Assignment

Due on Monday, August 29, 2022

Advanced Lectures on Pattern Processing
by Tomoya Sakai

You will make a Jupyter notebook (ipynb) on the CIFAR 10 image classification experiment in the following scenario. The notebook must include all your code and explanation texts, and run without an error on Google Colaboratory.

EXPERIMENT

■ Aims

- Show your understanding on how to build a convolutional neural network (CNN) classifier in PyTorch.
- Explain why the resulting classifier is reasonably tuned by providing convincing reasons/evidence.

■ Senario

- The task is image classification on the CIFAR 10 dataset. You will build a CNN model trained and validated with the CIFAR 10 dataset, and test it with CIFAR-10.1 dataset as instructed below. Note that it is forbidden to rebuild your classifier after the test.
- Instructions:
  - ✧ **Dataset usage**
    - ☐ Include a summary of the CIFAR 10 dataset in the notebook as a text.
    - ☐ Import the training and test datasets as `train_dataset` and `val_dataset` using `torchvision.datasets.CIFAR10()` with the options `train=True` and `train=False`, respectively (see PyTorch Tutorial #14).
    - ☐ You may apply any normalization to both datasets and data augmentation to the training dataset.
  - ✧ **CNN modeling and training**
    - ☐ Describe the architecture of your CNN model and explain why you designed it as such.
    - ☐ Implement your model using `torch.nn` modules.
    - ☐ Show the summary of your model using `torchsummary`.
    - ☐ Itemize the hyperparameters for training the model, e.g., the learning rate, the number of epochs, etc, and show how to reasonably set them.

- ☐ Display how the losses and accuracies behaved for `train_dataset` and `val_dataset`.

✧ **Evaluation**

- ☐ Show the accuracies and the confusion matrix for `val_dataset`.
- ☐ Discuss whether your model reasonably captures the image features by showing the CAM (class activation maps) or GRAD-CAM.
- ☐ What did (should) you do to achieve the better results? Show why as well.

✧ **Test scoring**

- ☐ Test your model with CIFAR-10.1 dataset using the sample code https://github.com/tsakailab/alpp/blob/main/ex_CIFAR-10/TestByCIFAR10_1.ipynb
- ☐ Write what you find in the test scores.
- ☐ DO NOT modify or train your model again on the basis of the test scores.

■ **Submission of your notebook:** Upload your ipynb at LACS. The filename should be `CIFAR10_CNN_bbXXXXXXXX.ipynb` where `XXXXXXXX` is your student ID. Do not clear the outputs of all cells. The shorter the running time and the simpler your code, the better.

REPORTING REQUIREMENTS

- ☐ Clearly written text cells in Japanese or English.
- ☐ Describe what each figure shows, and explain what it means.
- ☐ Provide convincing reasons for your definitions/settings.
- ☐ Try to explain why for every cause and result.
- ☐ Cite reliable sources and show the list of references. Note that a URL alone is not a citation.
- ☐ Justify if the contents of your notebook does not satisfy any one of these requirements.

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