

# OMR for Mensural Notation: Looking at a Guatemalan Music Manuscript

Martha E. Thomae

SIMSSA Workshop XIX

September 21<sup>st</sup>, 2019

# Dissertation Project

- Preservation of the colonial musical heritage of Guatemala
- Collection of 6 choirbooks written in mensural notation
- Increase access to these sources through:
  1. Digitization
  2. OMR
  3. Automatic transcription (into modern values)

## GuatC 1: Guatemalan Choirbook 1

- January 2019: Digitization stage
- Summer 2019: Working on the other two stages























# Optical Music Recognition (OMR)

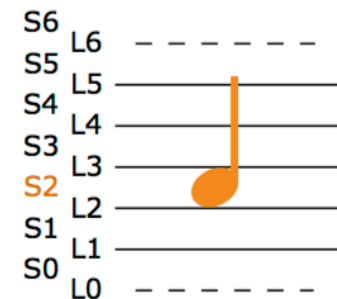
Test an End-to-End OMR Approach  
(Jorge Calvo-Zaragoza and David Rizo)

# End-to-End OMR Approach

- Convolutional Recurrent Neural Network (CRNN) model
- Staff level
- Extracts two pieces of information for each symbol:
  1. Category of the symbol
  2. Category of its vertical position within the staff

Group	Symbol			
Note	Semibrevis	Minima	Col. Minima	Semiminima
				
Rest	Longa	Brevis	Semibrevis	Semiminima
				
Clef	C Clef	G Clef	F Clef (I)	F Clef (II)
				
Time	Major	Minor	Common	Cut
				
Others	Flat	Sharp	Dot	Custos
				

(Pacha and Calvo-Zaragoza, 2018)



(Pacha and Calvo-Zaragoza, 2018)



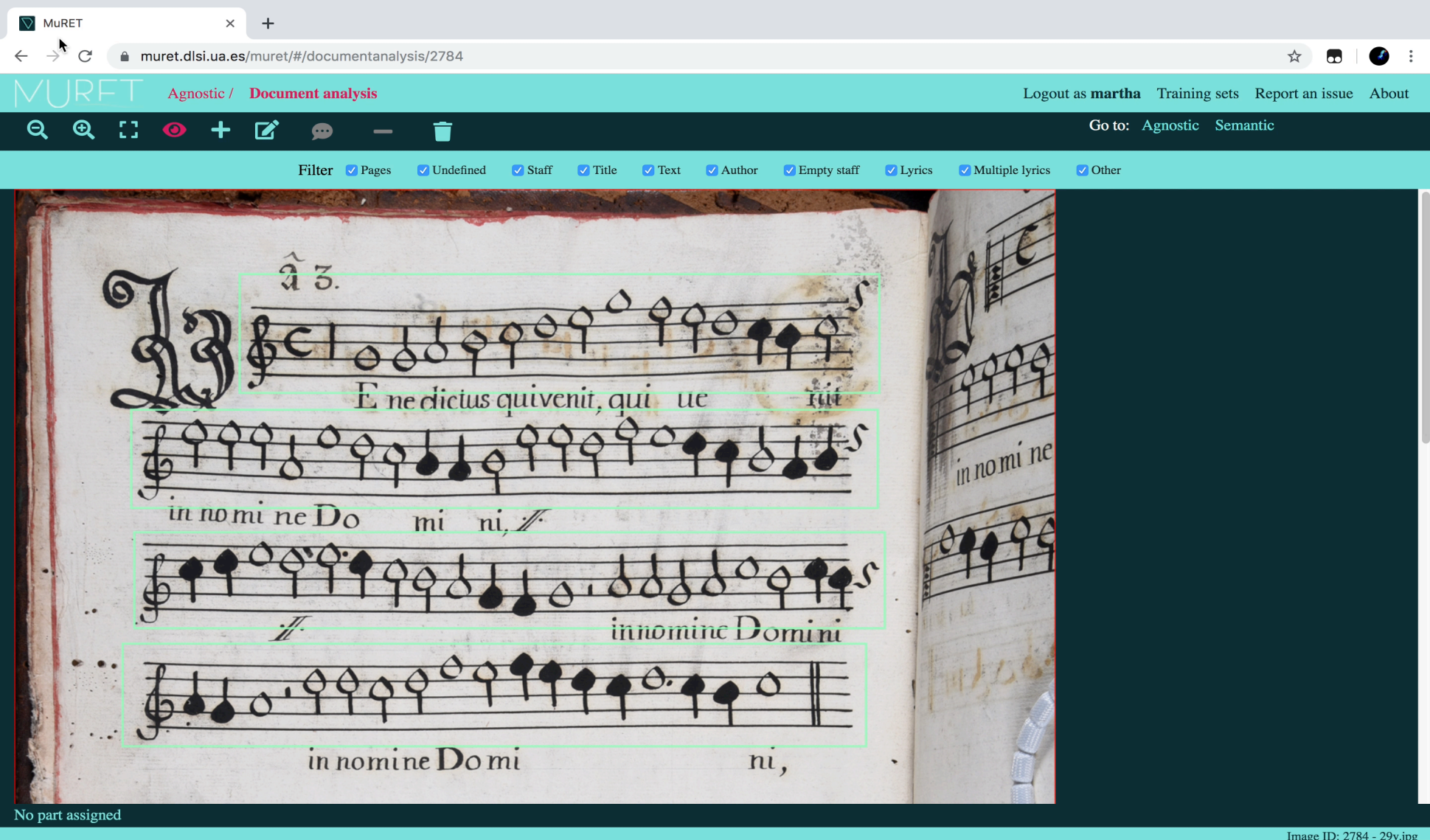
# End-to-End OMR Approach

## **Reasons:**

- a) Efficiency
- b) Model already trained on Spanish mensural notation
  - Seventeenth-century manuscript
  - Corresponding to a complete mass (a 12)
  - From the Cathedral of Zaragoza

# MuRET (Music Recognition, Encoding, and Transcription)

MuRET interface showing a document analysis of a musical score. The interface includes a browser window with the URL `muret.dlsi.ua.es/muret/#/documentanalysis/2784`. The main display shows a scanned image of a musical manuscript page with four staves of music. The lyrics are: "E ne dicius qui uenit, qui ue nit in no mi ne Do mi ni, in nomine Domini in nomine Do mi ni,". The interface also features a filter bar with options: Filter, Pages, Undefined, Staff, Title, Text, Author, Empty staff, Lyrics, Multiple lyrics, and Other. The status bar at the bottom indicates "No part assigned" and "Image ID: 2784 - 29v.jpg".



The screenshot displays the MuRET web application. At the top, a browser tab shows the MuRET logo and a close button. The address bar contains the URL `muret.dlsi.ua.es/muret/#/documentanalysis/2784`. Below the browser window, the MuRET header is visible, including the logo, navigation links for "Agnostic / Document analysis", and user information "Logout as martha". A toolbar with various icons for document manipulation is located below the header. A filter bar with checkboxes for "Pages", "Undefined", "Staff", "Title", "Text", "Author", "Empty staff", "Lyrics", "Multiple lyrics", and "Other" is present. The main content area shows a scanned image of a musical manuscript page with four staves of music. The lyrics are: "E ne dicius qui uenit, qui ue nit in no mi ne Do mi ni, in nomine Domini in nomine Do mi ni,". The interface also features a status bar at the bottom indicating "No part assigned" and "Image ID: 2784 - 29v.jpg".

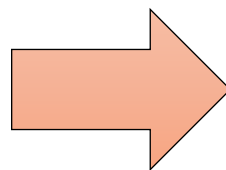
# Automatic Transcription of Mensural Notation

**Translation Problem:**

Graphical encoding (OMR) → Musical meaning

# Translator: Agnostic to Semantic

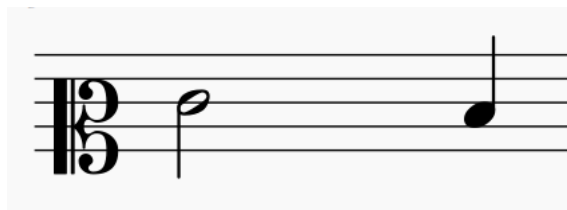
Agnostic Sequence  
token = symbol + line/space



Semantic Sequence  
token = symbol + pitch

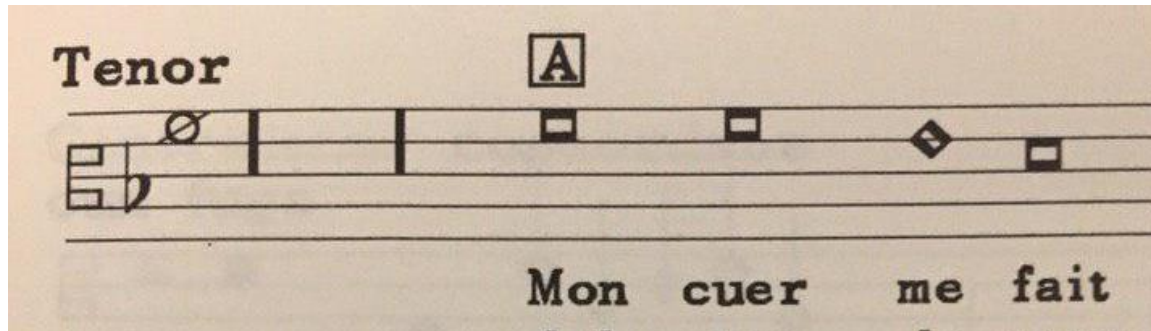
clef.C-L2 note.half-L3 note.quarter-S2

clef.C2 note-E4\_half note-D4\_quarter



# Translator: Agnostic to Semantic

- Note shape (i.e., symbol class) is not enough to convey the duration of a note in mensural notation

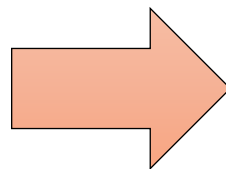


# Translation: Agnostic to Semantic

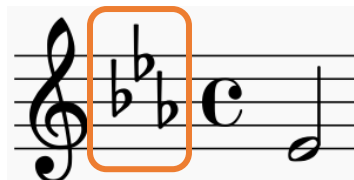
- Machine learning based model (sequence-to-sequence model)
  - Training set: pairs of agnostic and semantic sequences
  - Not enough training data for mensural notation (yet)
  - Test the implemented translator:
    - **PrIMuS** (Printed Images of Music Staves) dataset
      - Set of 87,678 real-music incipits
      - In common Western music notation
- <https://grfia.dlsi.ua.es/primus/>  
[\(Calvo-Zaragoza and Rizo 2018\)](#)

# Translator: Agnostic to Semantic

Agnostic Sequence  
token = symbol + line/space



Semantic Sequence  
token = symbol + pitch

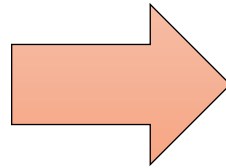


**clef.G-L2** accidental.flat-L3 accidental.flat-S4 accidental.flat-S2 **metersign.C/-L3** note.half-L1

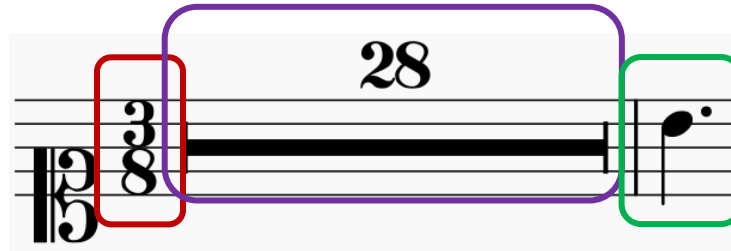
**clef-G2** keySignature-EbM **timeSignature-C/** note-Eb4\_half

# Translator: Agnostic to Semantic

Agnostic Sequence  
token = symbol + line/space



Semantic Sequence  
token = symbol + pitch



clef.C-L1 digit.3-L4 digit.8-L2 digit.2-S5 digit.8-S5 multirest-L3 barline-L1 note.quarter-S4 dot-S4

clef-C1 timeSignature-3/8 multirest-28 barline note-C5\_quarter.



# Future Work

- Finish performing OMR on the whole GuatC1 manuscript
- Obtain the training data for testing the translation model on mensural notation
- Compare the machine learning based approach against a heuristic one (MA thesis)

# Thank you!

[martha.thomaeelias@mail.mcgill.ca](mailto:martha.thomaeelias@mail.mcgill.ca)

Special thanks to: José Manuel Iñesta, David Rizo, and Jorge Calvo-Zaragoza



Social Sciences and Humanities  
Research Council of Canada

Conseil de recherches en  
sciences humaines du Canada

Canada



McGill



Schulich School of Music  
École de musique Schulich

DDMAL

DISTRIBUTED DIGITAL MUSIC  
ARCHIVES & LIBRARIES LAB

# Sequence-to-Sequence Model with Attention

