Week 2: Foundations in ML and climate modeling

Instructor: Candace Agonafir, PhD

Candace Agonafir has a Ph.D. in Civil Engineering from the City College of New York, a M.S. in Industrial Engineering from NYU, and a B.S. in Physical Science with a concentration in Physics and a minor in Catholic Theology from St. John's University. Her research involves utilizing regression and machine learning methodologies to provide invaluable information towards advancements in urban flooding detection, prediction and prevention.

Description

Deep learning is a powerful AI approach that uses multi-layered artificial neural networks to deliver state-of-the-art accuracy in tasks such as object detection, speech recognition, and language translation. Using deep learning, computers can learn and recognize patterns from data that are considered too complex or subtle for expert-written software. During this week, you will learn the basic structures of neural networks and employ techniques with examples in the Jupyter notebook. Specifically, the exercises involve the creation of neural network-based climate models with the machine learning toolbox, Tensorflow.

General Learning Goals

1. Become familiar with the background and methodology of neural networks. Understand the statistical applications involved.
2. Select and implement appropriate machine learning methods to solve real-world climate problems.
3. Effectively create predictive machine learning models utilizing Python-based coding and popular machine learning libraries.
4. Produce visualizations, do calculations, and present results using software.

Individual Project

On the last day of this week, you will present your own neural network-based climate model. This model may be similar to any of the labs presented. The objective is to utilize a dataset and implement any of the models presented in the in-class exercises. The goal is to become familiar with the research and the coding involved with the implementation of new data in an already established model.

Schedule

The schedule for the week is on the following page.

Schedule				
Day	**Time**	**Topic**	**Reading**	**Assignments**
1	9:30 am to 10:00 am	Warm-up and Video		
	10:00 am to 10:45 am	Lecture: Neural Networks	PPT slides will be provided at end of day	Begin working on Individual Project.
	10:45 am to 11:15 am	Lab: Using Neural Networks for emission prediction and temperature prediction.	Jupyter file will be available at end of day.	
	11:15 am to 11:30 am	Recap		
2	9:30 am to 10:00 am	Warm-up and Q/A		
	10:00 am to 10:45 am	Lecture: Convolutional Neural Networks	PPT slides will be provided at end of day	
	10:45 am to 11:15 am	Lab: Using CNN to forecast global temperature	Jupyter file will be available at end of day	Continue work on Individual Project.
	11:15 am to 11:30 am	Recap		
3	9:30 am to 10:00 am	Warm-up and Q/A		
	10:00 am to 10:45 am	Lecture: Recurrent Neural Networks	PPT slides will be provided at end of day	
	10:45 am to 11:15 am	Lab: LSTM Model	Jupyter file will be available at end of day	Continue work on Individual Project.

Schedule				
	11:15 am to 11:30 am	Recap		
4	9:30 am to 10:00 am	Warm-Up and Q/A		
	10:00 am to 11:00 am	Presentations		
	11:15 am to 11:30 am	Recap		