CGN 4905 Special Problems in Civil Engineering

Data Science for Civil and Coastal Engineering
Online Course Syllabus

Class Periods: MWF 7th Period, (1:55PM – 2:45PM)
Location: Online
Academic Term: Fall 2020

Instructor: Paul Gader
Email: pgader@ufl.edu
Office Hours: MWF 8th Period, (3:00PM - 3:50PM), via Zoom

Teaching Assistant/Peer Mentor/Supervised Teaching Student:
- Mr. Yuanhang (Allen) Lin, Ph.D. student

Course Pre-Requisites / Co-Requisites. The course requires CGN 3421 Computer Methods in Civil Engineering taught **using Python**. Alternatively, the student must have proficiency in Python programming including the standard data types and objects, the programming structures (conditionals, loops, etc.), and the numpy and matplotlib packages.

Course Description. This course is designed to provide students with the ability to manipulate and analyze large data sets produced by multiple sensor measurements, online databases, and other sources using Python.   Real data sets involving Civil, Coastal, and Environmental Engineering will be used for examples and for some homework.

It will be assumed that the students know basic Python programming. The course will begin with a very quick review of Python and installation of the *Anaconda* program which includes the *Jupyter Notebooks* and *Spyder* programming environments. Advanced techniques using *Numpy* will be discussed. Following that, the *Pandas* library in Python will be covered in detail. *Pandas* is a very popular Python Data Analysis library. Techniques for Data Visualization will also be described. The course ends with a discussion of analyzing data using Machine Learning.

Course Objectives.   The objectives are for students to gain proficiency in the following:

- Advanced data manipulation techniques using the Python package **numpy**.
- Advanced data manipulation techniques using the Python package **Pandas**.
- **Pandas** objects
- Handling missing data in small or large data sets.
- Combining all or subsets of small or large data sets according to specified variables.
- Time-series analysis
- Data structures and methods for fast processing of large data sets
- Visualizing multi-dimensional data
- **Scikit-Learn** python package for machine learning.
- Introduction to Machine learning using Scikit-Learn, including some of the following:
  Bayes classifiers, Linear regression, Decision trees and random forests, K-means clustering, Principal Component Analysis (PCA), Multi-dimensional Scaling (MDS)

Grading Scheme: Letter Grade
Learning to use a programming language to analyze data requires a significant amount of time thinking about how to solve problems efficiently and writing programs. Therefore, course will require many programming assignments. There will be two tests that will focus mainly on your knowledge of the methods required to complete the programming assignments. The assignments and tests will contribute the following percentages to the final grade:

Test 1	25%
Test 2	25%
Homework	50%

The final grades will be based on a curve.

Required Textbooks and Software
Textbook: Python Data Science Handbook, 1st Edition
Author: Jake VanderPlas
Publisher: O'Reilly
ISBN-13:   978-1491912058
ISBN-10:   9781491912058
Copyright: 2017

Software: ***Anaconda*** (free, installation will be covered in class). The version will be announced the first day of class. We will use ***Jupyter Notebooks*** which is an interactive Python interface that is included with Anaconda.

Online: This course will be offered online only due to COVID-19. We will try to offer the course via Zoom in Webinar mode. This will allow students to ask questions during class using the chat feature or the raise your hand features of Zoom. 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.

More information on UF grading policy may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

<u>Additional Information</u>

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 suppor*t*, 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.