Deep Learning for Computer Graphics
CIS 6930/CIS 4930 Section 27C9/29E7
Class Periods: **:** MWF, Period 5, 11:45AM-12:35PM
Location: Online
Academic Term: Fall 2020

Instructor:
Corey Toler-Franklin
ctoler@cise.ufl.edu
CSE 332 (Lab CSE 319)
Office Hours: TBD, Zoom conference

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
Please contact through the Canvas website
- Michael Perez, email address, TBD, Zoom conference

Course Description
Deep learning algorithms are prevalent in computer graphics: from convolutional neural networks (CNNs) for denoising rendered movie frames to Generative Adversarial Networks (GANs) for simulating facial animation. This course covers the fundamental theory and application of AI algorithms in the context of computer graphics through lectures, reading assignments and a semester long programming project. The course is open to both graduate and undergraduate students.

Course Pre-Requisites / Co-Requisites
Proficiency in a programming Language (Python and/or C++ recommended), COP 3530, MAS 3114 or 4105

Course Objectives
This course covers the fundamental theory and application of AI algorithms in the context of computer graphics. Deep learning is prevalent in graphics: from convolutional neural networks (CNNs) for denoising movie frames to Generative Adversarial Networks (GANs) for simulating facial animation. Through lectures, reading assignments (current research papers), and a semester long programming project, students will learn fundamental concepts including: supervised and unsupervised learning, convolutional neural network architectures, backpropagation, autoencoders and fine-tuning, as well as applications like image denoising and GANs for video simulation and animation.

Materials and Supply Fees
N/A

Professional Component (ABET):
Students will learn fundamental concepts for solving engineering problems related to deep learning. Students will apply mathematical concepts to develop AI algorithms in a semester long programming project.

Relation to Program Outcomes (ABET):

Outcome	Coverage[*]
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	

3. An ability to communicate effectively with a range of audiences	Low		
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	Medium		
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Medium		
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	High		
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium		

Required Textbooks and Software

- Title: Deep Learning
- Author: Ian Goodfellow, Yoshua Bengio and Aaron Courville
- Publication date and edition: Latest Online
- ISBN number: 9780262035613

Course Schedule

Date		Topic	Reading	Assignments
31-Aug		Introduction		course survey out
2-Sep		Machine Learning Basics	Goodfellow 5-5.2.0, 5.3	
4-Sep		Neural Networks	Goodfellow 6, 6.1, 6.4, 14, 14.1, 14.9	course survey due
7-Sep		**Labor Day (no classes)**		
9-Sep		Neural Networks	Goodfellow 4.3, 5.9, 6.5,	
11-Sep	*	Neural Networks	Goodfellow 7.12, 8.4, 8.7.1	
14-Sep		Course Project Discussion		course project out
16-Sep		Traditional Machine Learning	Lowe 2004	
18-Sep	*	Convolutional Neural Networks	Goodfellow 9-9.3	
21-Sep		Recurrent Neural Networks	Goodfellow 10-10.2.2, 10.10.1	course project selection/proposal due
23-Sep		Python, Torch, CUDA, cuDNN, TensorFlow		
25-Sep	*	Python, Torch, CUDA, cuDNN, TensorFlow		
28-Sep		Training, Testing, Fine-tuning	Goodfellow 15.2, 7.4	
30-Sep		Natural Language Processing		
2-Oct	*	Reinforcement Learning	Volodymyr2013	
5-Oct		Reinforcement Learning		course project part 1. due
7-Oct		Deep Learning in Graphics: Recent Trends		
9-Oct	*	Math for Computer Graphics	course notes	
12-Oct		Math for Computer Graphics		
14-Oct		Generative Adversarial Networks	Goodfellow2014	
16-Oct	*	Generative Adversarial Networks		
19-Oct		Image Synthesis	course notes	
21-Oct		Image Synthesis		

Date		Topic	Reading	Assignment
23-Oct	*	Image Denoising	Bako2017	course project part 2. due
26-Oct		Image Denoising		written assignment out
28-Oct		Motion from Video	Karpathy 2014	
30-Oct	*	Motion from Video		
2-Nov		Animation		written assignment due
4-Nov		Learning from Physics	Lerer2016	
6-Nov	*	Learning from Physics		
9-Nov		Learning from Physics		
11-Nov		Autonomous Driving		
13-Nov	*	Autonomous Driving		
16-Nov		**Veterans Day (no classes)**		
18-Nov		Robotics		
20-Nov	*	Robotics		
23-Nov		Final Exam		
25-Nov		**Thanksgiving Break (no classes)**		
27-Nov		**Thanksgiving Break (no classes)**		
30-Nov		**TBD**	TED Talk 1.	
2-Dec		**TBD**	TED Talk 2.	
4-Dec		Advanced Topics		
7-Dec		Advanced Topics		
9-Dec		**TBD**		course project part 3. due

Online Course Recording
Our class sessions may be audio visually recorded for students in the class to refer back and for 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, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate orally are agreeing to have their voices recorded. If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the "chat" feature, which allows students to type questions and comments live. The chat will not be recorded or shared. As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.

Attendance Policy, Class Expectations, and Make-Up Policy
Attendance is expected and noted. One half of a letter grade will be deducted (e.g. an A becomes a B+) for missing more than 3 classes for the semester without a documented university excused absence. Emergencies must be approved by the instructor. Excuses for school related business will be accepted only with prior approval. Make-Up homework, projects and exams for university excused absences must approved in advance by the instructor. Excused absences must be consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Course Project (submitted in 3 parts 20% each)	100	60%
Final Exam	100	15%
One Written Homework	100	15%
Quizzes (~weekly)	100 each	10%
		100%

Grading Policy
The following is given as an example only.

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
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:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Late Policy: Late programming projects will receive a late penalty of 10% per day late up to a maximum of a 50% reduction. Students are permitted 1 free late pass for 1 programming assignment (Course project Parts 1 and 2 only). No late penalties will be applied for up to 1 week over the deadline when using a late pass. Students must notify the instructor in writing by the assignment due date and receive a confirmation email from the instructor in order to use the late pass. Written homework is often reviewed in class in preparation for exams and cannot be turned in late.

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/.

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 (https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-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.

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
• Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.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

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: http://www.counseling.ufl.edu/cwc, 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://www.crc.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://care.dso.ufl.edu.

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