

Summer Project

Assignment2

CILAB

A Computer Vision Tutorial



July 6, 2023

Problem 1

1. Due date: 7.24. (Mon) 10 A.M.
2. Goal: On [CIFAR100](#) dataset, achieves top-1 accuracy $> 82\%$ within **2 train hour**.
3. Rules:
 - a) Train your network from scratch using train split and evaluate the network on test split, do not finetune or use the weight pre-trained from other datasets.
 - b) Try on training ResNet, SENet, CBAM.
 - c) Design your best network architecture that could be trained within **two hours** and have a number of parameters less than **30M**.
 - d) Start from [our tutorial code](#) and **never** modify the provided training & evaluation hyper-parameters. We call for improving accuracy by changing network architecture, not hyperparameter tuning. However, assuming that you realize the importance of the training framework, we also expect you to understand the provided training framework in detail while designing your network architecture.
 - e) Use `pytorch` library. Because our lab members including your mentor mainly work on `pytorch` library, you will get more practical feedback if you use the `pytorch` library.
 - f) Summarize the experiment result and write a report on a single paper (A4-sized, pdf). The report must include **(1) the ablation table** (refer to Table 9 of [this paper](#)) that shows the sequential path from baseline to the proposed network architecture, **(2) the experiment result** such as the best top-1 & 5 accuracies, flops, training time, and epoch vs eval-top1-acc graph, **(3) your proposal for novel network architecture**. e.g. *We argue that the SEUnit is the key factor for achieving the best network performance. In the experiment, the SENet improves 2.3% accuracy improvement.* Within a single paper, any contents other than mentioned things are okay.
 - g) Prepare the presentation (<3 min) using your single-paper report. Please show us **the figures and tables, not texts**.
4. Program:
 - Start: 7.17 (Mon)
 - QnA: 7.20 (Thu) 10 A.M.
 - End: 7.24 (Mon) 10 A.M.
5. Useful links and tips:
 - <https://github.com/huggingface/pytorch-image-models>.

Problem 2

1. Due date: 7.24. (Mon) 10 A.M.
2. Goal: On [CIFAR100](#) dataset, performs knowledge distillation (KD).
3. Rules:
 - a) **Task 1.** Select and train a student model and teacher model using the training script used in **Problem 1**.
 - b) **Task 2.** Performs knowledge distillation from the teacher model (pre-trained in **Task 1.**) to the student model (randomly initialized) by implementing a knowledge-distillation loss function (refer to [PS-KD](#)) satisfying the following formula:

$$\tilde{p}_i(\mathbf{x}; \tau) = \frac{\exp(z_i(\mathbf{x})/\tau)}{\sum_j \exp(z_j(\mathbf{x})/\tau)} \quad (1)$$

$$\mathcal{L}_{KD}(\mathbf{x}, \mathbf{y}) = (1 - \alpha)H(\mathbf{y}, P^S(\mathbf{x})) + \alpha\tau^2 H(\tilde{P}^T(\mathbf{x}; \tau), \tilde{P}^S(\mathbf{x}; \tau)) \quad (2)$$
 where τ denotes a temperature parameter and H is a cross-entropy loss and α is a hyperparameter to scale kd loss and T is teacher, S is student model.
 - c) **Task 3.** Performs knowledge distillation from the student model (pre-trained with KD in **Task 2.**) to the student model (randomly initialized).
 - d) **Task 4.** Performs knowledge distillation from the student (pre-trained in **Task 1.**) to the teacher model (randomly initialized).
 - e) Summarize the experiment result and write a report on a single paper (A4-sized, pdf). The report must include **(1) the ablation table** (refer to Table 1 of [this paper](#)) , **(2) the experiment result** such as the best top-1 & 5 accuracies and epoch vs eval-top1-acc graph, **(3) Write your opinion about KD** . Within a single paper, any contents other than mentioned things are okay.
 - f) Prepare the presentation (<3 min) using your single-paper report. Please show us **the figures and tables, not texts**.
4. Program:
 - Start: 7.17 (Mon)
 - QnA: 7.20 (Thu) 10 A.M.
 - End: 7.24 (Mon) 10 A.M.
5. Useful links and tips:
 - <https://github.com/yuanli2333/Teacher-free-Knowledge-Distillation>.