CAP6615 - Neural Networks

CAP6615 (Neural Networks) · Course Numbers 27848,27849 · Sections 3487,ZE31
Class Periods: Tuesday Period 8-9, Thursday Period 9
Location: Class sessions Florida Gym Rm 270, Office Hours & Work Sessions via Canvas and Zoom
Academic Term: Spring 2022

Instructor: Dr. Mark Schmalz
   a. Office location: CSE/E446
   b. Telephone: 352-294-6668 (office)
   c. E-mail address: **mssz@cise.ufl.edu**
   d. Office hours: Variable, as announced on **https://www.cise.ufl.edu/~mssz** (scroll to "Hours")
      and via Canvas announcements (sent to your email address)

TA: Mr. Michael Kummer
   e. Office location: CSE/E309
   f. Telephone: 941-345-5745 (mobile)
   g. E-mail address: **msk@cise.ufl.edu**
   h. Office hours: To be announced via Canvas announcements (sent to your email address)

Course Description – (3 credits) In this course, students will be introduced to various neural network models and algorithms, adaptive behavior, associative learning, competitive dynamics and biological mechanisms. Several applications of artificial neural networks will be studied including computer vision, cognitive information processing, control, and signal analysis.

Course Pre-Requisites / Co-Requisites – CAP5635 (Artificial Intelligence).

Course Objectives – : Introduce fundamental concepts of neural networks and study several network models in detail. After taking this course, the student will be ready to understand the structure, design, and training of various types of neural networks and will be ready to apply them to the solution of problems in a variety of domains.

   You must read your Canvas website and e-mail frequently to stay in touch with your instructor, concerning meeting announcements, presentation dates, etc. You are completely responsible for knowing these dates, and appearing at class sessions and exams *on time*, *fully prepared*, and *with the appropriate materials*.

Materials and Supply Fees – No fees required.

Required Textbooks and Software – Two textbooks are involved, as follows:

Required Text: Aggarwal, C.C. *Neural Networks and Deep Learning*, Springer, 2018.
                ISBN: 978-3-319-94463-0 (eBook)

Recommended: Ritter, G.X. and G. Urcid, *Introduction to Lattice Algebra with Applications in AI, Pattern Recognition, Image Analysis, and Biomimetic Neural Networks*, CRC Press, 2021. ISBN: 9780367720292 (hardcover only, no eBook)

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Software: Integrated code development environment such as Express, Python programming language, Python libraries such as PyTorch and TensorFlow, also Adobe PDF software (reading and editing capabilities), Microsoft Word, Excel, and PowerPoint; Zoom and webcam/microphone.

Anticipated Schedule: (subject to change)

Week	Topic
1	Introduction to Course | Basic Ideas of Neural Networks (NNs) | Overview of Models **Assignment:** Install Python + PyTorch & TensorFlow Libraries
2	**Shallow NNs:** Theory & Classification *Applications*: Matrices, Word2Vec, Graph Embedding
3-4	**Deep NNs:** Theory, Models, Training, Tricks, Generalizations **Due:** Program-1 *Applications*: Batch Normalization, Acceleration, Compression, Learning
5	**Radial Basis Function NNs:** Theory, Models, Training *Variations*: Classification, Linear Separability
6	**Restricted Boltzmann Machines:** Theory, Models, Relationship to Recurrent NNs *Practical*: Applications, Extension, Stacking **Due:** Program-2
7-8	**Recurrent NNs:** Theory, Models *Applications*: Echo-State Nets, LSTMs, GRUs, Time Series **Midterm Exam**
9-10	**Convolutional NNs:** Theory, Models, Training *Applications*: Case Studies, Image Analysis **Due:** Program-3
11-12	**Deep Reinforcement Learning:** Bootstrapping, Policy Gradient & Monte Carlo Techniques *Applications*: Games, Robotics, and Conversational Systems
13-14	**Lattice-Based NNs:** Theory, Training, Analysis *Applications*: Spectral Signature Analysis, Classification **Due:** Program-4
15	**Course Summary + Final Exam Review**
16	**Final Exam:** Take-Home, open-notes, open-book | Time/Date TBA **Final Exam**

Attendance Policy, Class Expectations, and Make-Up Policy – All students are expected to attend the lectures (or watch lecture videos via Zoom) and actively participate in class discussions. We will try to record in-class lectures, but may not be able to for technical reasons – in such cases, we will try to post a lecture summary video on the associated Canvas assignment page.

Students are also required to take the midterm and final exams at the scheduled time. There would be no makeup exams except for medical emergencies with appropriate documentation. Excused absences must be consistent with university policies in the Graduate Catalog (https://catalog.ufl.edu/graduate/regulations) and require appropriate documentation.

Additional information can be found here: https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/

Evaluation of Grades

Grades are determined by quality of work on the following items. In order to **pass** the class, students **must complete** their programming assignments and exams *on time* and *per specifications*, as follows:

- Midterm Exam: 15 percent of total score
- Final Exam: 25 percent of total score
- Programming Assignments: PA1: 10 pct, PA2: 15 pct, PA3: 15 pct, PA4: 20 pct of total score
- *Grade Computation*: **Step 1:** Add up total scores for programming assignments & exams
  Step 2: Add extra credit to result of Step 1, above
  Step 3: Divide by 2, then apply grading scale shown below

Summary

Assignment	Total Points	Percentage of Final Grade
Midterm Exam	30	15%
Final Exam	50	25%
Programming Assmts	120	60%
Extra Credit (EC)	TBD	In addition to 100%
TOTAL	**200 + EC**	**100% + EC**

Grading Policy: Grade will be computed by dividing total score by 2, adding earned extra credit, then applying UF grading scale (below)

Percent	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67

Percent	Grade	Grade Points
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:

http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting https://disability.ufl.edu/students/get-started/. It is important for students to share their accommodation letter with their instructor and discuss their access needs, 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 https://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 https://ufl.bluera.com/ufl/ . Summaries of course evaluation results are available to students at https://gatorevals.aa.ufl.edu/public-results/ .

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A "class lecture" is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To "publish" means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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 Conduct Code (https://sccr.dso.ufl.edu/process/student-conduct-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

  • Your academic advisor or Graduate Program Coordinator
  • Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
  • Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
  • Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

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. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity

Student 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

(Syllabus continues on next page…)

Campus Resources

Health and Wellness

U Matter, We Care:
Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: https://counseling.ufl.edu, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence
If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the Office of Title IX Compliance, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)
Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; https://career.ufl.edu.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus: https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/; https://care.dso.ufl.edu.

On-Line Students Complaints: http://www.distance.ufl.edu/student-complaint-process.