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Prerequisites: Basic linear algebra.

Course description:
Computational Archaeology is a rapidly growing field in which conventional archaeological data is used for purposes of analysis, interpretations and exposition in specially designed software and applications including geographical information systems, statistical or mathematical modeling, and simulations. This class will use NSF grant award number 0803670 “The 3D Colonial Philadelphia Project -- Digital Restoration of Thin-Shell Objects for Historical Archeological Research and Interpretation” and other research projects as learning tools, springboards, and sources of inspiration to gain familiarity in best practices in computational archaeology. Field trips will be made to Independence National Historic Park’s (INHP) archaeological lab where computational techniques are being developed, a Park exhibit where archaeology field evidence is being interpreted and an archaeological field site where excavations and recovery are underway. Class participants will form interdisciplinary research teams to develop research strategies and grant proposals for furthering computational archaeological knowledge and the application of cutting edge techniques. The class is open to seniors and graduate students in Engineering, Computer Science, Digital Media, and students in the Honors Program.

Course goals and objectives:
- To gain familiarity with the scope of computational archaeology including geographical information systems, statistical or mathematical modeling, and simulations.
- To obtain working knowledge of computational theory and methods.
- To acquire knowledge about Archaeology as a humanistic science and cultural heritage resource.
- To observe and participate in archaeological practices.
- To study and work in interdisciplinary teams to develop preliminary ideas and concepts that will contribute to the field.

Field Trips:
- Independence National Historic Park Archaeology Lab
- The President’s House (INHP)
- The National Constitution Center (INHP)
- Penn Dot archaeological site (I-95 excavation site between Spring Garden Street and Allegany Avenue)

Projects and Class Presentations: (35% in class presentation and 65% project)
- Based on class lectures, readings, discussions and field trips students will form 3 to 5 member teams each team will research an archaeological process, problem, or issue that may be addressed through computational archaeology. The team will be assigned or propose (subject to instructor(s) approval) a project to address a selected topic. There will also be a presentation of assigned or proposed reading material in the state of the art of computational methods. All presentations are given during the 10th week.

Lectures’ Content
- Archaeology and Cultural Heritage components, 4 classes in all:
  - 1 class session (3hrs.) devoted to Archaeology Patti Jeppson (see below for more details)
  - 1 class session (3hrs.) devoted Cultural Heritage Glen Muschio (see below for more details)
  - 2 class sessions (6 hrs.) devoted to field trips Jeppson/Muschio (see below for more details)
- Computational Methods, 5 classes in all:
  - Reconstruction and solving the puzzle using various cues
- Surface information (Fernand Cohen)
- Surface Markings (Fernand Cohen)
- Local Surface alignment, sherds breakage boundaries (lines or curves) (Ko Nishino)
- Texture and color information (Ali Shokoufandeh)
- Sorting and digital libraries (Ali Shokoufandeh)
- The expert opinion (Fernand Cohen)
- Using prior expert information in speeding up the stitching process
More in Depth Information on Archaeology and Cultural Heritage Lectures:

**Archaeology class (Patti Jeppson)**
- Archaeology (general intro; defined as humanistic science, as heritage resource, why it matters vis a vis ethics, authenticity, responsibility).
- Discussion of assigned readings (to be developed) may include an
  1. Overview of what heritage is with a focus on archaeology [Maybe something abstracted from “Lies My Teacher Told Me?”]
  2. Overview of the implications of virtual technologies for Archaeology, history, heritage.
  3. Charter under development by sectors of the archaeology community for guiding Virtual Archaeology presentations.
- Role play: practice with the steps of archaeology and archaeology as practiced showing virtual media's role in archaeology and archaeology's role in business, social identity, etc.

**Archeology Field Trip to INHP Archaeology Lab Patti Jeppson**
Case study practicum.
- Why INDE Archaeology is Heritage/set up for Virtual Archaeology (Patti)
- NCC Site --Overview Lecture (Debbie)
- Lab overview (explaining the human dimension). Includes overview outline of Lab processing done as by humans with look at collections (behind the scene look) -- (Willie)
- “How the archaeologist 'thinks' when mending ceramics” [expert knowledge for application in Virtual automating] (Jed)
- Students have an applied experience mending artifacts

**Digital Cultural Heritage class (Glen Muschio)**
- Overview of Cultural Heritage as an interdisciplinary pursuit and the role of cultural heritage in a broader social, historical, cultural and political context.
- Introduction to the multifaceted and emerging field especially in terms of digital media as it relates to virtual historic preservation, data management and exposition (3D models of the Dexter House and the President’s House).
- Discussion of assigned readings and visits to websites (to be developed) may include:
  1. The politics of Cultural Heritage readings from Edward Bruner, Donna Haraway, Seth Bruggerman.
  2. Case study INHP’s the President’s House as covered in the local press.
  4. Use of Digital Media and Augmented Reality in Cultural Heritage exposition and tourism.

**Cultural Heritage Field Trip (Glen Muschio)**
Two site visits 1 class session this will require arranging transportation
- INHP stops at the NCC site and the President’s House demo of the Instant Navigator
- Visit to the I-95 archaeological field site to observe excavation in Progress and having an expert addressing the group.