

Course Content

Introduction to AI and Python

Machine Learning

Week-by-Week Pages

Additional Resources

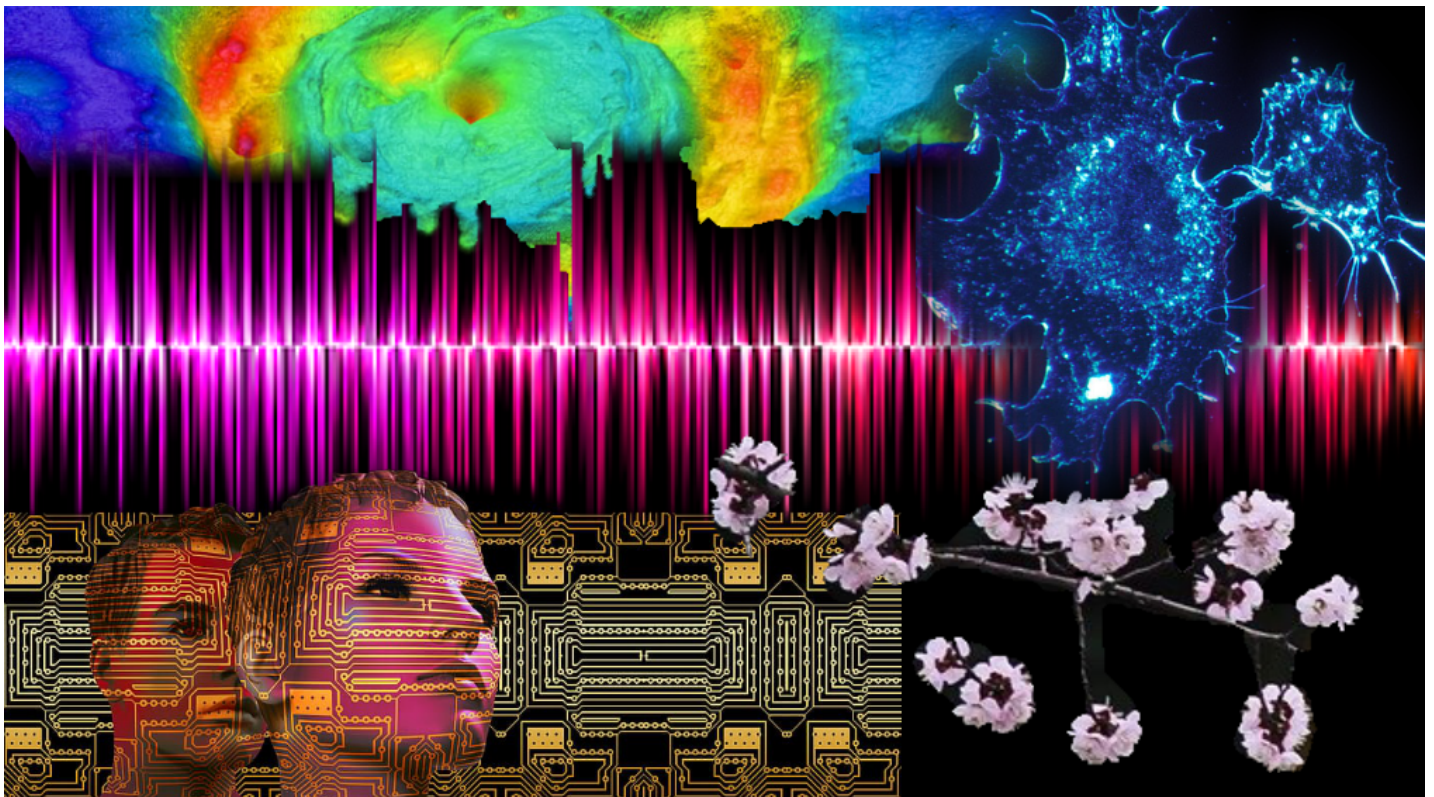


AI in Biology

Summary: Course website for the Spring 2022 edition of Zoo4926 (section 4G55) / Zoo6927 (section 5F55), AI in Biology. Covering applications of AI in Biology.

 [Edit in GitHub](#) 

Course Description



Artificial Intelligence (AI) as a field of research has existed since at least the 1950s. After initial enthusiasm, the gains of early years slowed and AI entered what has been referred to as an AI winter. Modern computing hardware, rapid growth in data collection and availability, and advances in algorithms have renewed interest in AI and revolutionized the field. AI is rapidly becoming ubiquitous in daily life and in diverse academic fields. This course will examine the applications of AI with particular focus on

applications in biology. We will address the topics of what AI is, how intelligent computers really are and may become, where limitations still exist, and how AI technologies can be used to advance biological research.

The course will attempt to provide sufficient background and foundations so that students understand AI algorithms at a conceptual level, but will not focus on the mathematical details. This is not a computer science or mathematics course.

Classes will have some lecture, though most classes will consist of live coding demos and hands-on exercises.

Instructor

Matt Gitzendanner

Email: magitz@ufl.edu (mailto:magitz@ufl.edu)

Office: Dickinson Hall, stop at front desk and they will call me

About: Dr Gitzendanner's background is in plant evolutionary genetics and genomics where he uses genetic tools to study the conservation, evolution, and diversity of plants. The field is generally computationally intensive, and Matt has worked for 10 years training users how to use HiPerGator and other high-performance computing systems to do the amazing research that is done across the University of Florida campus.

The initial version of this course, taught in Spring 2021, was co-developed with Brian Stucky [↗](#).

In addition to this course, Matt teaches

- Computational Tools for Research in Biology (BSC4452/6451) [↗](#)
- Frontiers in AI (EGN1935, Fall 2021. Will likely be offered in Fall 2022 as a IDS class!)
- Practicum AI [↗](#)
- Research Computing Trainings [↗](#)
- NVIDIA DLI Fundamentals of Deep Learning [↗](#) certified instructor

Matt enjoys spending time outdoors, hiking, backpacking and kayaking.

Prerequisites

Computer programming

The course assumes a **basic understanding of computer programming** in general, and Python in particular.

If you have not taken a programming course or are new to Python, there are several LinkedIn Learning courses that will give you sufficient background to be ready for this course (these are free for UF Students):

- Programming Foundations: Fundamentals [↗](#)
 - This course is best for people with no coding experience.
 - Most of the hands-on examples are in Python
- Python Essential Training [↗](#)
 - A good review or introduction for people who know some programming but not Python
- Learning Python [↗](#)
 - Another option for those with some coding experience

i Note: Note, you do not need to do all of these. Any **one** would get you at a good place to start the semester. We will review the basics of Python in the first weeks.

Math

You should have a **general understanding of probability and statistics** at the level of a first applied statistics course.

Knowledge of basic calculus and, to a lesser extent, linear algebra, can be helpful. We won't focus on the math, but having a conceptual understanding of derivatives, function optimization, and matrix math will be useful.

If you are unsure, contact the instructor.

Meeting Times

- **Mon, Wed, Fri from 1:55pm - 2:45pm in Bartram 211**

⚠ Important: You should make every effort to attend class synchronously. While I will record class sessions, **during class is the best opportunity to ask questions and get help from the instructors and others in the class.**

- I understand that some students will need to miss classes sometimes. That is fine and I will do my best to help you catch up, but regular attendance is the best way to learn.
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Help Session Times

Matt Gitzendanner

I will use Zoom for help sessions. Please see the link in Canvas.


- Tuesdays from 2:30 pm to 3:30 pm
- Wednesdays from 11:00am to noon
- Email Matt (<mailto:magitz@ufl.edu?subject=AI%20in%20Biology%20help%20request>) to setup a different time




Tip: Coding is not always easy. Simple solutions are not always obvious. There will be some frustration. **I expect that you will need help. You should expect that you will need help.** I want to help you! I cannot always help if you do not ask for the help you need. *Please ask for help!*

Course Textbooks

While we will not use any one text for the course, we will use sections of these books and other free resources. All will be free online resources.

-  Python Data Science Handbook by Jake VanderPlas [↗](#)

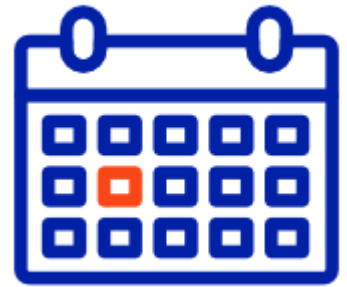
-  Dive into Deep Learning by Aston Zhang, Zachary Lipton, Mu Li and Alexander Smola [↗](#)



Course Calendar

⚠ Important: This is subject to change, please check back frequently.

For readings, there may be links to pages with my notes and additional explanations on the content from the texts.



Week	Date	Reading/Assignment	Topic
1 (Week_01.html)	Wed, Jan 5		Course introduction (slides ↗) What is AI, what is intelligence, what AI isn't (slides (/documents/intro_to_AI.pdf))
1 (Week_01.html)	Fri, Jan 7	Take the HiPerGator Account training ↗	Historical Context (slides (/documents/intro_to_AI.pdf)) * Origins of AI as an academic discipline. * A repeating pattern: major hype and enthusiasm followed by an AI "winter". * Where are we now?
2 (Week_02.html)	Mon, Jan 10		Introduction to Jupyter (/jupyter_intro.html)
2 (Week_02.html)	Wed, Jan 12		Introduction to Python ↗
2 (Week_02.html)	Fri, Jan 14	Problem set 1 available, due Friday, January 21	Introduction to Python ↗
3 (Week_03.html)	Mon, Jan 17		MLK: No Class

Week	Date	Reading/Assignment	Topic
3 (Week_03.html)	Wed, Jan 19	Ch 2 of PDSH: introduction to NumPy ↗	Introduction to NumPy ↗
3 (Week_03.html)	Fri, Jan 21	Ch 3 of PDSH: Data Manipulation with Pandas ↗ Problem Set 1 due	Introduction to Pandas ↗ Data Visualization in Pandas ↗ Review of general Python: Functions, Good programming practices (DRY, avoid globals, etc.).
4 (Week_04.html)	Mon, Jan 24	Problem Set 2 available, due Monday, January 31	Writing readable code, numpy array arithmetic, data visualization in Python ↗
4 (Week_04.html)	Wed, Jan 26	Section 5.01 of PDSH: What is Machine Learning? ↗	Introduction to machine learning and supervised learning ↗
4 (Week_04.html)	Fri, Jan 28		Supervised learning, introduction to numerical optimization
5 (Week_05.html)	Mon, Jan 31	Problem Set 2 due	Supervised learning and numerical optimization, scikit-learn and regression
5 (Week_05.html)	Wed, Feb 2	Section 5.02 of PDSH: Introducing Scikit-Learn (read through <i>Basics of the API</i>) ↗	Bias/variance tradeoff and regularization
5 (Week_05.html)	Fri, Feb 4		Model validation, cross-validation, and hyperparameters
6 (Week_06.html)	Mon, Feb 7	Problem set 3 available, due Monday, February 14	Hands-on data analysis practice

Week	Date	Reading/Assignment	Topic
6 (Week_06.html)	Wed, Feb 9		Hands-on data analysis, problem set help
6 (Week_06.html)	Fri, Feb 11	Section 5.06 of PDSH: In Depth: Linear Regression ↗	Linear Regression–Lasso and Ridge Regression
7 (Week_07.html)	Mon, Feb 14	Problem Set 3 due	Hands-on Linear Regression
7 (Week_07.html)	Wed, Feb 16		Classification, logistic regression ↗
7 (Week_07.html)	Fri, Feb 18	Section 5.07 of PDSH: In-Depth: Support Vector Machines) ↗	Support vector machines ↗
8 (Week_08.html)	Mon, Feb 21	Problem set 4 available, due Friday, February 28	Hands-on SVMs Work through either: - Tutorial: image classification with scikit-learn ↗ Remote Sensed Hyperspectral Image Classification With The Extended Morphological Profiles and Support Vector Machines ↗
8 (Week_08.html)	Wed, Feb 23		Intro to Artificial Neural Networks
8 (Week_08.html)	Fri, Feb 25		Intro to Artificial Neural Networks
9 (Week_09.html)	Mon, Feb 28	Problem Set 4 due	Convolutional Neural Networks

Week	Date	Reading/Assignment	Topic
9 (Week_09.html)	Wed, Mar 2		Convolutional Neural Networks
9 (Week_09.html)	Fri, Mar 4		Convolutional Neural Networks
10 (Week_10.html)	Mon, Mar 7		No Class: Spring Break
10 (Week_10.html)	Wed, Mar 9		No Class: Spring Break
10 (Week_10.html)	Fri, Mar 11		No Class: Spring Break
11 (Week_11.html)	Mon, Mar 14	Problem set 5 available, due Monday, March 21	Transfer Learning
11 (Week_11.html)	Wed, Mar 16		Time Series Analysis with RNNs
11 (Week_11.html)	Fri, Mar 18		Time Series Analysis with RNNs
12 (Week_12.html)	Mon, Mar 21	Problem Set 5 due	Time Series Analysis with RNNs
12 (Week_12.html)	Wed, Mar 23		Natural Language Processing

Week	Date	Reading/Assignment	Topic
12 (Week_12.html)	Fri, Mar 25		Natural Language Processing
13 (Week_13.html)	Mon, Mar 28		NLP and Transformers
13 (Week_13.html)	Wed, Mar 30		Transformers
13 (Week_13.html)	Fri, Apr 1		Transformers
14 (Week_14.html)	Mon, Apr 4	Problem set 6 available, due Friday, April 11	Medical Image Analysis
14 (Week_14.html)	Wed, Apr 6		Medical Image Analysis
14 (Week_14.html)	Fri, Apr 8		Topics TBD
15 (Week_15.html)	Mon, Apr 11	Problem Set 6 due	Project time
15 (Week_15.html)	Wed, Apr 13		Project time
15 (Week_15.html)	Fri, Apr 15	Project Due	Project time

Week	Date	Reading/Assignment	Topic
16 (Week_16.html)	Mon, Apr 18		Project Presentations
16 (Week_16.html)	Wed, Apr 20		Project Presentations

Software and Hardware

Participants will need a computer with internet connection, webcam and microphone for all classes.

Several free/open source software packages will be used throughout the course, and students will be required to install some of these. Students will use a (free) Research Computing account to access HiPerGator for coursework. Students will be required to apply for a (free) Github.com account for coursework.

If you have technical difficulties with Canvas, please contact the UF Helpdesk at:

- <http://helpdesk.ufl.edu>
- (352) 392-HELP (4357)
- Walk-in: HUB 132

Any requests for make-ups due to technical issues should be accompanied by the ticket number received from the Help Desk when the problem was reported to them. The ticket number will document the time and date of the problem. Please e-mail the instructor within 24 hours of the technical difficulty if you wish to request a make-up.


All faculty, staff and student 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.

Grading

Assignment Values

See also the List of Graded Work page (Grading.html).

- **Problem Sets:** 6 @ 30 points each: 180 points (75%)
- **Class Project:** 40 points (17%)
- **Project presentation:** 20 points (8%)


Grading in this class is consistent with UF policies available at: <https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/> 

Grade Disputes and Revisions

Grading Scale and GPA Equivalent

Course Policies

Class Attendance and Makeup Policy

Requirements for class attendance and makeup assignments, and other work in this course are consistent with university policies that can be found in the online catalog at: <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/> 

In general, I do not take attendance. You are all adults and I assume you are taking the class the learn. **The best way to learn is to regularly attend class.** I am sure students will miss class for various reasons. I am happy to help you catch up. If you regularly miss class and fall behind, I may ask that you hold questions on content you have missed until after class, or ask that you coordinate a time to go over the content. I will make every effort to record and post all classes to help those that miss classes.

Assignment Policy


Assignment dates will be announced at least one week in advance and students will have at least three days to complete the assignment. Each assignment will clearly state if it is an individual or group assignment. Individual assignments must be the student's own work, completed without the assistance of others.

All assignments are "open book, open internet", you may use whatever resources you desire to complete the assignment. Though only assignments specifically noted as group assignments should be worked on with other people.




Makeup and Late policy

Please notify the instructor of circumstances that lead to late work or missed classes. I will generally work with you and accept late work. All assignments are designed for both your own learning and my assessment of your efforts. Much of the course builds on previous sections and falling behind on assignments will make it harder to keep up. If you need help, please ask! **My goal is for all students to learn the material** and I understand that some students will need more help than others. The grade is based on the end product, not the amount of time and help needed to get there.

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://disability.ufl.edu/students/get-started/> ) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at gatorevals.aa.ufl.edu/students/ . Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via ufl.bluera.com/ufl/ . Summaries of course evaluation results are available to students at gatorevals.aa.ufl.edu/public-results/ .


Class Demeanor and Netiquette

Students are expected to be in class on time and behave in a manner that is respectful to the instructors and to fellow students.

Opinions held by other students should be respected in discussion, and conversations that do not contribute to the discussion should be held at minimum, if at all.

Students should be working on course content during class.

Discussion Boards

The GitHub discussion boards  can be used to ask for and provide help by all. Students should be supportive and considerate of others at all times. Rude or inappropriate comments will be removed and the poster will be warned.

University Honesty Policy

UF students are bound by The Honor Pledge which states:

We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students 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.”

The Honor Code [↗](#) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class

Health and Wellness


Inclusive Learning Environment

This course embraces the University of Florida’s Non-Discrimination Policy, which reads:

The University shall actively promote equal opportunity policies and practices conforming to laws against discrimination. The University is committed to nondiscrimination with respect to race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information and veteran status as protected under the Vietnam Era Veterans’ Readjustment Assistance Act.

If you have questions or concerns about your rights and responsibilities for inclusive learning environment, please see the instructor or refer to the Office of Multicultural & Diversity Affairs website: <http://multicultural.ufl.edu> [↗](#).

Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html> 

Statement Regarding Course Recording

Our class sessions may be audio visually recorded for students in the class to refer back to and for use of enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate verbally are agreeing to have their voices recorded. If you are unwilling to consent to have your voice recorded during class, you will need to keep your mute button activated. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Additional UF Policies and Resources