

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 grades
- Final project proposal guidelines and round
- Online music editors
- Online music scores and libraries
- Music Information Retrieval
- In-class final project proposal help

Final project proposal presentation guidelines

- Final project proposal (Two pages: abstract, 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 (2- to 4-page report)
 - Music project with description (2- to 4-page report)
 - Research paper (6 to 10 pages)

Final project proposal

The final project proposal consists on:

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

- You will write the abstract of your project, describing the main **goal** of 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, 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.

The final project proposal presentation will be on Monday, 3 December

The final project submission is due on Tuesday, 18 December

Round of ideas for final project

Online music editors

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

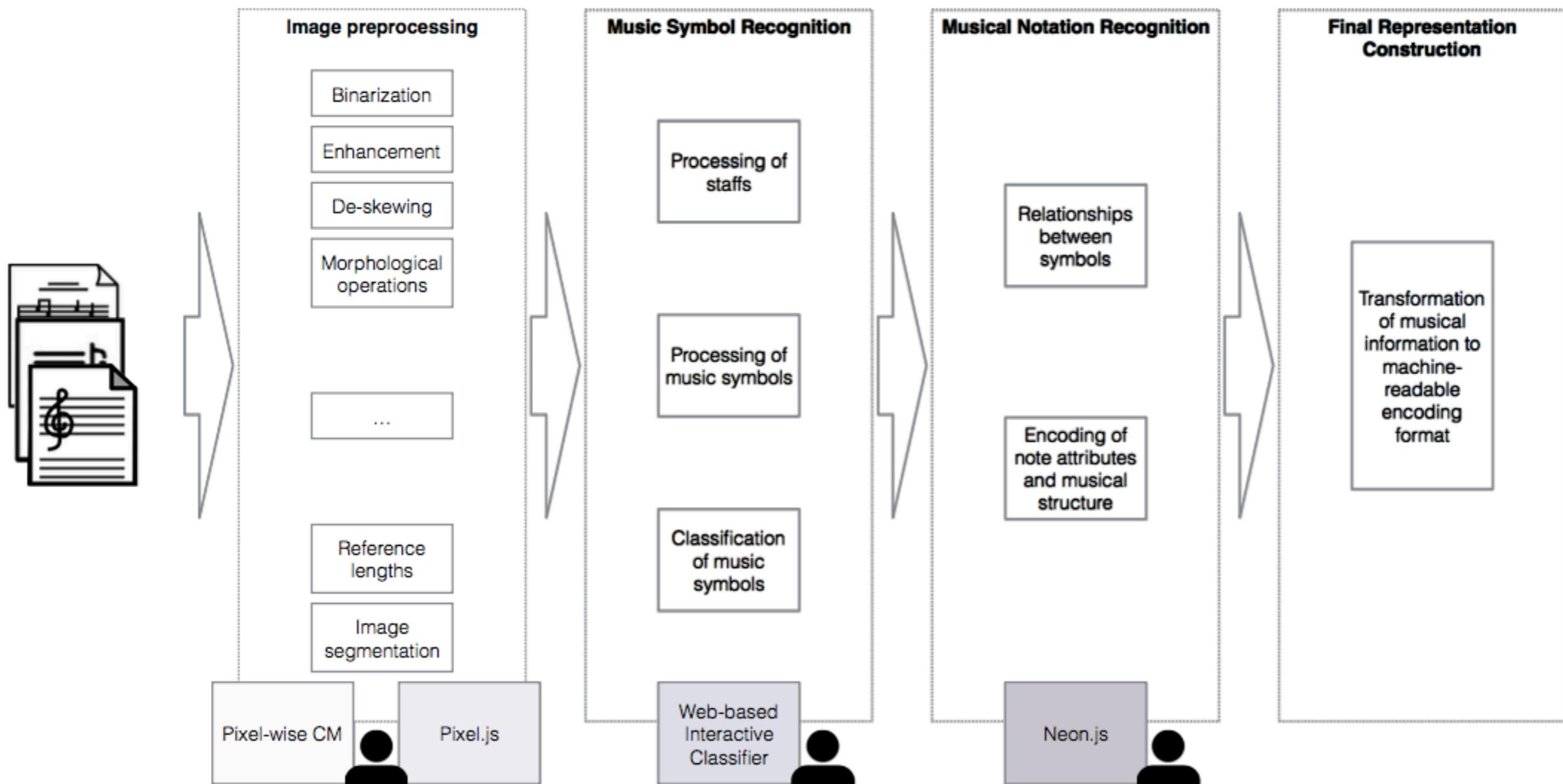
Online music scores and libraries

- 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

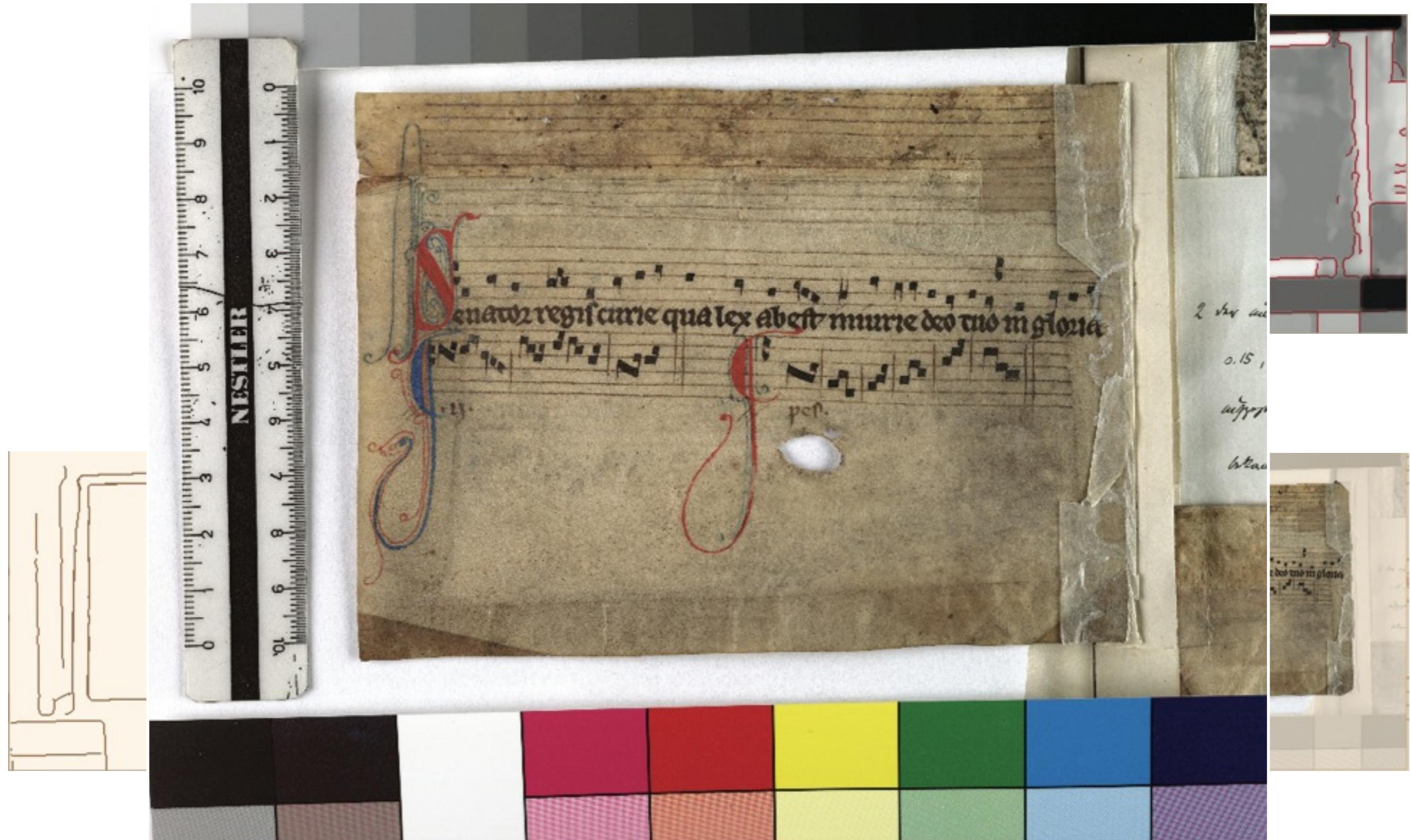


SIMSSA technologies

- 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



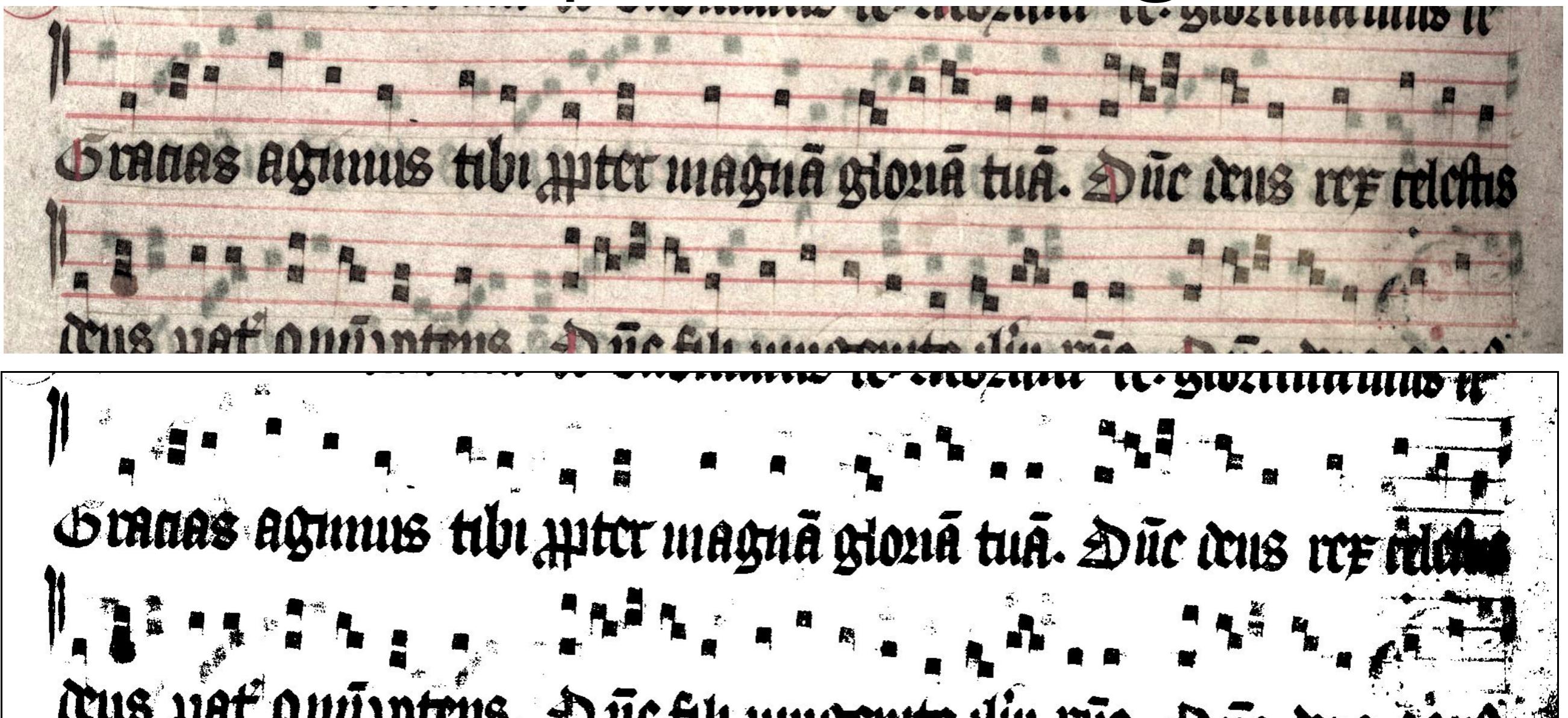
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Preprocessing



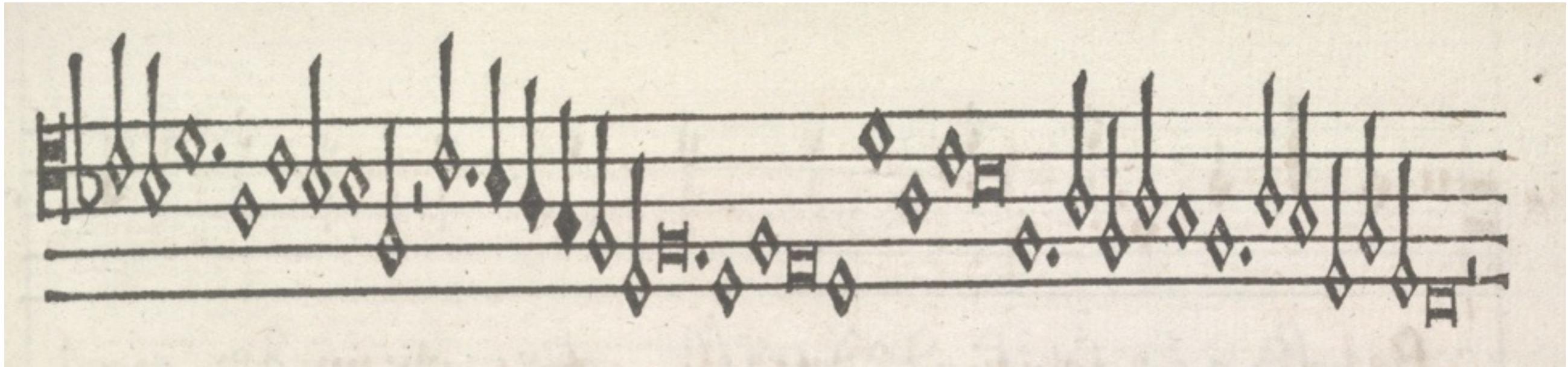
Brightness enhancement

Preprocessing

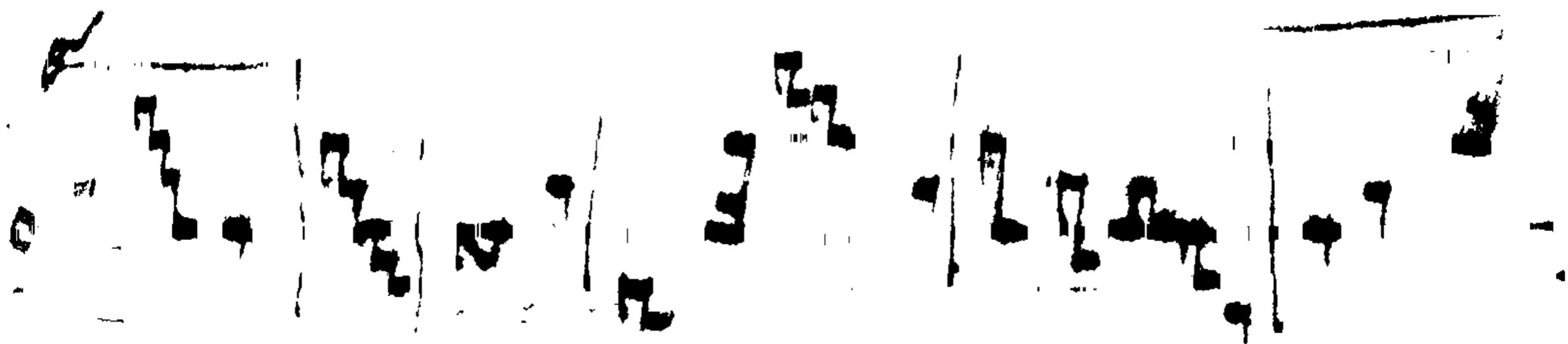


Thresholding

Staffline Removal

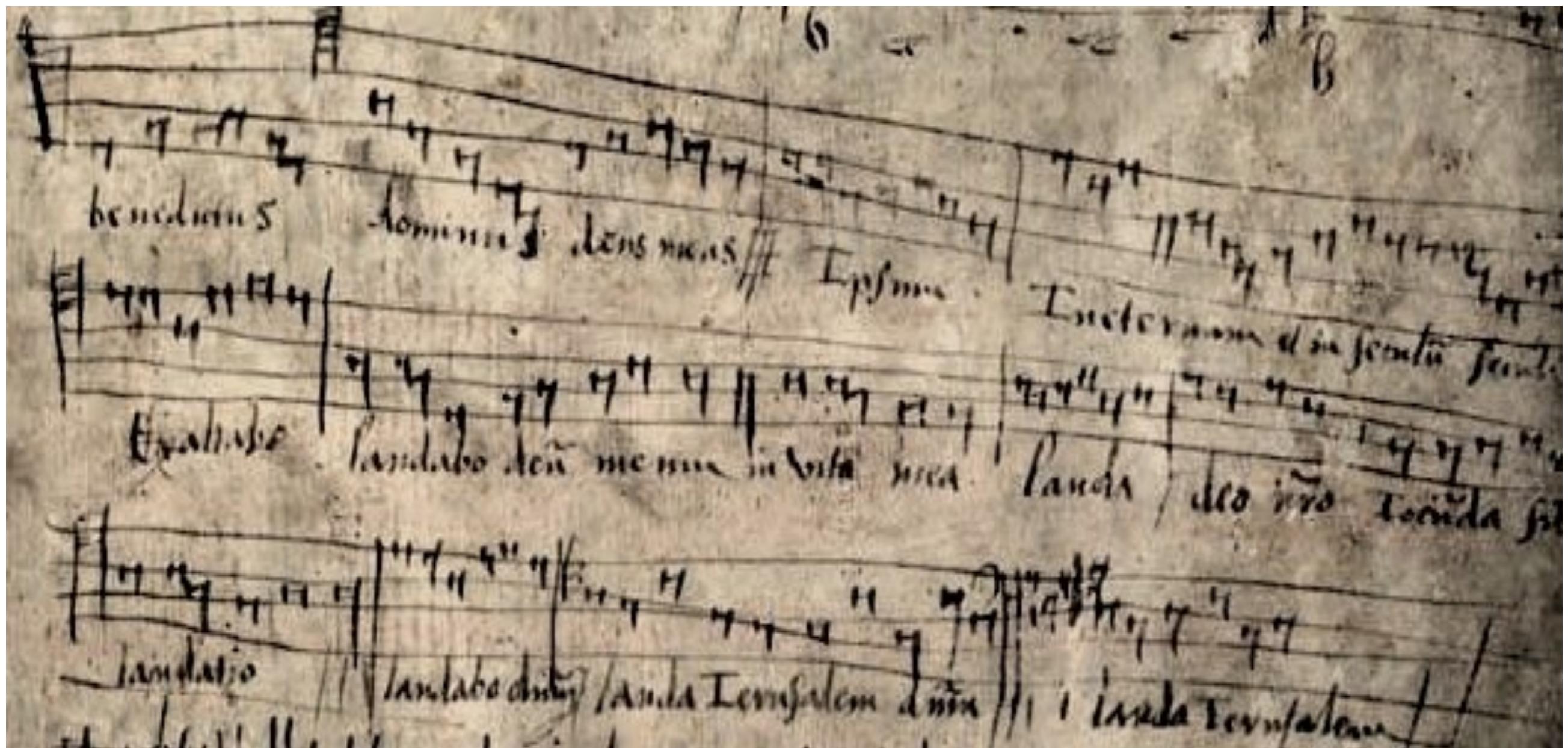


Staffline Removal



Four-line hand-drawn staff example

Staffline Removal



Difficult

Extracting lyrics from Early music



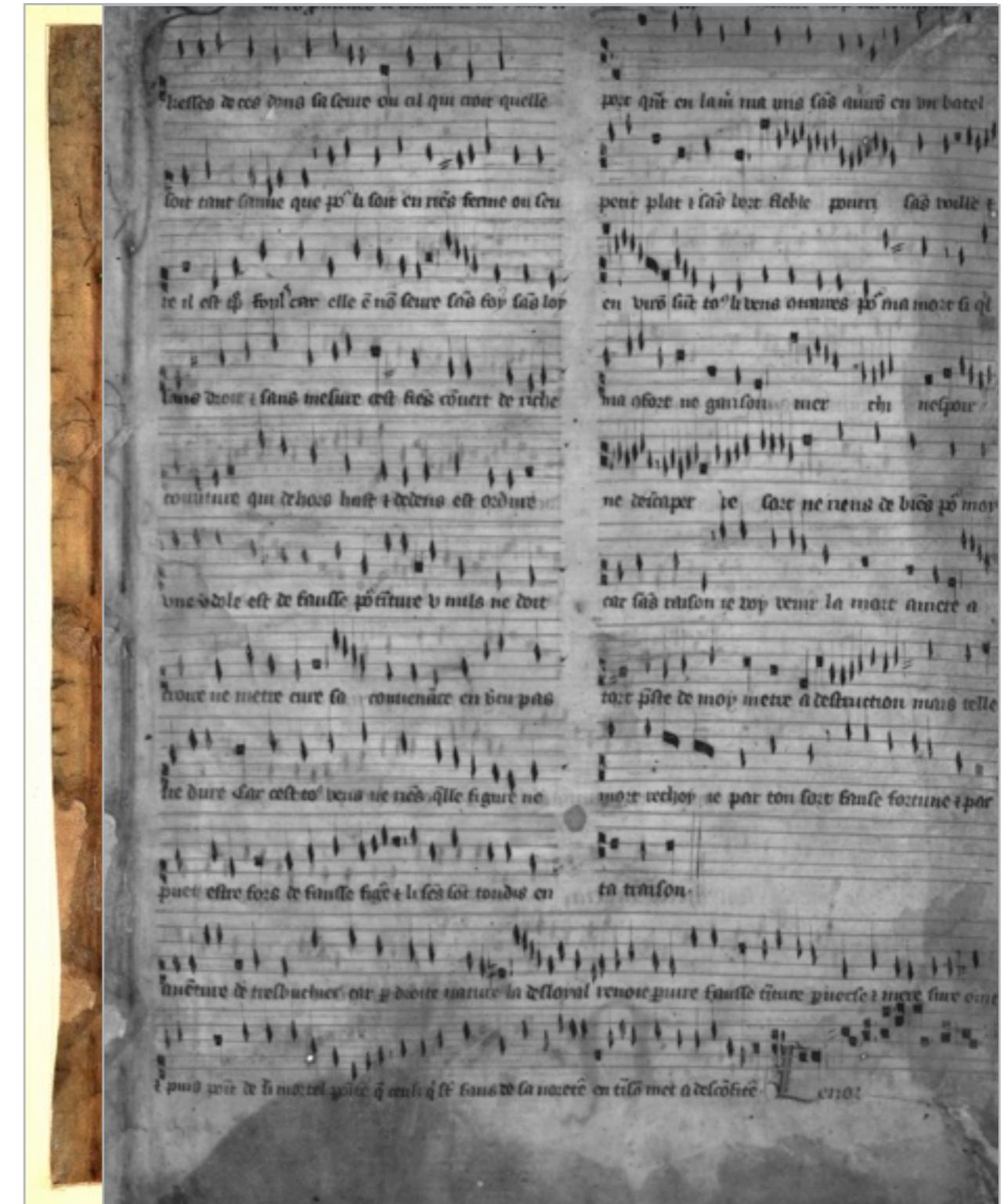
Images Courtesy of

Extracting lyrics from Early music

Images Courtesy of



Preprocessing: Greyscale



Preprocessing: BG estimation

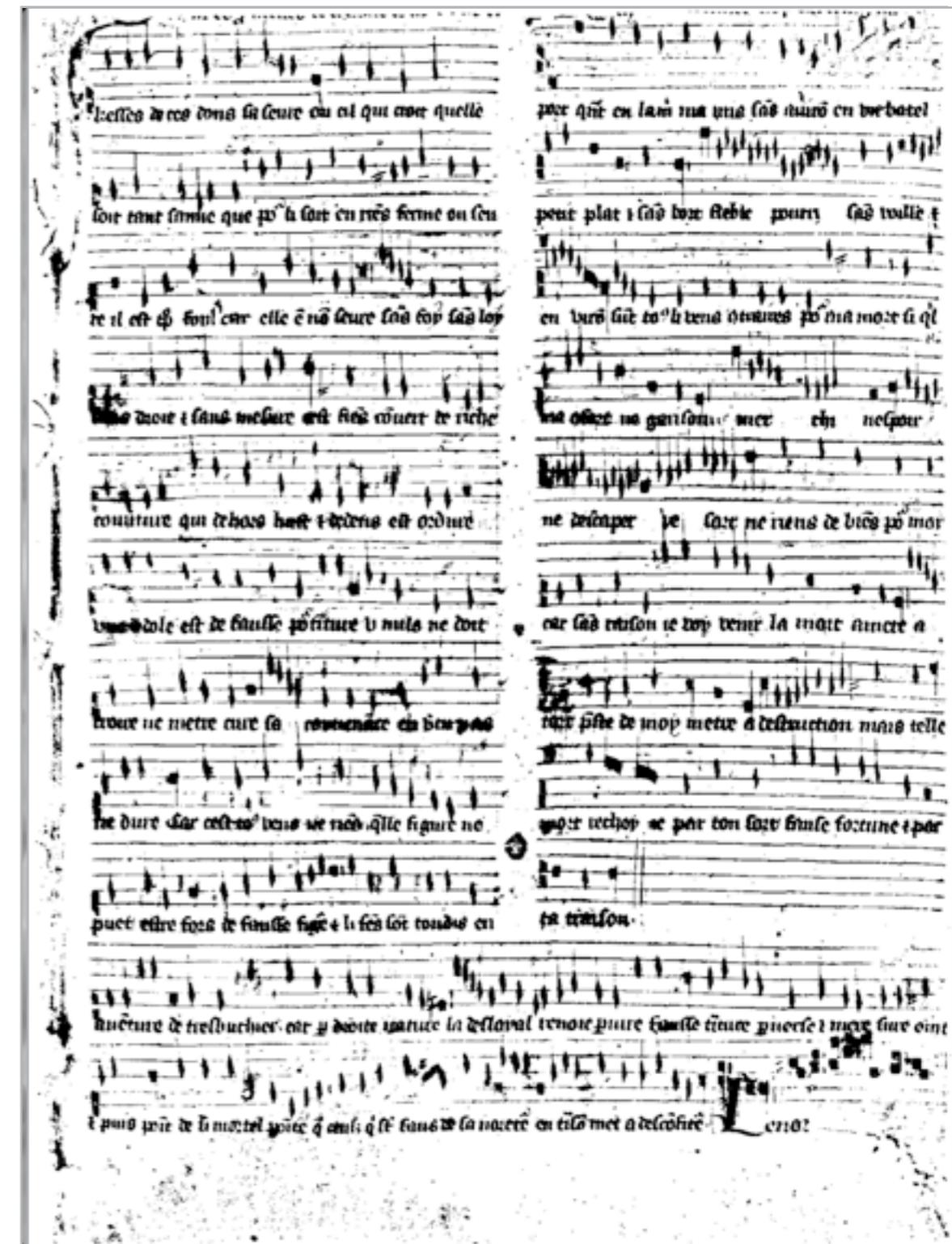


helles de ces dans la leure ou al qui amer quelle
loit tout simme que po' tu soit en rès ferme ou leu
te il est q' foul car elle e nō leure los moy las lor
lme droit i sans mesme est ries couert de riche
rousture qui dehos hant t dehors est ordure
une vole est de fausse pouture v mis ne dit
troue ne mette cure so conuenante en deu pas
lie dure l'ar cest le deus ne rès quelle figure ne
pue estre fors de fausse figure le ses lois toutes en
l'autre de tressbutier sur p doute nature la defforal renoue poutre fausse figure poutre t mere sine oint
t poutre poutre de la moutre grise q' ceul q' le bonis de la moutre en tilo met a descolorer L en 102

A grayscale image of a medieval manuscript page. The page contains musical notation on four-line staves and lyrics written below them in a Gothic script. The lyrics are as follows:

helles de ces dans la leure ou al qui amer quelle
loit tout simme que po' tu soit en rès ferme ou leu
te il est q' foul car elle e nō leure los moy las lor
lme droit i sans mesme est ries couert de riche
rousture qui dehos hant t dehors est ordure
une vole est de fausse pouture v mis ne dit
troue ne mette cure so conuenante en deu pas
lie dure l'ar cest le deus ne rès quelle figure ne
pue estre fors de fausse figure le ses lois toutes en
l'autre de tressbutier sur p doute nature la defforal renoue poutre fausse figure poutre t mere sine oint
t poutre poutre de la moutre grise q' ceul q' le bonis de la moutre en tilo met a descolorer L en 102

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

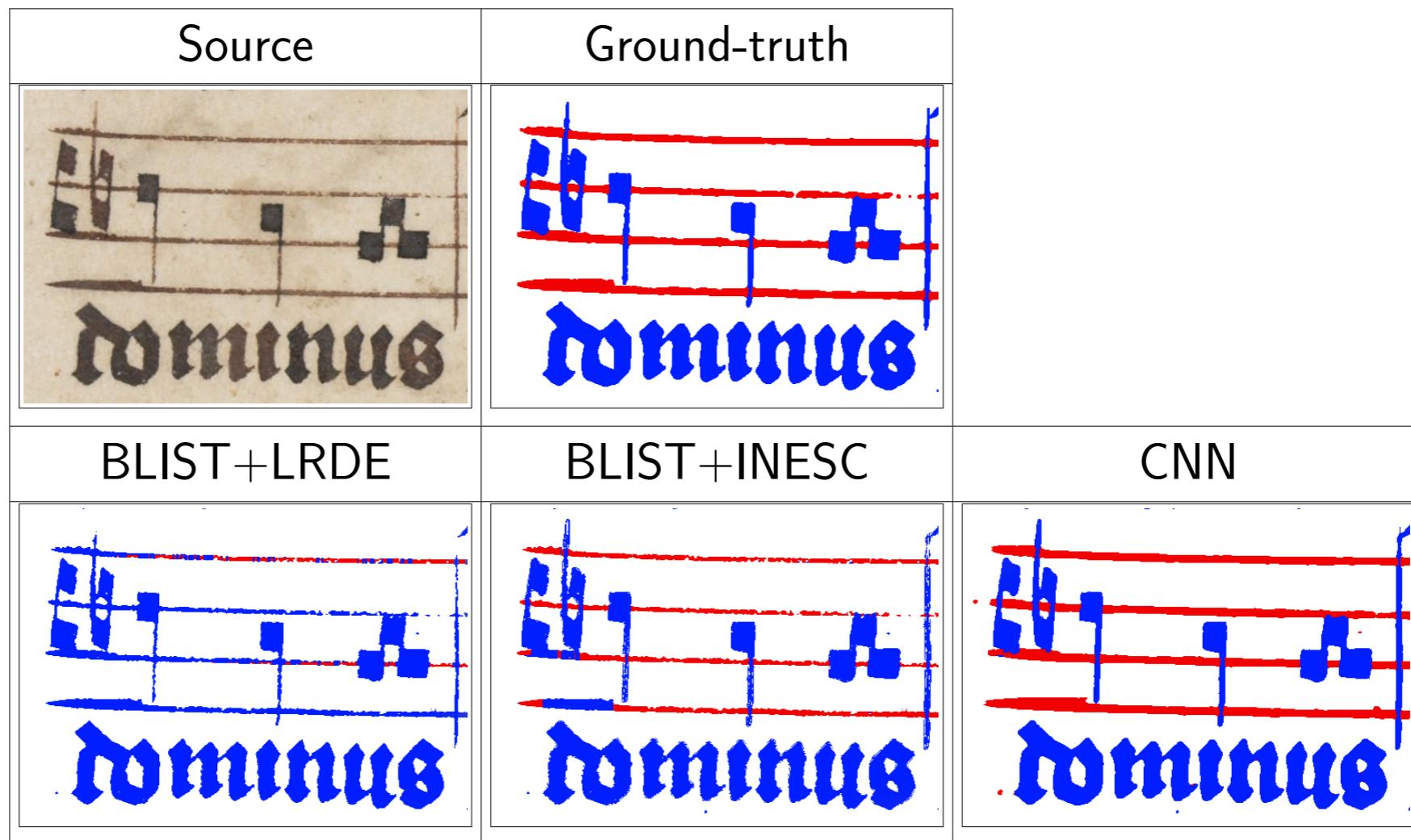
besses de ces dons la leure ou ou qui voit quelle
 soit tenu simile que po la soit en mes feme ou seu
 re il est qd foul car elle e na leure los for las loy
 ma dore i sans meurt est fies couer de riche
 couture qui debors hest tedenis est ordure
 une chose est de faulx porteur u nuls ne doit
 trouer ne mette oute sa rumeur en bres
 ne dure sur ceste 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?

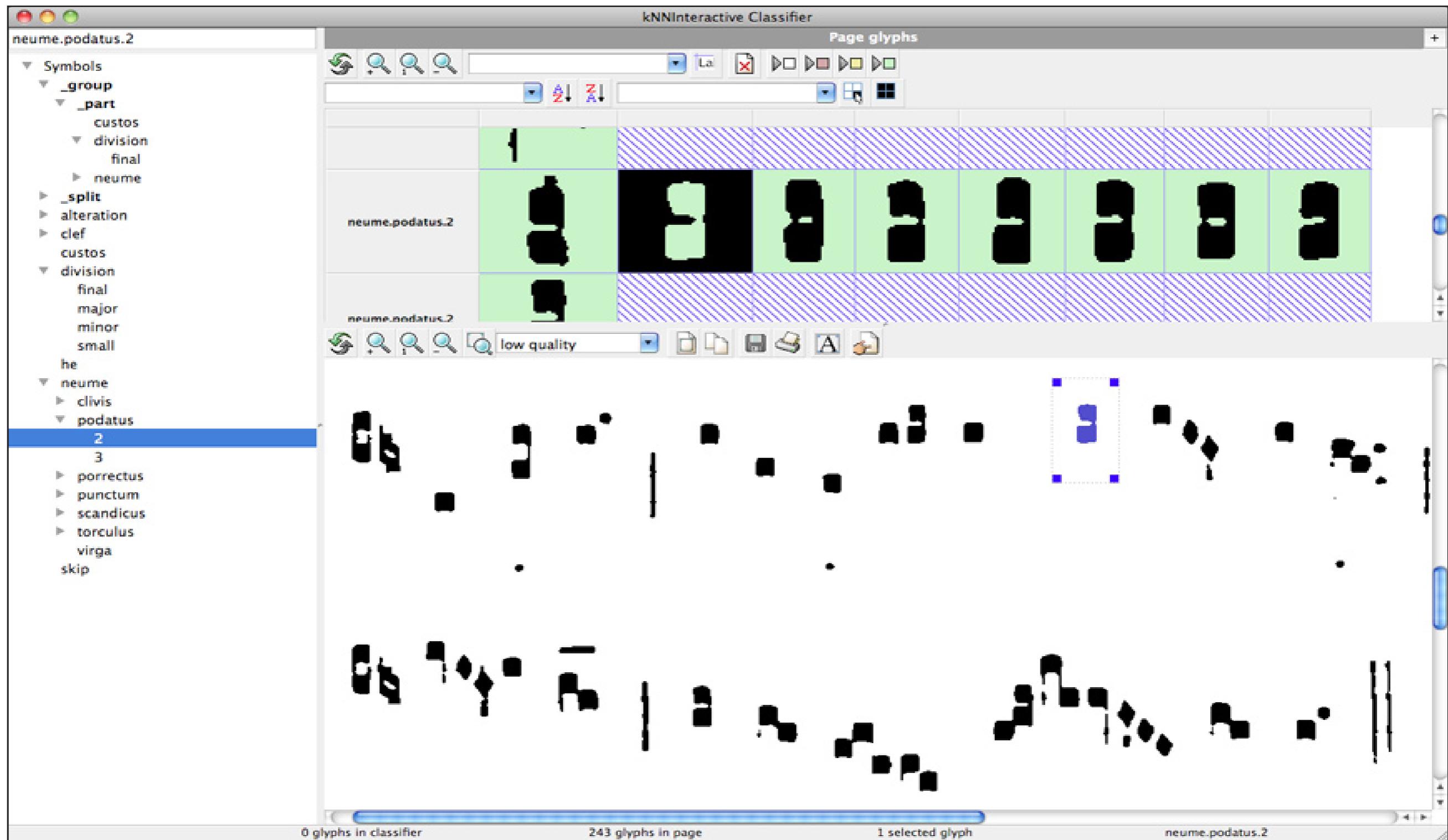
One-step detection of elements in music scores using machine learning

(Calvo-Zaragoza et al., 2017)

QUALITATIVE RESULTS



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

The manuscript page contains the following Latin text:

flere 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 salutem erimus. Domine. pmi.
Splendor paternae. verbi. Emitte agnum domine
dominatorem terrae. De petra deserti ad montem
filie syon. Ad benedictus antiphona.

Web visualizer: Diva.js



Zoom level: 2

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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 (another example)
 - 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
 - Annual evaluation campaign for MIR algorithms
 - Different tasks!

MIR: Music Information Retrieval

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

The End!