FLORIDA ATLANTIC UNIVERSITY

NEW COURSE PROPOSAL
Graduate Programs

UGPC Approval _____
UFS Approval _____
SCNS Submittal _____
Confirmed _____
Banner _____
Catalog _____

Department Biological Sciences

College
*(To obtain a course number, contact **erudolph@fau.edu**)*

Prefix BSC **Number** 6895	*(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)* **Lab Code**	**Type of Course** Lecture	**Course Title** Artificial Intelligence in Biology

Credits *(See Definition of a Credit Hour)*
3

Effective Date *(TERM & YEAR)*
Spring 2025

Grading *(Select One Option)*
Regular (●)
Sat/UnSat ( )

Course Description *(Syllabus must be attached; see Template and Guidelines)*
This course introduces the underlying concepts, techniques and potential of artificial intelligence (AI) in biology. It explores the application of AI and machine learning (ML) methods and algorithms to selected areas in biology. This is a graduate level course and applications are build around advanced problems. The course also exposes students to contemporary interactive tools to build AI and ML solutions without the need for extensive programming.

Prerequisites
PCB 3063 or BCH 3033 or permission of instructor

Prerequisites, Corequisites and Registration Controls are enforced for all sections of course.

Academic Service Learning (ASL) course ☐
Academic Service Learning statement must be indicated in syllabus and approval attached to this form.

Corequisites
None

Registration Controls *(For example, Major, College, Level)*
None

Minimum qualifications needed to teach course:
Member of the FAU graduate faculty and has a terminal degree in the subject area (or a closely related field).

List textbook information in syllabus or here
Introduction to Machine Learning with Python ISBN: 9781449369897 Authors: Andreas C. Müller, Sarah Guido Publisher: "O'Reilly Media, Inc."

Faculty Contact/Email/Phone
Rodrigo Pena/penar@fau.edu/6-8073

List/Attach comments from departments affected by new course

Approved by	***Date***
Department Chair Sarah L. Phillips	9-17-24
College Curriculum Chair	11/18/2024
College Dean	11/18/2024
UGPC Chair	
UGC Chair	
Graduate College Dean	
UFS President	
Provost	

Email this form and syllabus to UGPC@fau.edu 10 days before the UGPC meeting.

FLORIDA ATLANTIC UNIVERSITY

BSC 6895-006 16155

AI Applications in Biology

Date: Tuesday, Thursday 8:00 AM - 9:20 AM

3 Credit(s)

Spring 2025 - 1 Full Term

Instructor Information

Rodrigo De Oliveira Pena
Email: penar@fau.edu
Office: Zoom Meetings, computer labs in the Boca campus and in the Jupiter campus TBD.
Office Hours: Monday and Wednesday from 9 AM - 11 AM. Please note you can email me at any time with your questions, comments, and concerns, or use CANVAS. Additional times/days are available to meet through Zoom.
Phone: 561-799-8514

Course Description

This course introduces the underlying concepts, techniques and potential of artificial inteligence (AI) in biology. It explores the application of AI and machine learning (ML) methods and algorithms to selected areas in biology. This is a graduate level course and applications are build around advanced problems. The course also exposes students to contemporary interactive tools to build AI and ML solutions without the need for extensive programming.

Course Topical Outline

This preliminary course schedule is subject to changes announced in class or on Canvas.

Week	Topic(s)	Assignment(s)
Week 1	Introduction to the course content and tools + What is AI	

	(history, scope, definitions, concepts, applications, limitations, implications)	
Week 2	Python programming bootcamp	Assignment 1 - Python programming
Week 3	Python programming bootcamp	Assignment 2 - Python programming
Week 4	Exploratory Data Analysis (EDA) + data visualization + unique characteristics and challenges in biology	Assignment 3 - Data Exploration
Week 5	Fundamentals of Machine Learning and Model Thinking + The ML workflow	Assignment 4 - ML fundamentals
Week 6	Supervised Learning + Linear Models for Regression and Classification + Nearest-Neighbor Methods	Assignment 5 - Regression and classification
Week 7	Trees, Forest, and Ensembles	Assignment 6 - Random forests
Week 8	Unsupervised Learning, Principal Component Analysis (PCA) + Clustering	Assignment 7 - Cluster analysis and PCA
Week 9	Model Evaluation, Calibration, Imbalanced Data + Model Interpretation / Reviewing proposals for the final project	Midterm- Review of proposals
Week 10	Feature Selection and Feature Engineering	
Week 11	Parameter Tuning + Experiment management + Automatic Machine Learning	
Week 12	Neural Networks and Deep Learning	
Week 13	Neural Networks and Deep Learning (continuation)	Assignment 9 - Deep learning
Week 14	Project discussion and preparation for presentations	
Week 15	Project presentation and final	Projects

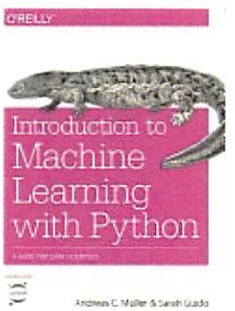
evaluation

Instructional Method

Online Live Lecture

100% of the course is delivered online, with synchronous meeting times. (The course will meet live on the specified meeting days and times.)

Required Texts/Materials



Introduction to Machine Learning with Python
ISBN: 9781449369897
Authors: Andreas C. Müller, Sarah Guido
Publisher: "O'Reilly Media, Inc."
Publication Date: 2016-09-26
This book is just a suggestion and not mandatory. Materials will be provided through the slides.

Course Objectives/Student Learning Outcomes

By the end of the course, students will be able to:

- Select, reproduce, and code Python for a variety of applications.
- Understand the fundamental concepts of artificial intelligence and machine learning, including supervised and unsupervised learning.
- Identify and apply appropriate AI and ML models and computational tools to specific problems in biology.
- Analyze the performance of specific AI and machine learning models as applied to biological problems and justify their use and limitations.

Faculty Rights and Responsibilities

Florida Atlantic University respects the rights of instructors to teach and students to learn. Maintenance of these rights requires classroom conditions that do not impede their exercise. To ensure these rights, faculty members have the prerogative to:

• Establish and implement academic standards.

• Establish and enforce reasonable behavior standards in each class.

• Recommend disciplinary action for students whose behavior may be judged as disruptive under the Student Code of Conduct University Regulation 4.007.

Disability Policy

In compliance with the Americans with Disabilities Act Amendments Act (ADAAA), students who require reasonable accommodations due to a disability to properly execute coursework must register with Student Accessibility Services (SAS) and follow all SAS procedures. SAS has offices across three of FAU's campuses – Boca Raton, Davie and Jupiter – however disability services are available for students on all campuses. For more information, please visit the SAS website at www.fau.edu/sas/.

Course Evaluation Method

- Homework Assignments (40%): Regular homework assignments will be given throughout the course. The approximate number and frequency will be communicated in class.
- Proposal of Final Project (20%): Students are required to submit a proposal for their final project, which will count towards a midterm grade. The proposal format and specific requirements will be provided by the instructor.
- Final Project (40%): The final project is an individual effort for both undergrad and graduate students. Clear guidelines for the project will be provided, and it will be evaluated for the final grading.
- Assignments and Lab Days: Assignments from the computational lab day can be submitted after class. Please follow the specified submission format, which will be communicated in class.
- Project Selection: Students are expected to select a project from a list provided by the instructor. Alternatively, they may propose their own ideas for approval.
- Group Work: Undergraduates are allowed to work on the final project in groups of two. Graduate students are expected to work individually.

Graduate level student (BSC 6936): Homework assignments will have more questions and a higher level. The proposal and final project have to be completed individually and not in groups. Projects must be presented individually as well.

Code of Academic Integrity

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. For more information, see University Regulation 4.001.

Attendance Policy Statement

Students are expected to attend all their scheduled University classes and to satisfy all academic objectives as outlined by the instructor. The effect of absences upon grades is determined by the instructor, and the University reserves the right to deal at any time with individual cases of non-attendance. Students are responsible for arranging to make up work missed because of legitimate class absence, such as illness, family emergencies, military obligation, court-imposed legal obligations, or participation in University-approved activities. Examples of University-approved reasons for absences include participating on an athletic or scholastic team, musical and theatrical performances, and debate activities. It is the student's responsibility to give the instructor notice prior to any anticipated absences and within a reasonable amount of time after an unanticipated absence, ordinarily by the next scheduled class meeting. Instructors must allow each student who is absent for a University-approved reason the opportunity to make up work missed without any reduction in the student's final course grade as a direct result of such absence.

Religious Accommodation Policy Statement

In accordance with the rules of the Florida Board of Education and Florida law, students have the right to reasonable accommodations from the University in order to observe religious practices and beliefs regarding admissions, registration, class attendance, and the scheduling of examinations and work assignments. University Regulation 2.007, Religious Observances, sets forth this policy for FAU and may be accessed on the FAU website at www.fau.edu/regulations.

Any student who feels aggrieved regarding religious accommodations may present a grievance to the executive director of The Office of Civil Rights and Title IX. Any such grievances will follow Florida Atlantic University's established grievance procedure regarding alleged discrimination.

Time Commitment Per Credit Hour

For traditionally delivered courses, not less than one (1) hour of classroom or direct faculty instruction each week for fifteen (15) weeks per Fall or Spring semester, and a minimum of two (2) hours of out-of-class student work for each credit hour. Equivalent time and effort are required for Summer Semesters, which usually have a shortened timeframe. Fully Online courses, hybrid, shortened,

intensive format courses, and other non-traditional modes of delivery will demonstrate equivalent time and effort.

Course Grading Scale

Letter Grade	Letter Grade
A	94 - 100%
A-	90 - 93%
B+	87 - 89%
B	83 - 86%
B-	80 - 82%
C+	77 - 79%
C	73 - 76%
C-	70 - 72%
D+	67 - 69%
D	63 - 66%
D-	60 - 62%
F	Below 60

Grade Appeal Process

You may request a review of the final course grade when you believe that one of the following conditions apply:

- There was a computational or recording error in the grading.
- The grading process used non-academic criteria.
- There was a gross violation of the instructor's own grading system.

University Regulation 4.002 of the University Regulations contains information on the grade appeals process

Policy on Make-up Tests, Late work, and Incompletes

Students are expected to attend all scheduled classes and arrive on time. If you miss a class you are responsible for ALL the material covered during that class, including lecture material and rules and

regulations about the course (such as penalties for late assignments, etc.). If you miss an entire or a part of a class, you are still expected to submit assignments for that week.

Assignments: The assignments are due on the dates assigned. These will be accepted up to 1 week late, but they will be penalized 10%/day. None will be accepted over 1 week late.

Project proposal: The project is due on the date assigned. It will be accepted up to 1 week late, but penalized 10%/day. No submission will be accepted over 1 week late.

Final project: The final project has to be presented on the assigned date. Appropriate documentation must be presented for justifiable absence from the final project delivery.

Special Course Requirements

Access to Google Colab: https://colab.research.google.com. Alternatively, students can develop projects on the FAU computers or their own personal computers.

Policy on the Recording of Lectures

Students enrolled in this course may record video or audio of class lectures for their own personal educational use. A class lecture is defined as a formal or methodical oral presentation as part of a university course intended to present information or teach students about a particular subject. Recording class activities other than class lectures, including but not limited to student presentations (whether individually or as part of a group), class discussion (except when incidental to and incorporated within a class lecture), labs, clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, and private conversations between students in the class or between a student and the lecturer, is prohibited. Recordings may not be used as a substitute for class participation or class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the University's Student Code of Conduct and/or the Code of Academic Integrity.

Counseling and Psychological Services (CAPS) Center

Life as a university student can be challenging physically, mentally and emotionally. Students who find stress negatively affecting their ability to achieve academic or personal goals may wish to consider utilizing FAU's Counseling and Psychological Services (CAPS) Center. CAPS provides FAU students a range of services – individual counseling, support meetings, and psychiatric services, to name a few – offered to help improve and maintain emotional well-being. For more information, go to http://www.fau.edu/counseling/

Student Support Services and Online Resources

- Center for Learning and Student Success (CLASS)
- Counseling and Psychological Services (CAPS)
- FAU Libraries
- Math Learning Center
- Office of Information Technology Helpdesk
- Office of International Programs and Study Abroad
- Office of Undergraduate Research and Inquiry (OURI)
- Science Learning Center
- Speaking Center
- Student Accessibility Services
- Student Athlete Success Center (SASC)
- Testing and Certification
- Test Preparation
- University Academic Advising Services
- University Center for Excellence in Writing (UCEW)
- Writing Across the Curriculum (WAC)

Special Topics
Variable title

Outlook

New Course Proposal

From William Brooks <wbrooks@fau.edu>
Date Mon 9/23/2024 2:37 PM
To Rodrigo De Oliveira Pena <penar@fau.edu>
Cc Marianne Porter <mporte26@fau.edu>; Rebecca Dixon <rdixon@fau.edu>; Sarah Milton <smilton@fau.edu>

1 attachments (2 MB)
BSC 6895 Artificial Intelligence in Biology-Pena.pdf;

Hello Rodrigo,

The College Graduate Programs Committee met and reviewed your new course proposal: BSC 6895 Artificial Intelligence In Biology

They requested that you articulate more about how this AI class specializes in biological systems. An overview of the syllabus shows some biological aspects, but the committee still questions the content. Discussing the course with Gary Perry (Complex Systems) and Yuan Wang (Math) about support for the new course could minimize concerns about potential course materials overlap. Hopefully, both could write letters presented to Sarah stating they endorse the course.

Regards,

Randy

W. Randy Brooks, PhD
Professor of Biology
Chair, FAU Biology Undergraduate & MS Graduate Program Committees
Boca Raton, FL 33431, Phone: 561-297-3888, Email: wbrooks@fau.edu

http://biology.fau.edu/directory/brooks/index.php

http://biology.fau.edu/academics/graduate/ms-programs.php

FLORIDA ATLANTIC UNIVERSITY

Charles E. Schmidt College of Science
Department of Biological Sciences
5353 Parkside Dr.
Jupiter, FL 33458
tel: 561.799-8073
e-mail: penar@fau.edu

November 5, 2024

Dear Members of the College Graduate Programs Committee,

I am writing to present the course proposal for **BSC 6895: Artificial Intelligence in Biology**. This course is an extension of an already approved IDS course, now tailored specifically for graduate students (see attached documentation).

The course is structured to provide a balance between theoretical knowledge and practical applications. Each week, students are introduced to the theoretical foundations of an artificial intelligence technique on one day, followed by hands-on practice with the technique on the next. When offered previously as a Special Topics course, students engaged in various applications of AI across biological fields, including Neuroscience, Computational Neuroscience, Ecology, Marine Science, Biochemistry, and diverse image recognition tasks.

A key component of the course is the development of an applied project. Students present this project twice during the semester. Many students use this opportunity to advance research projects from their respective labs by applying the techniques learned in class.

For the upcoming Spring 2025 semester, I have discussed data-sharing with Prof. Kate Detwiler and Prof. Marianne Porter, who kindly agreed to contribute data for use in class projects. Additionally, the Max Planck Florida Institute has generously provided datasets on dendritic spine detection and gold particle object detection from their experiments, enhancing the practical resources available to students.

Examples of recent student projects include:

- "Cardiovascular Disease Prediction Using Machine Learning"
- "Using Python to Automatically Process Fluorescence In Situ Hybridization (FISH) Images"
- "Land Cover Classification"
- "Animal Characteristic Categorization"
- "The Doubs River Ecosystem: Implications for Fish Population Dynamics and Ecosystem Health"
- "Microbial Community Analysis with Machine Learning"
- "Dendritic Spine Detection"

These projects illustrate the unique environment this course offers, where students explore AI applications directly relevant to biological research. Should you wish to review these and other projects in detail, they are available upon request.

Additionally, please find attached a letter of support from Prof. Gary Perry (Center for Complex Systems and Brain Sciences), who has conducted a thorough review of the course content together with Prof. Will Alexander.

Please feel free to reach out if you have any questions or need further information.
Thank you for considering this proposal.

Sincerely,

Rodrigo F. O. Pena

Rodrigo Pena
Assistant Professor

Outlook

(-BSC 6895 Artificial Intelligence In Biology

From Gary Perry <perryg@fau.edu>
Date Mon 11/4/2024 11:14 AM
To Rodrigo De Oliveira Pena <penar@fau.edu>
Cc William Alexander <walexander@fau.edu>

Good morning Rodrigo,

Following our review of the syllabus and discussion with Will Alexander regarding your new course on Artificial Intelligence in Biology, we do not believe there is significant overlap with Computational Neuroscience ISC 6460 and so are happy to support this course moving forward.

Cheers,
Gary

Gary W. Perry, PhD
Professor of Neuroscience & Acting Director
Center for Complex Systems and Brain Sciences
& Department of Psychology
Charles E. Schmidt College of Science
Florida Atlantic University
777 Glades Road
Boca Raton, FL 33431
Email: perryg@fau.edu

FLORIDA ATLANTIC UNIVERSITY

NEW COURSE PROPOSAL
Undergraduate Programs

Department Electrical Eng & Computer Science and Biology

College Engineering and Science

*(To obtain a course number, contact **erudolph@fau.edu**)*

UUPC Approval 3-28-22
UFS Approval _____
SCNS Submittal _____
Confirmed _____
Banner Posted _____
Catalog _____

Prefix IDS **Number** 4722	*(L = Lab Course; C = Combined Lecture/Lab; add if appropriate)* **Lab Code**	**Type of Course** Lecture	**Course Title** Artificial Intelligence Applications in Biology

Credits *(Review Provost Memorandum)*: 3

Effective Date *(TERM & YEAR)*: Fall 2022

Grading *(Select One Option)*: Regular (●) Sat/UnSat (○)

Course Description *(Syllabus must be attached; see Template and Guidelines)*

This course introduces the underlying concepts, techniques, and the potential of artificial intelligence (AI) in biology. It explores the application of AI and machine learning (ML) methods and algorithms to selected areas in biology. The course also exposes students to contemporary interactive tools to build AI and ML solutions without the need for extensive programming.

Prerequisites, with minimum grade*	**Corequisites**	**Registration Controls** *(Major, College, Level)*
PCB 3063 or BCH 3033 or permission of instructor	None	None

Default minimum passing grade is D-. Prereqs., Coreqs. & Reg. Controls are enforced for all sections of course

WAC/Gordon Rule Course

☐ Yes ☑ No

WAC/Gordon Rule criteria must be indicated in syllabus and approval attached to proposal. See WAC Guidelines.

Intellectual Foundations Program (General Education) Requirement *(Select One Option)*

None

General Education criteria must be indicated in the syllabus and approval attached to the proposal. See GE Guidelines.

Minimum qualifications to teach course

MS or PhD in a STEM discipline

Faculty Contact/Email/Phone

Oge Marques/omarques@fau.edu/7-3857

List/Attach comments from departments affected by new course

Approved by	***Date***
Department Chair Sarah L. Gutton	3-14-22
College Curriculum Chair Hongbo Su	3/18/22
College Dean	3/18/22
UUPC Chair Ethlyn Williams	3-28-22
Undergraduate Studies Dean Dan Meeroff	3-28-22
UFS President	
Provost	

Email this form and syllabus to mjenning@fau.edu seven business days before the UUPC meeting.