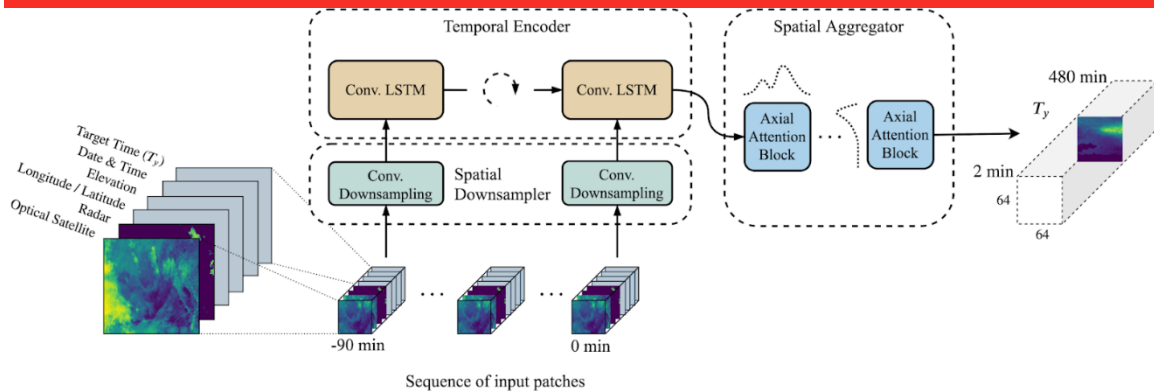


# Machine Learning in Meteorology GEO4938/GEO6938



## Course Objectives:

The primary objective of this course is to learn the principles, techniques, and applications of machine learning. Students will get hands-on experiences with machine learning from a series of practical case-studies in meteorology. With the ML methods learned in this class, students can perform intelligent applications such as, predictions, personalized recommendations and retrieval, non-linear features, and deep learning.

Specifically, the course objectives are for the student to be able to:

1. Explain different types of ML methods
2. Implement basic techniques in ML
3. Select the ML solution best-suited for various research in meteorology
4. Evaluate the effectiveness of selected ML method
5. Communicate ideas clearly to a variety of audiences both in oral and written.

## Class

**Time:** Monday Period 6-7, 12:50pm-2:45pm (TUR 2354);  
Wednesday Periods 6, 12:50pm-1:40pm (RNK 0220).

**Materials:** While no textbook is required, it can be helpful to have a text that will explain concepts in a different way than you get in lecture. The recommended textbook is:

*Deep Learning (Goodfellow, Bengio, and Courville)*

Go to <https://www.deeplearningbook.org/> for a free online textbook.

A portion of the course notes will be supplied through Canvas (elearning.ufl.edu). The notes will be comprehensive, but the books will provide helpful supplementation, and are a good investment for those who plan to major in a related field.

## Instructor

Dr. Yixin Wen, Yixin.wen@ufl.edu

**My office:** Turlington Hall, Geography Department, Room 3203

**Office hours:** Wednesday 1:40-3:40pm. If you want to make an appointment at another time, just email me. I will try to accommodate you as my schedule permits.

## Grades

The final grade will be calculated based on the following:

Undergraduate Students:		Graduate Students:	
Homework (10 @8%):	80%	Homework (10 @8%):	80%
Final presentation	10%	Final presentation:	10%
Attendance:	10%	Research Paper:	10%

## Homework assignments

There will be ten homework assignments for this class. You are expected to independently read the research papers, write the summary, and lead the discussions in class. Please hand in your assignments on the due day. Due dates will be on Canvas. There will be no makeup homework exercises. No late work will be accepted unless an extension is approved due to special circumstances (see Absences).

## Exams

There will be no exam.

## Attendance (for undergraduate students)

Students are expected to regularly attend class and actively participate in discussions.

## Research Project and Presentation (for all students)

All students will work to research a topic of their choosing, relating to weather and climate. All students will also be responsible for presenting their paper to the class. Students will meet with the professor regularly to discuss ideas and progress. More detailed instructions will be provided during class meetings.

## Research Paper (for graduate students)

Graduate students will write a research paper based on their research project.

Percentages necessary to earn a given final grade are as follows:

A	90.0-100%	B+	87.0-89.9%	C+	77.0-79.9%	D+	67.0-69.9%
		B	83.0-86.9%	C	73.0-76.9%	D	63.0-66.9%
		B-	80.0-82.9%	C-	70.0-72.9%	D-	60.0-62.9%

Grades will be supplied through Canvas throughout the semester. It is your responsibility to keep track of your grade and contact the instructor if you are struggling with the material.

## Class Structure

This is a lecture + seminar mixed class. Important material will be covered in every class. We will use a combination of slide presentations, some videos, in-class activities, and labs. You should listen well during class and take good notes for yourself. Homework assignments and in-class discussions are designed to synthesize material from the lectures. Weather and climate using machine learning/deep learning are a surprisingly complex topic.

**Schedule** The precise dates may change. I will update you as we go.

Week starting	Monday	Wednesday	Homework Due
21-Aug		T1_Introduction	
28-Aug	T2_MachineLearning basics	T3_Linear Regression	Hw1
4-Sep	Labor Day	T4_Logistic Regression	Hw2
11-Sep	T4_Logistic Regression	T5_Decision Trees	Hw3
18-Sep	T5_Decision Trees	T6_Random Forest	Hw4
25-Sep	T6_Random Forest	T6_Random Forest	Hw5
2-Oct	Final project proposal	T7_NaiveBayes	Homecoming week
9-Oct	Final project lab	T7_NaiveBayes	
16-Oct	T7_NaiveBayes+Final project	T8_Support vector machines	Hw6
23-Oct	T8_Support vector machines	T9_DeepLearning basics	Hw7
30-Oct	T9_DeepLearning basics	T10_Perceptron	Hw8
6-Nov	T10_Perceptron	T11_Convolutional neural network	Hw9
13-Nov	T11_Convolutional neural network	T12_Explainable AI	Hw10
20-Nov	T12_Explainable AI	<b>Thanksgiving</b>	
27-Nov	Prepare for final present	Final project presentation	
4-Dec	Final project presentation	Reading Day	
11-Dec	<b>Finals Week (Final paper is due for graduate students)</b>		

## Class Notes and Grading

There are many remote sensing and meteorology courses of this nature, and so there may be many notes floating around online. In general, I find online remote sensing and meteorological websites to be less helpful than other common subjects. However, the notes I will provide you, as well as information from legitimate subject-relevant textbooks will be considered as the final authority on matters of grading.

## **Math Content**

The study of radar and satellite meteorology can include some complicated Math! However, any equations that we use with the help from MATLAB will be very basic, explained in detail, and provided to you in lab assignments and/or exams (no memorization needed, although you will need to understand what the equation does). A calculator will not be required in class or for homework or exams unless I tell you in advance.

## **My Expectations of You**

You will read materials for a particular class period either before or shortly after class. Learning often isn't the most joyous activity because it requires a significant effort. The nationwide standard for university scholarship says students should study (read, review, reflect, practice, do homework) at least 2 hours for every hour you are in lecture.

Though we will be doing some activities that use the internet during class, don't text message, visit Facebook, browse the internet, etc. during class unless I approve you do so. This is a major distraction from learning for your peers as well.

## **Web page**

The class web page can be found at: [elearning.ufl.edu/](http://elearning.ufl.edu/). If you encounter any problems with the web page, do something (anything!) to let the instructor know.

## **Academic Honesty**

"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 ([sccr.dso.ufl.edu/process/student-conduct-code/](http://sccr.dso.ufl.edu/process/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 in this class."

## **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."

## **Excused Absences**

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>

“In general, acceptable reasons for absence from or failure to participate in class include illness, serious family emergencies, special curricular requirements (e.g., judging trips, field trips, professional conferences), military obligation, severe weather conditions, religious holidays, and participation in official university activities such as music performances, athletic competition or debate. Absences from class for court-imposed legal obligations (e.g., jury duty or subpoena) must be excused.”

I appreciate that unexpected events occur in all of our lives. If such events occur, and it causes you to attend an event (e.g., funeral, job interview) or a facility (e.g., doctor’s office, courthouse), then you will need to prove that you went to this event/facility on that date by providing some form of documentation of the event. An event program, a doctor’s note, or similar paperwork will suffice. Upon producing this documentation, you will be able to make up the midterm exam or any graded class activities from that date.

“A student should inform the faculty member of the religious observances of his or her faith that will conflict with class attendance, with tests or examinations, or with other class activities prior to the class or occurrence of that test or activity.”

## **Grades**

UF policies on grades and GPAs can be found at:

<https://catalog.ufl.edu/UGRD/academic-regulations/grades-grading-policies/>

## **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 [gatorevals.aa.ufl.edu/students/](http://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 [ufl.bluera.com/ufl/](http://ufl.bluera.com/ufl/). Summaries of course evaluation results are available to students at [gatorevals.aa.ufl.edu/public-results/](http://gatorevals.aa.ufl.edu/public-results/).”

## **Title IX**

For any concerns regarding gender-based discrimination, sexual harassment, sexual assault, dating/domestic violence, or stalking, there are resources available. To learn more or to report an incident, go to: [titleix.ufl.edu](http://titleix.ufl.edu). A professor/GA/TA is required to report instances of sexual harassment, sexual assault, or discrimination.

## **Drops, Absences, etc.**

Should you decide to drop the course for whatever reason, you must request to do so through the appropriate channels by the appropriate deadlines. You will receive a W for withdrawing. Failing to do so will result in an E grade for the course. If at the time you withdraw from the course you are scoring a failing grade, you will receive an E grade.

Should you need modifications or adjustments to your course requirements because of documented pregnancy-related or childbirth-related issues, please contact the instructor as soon as possible to discuss. Generally, modifications will be made where medically necessary.

**Disclaimer**

This syllabus represents my current plans and objectives. As we go through the semester, those plans may need to change. I have the right to institute new policies during the semester to ensure safety and a positive learning environment for all students.