BIOL 6810, CSCE 6810, MATH 6710

Advanced Topics in Computational Life Sciences
Topic: Deep Learning in Biology

Fall 2022

Instructor: Rajeev K. Azad

Lectures/Seminars: Thursday, 6:30 – 9:20 PM at Audb 218

Office Hours: Thursday, 5:45 - 6:30 PM at LSC B314 and Friday, 8-9:15 AM via Zoom: https://unt.zoom.us/j/2298672063, or by appointment

Phone: 940-369-5078

E-mail: Rajeev.Azad@unt.edu

Required Textbook: There will be no required textbook. The course will be based on published journal and conference articles.

Course Objective: This course focuses on recent advances in machine learning, particularly deep learning, with applications in biological and biomedical sciences. The goal of this course is to explore the literature on the topics of developments in deep learning modeling and analysis in the context current and emerging biological/biomedical problems. Advances in high-throughput technologies, including next generation sequencing data, have led accumulation of a vast amount biological data in various databases across the globe. This includes omics data, including those of genomics, transcriptomics, proteomics, metabolomics, methylomics, interactomics, and phenomics, and ecological and biomedical data. These data have been collected from diverse organisms, geographical locations, and environments. The focus of this course is on leveraging the rapidly growing field of deep learning for analysis and interpretation of complex biological/biomedical datasets. This will entail exploration of application of both supervised and unsupervised learning approaches to solving Big Data problems in biological/biomedical fields.

Students will present and discuss research papers that describe the latest developments in the field, focusing on the use of deep learning models and techniques in biological data analysis. These papers will form the basis for investigative research projects using the methodologies presented in these papers to address important problems in biology or medicine. Students will participate in projects (in team or individually) motivated by problems from this field. Applications of both state-of-the-art as well as emerging deep learning approaches in biological/biomedical data modeling and analysis will be discussed. Students will learn how deep learning techniques are currently being used in addressing a variety of problems in biology or medicine, and will then explore their use in addressing important open problems in these fields. Students will be encouraged to develop ideas or strategies for more robust analysis of biological/biomedical data and implement in their project works.

Assessment is primarily based on 1) paper and project progress presentations (45%), 2) project work, written report, and final presentation (30%), and 3) class participation─ attendance and discussions (25%).

Attendance: Attendance is essential and thus is expected.