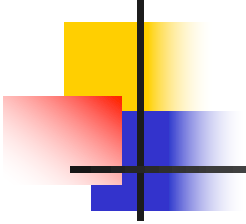
CMSC 510 – Fall 2020

Homework Assignment 2

Announced: 9/16

Due: Tuesday, 10/6, noon



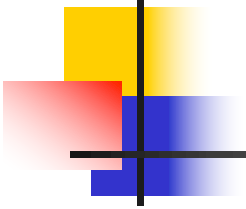
PyTorch

- We will use pytorch
  - It is a library for machine learning with built-in support for gradient descent
    - No need to derive gradients on paper, you get them for free!

- https://pytorch.org/get-started/locally/

Hints about PyTorch

- See: pytorch_minimizeF.py
  - Performs gradient descent on a simple function
  - The function has global minimum at w_1=-0.25, w_2=2
  - The code does the following
    - Defines f(w) using pytorch functions for arithmetic
      - Not numpy functions – so that we automatically get gradient formulas
    - Defines pytorch variable to store the evolving values of w
    - Defines pytorch variable z=f(w) – since it's a pytorch variable, it has gradients w.r.t. to w
    - Creates an optimizer (gradient descent), tells it to minimize f(w)
    - In a loop:
      - Run a single step of the optimizer – a gradient step on f(w)



PyTorch – HW Part A

- Part A
  - Redo HW1 in pytorch

PyTorch – HW Part B

- Part B:
  - You task is to perform experiments with a linear classifier on MNIST dataset
  - https://pytorch.org/docs/stable/torchvision/datasets.html#mnist
  - This is 10-class classification problem: hand-written digits
  - It has 5,000 samples per class
    - During development, you can randomly select a subset of samples, to speed up the calculations

PyTorch – HW Part B

- MNIST: a 10-class classification problem
- Convert it into 2-class problem by: taking last digit of your V# (class A), taking last different digit of your V# (class B)
  - E.g. V# V00078965: 6-vs-5, V00078966: 9-vs-6
- During training, training on the training set, and also apply the model to test set, to see how training error and testing error evolve during training
  - Error: % of predictions that are not classified correctly

- The model should be:
  - A linear model ($w^T x+b$)
  - Classes encoded as +1 / -1
  - Use logistic loss

Returning the Assignment

- Solution code should be written by you and you only (no web/book/friend/etc. code)
  - Exception: you can freely use the code provided on BB as your starting point

- Upload through Blackboard
  - A report in PDF
    - Plots from part A, like in HW1
    - Plot of training risk value vs. iterations of training for part B
    - Plot of test set risk value vs. iterations of training for part B
    - Plot of training set error and test set error vs. iterations of training for part B
  - Code for part A
  - Code for part B