Deep Learning, Homework 1

Out: Jan 22, 2024, Due: Feb 06, 2024 (beginning of the class), Total: 50

Note:

- This homework will carry 5 points towards your final score
- You will implement gradient descent in PyTorch library and Python 3.x for solving this problem.
- Homeworks are individual work, please do not collaborate with others inside or outside of the class.

Task

The data provided for this homework is generated by a Poisson regression model. In particular, there is an unknown parameter vector $\boldsymbol{w}$ and for each row there is an unknown Poisson mean λ_i given by a product of the vector and the data (along with a bias term):

$$\lambda_i = \exp(w_0 + w_1 \cdot x_1 + \cdots + w_5 \cdot x_5).$$

The label y_i is generated according to a Poisson random variable with that mean: $y_i \sim Pois(\lambda_i)$.

The likelihood (probability of observing the data given $\boldsymbol{w}$) is then,

$$\prod_{i=1}^{N} \frac{\exp(-\lambda_i)\lambda_i^{y_i}}{y_i!}$$

and the log-likelihood is (after neglecting the terms that does not have $\boldsymbol{w}$):

$$\sum_{i=1}^{N} [y_i(w_0 + w_1 \cdot x_1 + \cdots + w_5 \cdots x_4) - \lambda_i]$$

Use PyTorch and stochastic gradient descent to find the optimal vector $\boldsymbol{w}$.

Deliverable: Please submit source code (python file or a python notebook file) and pdf of the source code in Canvas.