

# Report of Assignment2

## CSC486B

### Zhilun Liu

#### Abstract

This assignment is focusing on Simple linear classifier, some function and steps and done previously by the Professor to make the assignment easier as it's a 3-week assignment. The main problem of this assignment for me is implement the model\_loss and model\_grad in the logistic\_regression.py. I set the config.dir to where I download the cifar10 files.

#### Derivation of the gradient for cross entropy

$$\begin{aligned} p_j &= \frac{e^{o_j}}{\sum_k e^{o_k}} \\ L &= - \sum_j y_j \log p_j, \\ \frac{\partial L}{\partial o_i} &= - \sum_k y_k \frac{\partial \log p_k}{\partial o_i} = - \sum_k y_k \frac{1}{p_k} \frac{\partial p_k}{\partial o_i} \\ &= -y_i(1-p_i) - \sum_{k \neq i} y_k \frac{1}{p_k} (-p_k p_i) \\ &= -y_i(1-p_i) + \sum_{k \neq i} y_k (p_i) \\ &= -y_i + y_i p_i + \sum_{k \neq i} y_k (p_i) \\ &= p_i \left( \sum_k y_k \right) - y_i = p_i - y_i \end{aligned}$$

#### Cross validation result

The report only need the first fold.

```
Training for fold 0...
Training data before: mean 0.012345678251285902, std 0.0136138951047508, min 0.0
, max 0.5253978665244754
Training data after: mean 6.722070602481495e-18, std 0.07373328606114685, min -0
.11643308823635191, max 1.0

Epoch 98 -- Train Loss: 8.761493082065412
Epoch 98 -- Train Accuracy: 30.45%
Epoch 98 -- Validation Accuracy: 21.57%
Epoch 99 -- Train Loss: 8.761484494690079
Epoch 99 -- Train Accuracy: 30.44%
Epoch 99 -- Validation Accuracy: 21.54%
Test data accuracy: 28.549999999999997 %
```

The train accuracy is keep decreasing.