

Classification of Historic Food Images - a pilot experiment on the example of the ChIA project

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Introduction

This paper is realised in the context of the interdisciplinary Digital Humanities (DH) project ChIA - accessing and analysing cultural images with new technologies (<https://chia.acdh.oeaw.ac.at/>). The project brings together expertise from Digital Humanities, the Cultural Heritage Sector and Computer Science. It generally aims at testing different Semantic technologies and Artificial Intelligence (AI) tools on a selected set of Europeana (<https://www.europeana.eu/de>) food images for improving access and analysis possibilities of knowledge contained within images for research and education purposes. This paper reports a pilot experiment on the human classification of historic food images for the purpose of creating a training data set. In particular, we are describing the classification process of a selected set of Europeana historic food images, taking into account also cultural aspects. This specific combination of concrete (food) and abstract (cultural) features contained within the images poses a significant challenge for both humans and machines when it comes to image classification. Here we report on the research process and provide insights on challenges faced.

Background - Food, Culture and Art

The kind of food we consume, the way it is produced, and the cultural features associated with it - these facets are all closely related to our political and economic history as food consumption evolves parallel to different major historic and cultural eras.

Images related to food, food production or consumption, typically carry strong cultural aspects, and can be found in archaeological representations, various art forms as well as in contemporary social media. Throughout history, food related items have been captured in different social situations and art forms. A large number of paintings and pictures stored in museums, libraries and galleries depict food items carrying strong cultural symbolism, but the cultural meaning often remains hidden to the contemporary observer. Still life paintings and images (see Figure 1) are a particularly prominent category, in which the depiction of food, its interpretation and symbolism has played a major role throughout the centuries. Searching for such images with cultural connotations is frequently hampered by the fact that a detailed description of all items on a picture is missing, also from the title or metadata. That's why creating structured access to implicitly and explicitly contained knowledge can create significantly more opportunities for analysis possibilities across different scholarly fields.



Fig. 1. Example of a still life painting (*Still Life with a Meal*; Peter Binoit, National Museum of Sweden. Image: CC-BY-PD).

The Experiment - Historic Food Image Classification

As a first step in the experiment, a specific dataset and vocabulary had to be selected, as a benchmark data containing images and their relevant semantic annotations were required in order to apply AI and CNN (Convolutional Neural Network) technologies for image recognition. For ChIA, this data is provided by the European portal for cultural heritage, the Europeana Collections portal (<http://www.europeana.eu>) with more than 32 million images available under different licenses. For image collection and retrieval, the ChIA infrastructure hosts a service that supports the collection of test datasets according to predefined search criteria and provides the unique possibility to create selected test sets for further analysis with CV/CNN/AI tools out of the wealth of (open access) Europeana digital content. A concise and homogenous set was chosen carefully, given the large and heterogeneous field of food images. In this case, images of still life scenes were chosen as the preferred dataset, yielding a total of around 700 images.

Next, the vocabulary for tagging was defined. Different approaches were considered based on the evaluation of frequently used concepts within the cultural images domain and iconographic descriptions, which also included the retrieval of a baseline of food concepts from the Getty Arts and Architecture Thesaurus (<https://www.getty.edu/research/tools/vocabularies/aat/>), the IconClass multilingual classification system for cultural content (<http://www.iconclass.org/>) and the FoodOn ontology (<https://foodon.org/>). As none of these common approaches yielded satisfactory solutions for our purpose, a different and simpler binary classification approach was chosen. Images were tagged for food items (food/non-food) and cultural features (formal/informal, appealing/non-appealing) using the MakeSense.AI application (<https://www.makesense.ai/>). Images were tagged by 4 independent annotators.

Results from this experiment showed that classifying historic food images according to both physical and cultural aspects are fairly different tasks. While defined physical patterns are a domain in which the machines have acquired the state-of-the-art, cultural features pose a much more challenging task for both machines and humans, requiring at times different strategies to the commonly applied approaches. The analysis of inter-annotator-agreement shows that humans are able to capture subtle nuances better than machines, no matter how much data is offered for the training task.

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