Cover Sheet: Request 15834

CAP 4600 – Deep Learning for Computer Graphics

Info

Process	Course|New|Ugrad/Pro
Status	Pending at PV - University Curriculum Committee (UCC)
Submitter	Corey Toler-Franklin ctoler@cise.ufl.edu
Created	2/11/2021 11:33:56 PM
Updated	3/18/2021 3:43:47 PM
Description of request	I would like to mainstream a special topics course I am currently teaching - 4930 Deep Learning for Computer Graphics. I am submitting two separate course requests as these should be taught separately. CAP 4600 is intended to be offered as an undergraduate course. This is an introductory deep learning course for seniors (level 4). The field of study is Artificial Intelligence. The SCNS number most appropriate for this course is 600.

Actions

Step	Status	Group	User	Comment	Updated
Department	Approved	ENG - Computer and Information Science and Engineering 19140000	Christina Gardner-McCune		2/18/2021
No document changes					
College	Conditionall Approved	ENG - College of Engineering	Heidi Dublin	Conditionally approved. Comments: Course description should not start with “This undergraduate course” If you want the registration system to check prereqs, they should be a list of prereq courses This is a joined course and this must be selected on the form. There is a mismatch between points and % in the grading table. Late policy must be in compliance with the UF policy. Notification ahead cannot be required and must accommodate all excused absences Include more information about final project. Take out example wording from grading scale. Please send back by 3/12/2021 so that it can be reviewed by Faculty Council on 3/18	3/5/2021
No document changes					
Department	Approved	ENG - Computer and Information Science and Engineering 19140000	Christina Gardner-McCune	All requested revision were made by the instructor and reviewed.	3/15/2021

Step	Status	Group	User	Comment	Updated
courseApproval-CAP4600-DeepLearningCG-Course-Syllabus-Online-Fall-2021-updated_v2.pdf courseApproval-CAP5619-DeepLearningCG-Syllabus-Online-Fall-2021-updated.pdf					3/15/2021 3/10/2021
College	Approved	ENG - College of Engineering	Heidi Dublin	Approved by HWCOE Curriculum Committee and Faculty Council.	3/18/2021
No document changes					
University Curriculum Committee	Pending	PV - University Curriculum Committee (UCC)			3/18/2021
No document changes					
Statewide Course Numbering System					
No document changes					
Office of the Registrar					
No document changes					
Student Academic Support System					
No document changes					
Catalog					
No document changes					
College Notified					
No document changes					

Course|New for request 15834

Info

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Submitter: Corey Toler-Franklin ctoler@cise.ufl.edu
Created: 3/10/2021 3:25:22 PM
Form version: 20

Responses

Recommended Prefix
Enter the three letter code indicating placement of course within the discipline (e.g., POS, ATR, ENC). Note that for new course proposals, the State Common Numbering System (SCNS) may assign a different prefix.

Response:
CAP

Course Level
Select the one digit code preceding the course number that indicates the course level at which the course is taught (e.g., 1=freshman, 2=sophomore, etc.).

Response:
4

Course Number
Enter the three digit code indicating the specific content of the course based on the SCNS taxonomy and course equivalency profiles. For new course requests, this may be XXX until SCNS assigns an appropriate number.

Response:
600

Category of Instruction
Indicate whether the course is introductory, intermediate or advanced. Introductory courses are those that require no prerequisites and are general in nature. Intermediate courses require some prior preparation in a related area. Advanced courses require specific competencies or knowledge relevant to the topic prior to enrollment.

Response:
Intermediate

- *1000 level = Introductory undergraduate*
- *2000 level = Introductory undergraduate*
- *3000 level = Intermediate undergraduate*
- *4000 level = Advanced undergraduate*
- *5000 level = Introductory graduate*
- *6000 level = Intermediate graduate*
- *7000 level = Advanced graduate*
- *4000/5000= Joint undergraduate/graduate*
- *4000/6000= Joint undergraduate/graduate*

**Joint undergraduate/graduate courses must be approved by the UCC and the Graduate Council)*

Lab Code
Enter the lab code to indicate whether the course is lecture only (None), lab only (L), or a combined lecture and lab (C).

Response:
None

Course Title
*Enter the title of the course as it should appear in the Academic Catalog. There is a 100 character limit for course titles. *

Response:
Deep Learning for Computer Graphics

Transcript Title
Enter the title that will appear in the transcript and the schedule of courses. Note that this must be limited to 30 characters (including spaces and punctuation).

Response:
Deep Learning Comp Graphics

Degree Type
Select the type of degree program for which this course is intended.

Response:
Baccalaureate

Delivery Method(s)
Indicate all platforms through which the course is currently planned to be delivered.

Response:
On-Campus

Co-Listing
Will this course be jointly taught to undergraduate, graduate, and/or professional students?

Response:
No

Effective Term
Select the requested term that the course will first be offered. Selecting "Earliest" will allow the course to be active in the earliest term after SCNS approval. If a specific term and year are selected, this should reflect the department's best projection. Courses cannot be implemented retroactively, and therefore the actual effective

term cannot be prior to SCNS approval, which must be obtained prior to the first day of classes for the effective term. SCNS approval typically requires 2 to 6 weeks after approval of the course at UF.

Response:
Earliest Available

Effective Year
Select the requested year that the course will first be offered. See preceding item for further information.

Response:
Earliest Available

Rotating Topic?
Select "Yes" if the course can have rotating (varying) topics. These course titles can vary by topic in the Schedule of Courses.

Response:
No

Repeatable Credit?
Select "Yes" if the course may be repeated for credit. If the course will also have rotating topics, be sure to indicate this in the question above.

Response:
Yes

If repeatable, # total repeatable credit allowed
Indicate the maximum number of total repeatable credits allowed per student.

Response:
3

Amount of Credit
Select the number of credits awarded to the student upon successful completion, or select "Variable" if the course will be offered with variable credit and then indicate the minimum and maximum credits per section. Note that credit hours are regulated by Rule 6A-10.033, FAC. If you select "Variable" for the amount of credit, additional fields will appear in which to indicate the minimum and maximum number of total credits.

Response:
3

S/U Only?
Select "Yes" if all students should be graded as S/U in the course. Note that each course must be entered into the UF curriculum inventory as either letter-graded or S/U. A course may not have both options. However, letter-graded courses allow students to take the course S/U with instructor permission.

Response:
No

Contact Type
Select the best option to describe course contact type. This selection determines whether base hours or headcount hours will be used to determine the total contact hours per credit hour. Note that the headcount hour options are for courses that involve contact between the student and the professor on an individual basis.

Response:
Regularly Scheduled

• Regularly Scheduled [base hr]
• Thesis/Dissertation Supervision [1.0 headcount hr]
• Directed Individual Studies [0.5 headcount hr]
• Supervision of Student Interns [0.8 headcount hr]
• Supervision of Teaching/Research [0.5 headcount hr]
• Supervision of Cooperative Education [0.8 headcount hr]

Contact the Office of Institutional Planning and Research (352-392-0456) with questions regarding contact type.

Weekly Contact Hours
Indicate the number of hours instructors will have contact with students each week on average throughout the duration of the course.

Response:
3

Course Description
Provide a brief narrative description of the course content. This description will be published in the Academic Catalog and is limited to 500 characters or less. See course description guidelines.

Response:
This undergraduate course covers deep learning basics, related math and the fundamental theory and application of AI algorithms most popular in the field of computer graphics. Programming assignments will help students develop GPU programming skills while implementing concepts learned in lectures and readings using deep learning APIs on a GPU cluster. Convolutional neural networks (CNNs) for colorizing black and white movies is an example.

Prerequisites
Indicate all requirements that must be satisfied prior to enrollment in the course. Prerequisites will be automatically checked for each student attempting to register for the course. The prerequisite will be published in the Academic Catalog and must be formulated so that it can be enforced in the registration system. Please note that upper division courses (i.e., intermediate or advanced level of instruction) must have proper prerequisites to target the appropriate audience for the course.
Courses level 3000 and above must have a prerequisite.
Please verify that any prerequisite courses listed are active courses.

Response:
COP 3530, MAS 3114 or 4105

Completing Prerequisites on UCC forms:

• Use "&" and "or" to conjoin multiple requirements; do not used commas, semicolons, etc.
• Use parentheses to specify groupings in multiple requirements.
• Specifying a course prerequisite (without specifying a grade) assumes the required passing grade is D-. In order

to specify a different grade, include the grade in parentheses immediately after the course number. For example, "MAC 2311(B)" indicates that students are required to obtain a grade of B in Calculus I. MAC2311 by itself would only require a grade of D-.
• Specify all majors or minors included (if all majors in a college are acceptable the college code is sufficient).
• "Permission of department" is always an option so it should not be included in any prerequisite or co-requisite.
• If the course prerequisite should list a specific major and/or minor, please provide the plan code for that major/minor (e.g., undergraduate Chemistry major = CHY_BS, undergraduate Disabilities in Society minor = DIS_UMN)

Example: A grade of C in HSC 3502, passing grades in HSC 3057 or HSC 4558, and undergraduate PBH student should be written as follows: HSC 3502(C) & (HSC 3057 or HSC 4558) & UGPBH
* *

Co-requisites
Indicate all requirements that must be taken concurrently with the course. Co-requisites are not checked by the registration system. If there are none please enter N/A.

Response:
N/A

Rationale and Placement in Curriculum
Explain the rationale for offering the course and its place in the curriculum.

Response:
Having taught a high-enrollment special topics course covering this material, for 2 semesters, there is a clear need for more AI courses at UF. In particular with the new HiPerGator system and NVIDIA partnership, there has been increased requests to continue this offering. The course has attracted students from multiple departments.

This is not a joined course. The course will be taught separately.

The graduate level (CAP 5619) and undergraduate level (CAP4600) versions of this course meet different academic needs for our students and are taught separately:
(1) The undergraduate course emphasizes GPU programming and using deep learning APIs to implement course concepts. In addition to GPU programming skills, the graduate level course explores research applications and technical writing through a semester long project.
(2) The syllabus for the undergraduate course includes more lectures on background math and introductory concepts.
(3) While both courses use quizzes, an exam and a written homework for developing problem solving skills using the math presented in the course, other evaluation criteria are different. Undergraduates have well-defined programming projects and one final project. Graduate students develop one project in which they implement concepts from research publications covered in class. This semester project incorporates key concepts from the course and is evaluated at three different stages of development.

Course Objectives
Describe the core knowledge and skills that student should derive from the course. The objectives should be both observable and measurable.

Response:
This undergraduate course covers the fundamental theory and application of AI algorithms in the context of computer graphics. This course begins with deep learning basics including several lectures that cover related math (numerical analysis, gradient optimization, singular value decomposition and math for computer graphics). Students will then learn fundamental deep learning concepts including: supervised and unsupervised learning, convolutional neural network architectures, backpropagation, autoencoders and fine-tuning. In this undergraduate level course,

there is an emphasis on developing GPU programming skills while implementing concepts learned for real computer graphics applications. CNNs for colorizing black and white movies is an example. Students will complete programming assignments using a GPU cluster. Weekly quizzes are designed to help students access their understanding of course material on a regular basis. These quizzes also provide preparation for the written homework and take-home exam which are designed to help students develop problem solving skills that use mathematical concepts covered in the course material.

Course Textbook(s) and/or Other Assigned Reading

*Enter the title, author(s) and publication date of textbooks and/or readings that will be assigned. Please provide specific examples to evaluate the course and identify required textbooks. *

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

Weekly Schedule of Topics

Provide a projected weekly schedule of topics. This should have sufficient detail to evaluate how the course would meet current curricular needs and the extent to which it overlaps with existing courses at UF.

Response:

		Date	Topic	Reading	Assignments
Week 1		Introduction		course survey out	
Week 1		Machine Learning Basics		"Goodfellow 5-5.2.0, 5.3"	
Week 1		Machine Learning Basics			course survey due
Week 2		Place Holder Holiday			
Week 2		Math:Numerical Analysis:Gradient Optimization		Goodfellow 4.3	
Week 2	*	Math:Numerical Analysis:Gradient Optimization			
Week 3		Math:Numerical Analysis:Gradient Optimization			
Week 3		Neural Networks		"Goodfellow 6, 6.1, 6.4, 14, 14.1, 14.9"	
Week 3	*	Neural Networks		"Goodfellow 5.9, 6.5"	Proj 1. Classification/Regression
Week 4		Neural Networks		"Goodfellow 7.12, 8.4, 8.7.1"	
Week 4		"Python, Torch, CUDA, cuDNN, TensorFlow"			
Week 4	*	"Python, Torch, CUDA, cuDNN, TensorFlow"			
Week 5		"Python, Torch, CUDA, cuDNN, TensorFlow"			
Week 5		"Training, Testing, Fine-tuning"		" Goodfellow 15.2, 7.4"	
Week 5	*	"Training, Testing, Fine-tuning"			
Week 6		Convolutional Neural Networks		Goodfellow 9-9.3	Proj 2. CNNs for Graphics
Week 6		Convolutional Neural Networks			Proj 1. due
Week 6	*	Traditional Machine Learning			
Week 7		Traditional Machine Learning		"Lowe 2004, Toler-Franklin 2010"	
Week 7		Recurrent Neural Networks		"Goodfellow 10-10.2.2, 10.10.1"	
Feb.25th No Work Day					
Week 7	*	Natural Language Processing			
Week 8		Math for Computer Graphics			
Week 8		Math for Computer Graphics			
Week 8	*	Math for Computer Graphics			
Week 9		Deep Learning - inverse Graphics Problem			Proj 2. due
Week 9		Deep Learning - inverse Graphics Problem			Final Project Proposal

Week 9	*	Deep Learning in Graphics: Recent Trends	
Week 10	Deep Learning in Graphics: Recent Trends		
Week 10	Deep Learning in Medicine	" Zhang, Heldermon,Toler-Franklin 2020"	
Week 10	*Reinforcement Learning		
Week 11	Reinforcement Learning	"Mnih2013, Volodymyr2013"	
Week 11	Place Holder Holiday	written hw out	
Week 11	*Generative Adversarial Networks	Goodfellow2014	
Week 12	Generative Adversarial Networks		
Week 12	Image Synthesis	Portenier 2019	Final Project .mid eval
Week 12	*Image Denoising	Bako2017	written hw due
Week 13	Take Home Exam	Take Home Exam: 48 hours	
Week 13	Motion from Video	"Karpathy 2014, Vondrick2016"	
Week 13	Learning from Physics	Lerer2016	
Week 14	Learning from Physics		
Week 14	Autonomous Driving	TED Talk 1.	
Week 14	Autonomous Driving	Janai 2017	
Week 15	Robotics	TED Talk 2.	
Week 15	Robotics	Pinto 2017	Final Project due

Grading Scheme

List the types of assessments, assignments and other activities that will be used to determine the course grade, and the percentage contribution from each. This list should have sufficient detail to evaluate the course rigor and grade integrity. Include details about the grading rubric and percentage breakdowns for determining grades. If participation and/or attendance are part of the students grade, please provide a rubric or details regarding how those items will be assessed.

Response:
Assignment, Percentage of Final Grade
Programming Proj. (2) 40%
Take Home Exam (1) 15%
Written Homework (1) 15%
Final Project 20%
Quizzes (~weekly) 10%

Quizzes are conducted in canvas and include 15 multiple choice, short answer and fill-in-the blank questions to be completed in 20 minutes. These are closed book and occur at the end of each week in class and cover the week's lectures.

The take home exam consists of multiple choice, short answer, and essay questions that include math problems. The exams covers all material presented in the course at the time of the exam. This homework is open book.

The written homework consists of multiple choice, short answer, and essay questions that include math problems. Students are given 48 hours to complete this exam including one class period. This exam is open book.

Programming assignments cover teach students how to train and evaluate classifiers and regressors, how to implement neural network architectures and how to use deep learning for graphics applications. Students are evaluated for code completeness and correctness, evaluation results and written presentation. In general each programming stage is graded 30%, 60%, 10% for code, results/evaluation, and presentation respectively.

The final project is a programming project that demonstrates practical understanding of at least

two topics covered in class. Students will implement classic or new deep learning algorithms to produce a creative computer graphics application of their choice. Students are given guidance to help them design their projects; including prior project examples, a review of possible project ideas and feedback on a required project proposal. The project proposal is used to verify the scope and complexity of the project. Final projects may be implemented individually or in groups of 2 or 3 and may incorporate APIs and datasets chosen by the student. Students are evaluated as follows:
Final Project Grading Rubric:
10 Mid-Point Evaluation (initial results, source code, individual contribution)
10 Complexity
10 Novelty/approach/creativity
20 Results
20 Report
20 Source Code
10 Slide Presentation – Content : Background, goal, implementation, results, limitations, future work
Total Points: 100

Class Grading policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

Attendance is expected and taken in class. 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 excuse. Make-Up homework, projects and exams will be coordinated with the instructor for university excused absences. 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.

Late Policy: Late programming projects will receive a late penalty of 10% per day late up to a maximum of a 50% reduction unless there is a documented university excused absence. Students are permitted 1 free late pass for 1 programming assignment (not including the final project which is due at the end of the semester). No late penalties will be applied for up to 1 week over the deadline when using a late pass. The written homework is reviewed in class in preparation for the exam and cannot be turned in late without a documented university excused absence.

Instructor(s)
Enter the name of the planned instructor or instructors, or "to be determined" if instructors are not yet identified.

Response:
Corey Toler-Franklin

Attendance & Make-up
Please confirm that you have read and understand the University of Florida Attendance policy.
A required statement statement related to class attendance, make-up exams and other work will be included in the syllabus and adhered to in the course. Courses may not have any policies which conflict with the University of Florida policy. The following statement may be used directly in the syllabus.

• Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

Response:
Yes

Accomodations
Please confirm that you have read and understand the University of Florida Accommodations policy.
A statement related to accommodations for students with disabilities will be included in the syllabus and adhered to in the course. The following statement may be used directly in the syllabus:

• Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) 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.

Response:
Yes

UF Grading Policies for assigning Grade Points
Please confirm that you have read and understand the University of Florida Grading policies.
Information on current UF grading policies for assigning grade points is require to be included in the course syllabus. The following link may be used directly in the syllabus:

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

Response:
Yes

Course Evaluation Policy
Course Evaluation Policy
Please confirm that you have read and understand the University of Florida Course Evaluation Policy.
A statement related to course evaluations will be included in the syllabus. The following statement may be used directly in the syllabus:

• 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/public-results/. 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/.

* *

Response:
Yes

Deep Learning for Computer Graphics

CAP 4600 Section TBD
Class Periods: MWF, Period 5, 11:45am-12:35PM
Location: TBD
Academic Term: Fall 2021

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

- TBD, Zoom conference

Course Description
Explore deep learning basics, related math and the fundamental theory and application of AI algorithms most popular in the field of computer graphics. Programming assignments will help students develop GPU programming skills while implementing concepts learned in lectures and readings using deep learning APIs on a GPU cluster. Convolutional neural networks (CNNs) for colorizing black and white movies is an example.

Course Pre-Requisites / Co-Requisites
COP 3530, MAS 3114 or 4105

Course Objectives
This undergraduate course covers the fundamental theory and application of AI algorithms in the context of computer graphics. This course begins with deep learning basics including several lectures that cover related math (numerical analysis, gradient optimization, singular value decomposition and math for computer graphics). Students will then learn fundamental deep learning concepts including: supervised and unsupervised learning, convolutional neural network architectures, backpropagation, autoencoders and fine-tuning. In this undergraduate level course, there is an emphasis on developing GPU programming skills while implementing concepts learned for real computer graphics applications. CNNs for colorizing black and white movies is an example. Students will complete programming assignments using a GPU cluster. Weekly quizzes are designed to help students access their understanding of course material on a regular basis. These quizzes also provide preparation for the written homework and take-home exam which are designed to help students develop problem solving skills that use mathematical concepts covered in the course material.

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	Medium
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
Week 1		Introduction		course survey out
Week 1		Machine Learning Basics	Goodfellow 5-5.2.0, 5.3	
Week 1		Machine Learning Basics		course survey due
Week 2		**Place Holder Holiday**		
Week 2		Math:Numerical Analysis:Gradient Optimization	Goodfellow 4.3	
Week 2	*	Math:Numerical Analysis:Gradient Optimization		
Week 3		Math:Numerical Analysis:Gradient Optimization		
Week 3		Neural Networks	Goodfellow 6, 6.1, 6.4, 14, 14.1, 14.9	
Week 3	*	Neural Networks	Goodfellow 5.9, 6.5	Proj 1. Classification/Regression
Week 4		Neural Networks	Goodfellow 7.12, 8.4, 8.7.1	
Week 4		Python, Torch, CUDA, cuDNN, TensorFlow		
Week 4	*	Python, Torch, CUDA, cuDNN, TensorFlow		
Week 5		Python, Torch, CUDA, cuDNN, TensorFlow		
Week 5		Training, Testing, Fine-tuning	Goodfellow 15.2, 7.4	
Week 5	*	Training, Testing, Fine-tuning		

Week 6		Convolutional Neural Networks	Goodfellow 9-9.3	Proj 2. CNNs for Graphics
Week 6		Convolutional Neural Networks		Proj 1. due
Week 6	*	Traditional Machine Learning		
Week 7		Traditional Machine Learning	Lowe 2004, Toler-Franklin 2010	
Week 7		Recurrent Neural Networks	Goodfellow 10-10.2.2, 10.10.1	**Feb.25th No Work Day**
Week 7	*	Natural Language Processing		
Week 8		Math for Computer Graphics		
Week 8		Math for Computer Graphics		
Week 8	*	Math for Computer Graphics		
Week 9		Deep Learning - inverse Graphics Problem		Proj 2. due
Week 9		Deep Learning - inverse Graphics Problem		Final Project Proposal
Week 9	*	Deep Learning in Graphics: Recent Trends		
Week 10		Deep Learning in Graphics: Recent Trends		
Week 10		Deep Learning in Medicine	Zhang, Heldermon,Toler-Franklin 2020	
Week 10	*	Reinforcement Learning		
Week 11		Reinforcement Learning	Mnih2013, Volodymyr2013	
Week 11		**Place Holder Holiday**		written hw out
Week 11	*	Generative Adversarial Networks	Goodfellow2014	
Week 12		Generative Adversarial Networks		
Week 12		Image Synthesis	Portenier 2019	Final Project .mid eval
Week 12	*	Image Denoising	Bako2017	written hw due
Week 13		Take Home Exam		Take Home Exam: 48 hours
Week 13		Motion from Video	Karpathy 2014, Vondrick2016	
Week 13		Learning from Physics	Lerer2016	
Week 14		Learning from Physics		
Week 14		Autonomous Driving	TED Talk 1.	
Week 14		Autonomous Driving	Janai 2017	
Week 15		Robotics	TED Talk 2.	
Week 15		Robotics	Pinto 2017	Final Project due

**** weekly in class quiz dates***

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 taken in class. 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 excuse. Make-Up homework, projects and exams will be coordinated with the instructor for university excused absences. 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	Percentage of Final Grade
Programming Assignments (2)	40%
Take Home Exam (1)	15%
Written Homework (1)	15%
Final Project	20%
Quizzes (~weekly)	10%

Grading Policy

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

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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

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Campus Resources:

Programming assignments are done on a GPU cluster.

Health and Wellness

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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.

Deep Learning for Computer Graphics

CAP 5619 Section TBD
Class Periods: MWF, Period 5, 11:45am-12:35PM
Location: TBD
Academic Term: Fall 2021

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

Teaching Assistant:
Please contact through the Canvas website

- 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 that develops GPU programming skills on a GPU cluster. In this graduate level course, there is an emphasis on applying concepts learned to research problems in computer graphics culminating in a semester long programming course project and technical paper write-up.

Course Pre-Requisites / Co-Requisites
Proficiency in a programming Language (Python and/or C++ recommended), Data Structures and Algorithms, Linear Algebra, and Calculus.

Course Objectives
This course teaches the fundamental theory and application of AI algorithms in the context of computer graphics. Students will learn fundamental deep learning concepts including: supervised, unsupervised and reinforcement learning, convolutional neural network architectures, backpropagation, autoencoders and fine-tuning. In this graduate level course, there is an emphasis on applying concepts learned to computer graphics problems. This is explored through a semester long project where students develop GPU programming skills as they implement theoretical concepts learned in practical computer graphics research applications. CNNs for image denoising and GANs for video simulation and animation are examples. Several lectures focus on technical paper writing and presentation skills. This is further supported in the second half of the course where students read research papers that incorporate deep learning concepts in computer graphics research.

Weekly quizzes are designed to help students access their understanding of course material on a regular basis. These also provide preparation for the written homework and a take-home exam which are designed to help students develop problem solving skills that use mathematical concepts covered in the course material.

Materials and Supply Fees
N/A

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
Week 1		Introduction		course survey out
Week 1		Machine Learning Basics	Goodfellow 5-5.2.0, 5.3	
Week 1		Machine Learning Basics		course survey due
Week 2		**Martin Luther King Jr. Day (no classes)**		
Week 2		Neural Networks	Goodfellow 6, 6.1, 6.4, 14, 14.1, 14.9	
Week 2	*	Neural Networks	Goodfellow 4.3, 5.9, 6.5	
Week 3		Neural Networks	Goodfellow 7.12, 8.4, 8.7.1	
Week 3		Course Project Discussion		course proj. out
Week 3	*	Convolutional Neural Networks	Goodfellow 9-9.3	course proj. part1 out
Week 4		Convolutional Neural Networks		
Week 4		Python, Torch, CUDA, cuDNN, TensorFlow		
Week 4	*	Python, Torch, CUDA, cuDNN, TensorFlow		
Week 5		Training, Testing, Fine-tuning	Goodfellow 15.2, 7.4	
Week 5		Training, Testing, Fine-tuning		
Week 5	*	Traditional Machine Learning	Lowe 2004, Toler-Franklin 2010	
Week 6		Traditional Machine Learning		course proj. part2 out
Week 6		Recurrent Neural Networks	Goodfellow 10-10.2.2, 10.10.1	course proj. part1 due
Week 6	*	Natural Language Processing		
Week 7		Deep Learning – inverse graphics problem		
Week 7		Deep Learning in Graphics: Recent trends		
Week 7	*	Deep Learning in Medicine	Zhang, Heldermon &Toler-Franklin 2020	
Week 8		Guest Lecturer		
Week 8		Reinforcement Learning	Mnih2013, Volodymyr2013	
Week 8	*	Reinforcement Learning		course proj. part3 out
Week 9		Generative Adversarial Networks	Goodfellow2014	course proj.part2. due
Week 9		Generative Adversarial Networks		course proj. proposal
Week 9	*	Technical Writing | Discussion Course Proj.		
Week 10		Technical Writing | Discussion Course Proj.		
Week 10		Technical Writing | Discussion Course Proj.		
Week 10	*	Image Synthesis	Portenier 2019	
Week 11		Image Denoising	Bako2017	
Week 11		**March 24th Recharge Day: No Class**		written hw out
Week 11	*	Motion from Video	Karpathy 2014, Vondrick2016	
Week 12		Motion from Video		
Week 12		Learning from Physics	Lerer2016	course proj.mid eval
Week 12	*	Learning from Physics		written hw due
Week 13		Take Home Exam		Take Home Exam
Week 13		Autonomous Driving	TED Talk 1.	
Week 13		Autonomous Driving	Janai 2017	
Week 14		Autonomous Driving		
Week 14		Autonomous Driving		
Week 14		Robotics		
Week 15		Robotics	TED Talk 2.	

**** weekly in class quiz dates***

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. Make-Up homework, projects and exams will be coordinated with the instructor for university excused absences. Excused absences must be consistent with university policies in the graduate catalog (http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance) and require appropriate documentation.

Evaluation of Grades

Assignment	Percentage of Final Grade
Course Project (submitted in three parts)	60%
Take Home Exam (1)	15%
Written Homework (1)	15%
Quizzes (~weekly)	10%

Grading Policy

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

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