DEEP LEARNING HW2 2-LAYER PERCEPTION

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ABSTRACT

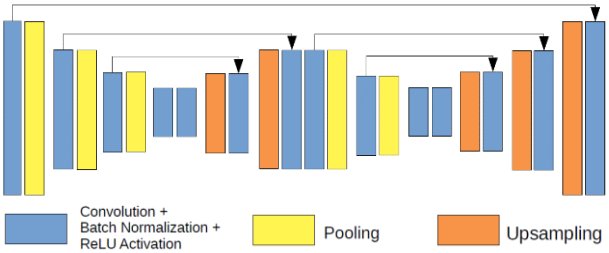
This is second homework for Deep Learning class, we want to classify a dataset of pictures to fifty categories of class.
Code website: https://github.com/ss9636970/deep_learning_HW2

1. INTRODUCTION

We use feature extract method to make every picture transform to feature vectors, then put these feature vectors into a two layer perception, the two layer perception may give us a vector which elements representative the probability of every categories.

2. FEATURE EXTRACTOR

Use unsupervised CNN to extract picture feature vectors the CNN structure is in the figure 1.



Input a picture from left to right, through many layer CNN, we may let the CNN map which are connected by arrows be close, and last use the middle two layer CNN map to be out feature vectors.

3. TWO LAYER PERCEPTION

We use two layer perception to be our classify method, the process is following:

$$\text{Let } X \in R^{N*D}$$

be inputs data, N is inputs number, D is picture feature dimension.

$$\text{Let } W_1 \in R^{D*H_1}, B_1 \in R^{1*H_1}, W_2 \in R^{H_1*50}, B_2 \in R^{1*50}$$

These are parameters we want to update in training time.
The formula is following:

$$\hat{Y} = \text{softmax}\left((X * W_1 + B_1) * W_2 + B_2\right)$$

$\hat{Y} \in R^{N*50}$ is the probability vectors for categories with N datas.

$$\left(\text{softmax}(v)\right)_i = \frac{e^{v_i}}{\sum_{c=1}^{50} e^{v_c}}$$

The proposal for softmax is let the sum for vector elements be 1, and each elements in vector is represent the probability for that class.
The last step is compute gradient for $W_1, B_1, W2, B2$

4. LOSS FUNCTION

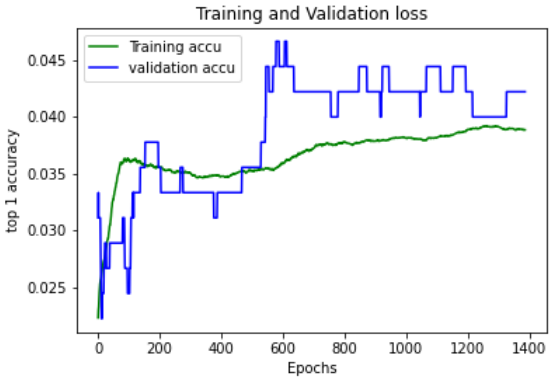
Use cross entropy to get loss.

$$\text{loss}(\hat{Y}, Y) = \frac{1}{N}\sum_{i=1}^{N}\left(-\log\left(\frac{e^{\hat{Y}_{i,Y[i]}}}{\sum_{j=1}^{50} e^{\hat{Y}_{i,j}}}\right)\right)$$

5. EXPERIMENT

	1 layer perception	2 layer perception
test top 1	0.88%	5.3%
test top 5	11.1%	15.3%
val top 1	2.4 %	4.2%
val top 5	11.7%	17.1%

下圖為 top1 accuracy 在 train data 和 validation data 的結果



下圖為 top5 accuracy 在 train data 和 validation data 的結果