Instructor(s): Davide Tanasi
Email: tanasid@arcadia.edu
Course Title: 3D Modeling for Archaeology and Cultural Heritage
Course Code: MCAS CSAR 360
Subject: Computer Science, Archaeology
Credits: 3
Semester/Term: ☒ Spring
☒ Fall
☐ Summer

Course Description:
This course focuses on application of computer graphics on archaeological research taking into account theoretical assumptions and most popular outcomes as virtual reassembly, digital restoration, 3D scanning, 3D modeling, and virtual museums. It includes practical exercises of 3D scanning of archaeological artifacts, processing and editing of scanner data. This course provides a clear and concise introduction to the ultimate scientific approach to archaeological issues. Fieldwork, projects, and research of contemporary Archaeology will be connected to Computer Science, and specifically to its more popular branch, Computer Graphics.

Students will learn how computer techniques can support the archaeological interpretation as well as their influence on the scholar’s perspective. The analysis of main outcomes and different areas of application will be done using case studies related to Greek and Roman archaeology and the work of some international research teams.

Course Requirements:
Required Text

Assignments

<table>
<thead>
<tr>
<th>Course Requirements</th>
<th>Percentages</th>
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<tbody>
<tr>
<td>1. Paper 1</td>
<td>15 %</td>
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<tr>
<td>2. Mid-term test</td>
<td>30 %</td>
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<tr>
<td>3. Paper 2</td>
<td>15 %</td>
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<tr>
<td>4. Final project</td>
<td>40 %</td>
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<tr>
<td>Total</td>
<td>100%</td>
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Student attendance at classes and fieldwork is compulsory. Penalties for unexcused absences from class range from 10% being deducted from the overall grade (for missing more than one class meeting) for the appropriate class to enforced withdrawal.

1. Paper 1 tests student’s background knowledge on archaeological theory and solutions offered by computer science to current issues of archaeological research.

2. Paper 2 focuses on a specific branch of digital archaeology and to the description of one of the cases study presented in class or in the readings. Mid-term test is a project of virtual reassembly and digital restoration and it will test student’s knowledge about the pipeline comprising these projects and the outcomes.

3. Final project consists in a personal work of each student including the acquisition with the laser scanner of an original Greek vessel, the processing and editing of the data via Blender and Meshlab, the development of a complete 3D replica of the vessel, realized in the second part of the semester.

4. In the final test students must be present in a detailed way the pipeline of their work and the possible use of the outcome in a digital archaeology project.

Mandatory Field Studies:
Image Processing Laboratory, Department of Math and Computer Science, University of Catania.

The Image Processing Laboratory of Catania University is one of the few Italian research centers specialized in developing digital archaeology projects. In 2007, a team of computer scientists, archaeologists and technicians founded a research program, named ‘Archeomatica Project’, aimed to produce innovative applications for solving problems coming from the interpretation of archaeological data. Connected with several national and international academic institutions and local Cultural Heritage Offices, the Lab is equipped with the software and hardware state-of-the-art available even for all students attending stages in the ‘Archeomatica Project’.
Learning Outcomes and/or Expected Student Competencies:

On completion of the course, students should be able to:

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<tr>
<th>Learning Outcome</th>
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<tr>
<td>1. Use computer science applications in archaeological research to distinguish between offered solutions and theoretical influences.</td>
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<td>2. Demonstrate familiarity with the main outcomes of computer graphics applied to archaeology; virtual reassembly, digital restoration, 3D scanning, 3D modeling, virtual museum.</td>
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<td>3. Appropriately choose which kind of computer graphics technique is more appropriate for solving specific archaeological problems or issues related to dissemination of knowledge.</td>
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<td>4. Use state-of-the-art software and hardware in this field to complete a digital archaeology project including practical 3D scanning of archaeological artifacts (with a triangulation laser scanner Next Engine), 3D modeling (with the software Blender) and data processing and editing (with the software Meshlab).</td>
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Course Outline:

<table>
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<tr>
<th>Session</th>
<th>Topic</th>
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<tr>
<td>Session 1</td>
<td>Introduction to the course</td>
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<tr>
<td>Session 2</td>
<td>The past and the future. Archaeology and Computer Science</td>
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<tr>
<td>Session 3</td>
<td>Digital archaeology</td>
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| **Session 4** | From the field to the screen  
| **Session 5** | Monitoring the heritage  
**Assignment paper 1: a 1,500 word essay** |
| **Session 6** | Virtual museums and dissemination of knowledge: The Virtual Museum of Iraq  
Readings: F. Niccolucci, Virtual museums and archaeology: an international perspective, in Archeologia e Calcolatori, suppl. 1, 2007, pp. 15-30  
http://www.virtualmuseumiraq.cnr.it |
| **Session 7** | Digital Restoration: Parthenon Project  
http://www.debevec.org/Parthenon/film.html |
| Session 8 | Virtual reassembly: Forma Urbis Romae  
[http://formaurbis.stanford.edu](http://formaurbis.stanford.edu) |
| --- | --- |
| Session 9 | Virtual reassembly: pottery and frescoes  
[Paper 1 due](#) |
| Session 10 | Review session for Midterm examination |
| Session 11 | MIDTERM examination |
| Session 12 | BREAK |
| Session 13 | Rome reborn and Google Earth  
[http://www.romereborn.virginia.edu](http://www.romereborn.virginia.edu) |
| Session 14 | 3D modeling as cognitive tool  
|---|---|
| Session 15 | The Archeomatica Project: 3D modeling experience  
www.archeomatica.unict.it |
| Session 16 | The Archeomatica Project: 3D scanning experience  
www.archeomatica.unict.it |
| Session 17 | The Archeomatica Project: computer vision experience  
www.archeomatica.unict.it |
| Session 18 | Field Study - Image Processing Laboratory of University of Catania |
| Session 19 | Practical exercise with triangulation 3D scanner on archaeological artifacts  
| Session 20 | Practical exercise with triangulation 3D scanner on archaeological artifacts  
|---|---|
| Session 21 | Practical exercise of data processing with Meshlab  
| Session 22 | Practical exercise of data processing with Meshlab  
Tutorial on [http://meshlabstuff.blogspot.com](http://meshlabstuff.blogspot.com)  
| Session 23 | Practical exercise of data processing with Blender  
[http://www.blender.org](http://www.blender.org)  
**Paper 2 due** |
| Session 24 | Practical exercise of data processing with Blender  
Tutorial on [http://www.redbaron85.com](http://www.redbaron85.com)  
[http://www.blender.org](http://www.blender.org) |
| Session 25 | Dealing with Image Data in Archaeology: new perspectives  
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<th>Session 26</th>
<th>Review session for Final examination</th>
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<tr>
<td>Session 27</td>
<td>FINAL examination</td>
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**Other Policies:**

**Expectations**
Professional behavior is expected of all students. This includes preparation for classes, on-time attendance at classes, attendance at all group sessions and appropriate participation in the form of attentiveness and contributions to the course. Respect for the academic process is the major guiding principle for professional behavior and extends to all communications, including e-mail.

**Attendance/Participation**
Prompt attendance, full preparation, and active participation in class discussions are expected from every student in every class session.

**Course Policies**
For e-mail communications, students must use their Arcadia University e-mail account. Students are responsible for any information provided by e-mail or through Intranet postings.

**Plagiarism**
Representation of another’s work or ideas as one’s own in academic submissions is plagiarism, and is cause for disciplinary action. *Cheating* is actual or attempted use of resources not authorized by the instructor(s) for academic submissions. Students caught cheating in this course will receive a failing grade. *Fabrication* is the falsification or creation of data, research or resources to support academic submissions, and cause for disciplinary action.

**Late or Missed Assignments**
Will not be accepted for grading.

**Students with Disabilities**
Persons with documented disabilities requiring accommodations to meet the expectations of this course should disclose this information while enrolling into the program, and before leaving the United States so that appropriate arrangements can be made.
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<tr>
<th>Prerequisites:</th>
<th>No specific prerequisites are needed in the field of archaeology or computer science.</th>
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<tr>
<td>Country and Program Connection:</td>
<td>The Mediterranean Center for Arts and Sciences of Syracuse has an agreement with the Faculty of Sciences of University of Catania. Thanks to this, students can easily and freely access to facilities of Image Processing Laboratory of that University, where a multidisciplinary team of scholar carries on a digital archaeology research program called ‘Archeomatica Project.’ This Lab includes the software and hardware which are state-of-the-art in this field and thanks to its recent scientific outcomes and connections with other national and international academic groups is considered one of the most advanced in Italian academic scenario.</td>
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