FALL 2024 COSC 41000 OVERVIEW

Week 1 & 2 (Sept 9 – Sept 22): Introduction to Deep Learning and PyTorch Basics

- **Course Introduction & Deep Learning Overview**
    - Topics: History of neural networks, biological inspiration, basic architecture (neurons, layers, activation functions).
    - **PyTorch Focus**: Installation and setup, basic tensor operations, broadcasting, gradients.
    - **Assignment 1 Released**: **Monday, Sept 16, 2024**
        - **Assignment 1 Description**: Data preprocessing and manipulation in PyTorch, working with tensors.
        - Task: Students will preprocess a dataset using PyTorch's tensor operations, including normalization, reshaping, and basic transformations.

Week 3 (Sept 23 – Sept 29): Neural Networks Fundamentals in PyTorch

- **Building a Neural Network**
    - Topics: Neural networks, forward propagation, activation functions, layers, loss functions.
    - **PyTorch Focus**: Building simple neural networks using torch.nn.Module.
    - **Assignment 1 Due**: **Monday, Sept 30, 2024** (15%)

Week 4 & 5 (Sept 30 – Oct 13): Backpropagation & Optimization

- **Backpropagation and Optimization Techniques**
    - Topics: Backpropagation, gradient descent, optimization methods (SGD, Adam, RMSprop).
    - **PyTorch Focus**: Implementing backpropagation and optimization techniques in PyTorch.
    - **Midterm Test**: **Monday, Oct 7, 2024** (25%)
    - **Assignment 2 Released**: **Monday, Oct 7, 2024**
        - **Assignment 2 Description**: Building and training a simple RNN model.
        - Task: Students will implement a recurrent neural network (RNN) in PyTorch, train it on a simple sequential dataset, and evaluate its performance.

Week 6 (Oct 14 – Oct 20): Thanksgiving and Preparation

- **Thanksgiving (No Classes)**: **Monday, Oct 14, 2024**
- Students can use this week to complete assignment 2.

Week 7 (Oct 21 – Oct 27): Reading Week

- **Reading Week**: **Monday, Oct 21 – Friday, Oct 25, 2024**
- No classes this week. Students can work on their assignments and review.

Week 8 (Oct 28 – Nov 3): Sequential Data and RNNs

- **Sequential Data & Introduction to RNNs**
    - Topics: Sequential data types, recurrent neural networks (RNNs), how RNNs work with sequential data.
    - **PyTorch Focus**: Implementing basic RNNs using torch.nn.RNN.
    - **Assignment 2 Due**: **Monday, Oct 28, 2024** (15%)

Week 9 (Nov 4 – Nov 10): LSTM & GRU Networks

- **Introduction to Advanced Sequential Models**
    - Topics: LSTM and GRU models to handle long-term dependencies and vanishing gradient problems.
    - **PyTorch Focus**: Building LSTM and GRU models for sequential data.
    - **Final Project Released**: **Tuesday, Nov 5, 2024**
        - **Final Project Description**: The project will involve building a sequence-to-sequence model using either LSTM, GRU, or Transformer architecture.
        - Task: Students must preprocess data, build the model, train it, and evaluate it on a sequence-to-sequence task such as text generation, time series forecasting, or translation.

Weeks 10 & 11 (Nov 11 – Nov 24): Transformers & Attention Mechanisms

- **Introduction to Attention Mechanisms and Transformers**
    - Topics: Attention mechanisms, self-attention, transformer architecture.

    - **PyTorch Focus**: Implementing attention mechanisms and transformer models for natural language processing (NLP).

Week 12 (Nov 25 – Dec 1): Final Project and Test Preparation

- **Final Project Due**: **Monday, Nov 25, 2024** (20%)
- **Final Test Preparation**: Review of all key topics, including neural networks, backpropagation, sequential models, transformers, and attention mechanisms.

Week 13 (Dec 2 – Dec 13): Final Test and Last Day of Classes

- **Final Test**: **Monday, Dec 9, 2024** (25%)
- Wrap-up, project presentations, feedback, and course completion.
    - **Last Day of Classes**: **Friday, Dec 13, 2024**

Summary of Key Dates:

- **Assignment 1 Released**: **Sept 16, 2024**
- **Assignment 1 Due**: **Sept 30, 2024** (15%)
- **Midterm Test**: **Oct 7, 2024** (25%)
- **Assignment 2 Released**: **Oct 7, 2024**
- **Assignment 2 Due**: **Oct 28, 2024** (15%)
- **Final Project Released**: **Nov 5, 2024**
- **Final Project Due**: **Nov 25, 2024** (20%)
- **Final Test**: **Dec 9, 2024** (25%)
- **Last Day of Classes**: **Dec 13, 2024**