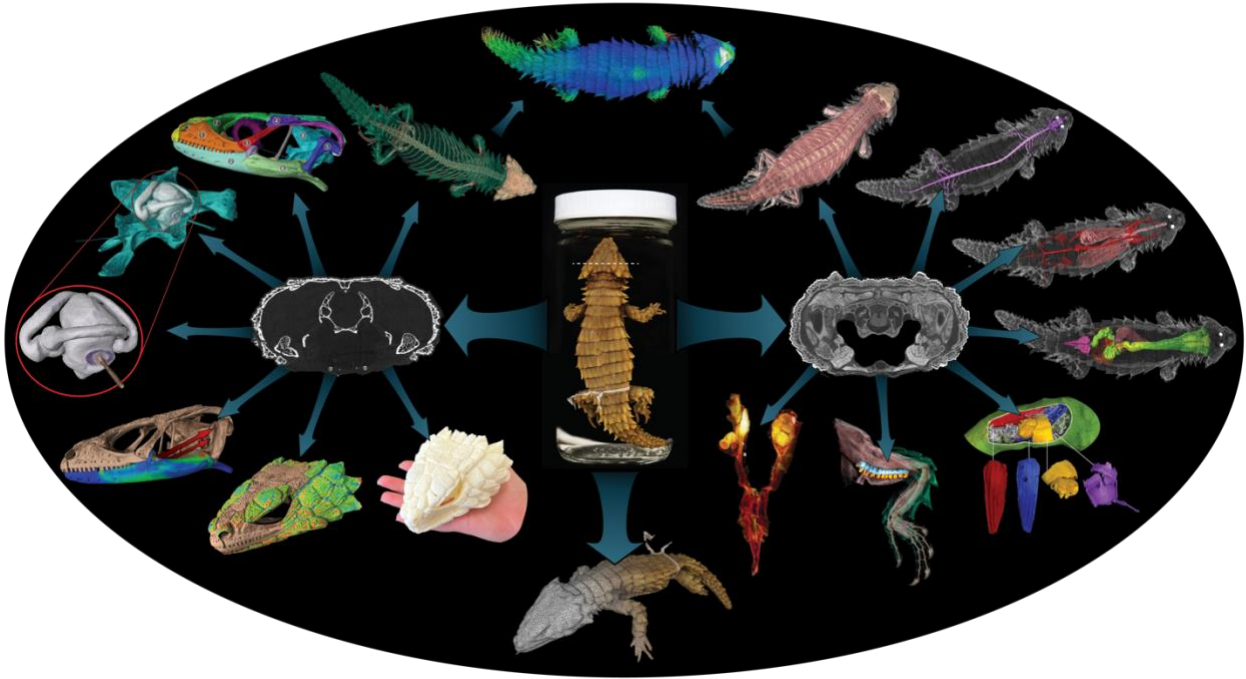


CT for Biologists (ZOO6927 / ZOO4926)

Syllabus – Fall semester 2024



Lectures: Monday Periods 4–5 (10:50am – 12:45pm), CARR 221/ NRF 116

Office hours: Dickinson Hall 229A; Wednesday 11:00am –1:00pm

Instructor: Dr. Edward Stanley. elstanley@flmnh.ufl.edu

Course Description: In this course, students will learn the fundamental principles and practical applications of Computed Tomography (CT). Lectures will be carried out in person and will also be accessible via Zoom. This course will focus on the history and theory of CT, with a strong emphasis on practical applications for biologists. Each two-hour class will be divided into a one-hour lecture that will focus on guiding principles and background on that week's topic, followed by a practical demonstration and hands-on experience with Volume Graphics and 3Dslicer reconstruction software. Each student will also be required to visit the Nanoscale Research Facility for two hands-on training sessions where they will learn how to set up and scan specimens with Phoenix and Xradia CT scanners for their class projects. In the second half of the course, students will be able to reserve 1–2 hours per week on the 3D lab reconstruction computers to work remotely on their projects. Grades will be dictated by attendance, class participation, a mid-term exam, and a term paper with an associated presentation. These projects can utilize comparative analysis of oVertCN material but may also include CT data produced over the course of this class.

Course Objectives:

- 1) Understand the principals of x-ray imaging and CT scanning.
- 2) Gain practical experience in generating, processing and analyzing volumetric and mesh data.
- 3) Become familiar with commonly used CT software packages and their appropriate use.

Class Schedule

	Title	Date	Lecture subjects	Practical subject/ Assignment
Class 1	Introduction to the course	Monday 26 th August*	Digital Imaging modalities at UF. Projects discussion	Introduction to Morphosource
Class 2	Basics of X-ray 1	Monday 9 th September	X-ray Generation and detection.	Finding and Importing datasets
Class 3	Basics of X-ray 2	Monday 16 th September	X-ray Attenuation, Detection and X-ray based imaging artifacts	Navigating VGStudioMax/Slicermorph
Class 4	A brief History of CT	Monday 23 rd September	A timeline of CT and intro to CT Algorithms	Basic segmentation
Class 5	Computed Tomography methods	Monday 30 th September	Reconstruction, Image Quality and CT Artifacts	Basic Metrology
Class 6	Biological Applications of CT Scanning	Monday 7 th October	Paleontology, Embryology, Taxonomy, comparative anatomy and more	images/ videos/ shapefiles for 3D printing
Class 7	Soft tissue Imaging	Monday 21 st October	Contrast CT, MRI	Advanced segmentation
Class 8	CT Training part 1	Monday 28 th October	Using the Phoenix CT system	
	Midterm exam	28 th Oct – 1 st Nov	20 question exam	----
Class 9	CT Training Part 2	Monday 4 th November	Using the Versa 620 system	
Class 10	Volume analysis	Monday 11 th November	Geometric morphometrics Finite Element Analysis, metrology approaches	R {Geomorph}
Class 11	Data Storage & dissemination	Monday 18 th November	FAIR principles, Local and Online Archiving, NoCTURN	Morphosource, Batch uploading
Class 12	Recent advances in Tomography	Monday 25 th November	Synchrotron data, 4D CT, Additive Manufacture, AI.	Structural Mechanics Fiber analysis
Class 13	Presentations	Monday 2 nd December		
	Project write-up due	Friday 6 th December		

* The first class will be held in Carr 221 with all subsequent classes taking place in the Nanoscale Research Facility, room 116. The NRF is located southwest of Carr hall, through the Carr woods at 1041 Center Drive. All lectures will be accessible via Zoom

Communication: Email is the best way to reach Dr. Stanley (elstanley@flmnh.ufl.edu). Please use "Zoo:6927" or "Zoo:4926" in the subject line.

Course Materials:

Free eBook: Buzug T.M., Computed Tomography: From Photon Statistics to Modern Cone-Beam CT. Springer, Berlin, Heidelberg. <https://link.springer.com/book/10.1007%2F978-3-540-39408-2>

Software programs: A number of the Florida Museum of Natural History's CT reconstruction systems will be made available to students for their term projects. Students will coordinate with Dr. Stanley to arrange access. In addition, students should download and install [3DSlicer](#), [Meshlab](#) and the [Geomorph](#) package for R.

Equipment Training: Completion of this class includes two face-to-face training sessions at the Nanoscale Research Facility, which satisfy the Equipment Training requirement for the Phoenix and Zeiss CT Scanners at the NRF. Students that have taken this course can gain full access to CT system by completing the NRF pre-training steps and paying the training fee. Visit the RSC website to start the process here <https://rsc.aux.eng.ufl.edu/ccb/prerequisites.asp?m=reso>.

Grades and Grade Points: For information on current UF policies for assigning grade points, see: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Attendance and input: Our learning environment depends heavily on discussion, and each student has a responsibility to attend and contribute to the class. Requirements for class attendance and, assignments and other work are consistent with university policies that can be found at: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>.

Online Course Evaluation Process: Student assessment of instruction is an important part of efforts to improve teaching and learning. **Students are** encouraged to share your opinions at any time with Dr. Stanley in person or by email. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. These evaluations are conducted online at <https://evaluations.ufl.edu>. Evaluations are typically open for students to complete during the last two or three weeks of the semester; students will be notified of the specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results>.

Academic Honesty: As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: *"We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity."* You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: *"On my honor, I have neither given nor received unauthorized aid in doing this assignment."*

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your

individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see: <https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>

Software Use: All faculty, staff and students of the university are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against university policies and rules, disciplinary action will be taken as appropriate.

Campus Helping Resources: Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- University Counseling & Wellness Center, 3190 Radio Road, 352-392- 1575, www.counseling.ufl.edu/cwc/
Counseling Services Groups and Workshops Outreach and Consultation Self-Help Library Training Programs
- U Matter We Care, www.umatter.ufl.edu/
- Career Resource Center, First Floor JWRU, 392-1601, www.crc.ufl.edu/

Services for Students with Disabilities: The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty- student disability related issues. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation. 0001 Reid Hall, 392-8565, www.dso.ufl.edu/drc/

Student Complaints: Each online distance learning program has a process for, and will make every attempt to resolve, student complaints within its academic and administrative departments at the program level. See www.distance.ufl.edu/student-complaint-process

Sexual Harassment: It is the policy of The University of Florida to provide an educational and working environment for its students, faculty, and staff that is free from sex discrimination and sexual harassment. In accordance with federal and state law, the University prohibits discrimination on the basis of sex, including sexual harassment. Sex discrimination and sexual harassment will not be tolerated, and individuals who engage in such conduct will be subject to disciplinary action. The University encourages students, faculty, staff, and visitors to promptly report sex discrimination and sexual harassment. If you believe you have been subjected to sex discrimination or sexual harassment please report the incident to me or any University official, administrator, or supervisor. The Office of Human Resource Services investigates all complaints. Incidents should be reported as soon as possible after the time of their occurrence (larry-ellis@ufl.edu).