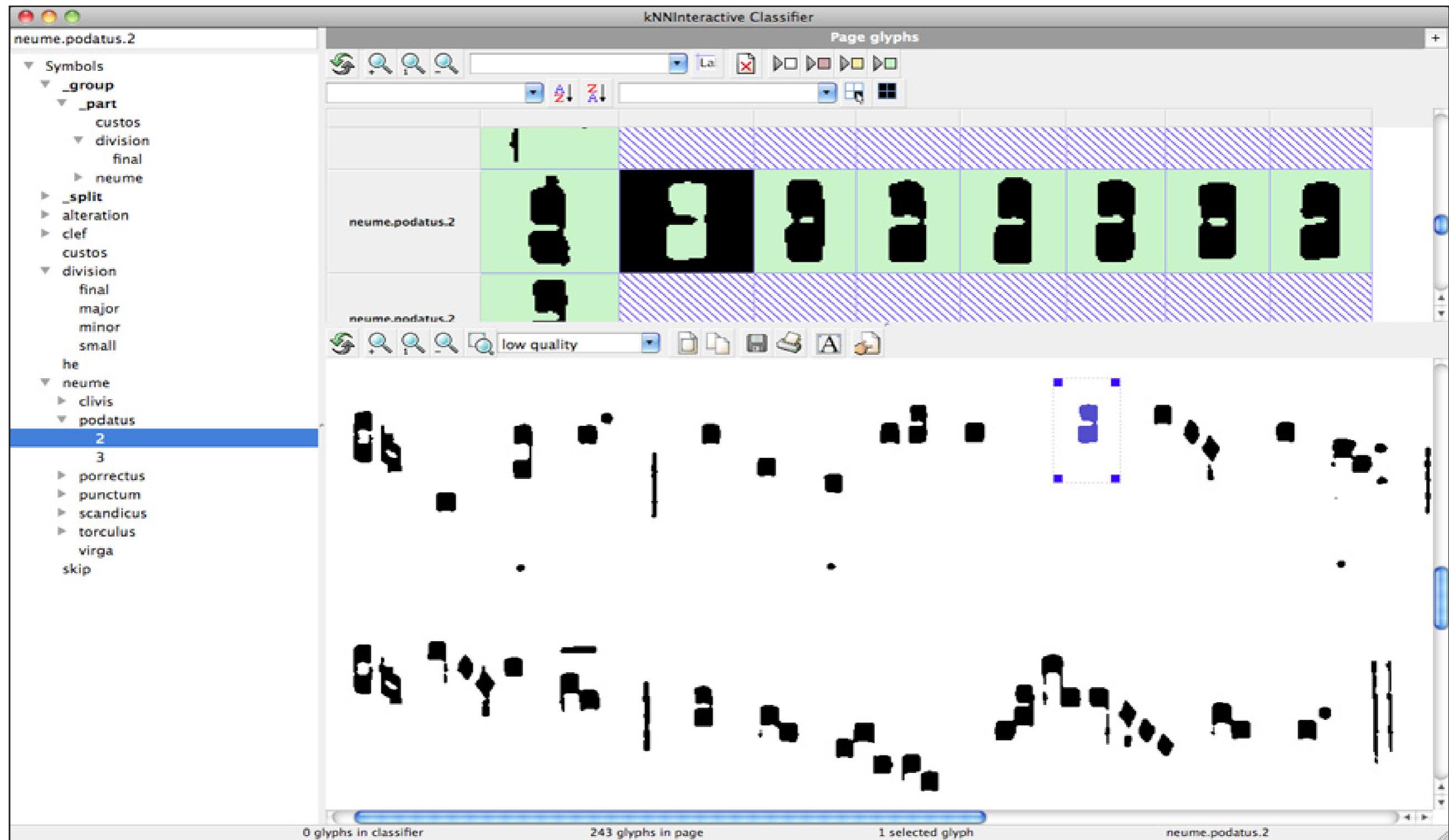
# One-step detection of elements in music scores using machine learning

(Calvo-Zaragoza et al., 2017)

## QUALITATIVE RESULTS

Source	Ground-truth	
BLIST+LRDE	BLIST+INESC	CNN

# Symbol classifier / Gamera



# Neume correction: Neon.js

Neon.js File ▾ Hotkey Glossary | Help | Developers | DDMAL

## Editing CF-012

MODE + Insert Edit

INSERT ■ Neume || Division System C/F Clef

Select Head Shape

- Punctum
- Quilisma
- Custos

flece quia cito veniet salus tu a. dicitur  
In laud. Antiphona. Alleluia. ps. Misericordie. R.  
Ueni ad liberandum nos. Domine deus virtutum. da t ostende faciem  
tuam et latum erimus. Domine. pmi.  
Splendor paternae. Versus. Emitte agnum domine dominatorem terrae. De petra deserti ad montem filie syon. Ad benedictus Antiphona.

# Web visualizer: Diva.js



Zoom level: 2

Page 3 of 479



Go



# SIMSSA proof-of-concept projects

- Liber Usualis
- 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 (Ex. 1, Ex. 2)
    - 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 value
  - Non-Western music
  - Personalization / privacy
- Intellectual property issues
  - Watermarking and digital rights management
  - Audio fingerprinting
- Evaluations of MIR systems
  - User needs 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 algorithms

# MIR: Music Information Retrieval

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

# The End!