CIS 495 Bio-inspired Artificial Intelligence
Fall 2017

Professor: Dr. Laura Grabowski
Office: Dunn 303
Office Hours: MTWRF 11:00 AM – 12:00 PM, TR 1:00 – 3:00 PM, *and by appointment.*[1]
Voice: 267-2216
E-mail (usually the best way to communicate remotely): grabowlm@potsdam.edu

Course Description and Topics:

   A systematic introduction to the theories and methods of *bio-inspired Artificial Intelligence,* encompassing a range of computational approaches inspired by biological processes and phenomena that function on different spatial and temporal scales. The course will provide an application-centered view of computational methods and topics including evolutionary systems, neural systems, developmental systems, artificial immune systems, and collective systems.

Prerequisites:

   CIS 203, MATH 152.

Course Objectives:

   The purpose of this course is to provide the student with an understanding of bio-inspired Artificial Intelligence approaches, and experience with implementing selected systems.

Learning Objectives and Outcomes:

Objectives

The Computer Science program has adopted ten learning objectives for students completing an undergraduate major or minor in the department. Each course in the curriculum is designed to address particular objectives so that the overall curriculum fulfills our goal of producing capable computer scientists. The objectives (and broad outcomes) serve as a rubric for evaluating the learning that happens in this class. You may wish to review this section of the syllabus when filling out the course evaluation.

Below are the learning objectives that are applicable to CIS 495.002. You can find the complete list of objectives on the course Moodle page.

Students in the Computer Science program at SUNY Potsdam are expected to graduate with a:

- **knowledge of discrete and continuous mathematics including elementary probability and statistics and the ability to apply logic and mathematical proof techniques to computing problems.**
  a) Students will gain experience in the meaning of randomness and its use and importance in AI algorithms.
  b) Students will apply concepts of probability and statistics to programming and solving problems.
- **knowledge of fundamental data structures and algorithms including analysis of their correctness and complexity related to various fields of computer science, and the ability to apply this knowledge to problems through the use of appropriate programming languages.**
  a) Students will complete assignments that require using fundamental data structures.
  b) Students will make design decisions regarding the best data structure to use for an implementation.
- **an understanding of professional, ethical, legal, security, and social responsibilities and issues, including an awareness of impact of computing on individuals, organizations and society.**
  a) Students will engage in discussions that touch on ethical and social responsibilities related to Artificial Intelligence technologies.
  b) Students will formulate questions that address ethical and social aspects of Artificial Intelligence.

Outcomes

Upon completing this course, students will be able to:

1. Evaluate bio-inspired AI techniques and synthesize solutions to practical examples.
2. Develop a range of typical applications using bio-inspired AI methods.

---

[1] I usually maintain an open-door policy. If my office door is open, you're welcome to stop in with questions, even if it's not during official office hours. If the door is closed, I am busy and cannot see students at that time.

3. Demonstrate problem-solving skills through implementing selected algorithms.
4. Discuss key elements of the bio-inspired artificial systems addressed in the course.
5. Compare and contrast different bio-inspired approaches, methods, and algorithms.
6. Discuss applications of bio-inspired algorithms to real-world problems.

General Class Information
- **Class Time/Place:** TR 9:30-10:15 AM, Dunn 102
- **Required Text:** Floreano, D. & Mattiussi, C. (2008). Bio-inspired Artificial Intelligence: Theories, Methods, and Technologies. Cambridge, MA, MIT Press. ISBN: 978-0-262-06271-8 . See more information on the course Moodle page.
- **Examination Dates/Time** (tentative) **and Other Important Dates**
  - o This is a project-based course, so there are no exams. There will be a final presentation, which will take place during the final exam time (Thursday, December 14 2017, 10:15 AM – 12:15 PM).
  - o See the last page of this syllabus for the "Tentative Class Schedule."
  - o Other important dates
    - ▪ **Fall recess:** Friday, October 6 (10 PM) – Tuesday, October 10. Classes resume 8 AM on Wednesday, October 11.
    - ▪ **Thanksgiving recess:** Tuesday November 21 (10 PM) – Sunday November 26. Classes resume at 8 AM on Monday November 27.
    - ▪ See the university website for additional calendar information, http://www.potsdam.edu/academics/calendar.

Course Requirements and Procedures

Course Grading:
- **Distribution of your grade:** I will grade your course work using the following distribution:

Weekly discussion forum	10%
Daily question	15%
Homework	60%
Lightning talk	15%
Pre-test and post-test surveys	Extra credit!

- **Grading procedure:** Your course-grade average (on a scale of 0 – 100%) will be calculated as the weighted average of your averages on each area above using the weight distribution that is listed above. Each area average that is used for the weighted average is calculated as:

  (number of points earned) / (total number of points) * 100

  For example, if you earn 105 points out of a total of 140 points that are possible for you to earn for homework, your homework average will be: (105 / 140) * 100 = 75%. This average is then multiplied by the weighting factor (in this case, 60%), and that value is summed with the other weighted averages.

  Final grades are determined according to the scale shown below, subject to a curve at the discretion of the professor.

  4.0: 95 – 100%
  3.7: 90 – 94%
  3.3: 85 – 89%
  3.0: 80 – 84%
  2.7: 77 – 79%
  2.3: 73 – 76%
  2.0: 70 – 72%
  1.7: 67 – 69%
  1.3: 63 – 66%
  1.0: 60 – 62%
  0.0: <60%

  NOTE: The actual scale used may be adjusted according to the performance of the class a whole, again at the professor's discretion. In borderline cases, attendance, class participation, and completion of assigned work will be used to make a decision on the course grade.

- **Extra Credit: No special arrangements will be made for extra credit for improving grades.**
- **Attendance:** Attending all class meetings and completing required work is crucial to your success in this course. Missing class will result directly in loss of credit, since you will not submit a daily question. I strongly advise that you never miss class lightly, doing so only when it is unavoidable. Please see especially "Impact of extracurricular activities on class work," below.
- **Weekly discussion forum.** There will be discussion threads posted in Moodle each week, related to the current topic. You will post in each discussion and respond to posts by others. The discussions will be graded on participation and thoughtfulness of your discussion. I will provide the evaluation rubric that I will use for the discussions.
- **Daily Question.** Each class meeting, you will bring a written question that you will hand in at the start of class. The question may be about anything relating to the course material, whether it's a question from the last class meeting or two, a question about the assigned reading, a clarification on an assignment, or something relevant that you saw/heard/read in the news. Class will begin each day with answering some of the daily questions. Daily questions will be turned in in hard copy, and may be hand-written. Please be sure that your name is on your question. Try to think of interesting questions: the most interesting questions may end up in the Discussion Forum. If your question makes the cut, you'll get 0.25 points extra credit on your Daily Question total score! That doesn't sound like much, but it can add up over time. Grading is binary – either you turn it in or you don't. The daily question cannot be made up, and I will accept them ONLY at the start of class.
- **Homework.** Programming assignments will make up most of the homework for the course, and may include analysis and discussion. There will be a new programming assignment approximately every 2-3 weeks, for a total of 6-8 assignments. Homework will be turned in through Moodle assignments.
- **Lightning Talk.** You will research a bio-inspired AI method or system and deliver a 5-minute "lightning talk"[2] during the final exam time for the course. To help with time management, I have set up 4 "Talk" deadlines throughout the semester. Each of these aspects of the talk, plus the talk itself, will go into your grade.
  - o Talk topic – 10%. You will submit your planned topic to me so that I can prevent multiple students covering the same topic, and so that I can provide feedback to help you refine your topic. If more than one person chooses the same topic, I will moderate a discussion between those involved to separate the topics.
  - o Topic refinement – 10%. Using my feedback, you will submit a refined description of your topic.
  - o Sources – 10%. You will turn in the bibliographic information about the sources you are using for your talk. Generally, you should have multiple sources. You can always talk to me if you are having problems finding sources.
  - o Talk slides – 20%. Slides for your talk will be submitted the week before finals. The slides should be in their final, finished form when you turn them in.
  - o Talk – 50%. All talks will be presented during the final exam period. This cannot be rearranged. I will provide a presentation rubric to help you prepare.
- **Pre-test and Post-test Surveys.** You have the chance to help the Avida-ED developers and the "Active LENS (Learning Evolution and the Nature of Science) researchers by completing two surveys, one immediately at the start of the semester and the other later on. If you complete the surveys, you will be entered in a drawing for an iPad Mini! I will also give you **1.5 points extra credit on your overall homework grade** for each of the surveys that you complete (total possible = 3 points). Don't worry, I won't know what you said in your surveys. The investigators will just let me know who completed the survey so I can give the appropriate credit.
- **Late assignments:** This is an upper division (*i.e.,* advanced) course. **No late assignments will be accepted.**
- **Impact of extracurricular activities on class work:** You make the choices about how you will spend your time, including investing your time in non-academic activities. As a student, you need to give priority to your academic work, and prevent extracurricular commitments from negatively impacting your work for classes. You are, of course, free to participate in activities that are meaningful to you; however, do not expect me to give special consideration because of time management issues that arise from those activities. You should not be missing class because of extracurricular activities, nor should you allow

---

[2] We will discuss the talk type and length at the beginning of the semester. With the small class size, we can do a longer talk if the students prefer. Believe me, a longer talk is easier than a lightning talk!

yourself to fall behind on assignments. **NOTE: I will not give extensions that relate to participation in extracurricular activities, even if the activity is related to Computer Science.**

- **Grading questions:** If you have a question about a grade, you must see me within one week of the day the graded work is returned to you. You lose the right to re-grading after that time.
- **Incompletes:** Incomplete grades (Inc) are granted rarely. Incompletes are not to be used as a shelter from potentially low grades. An incomplete grade may be reported for you only when the following conditions are satisfied (SUNY Potsdam 2016-2018 Undergraduate Catalog, p. 43[3]):
  1. The student has requested an incomplete.
  2. Course requirements have not been completed for reasons beyond the student's control.
     (e.g. illness or family emergency).
  3. The student has completed the majority of the work for the class, and the student can accomplish the remaining requirements without further registration.
- **Academic integrity:** You are expected follow the "SUNY Potsdam Academic Honor Code" (SUNY Potsdam 2016-2018 Undergraduate Catalog, p. 35[4]) by doing your own work on all required work for the course unless specifically directed otherwise by the professor. **Copying is strictly forbidden**. Students caught cheating will receive a grade of 0 for that evaluation. More than one offense will result in dismissal from the course and possible disciplinary sanctions by the university. Academic Misconduct definitions, procedures, due process, and student rights are described on page 35 of the SUNY Potsdam 2016-2018 Undergraduate Catalog, as cited above.
- **Accommodative Services:** If you have special needs that must be accommodated to fulfill the course requirements, you must notify the professor and Sharon E. House, Director of Accommodative Services, 111 Sisson Hall, 267-3267. The university has resources available to assist qualified students with their academic studies. Please note that the professor is not able or qualified to determine what accommodations are necessary and appropriate. That task must be accomplished by the Accommodative Services staff. It is up to the student to initiate the process with Accommodative Services.
- **Food and Drink in Class:** Beverages are allowed in the lecture classroom as long you clean up after yourself and do not disturb others. Please do not bring food to lecture. In the Unix classroom (lab), food and drink are restricted to the coffee table. UNDER -**NO**- CIRCUMSTANCES ARE FOOD AND BEVERAGES (EVEN GUM OR WATER BOTTLES) ALLOWED NEAR THE COMPUTERS!
- **Accommodation of Religious Observances:** I will make reasonable accommodation for a student's religious beliefs. Please notify me within the first week of classes about any scheduled class date that conflicts with a religious observance.
- **Course Withdrawal:** The last day to drop a semester course without receiving a grade is Friday, November 3.
- **Moodle Page:** All the information and content for the course will be distributed through the course Moodle page. I expect that you will check the page daily for updates and announcements. Announcements posted in the News Forum in Moodle will automatically be sent to your Potsdam email, so you must also check your email daily. If you have schedule questions, look in Moodle first, before you send me an email.

Assignment Submission Policy and Guidelines

- You will submit your assignment files electronically through the Moodle assignment. Unless instructed otherwise, create a zipped folder for your assignment with the name

  `<yourLastName><yourFirstInitial><hw/talk><number>.<ext>`

  where `<yourLastName>` is your last name, `<yourFirstInitial>` is the first letter of your first name, `< hw/talk >` indicates either homework or talk, `<number>` is the assignment   or presentation number (for example, "01"), and `<ext>` is the file extension (.zip, .tar, .tgz).

- Every homework that you submit **must** have an id-box header like the one shown below ON ALL CODE FILES, and a similar ID section on non-code assignments.

  `/*`

```
Name: John Doe
Course: CIS 495.002 Bio-inspired AI
Fall 2017
Assignment 42: Dead Parrot Simulation
*/
```

Slides must include your name on the title slide.

- Assignments must reflect your ability to do the work. Anything that you submit for credit, whether written work or presentation, must be solely your work. It is strictly forbidden to submit anything that isn't your own work for credit, including items found online. You may (indeed, you must) draw from resources that you find, but they must be properly credited, as discussed in class. I will not hesitate to question your work if I am suspicious of its origin.

Expectations of students
- You should arrive to lecture on time and remain throughout the entire class period, except if I dismiss the class early.
- You will come to class prepared, whether with a presentation or an assigned reading.
- You will ask questions, participate in class discussions, and remain on task throughout the class meeting. Talking out of turn, engaging in non-class-related discussions with others (including the professor), using electronic devices during lecture, and other disruptive behavior will not be tolerated. If you are disrupting class, I may ask you to leave. Repeated offenses may result in your referral to the Office of Student Conduct and Community Standards, and possible dismissal from the class.
- All members of the Potsdam Computer Science community are governed by the ACM Code of Ethics and Professional Conduct, https://www.acm.org/about-acm/acm-code-of-ethics-and-professional-conduct, which we have distilled into our SUNY Potsdam Department of Computer Science Code of Professional Conduct (see below). The department faculty are committed to modeling and promoting ethical and professional behavior for all our students.

SUNY Potsdam Department of Computer Science Code of Professional Conduct

1. **Preamble**
   All members of the ACM, including the Computer Science faculty of SUNY Potsdam, are committed to ethical professional conduct as specified in the ACM Code of Ethics and Professional Conduct. Students, taking courses from the faculty, are bound by our commitment.

   All members of the Department are obliged to remind one another to behave professionally. Violations should be reported promptly; however, capricious or malicious reporting of violations is, itself, a violation. When reporting, bring all relevant aspects of the incident to the faculty's attention.

2. **Moral Imperatives**
   As a Computer Science student I will...
   2.1. Respect all members of the Department.
      2.1.1. Be professional in face-to-face and electronic interactions.
      2.1.2. Be fair so everyone is free to work and learn.
      2.1.3. Be active in preventing discrimination in physical and electronic spaces frequented by Department members.
   2.2. Accept and provide appropriate feedback.
      2.2.1. Avoid starting or spreading rumors.
      2.2.2. Respect confidentiality.
   2.3. Be honest, trustworthy, and respect intellectual property.
      2.3.1. Only take credit for my own work.
      2.3.2. Respect the privacy of others.
      2.3.3. Access computing resources only when authorized and report any access risks discovered.
   2.4. Contribute to society and human well-being.
      2.4.1. Improve public understanding of computing and its consequences.
      2.4.2. Consider both the direct and indirect impacts of my actions.

Tentative Class Schedule:

Be sure to stay up to date by checking the course Moodle page regularly. The schedule below is likely to change, including homework due dates. Details of reading and homework assignments will be posted on the course Moodle page.

Week starting	Week	Topics	Assignment Due
Aug. 28	1	Course Introduction; Randomness	Homework 0.5: Pre-test Survey; Daily Questions (Th)*
Sept. 4	2	Fundamentals of Probability; Evolutionary Systems	Homework 1: Understanding Evolution
Sept. 11	3	Evolutionary Systems	
Sept. 18	4	Cellular Systems; Neural Systems	Homework 2: Genetic Algorithm
Sept. 25	5	Neural Systems	Talk 1: Lightning Talk Topic Submission
Oct. 2	6	Neural Systems	Homework 3: ANN 1
Oct. 9	7	*October Recess, October 9-10* Developmental Systems	Talk 2: Topic Refinement
Oct. 16	8	Developmental Systems	Homework 4: ANN 2
Oct. 23	9	Developmental Systems; Immune Systems	
Oct. 30	10	Immune Systems	Homework 5: ANN
Nov. 6	11	Immune Systems; Behavioral Systems	Talk 3: Sources
Nov. 13	12	Behavioral Systems	Homework 6: Artificial Immune System
Nov. 20	13	Behavioral Systems *Thanksgiving Recess, November 22-24*	
Nov. 27	14	Collective Systems	Homework 6.5: Post-test Survey
Dec. 4	15	Collective Systems	Homework 7: TBA Talk 4: Submit slides
Dec. 11		**Final Exam: Lightning Talks Thursday, December 14, 10:15 AM – 12:15 PM**	

*Daily Question will be due EACH CLASS MEETING AT THE BEGINNING OF CLASS. See above for more details.

See https://www.potsdam.edu/academics/calendar for important dates for Fall 2017.