CPSC 8810 Deep Learning for Computational Photography

Part 1: (30 pts) ChatGPT

For this task, play around with ChatGPT. Submit the answers from ChatGPT using the prompts listed in the project description.

1. Define a linear classifier using the function y=Wx+b in Python. Explain how changes in the line's slope and intercept affect classification.

2. Define what a loss function is in the context of machine learning models. Then, using Python, implement a simple mean squared error (MSE) loss function. Apply this function to evaluate the difference between predicted and actual values in a small dataset.

3. Explain the concept of gradient descent and its importance in optimizing machine learning models. Write a Python script that demonstrates a simple gradient descent algorithm to find the minimum of a quadratic function. Visualize the steps taken by the algorithm on a plot.

4. Describe the architecture of a multi-layer perceptron (MLP). Using PyTorch, create a simple MLP with one hidden layer to perform a binary classification task on a small dataset. Include activation functions and initialize weights randomly.

5. Explain the backpropagation algorithm and its role in training neural networks. Modify your MLP code to include a backpropagation function that updates the weights based on the gradient of the loss. Test the training process with a few epochs and observe the change in loss.

6. Introduce 3D representation of data and its significance. Use Python to generate a 3D scatter plot of a small dataset with random values. Experiment with different viewpoints and colors to enhance the visualization.

Part 2: (10 pts) 3D shape images

Search for an interesting 3D shape that you can import in PyTorch3D. Please mention the source as well.

Part 3: (60 pts) PyTorch3D

1. Learn the basics of rendering with PyTorch3D, explore 3D representations, and practice constructing simple geometry. You may find it also helpful to follow the Pytorch3D tutorials (https://github.com/facebookresearch/pytorch3d)

- Setup: follow the instruction in https://github.com/learning3d/assignment1 to setup Pytorch3D
- Setting up Pytorch and Jupyter notebook in Google Colab
    - please watch the video in the following website: https://cs231n.github.io/assignments2022/assignment1/
- Setting up Pytorch and Jupyter notebook on Palmetto
    - Please follow the instructions on: https://github.com/clemsonciti/palmetto-examples/tree/master/PyTorch/PBS

2. Follow the instruction on https://github.com/learning3d/assignment1 and import the 3D model you find in Part2 to PyTorch3D and create a 360-degree gif video that shows many continuous views of the provided mesh.