Applied Machine Learning Systems  
EEL 4930  Section XXXX

Class Periods: Days of week, period, and corresponding time of day  
Location: Classroom location  
Academic Term: Fall/Spring NNNN

Instructor:  
Dr. Catia Silva  
Email: catiaspsilva@ece.ufl.edu  
Phone: (352) 392-6502  
Office: NEB 467  
Office Hours: TBD

Teaching Assistant/Peer Mentor/Supervised Teaching Student:  
Please contact through the Canvas website  
  • TBD

Course Description  
(3 credits) This course aims to provide a framework to develop real-world machine learning systems that are deployed, reliable, and scalable. It covers introductory topics in machine learning systems and the use of these systems in a variety of real-world applications. The focus of this course is to introduce students to basic machine learning concepts and how to use associated state-of-the-art machine learning tools.

Course Pre-Requisites / Co-Requisites  
Students are expected to have the following background:  
  • Knowledge of basic programming (Python preferred)  
  • Knowledge of basic probability theory and statistics  
  • Knowledge of basic linear algebra  
  • Other: Students are expected to bring a portable computer to class meetings

Course Objectives  
Upon completion of this course, students will be able to:  
  • Utilize terminology for Artificial Intelligence (AI), Machine Learning (ML) and Deep Learning (DL) tools  
  • Design and conduct meaningful experiments to evaluate the performance of ML models  
  • Determine which ML model to use for an application and/or task  
  • Identify and explain strengths and limitations of ML models  
  • Select appropriate metrics of success  
  • Implement in code several ML models utilizing state-of-the-art off-the-shelf libraries

Materials and Supply Fees  
None

Relation to Program Outcomes (ABET):  
The table below is an example. Please consult with your department’s ABET coordinator when filling this out.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics</td>
<td>High</td>
</tr>
<tr>
<td>2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare,</td>
<td>High</td>
</tr>
</tbody>
</table>
as well as global, cultural, social, environmental, and economic factors

3. An ability to communicate effectively with a range of audiences

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

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

6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

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**Required Textbooks and Software**

- **Software:**
  - Python 3+
  - Git
  - PyTorch
  - TensorFlow
  - Anaconda (recommended)
- The course notes are developed by the instructor

**Recommended Materials**

- **Python Data Science Handbook – Essential Tools for Working with Data**
  - Jake VanderPlas
  - O’Reilly Media, 2016
  - ISBN: 978-1-491-91205-8
- **Hands-On Machine Learning with Scikit-Learn, Keras and Tensorflow**
  - Aurélien Géron
  - O’Reilly Media, 2nd edition, 2019
  - 978-1-492-03264-9
- All reading materials will be available as physical and electronic copies with Course Reserves

**Course Schedule**

<table>
<thead>
<tr>
<th>Week</th>
<th>Subject</th>
<th>Assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>AI Systems and Machine Learning Overview</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Using Scikit-Learn for Building a Simple Classifier</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Hyperparameter Tuning &amp; Sampling Strategies (cross-validation, nested CV, stratified CV, Bootstrap)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Model Selection and Performance Metrics (hypothesis testing, confidence intervals, ROC, F1, etc.)</td>
<td>Project 1 Assign: Building &amp; Evaluating Classifiers</td>
</tr>
<tr>
<td>5</td>
<td>Decision Trees, Random Forests</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Bagging and Boosting, Gradient Boosting Machines (GBM)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Support Vector Machines (SVM)</td>
<td>Project 1 Due</td>
</tr>
<tr>
<td>8</td>
<td>Dimensionality Reduction with PCA, LLE and t-SNE</td>
<td>Project 2 Assign: Unsupervised Learning</td>
</tr>
</tbody>
</table>
### Attendance Policy, Class Expectations, and Make-Up Policy
Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:
[https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/](https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/)

### Evaluation of Grades

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Total Points</th>
<th>Percentage of Final Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project 1</td>
<td>100</td>
<td>20%</td>
</tr>
<tr>
<td>Project 2</td>
<td>100</td>
<td>20%</td>
</tr>
<tr>
<td>Project 3</td>
<td>100</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm Exam</td>
<td>100</td>
<td>20%</td>
</tr>
<tr>
<td>Final Exam</td>
<td>100</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>100%</td>
</tr>
</tbody>
</table>

Description of assignments:
- **Exams:** The course exams will be based on theoretical Machine Learning concepts learned in class. No programming questions will be included in the exams. Exams will not be cumulative.
- **Projects:** Each project will be based on concepts covered in class (Project 1: Building & Evaluating Classifiers, Project 2: Unsupervised Learning, Project 3: Neural Networks). All projects are individual assignments. For each project, students are expected to write a report, submit their code and create a written demo (README file) on how to use their code. The code should be pushed to a GitHub repository in a form that can be cloned and run readily.

**Note:** This course is co-listed with the graduate class. The exams will involve additional questions for the graduate section with respect to the undergraduate section. Grading for the projects are different from the undergraduate course. The graduate and undergraduate sections will be graded separately, for which the graduate section has additional problems and different weights for all problems.

### Grading Policy

<table>
<thead>
<tr>
<th>Percent</th>
<th>Grade</th>
<th>Grade Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>93.4 - 100</td>
<td>A</td>
<td>4.00</td>
</tr>
<tr>
<td>90.0 - 93.3</td>
<td>A-</td>
<td>3.67</td>
</tr>
<tr>
<td>86.7 - 89.9</td>
<td>B+</td>
<td>3.33</td>
</tr>
<tr>
<td>83.4 - 86.6</td>
<td>B</td>
<td>3.00</td>
</tr>
<tr>
<td>80.0 - 83.3</td>
<td>B-</td>
<td>2.67</td>
</tr>
<tr>
<td>76.7 - 79.9</td>
<td>C+</td>
<td>2.33</td>
</tr>
<tr>
<td>73.4 - 76.6</td>
<td>C</td>
<td>2.00</td>
</tr>
<tr>
<td>70.0 - 73.3</td>
<td>C-</td>
<td>1.67</td>
</tr>
</tbody>
</table>
More information on UF grading policy may be found at: 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, ipennacc@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](https://registrar.ufl.edu/ferpa.html)

**Campus Resources:**

**Health and Wellness**

<table>
<thead>
<tr>
<th>Covid-19 Protocols:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.</td>
</tr>
<tr>
<td>• If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test &amp; Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email <a href="mailto:covid@shcc.ufl.edu">covid@shcc.ufl.edu</a>) to be evaluated for testing and to receive further instructions about returning to campus.</td>
</tr>
<tr>
<td>• If you are withheld from campus by the Department of Health through Screen, Test &amp; Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.</td>
</tr>
<tr>
<td>• UF Health Screen, Test &amp; Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the UF Health Screen, Test &amp; Protect website for more information.</td>
</tr>
<tr>
<td>• Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.</td>
</tr>
</tbody>
</table>

**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](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](mailto: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.polk.ufl.edu/](http://www.police.ufl.edu).

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**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](https://lss.at.ufl.edu/help.shtml).

**Career Connections Center**, Reitz Union, 392-1601. Career assistance and counseling: [https://career.ufl.edu](https://career.ufl.edu).

**Library Support**, [http://cms.uflib.ufl.edu/ask](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/](https://teachingcenter.ufl.edu/).

