A review of the ChIA Project

Accessing and Analysing Cultural Images with New Technologies

Amelie Dorn[1], Yalemisew Abgaz[2], Gerda Koch[3] Renato Rocha Souza[1] & Japesh Methuku[2]

[1]ACDH-CH ÖAW, [2]Dublin City University, [3]Europeana Local - Österreich

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Background

ChIA

Project details

Funded in 2018 by the go!digital Next Generation call of the Austrian Academy of Sciences
Project duration: 24 months

Involved expertise

Digital Humanities, AI & NLP (ACDH-CH OeAW, AT)
Semantic technologies (Dublin City University, IE)
Cultural Image aggregation (Europeana Local - Österreich, AT)

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Project team

ChIA

PI: Amelie Dorn (ÖAW)

PI: Yalemisew Abgaz (IE)

Gerda Koch (Europeana)

Renato Rocha Souza (ÖAW)

Japesh Methuku (IE)

with Ramiro Ortiz

Advisory board

- Artificial Intelligence: Ulla Kruhse-Lehtonen (Dain Studios) -FI
- Infrastructures and GLAM: Luca Pezzatti (E-RIHS) – IT
- Knowledge Design / DH: Jeffrey Schnapp – US
- Semantic Technologies: Anna Fensel (STI) – AT

Former Project members:

José Luis Preza Díaz (ÖAW)

meta ℓ[a]6(at) harvard

DAIN STUDIOS

E-RIHS EUROPEAN RESEARCH INFRASTRUCTURE FOR HERITAGE SCIENCE

universität innsbruck

Project team

Expertise

PI: Amelie Dorn (ÖAW)

DH, Cultural analysis

PI: Yalemisew Abgaz (IE)

Semantic technologies

Gerda Koch (Europeana)

Image aggregation
Cultural Heritage

Renato Rocha Souza (ÖAW)

Japesh Methuku (IE)

AI, NLP, Machine learning

Advisory board

- Artificial Intelligence: Ulla Kruhse-Lehtonen (Dain Studios) -FI
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Project aims

ChIA

- engage and **test** **new technologies** (Semantic/ AI) against a background of a selected dataset of **food images**

- enhance **access** and **analysis** possibilities for **cultural data**

Image: Abraham van Beyeren, 1655, Mauritshuis. (CC-BY-PD)

Image: Abraham van Beyeren, 1655, Mauritshuis. (CC-BY-PD)

Title: Banquet Still Life

Image: Balthasar van der Ast, 1620, Mauritshuis. (CC-BY-PD)

Image: Balthasar van der Ast, 1620, Mauritshuis. (CC-BY-PD)

Title: Fruit Still Life with Shells and Tulip

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Research Context

ChIA

The major research questions

- How can we explicitly and semantically represent and interlink the rich information contained in historical food images?
- How can we support efficient search, analysis and exploit historical images by both humans and machines?
- What AI tools are available and how can we build AI tools for the exploitation of historical images?

Image: Banquet Still Life (Adriaen Van Utrecht); CC-By-PD

Data

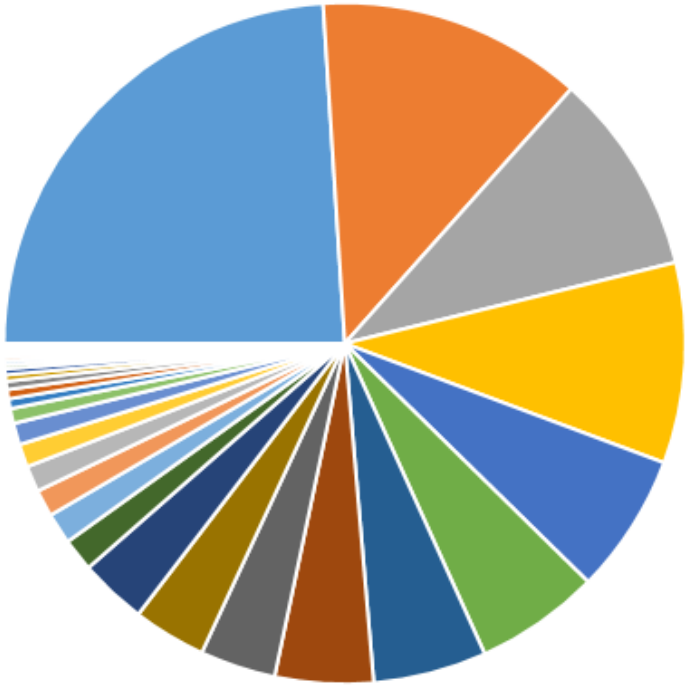
Europeana data set

Total: 58.6 Mio digital objects

Includes: 34.2 Mio digital images

from: 3.500 institutions in 42 countries

Netherlands	United Kingdom	Sweden	Germany	France
Italy	Norway	Belgium	Spain	Denmark
Austria	Czech Republic	Hungary	Finland	Poland
Europe	Greece	Estonia	Lithuania	Slovenia
Portugal	Switzerland	Ireland	Croatia	Latvia
Romania	Malta	Bulgaria	Slovakia	Cyprus
Israel	Serbia	Iceland	Ukraine	Turkey
Russia	Macedonia	Moldova	Montenegro	Georgia
Bosnia and Herzegovia	Luxembourg	Albania		



https://www.europeana.eu/de

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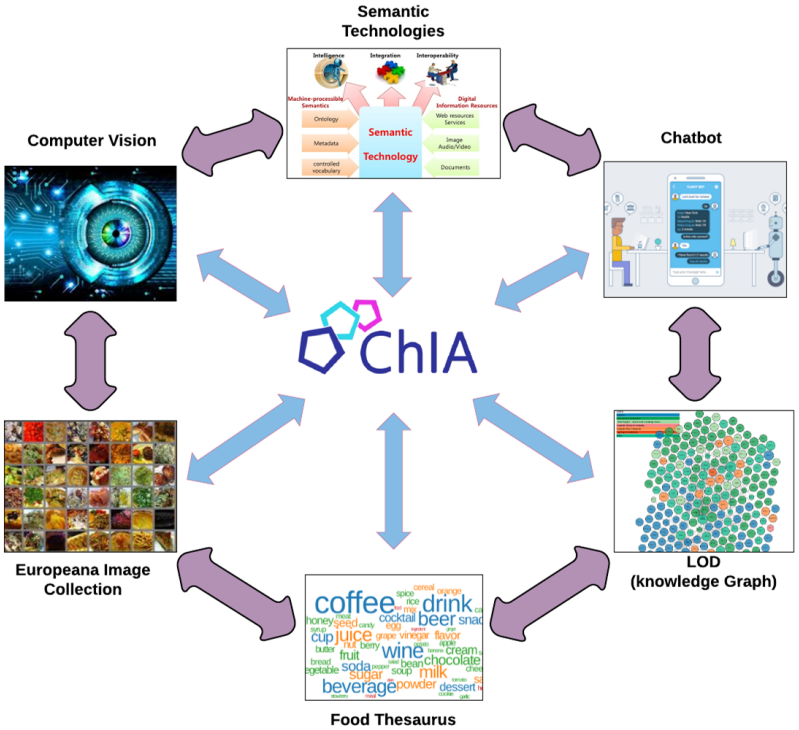
The ChIA dataset

- Selection based on food context of images
- 42.969 images (available with Free Access licenses); ~20.000 images dealing with “food” selected in form of various sets (baskets) for later download & analysis of metadata and images

The ChIA system

Methods & Tools



- Semantic Technologies
- Chatbot Technology
- Knowledge Maps/Graphs
- Visual Search

Collaboration

The case of building an experimental dataset

- Bridging the gap between the information packed in the images and the explicit annotation of the content of the images using ontologies.

- Interactions between the team members to understand the problem and to work towards the solution

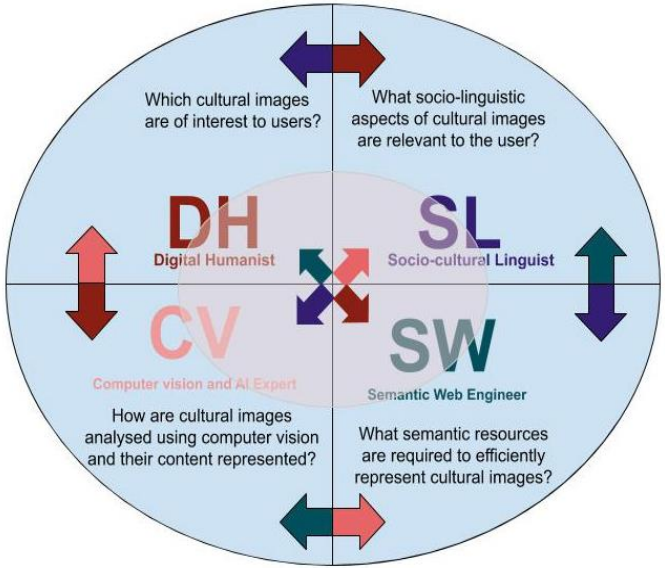


Image: CC-BY-4.0 Yalemisew Abgaz in Abgaz, Dorn, Koch & Preza Diaz. (2020).

Overall Outcomes

- the ChIA system
- A search and exploration system for Europeana datasets

  → experimentation with alternative modes of navigation
  → approach to objects within networks of relations

- Reports on advantages/challenges of the application of current and next technologies on the example of Europeana data

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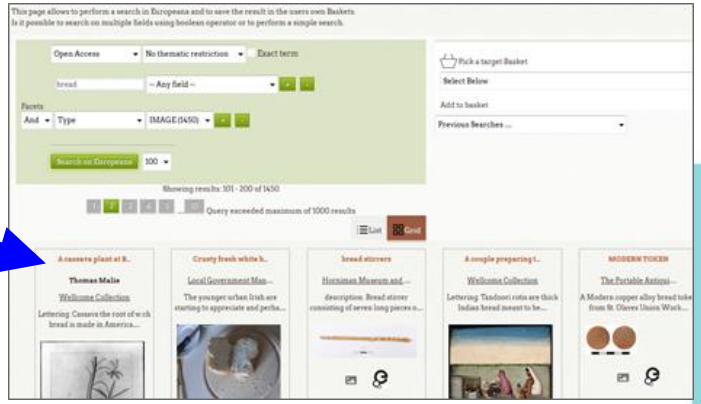
Results: the ChIA platform

europeana local Österreich

The ChIA intermediate infrastructure...

- ...was set up as one-stop shop for **access&download** of Europeana images and supports download of digital **images&metadata** in one process including a checking routine on data availability and data access rights
- ...provides for researchers the possibility to easily **generate** out of the wealth of (open access) Europeana digital content **customized test data sets** for further analysis with CV/CNN/AI tools.



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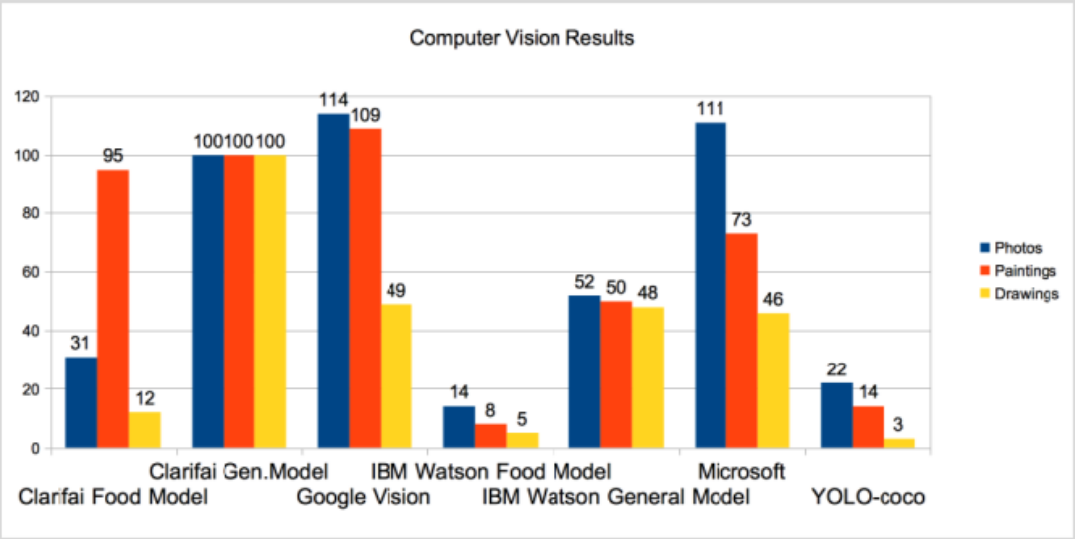
Results: Computer Vision

Pilot-test on selected images (n=15) of different commercial (Google Vision, Clarifai, IBM Watson, Microsoft Services) and open-source (YOLO) Computer Vision (CV) tools for cultural food image analysis. 3 image categories: photographs, drawings, sketches



Source: Preza Diaz et al. 2020

- Not only quantity, but also quality of generated CV concepts seems important for successfully enriching cultural food images.
- Some types of images (e.g. sketches) particularly challenging to process for CV solutions.

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Image classification

Assessing the (human) inter-annotator agreement

Task_1	Amelie	Gerda	Marcos	Renato	Yalemisew
Amelie	1.000/(392)	0.928/(392)	0.892/(392)	0.907/(392)	0.886/(391)
Gerda	0.928/(392)	1.000/(392)	0.892/(392)	0.938/(392)	0.896/(391)
Marcos	0.892/(392)	0.892/(392)	1.000/(392)	0.923/(392)	0.923/(391)
Renato	0.907/(392)	0.938/(392)	0.923/(392)	1.000/(392)	0.918/(391)
Yalemisew	0.886/(391)	0.896/(391)	0.923/(391)	0.918/(391)	1.000/(391)

Task_2	Amelie	Gerda	Marcos	Renato	Yalemisew
Amelie	1.000/(392)	0.330/(392)	0.252/(392)	0.316/(392)	-0.091/(392)
Gerda	0.330/(392)	1.000/(392)	0.210/(392)	0.306/(392)	0.153/(392)
Marcos	0.252/(392)	0.210/(392)	1.000/(392)	0.051/(392)	-0.031/(392)
Renato	0.316/(392)	0.306/(392)	0.051/(392)	1.000/(392)	-0.028/(392)
Yalemisew	-0.091/(392)	0.153/(392)	-0.031/(392)	-0.028/(392)	1.000/(392)

Task_3	Amelie	Gerda	Marcos	Renato	Yalemisew
Amelie	1.000/(392)	0.659/(392)	0.296/(392)	0.534/(392)	0.317/(392)
Gerda	0.659/(392)	1.000/(392)	0.325/(392)	0.453/(392)	0.268/(392)
Marcos	0.296/(392)	0.325/(392)	1.000/(392)	0.424/(392)	0.370/(392)
Renato	0.534/(392)	0.453/(392)	0.424/(392)	1.000/(392)	0.454/(392)
Yalemisew	0.317/(392)	0.268/(392)	0.370/(392)	0.454/(392)	1.000/(392)

Table and analysis @ Renato Rocha Souza

Study of available CNN architecture candidates for transfer learning

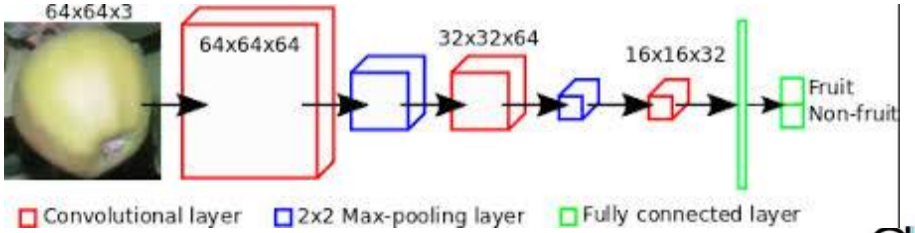

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Image Classification

- Europeana aggregates millions of cultural objects including cultural images on its platform.
- Among the cultural images, we focus on food related images - We love culture and we also love food!
- The collection contains varieties of food images
- We wanted to answer the following questions
    - Can I find food images that contain fruit?
    - Can I find food images that are appealing?
    - Can I find food images that are formal?

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The problem

- The answer to the previous questions is “May be”

- The main reasons are:
  - Cultural concepts such as “appealing” and “formal” are often difficult to understand and define
  - Not sufficient metadata/description is available
  - Existing computer vision is not yet effective in classifying cultural images

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Methods

Our proposed method focuses on

- Formalisation: we use domain specific ontology terms from Existing vocabularies such as Getty Arts and Architecture Thesaurus , Iconclass and FoodOn Ontology
- Annotation: we annotate the images with three vocabulary terms
  - fruit/non-fruit Relatively less complex
  - appealing/non-appealing abstract and dependent on cultural background
  - formal/informal abstract and dependent on cultural background
- Model: we will train and build a CNN model using manually collected annotation
- Automatic annotation: Using the model, we will apply our solution to the bigger Europeana collection

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ChIA

Image Classification Task

1) Definition of a training dataset:

   Still life images

1) Definition of classification protocol
2) Definition of food tags
   & cultural tags

1) Deployment of tool (MakeSense.AI)

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Image Classification Task

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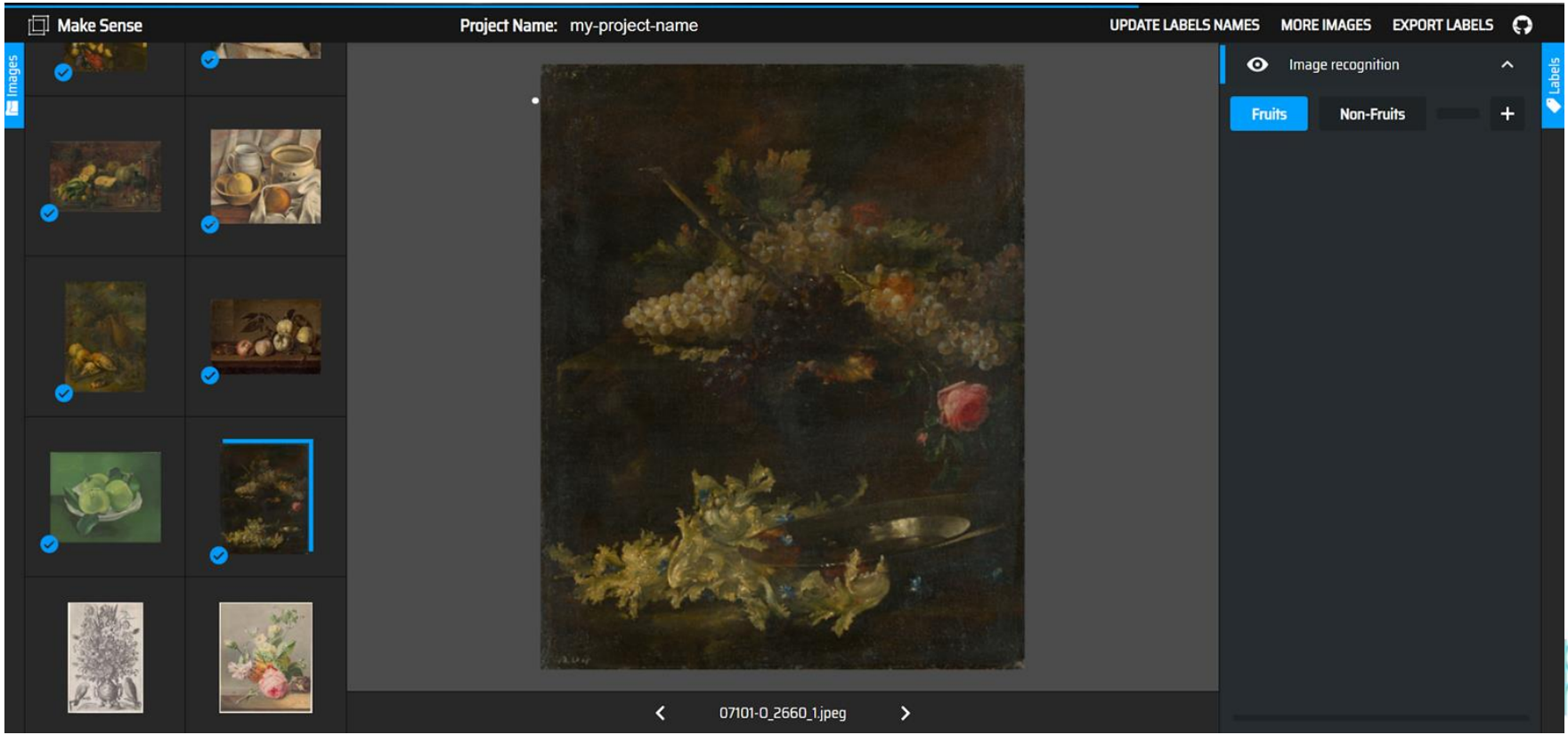

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Results

Lesson learned

- Identifying cultural aspects from the images is very challenging task
- A clear definition of the cultural concepts is crucial for inter rater agreement
- Cultural background of the annotators, gender and personal preference contributed to the low/random agreement

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ChIA cultural food image game

ChIA Cultural Food Image Memory Game – find the historical and corresponding current food images that match!

https://chia.acdh.oeaw.ac.at/games/

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DCU

europeana local Österreich

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ChIA

Thank you

#chia4dh

@adooorn
@yalemisew
@rrsouza
@Europeanaeu

https://chia.acdh.oeaw.ac.at

Yalemisew.Abgaz@adaptcentre.ie
Amelie.Dorn I Renato.Souza@oeaw.ac.at
kochg@europeana-local.at