# BIOF 398: Practical Deep Learning

Deep learning (DL) is emerging as a major disruptive technology in biomedical and clinical research. It is also a skill with high demand in the decade to come. This course aims to teach the foundations to understand how neural network works and also introduce latest developments. You will build your own neural networks and gain skills to apply deep learning to your field. The course consists of a set of lectures over the 7 weeks. A number of course videos and assignments will be released every week to cover basis and advanced topics in deep learning. The assignments consist of multi-choice and short-answering questions, and coding problems. We will start from basics of neural networks, introduce the loss function, optimization and how to setup and manage the training session. The next section is the convolutional neural network for imaging and vision tasks. We will learn the recurrent neural network (RNN) for the sequence data. More recently, attention mechanism and transformer models (BERT, GPT family etc.) are very popular. They are introduced after RNN. We will teach generative model and in details the GAN (generative adversarial network). The technique to visualize the neural network is introduced to help understand how and why the neural network works. The course will end with a focus on how to handle "small dataset" use case, as in many practical applications, we may not be able to acquire large labelled dataset. Three techniques are introduced, transfer learning, meta learning and contrastive learning (as the more recent development of self-supervised learning).

# Learning Objectives

- Introduce the theory of deep learning
- Present in-depth how DL model works
- Present the widely used DL architecture
- Grow the mindsets of machine learning and DL based problem solving
- Provide practices to build your own model
- Prepare students for DL related job opportunities.

**Credits:** 2
**Class Type:** Graduate Course
**Program:** Bioinformatics and Data Science
**Availability** Fall 2021
**Session** Session B