# GEO 391 – Advanced Digital Methods in Paleontology (Spring 2013)
Unique Number 27745
Class: EPS 2.104; MW 2:00-3:30

**Professor:**
Rich Ketcham, JGB 3.316E, 471-6942, ketcham@jsg.utexas.edu
Office hours: by appointment

Online course information: https://courses.utexas.edu/webapps/login/ plus your EID

**Classroom and Lab:**
The main course classroom in EPS 2.014.  However, on certain days the class may meet in the "Digital Morphology Lab", JGB 2.306, when the work is to be computer-oriented.

**Textbook:**
There is no textbook for this course.  I will be primarily using papers and lecture notes, which will be distributed on Blackboard.

**General:**
This class is intended to enable students studying morphology through volumetric imaging methods, primarily X-ray CT, to utilize these data to their maximum potential, beyond visualization and segmentation.   There are three tiers to this: understanding the data; understanding how a computer stores and manipulates those data, and how to control this process through programming; and becoming familiar with the computational tools that exist or are being developed for morphology research.

A large part of course content will be decided by the interests of the students (you).  Since this is to be an "enabling" course, it will be geared particularly toward topics that are of use or relevance for your research.

Particular and potential topics are:
- The engineering, math, and physics principles of CT data acquisition and instrumentation.
- Interacting with CT data on a basic level, using computer programming.  IDL will be the platform we use, but principles will be taught in a general way.
- IDL-based programs for analyzing CT data (Blob3D, Quant3D, etc).
- Other computational methods, possibly including:
  o Finite element modeling
  o Morphometrics (2D and 3D)
  o Retrodeformation
  o Segmentation
  o CT artifact correction
  o Dissemination and informatics
  o Advanced visualization with Drishti (i.e. utilizing grays and gradients)
- Other topics of interest to students.

## Course Schedule:

*This schedule is preliminary, and based on the last time the course was taught.  It will be changed based on responses to the course questionnaire.*

| Date | | Topic | Exercises |
|---|---|---|---|
| Jan | 14 | Example problem: retrodeformation | |
| Jan | 16 | CT Principles 1 | |
| Jan | 21 | *No class - MLK holiday* | |
| Jan | 23 | CT Principles 2 | |
| Jan | 28 | Quantification from CT data | |
| Jan | 30 | Computer data I and IDL | |
| Feb | 4 | Computer data II | Data handling |
| Feb | 6 | Programming Logic I | |
| Feb | 11 | Programming Logic II | Data handling due |
| Feb | 13 | Segmentation I | |
| Feb | 18 | Segmentation II | Programming 1 |
| Feb | 20 | Image processing I | |
| Feb | 25 | Image processing II | Programming 1 due |
| Feb | 27 | *No class - Ketcham out of town* | |
| Mar | 4 | Trabecular bone I | Quant3D |
| Mar | 6 | *No class - Ketcham out of town* | |
| Mar | 11 | *No class - Spring Break* | |
| Mat | 13 | *No class - Spring Break* | |
| Mar | 18 | Retrodeformation I | |
| Mar | 20 | Retrodeformation II | Quant3D due, Programming 2 |
| Mar | 25 | Isosurfacing and modeling | |
| Mar | 27 | Programming III | Programming 2 check point |
| Apr | 1 | Morphometrics I | |
| Apr | 3 | Morphometrics II | Programming 2 due |
| Apr | 8 | FEA I | |
| Apr | 10 | FEA II | |
| Apr | 15 | CT reconstruction and artifact correction I | |
| Apr | 17 | CT reconstruction and artifact correction II | |
| Apr | 22 | Project work | |
| Apr | 24 | Project work | |
| Apr | 29 | Project presentation | |
| May | 1 | Project presentation (Last day) | |

**Lecture and Discussion:**

The opening part of the course will consist of lectures on various topics to get everyone started and up to the same level on topics related to CT and computation. We will then segue to a discussion format in which we will go over principles of the methods we study and evaluate recent work using these methods. Papers and other readings will be assigned for these discussions, and, given that this is a small class, it is incumbent on everyone to do the readings.

**Grading:**

Homework (4 assignments at 5% each) = 20%
Participation/Presentations = 20%
Research project = 60%

There will be a number of homework assignments, which should overall be easy, but are intended to get you familiar and conversant with programming and various tools.

The principal component of your grade will be a project in which you apply something from this course to a topic of interest to you and hopefully relevance to your research. The product to be turned in will be in the form of a short, peer-reviewable text, including appendices. It does not need to be truly submittable (although that would be nice); the idea is to achieve the level of preliminary research, presentation of methods, execution of work, and description and interpretation of results that one would expect in a journal publication.

**Blackboard:**

Blackboard (https://courses.utexas.edu/webapps/login/ plus your EID) will be used to post course materials, including reading assignments, code examples, etc. You can find support in using Blackboard at the ITS Help Desk at 475-9400, Monday through Friday, 8 a.m. to 6 p.m., so plan accordingly. Check your Blackboard and email regularly for class updates. Email is recognized as an official mode of university correspondence; therefore, you are responsible for reading your email for university and course-related information and announcements.

**Special Needs:**

The University of Texas is committed to helping students with special physical or learning needs. Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities (SSD) at (512) 471-6259 (voice) or 1-866-329-3986 (video phone). Students with special needs should contact one of us as soon as possible to ensure that your needs are met in a timely manner.

**The University of Texas Honor Code:** "The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community."

Students are expected to read and to strictly adhere to the University's Honor Code and written policies on academic dishonesty. Cheating or plagiarism will not be tolerated. Any student caught violating University policy will be referred to the Dean of Student Affairs for disciplinary action. *All written work must be in your own words!*