EUROGRAPHICS Workshop on Graphics and Cultural Heritage (2022)
R. Pintus and F. Ponchio (Editors)

A Course on the Digital Humanities for the Premodern World

Holly Rushmeier[1] and Anne Chen[2]

[1]Yale University [2] Bard College

Abstract

With the roots of digital humanities in text-centric disciplines, coursework has traditionally focused on instruction in skills of relevance for text-based resources, while digital methods for non-textual sources have remained in the minority. We describe a digital humanities course targeted at undergraduate computer science majors and graduate students in cultural heritage adjacent fields. The course foregrounds a specific blend of text-based and visual methods of relevance to practitioners in cultural heritage fields. Acknowledging that digital projects in the humanities are more often than not cross-disciplinary and collaborative, the course is designed to emphasize visual computing techniques while helping students develop experience in cross-disciplinary communication. The requirements for the two groups are different to ensure that all students are challenged. The course includes a substantial group project. Each group is composed of both humanities and computer science students and the project goal is defined by the humanities students. The purpose of the project is both to apply methods learned in the course and to learn collaboration in a team with individuals with different levels and types of expertise.

CCS Concepts

• ***Applied computing*** → ***Arts and humanities; Education;***

1. Introduction

The digital humanities (DH) has expanded into a vast field including a wide array of methods for analysis and communication in humanist studies. The area has come a long way since its first robust growth among (primarily) researchers working with text-based source material. Today, collections of digitized data available for study have grown in size and variety, including painting and sculpture, live performance, architecture, and much more. Relevant concepts and methods are drawn from across computer science including artificial intelligence, databases, information retrieval, human computer interaction, graphics, vision, natural language processing and software engineering. As the area of DH has grown, so too has existential debate about its future: should the area exist as a niche of its own, or should digital methods be integrated into existing disciplines?

No matter where an individual scholar falls in this debate, there is a growing consensus that it has become impossible to thoroughly prepare students to effectively do work across all of DH in a single course, and that interdisciplinary communication and collaboration are fundamental to most DH endeavors. In our experience, however, DH courses are frequently targeted at either computer science students or humanities students of various disciplines, leaving very little opportunity for students to gain experience in the sort of cross-disciplinary communication between technical and content experts that characterizes most real-world DH work. To stimulate more exchange about how to effectively train DH students whose humanities discipline is grounded in more than just text-based evidence, we describe a digital humanities course targeted at undergraduate computer science majors and graduate students in cultural heritage-adjacent fields. The course foregrounds a specific blend of text-based and visual methods of relevance to practitioners in cultural heritage fields. The course is designed to emphasize visual computing techniques [MT19] while helping students develop experience in cross-disciplinary communication.

A leading concern in interdisciplinary courses is lack of coherence. Jumping around from topic to topic in both the humanities and computer science can leave students without a coherent understanding of the material. As the study of cultural heritage is inherently interdisciplinary (involving such fields as art history, history, religious studies, literature, performing arts, and philosophy, among many others), we decided that grounding the course in a single archaeological site – Dura-Europos, in what is today Syria – would provide a shared reference point while allowing students the possibility to approach content from a chosen (humanities) disciplinary angle. This approach also demonstrated how a variety of methods could be used in a single investigation. The site was chosen because both digital and physical materials from the site could be made available to students from our university museum. Examples of artifacts representing different aspects of life (e.g. military, religious), different materials (organic and inorganic), and different cultures (Greek, Roman, Parthian) are shown in Fig. 1.

Finally, another concern in interdisciplinary courses students

Figure 1: *Examples of the wide range of artifacts from Dura-Europos available for study. Top: A painting which shows Greek, Roman, and Palmyrene influences. Bottom left: A fragment of wool tapestry, Bottom right: Horse armor. All images public domain.*

may walk away with the false impression that expertise in multiple disciplines is necessary to do useful work. It is important to learn how to collaborate with people with different areas of expertise. The large group projects in the last weeks of the course were intended to develop the ability to collaborate. Like critical thinking, interdisciplinary collaboration takes practice.

Below we describe the in-class topics and activities, assignments, and results. The goal of this paper is to promote exchange between educators on effective education in the humanities particularly in the area of visual media.

2. In-Class Topics and Activities

The course consisted of 13 weeks of class meetings followed by a week and a half of further project work. The first ten weeks were lectures contextualizing the archaeological site of Dura-Europos and topics in (primarily visual) computing (with selected textbased methods as suited the course's unifying archaeological theme). The final three weeks were reserved for in-class project work. In-person course attendance and active participation in class were 20% total grade.

The course began with a week of introductory lectures on the digital humanities in general and the history of Dura-Europos. Readings included a chapter on the site (chapter 2 of [Bai18]) and tutorials on computer programming languages with examples.

The second and third weeks considered two widely-used languages in the digital humanities – Python and Javascript – and the sorts of issues typically found in records from cultural heritage sites like Dura-Europos. Readings included a discussion of the bias in photographs of an excavation [BM14] and in the cleaning of meta-data for artifacts [RM16]. These themes were related by discussing how programs are designed to analyze images and clean meta-data The class was divided into small mixed groups to do simple in-class programming assignments. The goal was to have the computer science students assist the humanities students to begin the process of learning how to collaborate.

The fourth and fifth weeks were devoted to web technologies to collect, access, and present information and a consideration of the differences between in-person and virtual experiences. Readings included a paper on "generous interfaces" for collections [Whi15], in addition to tutorials on web technologies. Students were required to visit and record observations of Dura-Europos artifacts in the museum, and then discuss the contrast between the in-person experience with viewing images available on-line.

The discussion of information retrieval via web technologies and using online databases segued to the topic of Wikidata and the semantic web in the sixth week. Readings included the original paper on the semantic web [BLHL01] and an example of a web site that uses Wikidata [TSN18]. In class activities included a Wikidata editathon to enter Dura-Europos data.

The seventh week covered text encoding and inscriptions. All of the students participated in the lecture on mark-ups for epigraphers [RF21]. This was followed by a session where students were split into two groups – with the humanities students doing practical inscriptional encoding and the computer science students attending a lecture on the principles of computational photography.

The eighth through tenth weeks considered computational photography with an emphasis on photogrammetry on the computer science side and on museum conservation and documentation on the humanities side. This began with a survey of techniques and a demonstration of photogrammetry and RTI. In class the students were divided into small groups and used their phones to image and process a variety of 3D test objects selected to pose a variety of challenges to photogrammetric reconstruction. Students heard lectures from professionals from our university museum – a conservator who has worked on a variety of objects from Dura-Europos and photographers who use imaging in documentation. This section culminated with the students working in the museum capturing photogrammetric models of actual artifacts from Dura-Europos. The students were also required to research the literature related to the object they modeled. The students again worked in teams so that the humanities students could provide guidance in researching the information about the artifacts.

The final three weeks were devoted to working in small groups on a final project. Students were required to work in-person as a team during the class period (as well as outside of class.) This allowed the instructors to meet with each group and ensure that all members were engaged and that projects were progressing.

3. Assignments

Before each lecture, students were required to submit responses to assigned readings. Many of the readings were the same for all, but in some cases were tailored for the different groups. For computer

science students the reading responses were prompted by specific "guided reading" questions. For humanities students more complex reflections on issues raised and the relationship to their own research work were required.

To allay anxieties the humanities students were not required to do any programming assignments. They were required to work through tutorials on Python and Javascript, but were not tested or required to do problem sets. Humanities students were required, however, to turn in computational results for less-technically demanding tasks such as creating Wikidata queries and processing images into a photogrammetric model. Uploaded in-class assignments counted as part of a student's averaged assignments grade. In exchange for adjusted technical mastery expectations, humanities students were required to take the lead on humanities research question development and content research that would serve as the basis for the development of team-based final projects. Interdisciplinary groups formed on the basis of working to solve a humanities-based question/problem suggested by a student trained primarily in the humanities. Groups met individually multiple times with the humanities professor to refine their ideas on suitable questions that could be addressed with methods covered in class.

The computer science students were given three independent programming assignments to develop themes from the first ten weeks of the class. Altogether these assignments accounted for 20% of their grade. The assignments had both well-specified input/output components and more open-ended components. The students came with a variety of backgrounds in web development, databases, and computer graphics/vision.

The first assignment, based in Python, considered data cleaning and image analysis. For data cleaning, students were given a spreadsheet of museum meta-data of approximately 15,000 items and asked to print out the name and number of unique entries for each field in the file and the top ten most frequent entries for each field. They were then given the open-ended question to "clean" the data in some way such as correcting typos or removing redundancies. Follow-up in-class plenary discussion focused on assessing what may be inadvertently lost in the process of data cleaning. A second open-ended task for more advanced students was to implement a method of summarizing the contents of the file.

To stimulate creative thinking about the limits of computational image analysis, a further technical assignment pointed students to a paper [GS20] that computes sounds from image pixel values in field photographs from Dura-Europos such as those shown in Fig. 2. Proponents argue that such technical interventions make the seemingly familiar (the photograph), strange again, thus opening the way for new insights. As pixels are converted to sounds, viewers are invited to spend more time studying each photograph and to think about the people and structures shown. As an alternate method of utilizing technical means to force viewers to spend more time with an image set, students were asked to compute a vector of three values from an image, and then use the image vectors to order the images. The students were then asked to experiment with alternate vectors to produce more meaningful orderings.

The second assignment, in JavaScript, considered a front end application. In the first part of the assignment students were given the task of creating a quiz in a specified format. The second part was

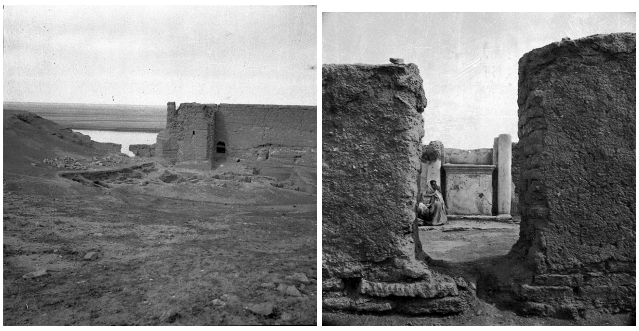

Figure 2: *Examples of field photographs from the 1930's excavation of Dura-Europos showing people, structures and the landscape. Images public domain.*

to create an application to display field photographs such as those in Fig. 2 and prompt the user to enter metadata to be saved in a file. The open-ended aspect was to create prompts for various types of data.

The first part of the third assignment introduced a simple data visualization related to converting tables to linked data triplets. The students were given a table of museum artifact metadata and asked to convert it to a series of object-property-value statements that could be interpreted as a network of nodes and links. They were given D3js starter code to create graph visualizations as shown in Fig. 3.

ID	Classification	Period	Medium
3436	Containers - Ceramics	Greco-Roman or Parthian	Terracotta
3437	Containers - Ceramics	Greco-Roman or Parthian	Terracotta
3439	Lighting Devices	Greco-Roman or Parthian	Terracotta
3440	Lighting Devices	Greco-Roman or Parthian	Terracotta
3478	Containers - Ceramics	Roman (2nd or 3rd century A.D.)	Terracotta
3479	Containers - Ceramics	Roman (2nd or 3rd century A.D.)	Terracotta
3549	Jewelry	Greco-Roman or Parthian	Silver
3550	Jewelry	Greco-Roman or Parthian	Silver
5990	Textiles	Roman (2nd or 3rd century A.D.)	Wool
5991	Textiles	Roman (3rd century A.D.)	Wool
10300	Containers - Glass	Hellenistic	Glass
6589	Containers - Glass	Greco-Roman or Parthian	Glass

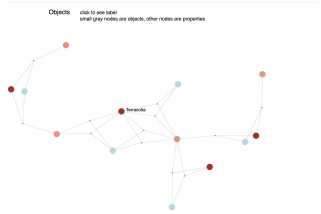

Figure 3: *Examples of metadata table and generated network.*

The second part of the third assignment was to develop both front and back ends for acquiring and retrieving data about images using a MySQL data base. The application needed to allow the user to enter data for specific areas in the image. All of the data needed to be in a single database that could be queried and updated.

The goal of these assignments, as well as the in-class activities requiring the upload of their Wikidata and photogrammetry results, was to have the students apply concepts presented in class. Further, the goal was to ensure that all students, regardless of disciplinary training, had the skills and shared vocabulary to meaningfully contribute to final group projects.

The final project assignment was 60% of the grade and was divided into three parts. The first part (10% of total grade), due at midterm, required each student to join a group, and for the group to produce a written document three to five pages in length plus a preliminary bibliography, defining and describing the proposed scope of the group's project and deliverables. The second part (25% of

total grade), due at the end of the course, was the set of project deliverables described in part 1. The grade for the second part was given on a per project, rather than per student, basis. The third part (25% of total grade), due at the end of the course, was an individual paper giving a critical assessment of the project, to be graded on a per student basis. For computer science students an 8 page paper was required. For humanities students a 10 to 15 page paper evidencing higher-order complexity, nuance, and research skill was required. Issues the students were to reflect on included: What humanities-grounded question or problem with regard to accessibility/intelligibility/archival preservation/etc. of the site does this project aim to answer/solve, and how? Are there any ethical issues that you considered in designing your project, and how did you and your team address them? What were the strengths and weaknesses of the final product from your disciplinary perspective, and do you see room for further improvement? What would you do differently in the future?

4. Results

The course attracted 14 students in the humanities with majors including Religion, Architecture, History, and Classics. There were 40 undergraduate students from Computer Science.

The student teams produced 9 projects each successfully applying technologies discussed in the course. One project considered coin hoards found at Dura-Europos. The team extracted data for the hoards from texts describing the finds using a combination of automated and manual means. The newly available data was then used to visualize where the coins originated, their weights, and time of minting. Another project developed an interactive instructional website focused on a painting from the Christian church at the site. The user is led through developing their own impressions viewing the work in 2D and in 3D context, and then through scholarly interpretations of the paintings as evolving in publications over time. A third exemplary project grappled with the curatorial challenge of serving diverse visitor needs in the museum space. This group developed a mobile web application for providing museum visitors with information beyond what is available on the descriptive card for each object. Users are given the option to explore information related to the inscriptions and figures on an object. The painting shown at the top of Fig. 1 is an example of an object with a complex presentation of figures and inscriptions that the user can explore in the application. The application used Wikidata queries so that more information could be available to the user as relevant data statements are added.

The students submitted courses evaluations using the standard instrument for courses at the university. For the basic question of whether the student would recommend the course to others, the results were overwhelmingly yes. The main appeal of the course was the integration of humanities and computing. In general students cited the mix of students with different majors and at different stages of their studies as a strength of the course. One highlight for students was the museum visit guided by the humanities instructor. This visit helped to introduce students to the method of close critical looking and raised the issues of biases in metadata and differences between first-hand engagement with an object and interaction with a digital surrogate. Another highlight was an exercise that challenged students to create photogrammetric models of the museum objects. Assigned objects for this task were specially selected by the instructors to introduce students to the potential challenges of photographing certain kinds of materials and object types. Negative comments included that there was inadequate depth in topics in both humanities and computing. Some students also felt that the topics could be better organized and connected to each other.

As far as the main course project, students commented that they would have liked more structure in the process of forming teams. There were also recommendations for more faculty comment on the proposed concepts and what the grading criteria would be.

5. Conclusions and Outlook

The course was successful and will be offered again in the next academic year. Following student comments and instructor observations during the project phase, the topics covered will be adjusted and the course roadmap will be presented at the start of the term to provide students with a better view of the intended course organization. Topics that will be introduced include geographic information systems with some reduction in time spent on other topics. The reading list will be adjusted to ensure better alignment between class discussions and the readings. More split sessions (i.e. humanities and computer science students meeting in parallel) may be introduced to provide each group with specialized coverage of topics to address the desire for more depth. More guidance will be provided in the forming of project groups.

Any course in digital humanities will change rapidly due to rapid changes in the field. One aspect that is likely not to change as the area matures, however, is the need for collaborative communication among differently-trained technically-oriented and content-area specialists, and this is therefore a skill that instructors should actively aim to help students cultivate.

References

[Bai18] BAIRD J.: *Dura-Europos*. Bloomsbury Academic, 2018. 2

[BLHL01] BERNERS-LEE T., HENDLER J., LASSILA O.: The semantic web. *Scientific american 284*, 5 (2001), 34–43. 2

[BM14] BAIRD J. A., MCFADYEN L.: Towards an archaeology of archaeological archives. *Archaeological Review from Cambridge 29*, 2 (2014), 14–32. 2

[GS20] GRAHAM S., SIMONS J.: Listening to Dura Europos: An experiment in archaeological image sonification. *Internet Archaeology*, 56 (2020). 3

[MT19] MÜNSTER S., TERRAS M.: The visual side of digital humanities: a survey on topics, researchers, and epistemic cultures. *Digital Scholarship in the Humanities 35*, 2 (05 2019), 366–389. 1

[RF21] ROUECHE C., FLANDERS J.: Gentle introduction to markup for epigraphers. https://epidoc.stoa.org/gl/latest/intro-eps.html, 2021. 2

[RM16] RAWSON K., MUÑOZ T.: Against cleaning. *Curating Menus 6* (2016), 1–14. 2

[TSN18] THORNTON K., SEALS-NUTT K.: Science Stories: Using IIIF and Wikidata to Create a Linked-Data Application. In *ISWC (P&D/Industry/BlueSky)* (2018). 2

[Whi15] WHITELAW M.: Generous interfaces for digital cultural collections. *DHQ: Digital Humanities Quarterly 9*, 1 (2015). 2