ECE 364: Programming Methods for Machine Learning, Spring 2025

Skillset - Midterm 1

The first midterm will test material covered in lectures 0 through 12. Any results proved in homework assignments are also part of material that can be tested on the midterm.

The subjects tested include (but are not limited to):

1. **Basic matrix operations** - adding, multiplying, and other basic operations with matrices.
2. **PyTorch tensors operations** - Views, indexing, strides, etc.
3. **Activation functions** - relu, sigmoid functions and how they work.
4. **Calculating gradients** - basic derivatives and chain rules.
5. **Linear algebra** - how to model a system of linear equations as a matrix and how to solve them manually and in PyTorch.
6. **Matrix calculus** - how to calculate the partial derivative of matrix functions with respect to matrices/vectors
7. **Computation graphs** - how to read computation graphs and calculate forward pass and backwards gradient.
8. **Optimization** - gradient descent, step sizes, using momentum, where fixed step size may go wrong.
9. **Classification** - formulating a classification problem instead of a simple regression problem.
10. **Regression models** - linear, multi-input, polynomial regression models.
    - **Binary linear classification** - basic linear regressions and support vector machines.
    - **Binary logistic classification** - using the sigmoid function to classify things.
    - **Multi-class classification** - basics of multi-class classification including softmax.
11. **Loss functions** - Mean squared error vs binary cross entropy loss. L2 loss. SVM loss model.
12. **PyTorch libraries** - Using torch.nn to define machine learning models. Using the Dataset class to organize and load dataset values. Training vs. validation vs. testing datasets.