This document includes information about course project for the undergraduate course Deep Learning, from School of Computer Science and Engineering, Sun Yat-sen University, 2023.

Small project: Image classification on CIFAR10

In this small project, you need to familiarize model training and evaluation with PyTorch, and achieve the goal of classification accuracy 96% on the test set of CIFAR10. Use ResNet (e.g., ResNet34 or ResNet50) as the model backbone. You need to use all possible training tricks and tips to help improve the classifier performance. Evaluation metrics include classification accuracy and confusion matrix. Try to use figures, tables, and visual demonstrations in results. A short summary of method and results together with the source code should be submitted.

Submission deadline: End of week 9, i.e., 2023.04.23

Main Project: Fine-grained classification

In this project, you need to develop a deep learning model or method to solve the fine-grained visual classification task. The challenge is that images from different classes often look similar and images from a single class could look different. To solve this classification problem, you are required to apply multiple techniques learned in class, including

- Various training tricks to improve model performance
- Transfer learning: fine-tune pretrained model
- Attend to local regions: object localization or segmentation
- Synthetic image generation as part of data augmentation
- ViT model backbone vs. CNN backbone: explore how to effectively use ViT
- Interpretation of the model: visualization of model predictions
- Robustness of the model: adversarial examples as input, (optional) improve robustness
- Self-supervised learning: e.g., generate a pre-trained model, and/or used as an auxiliary task
- (Optional) few-shot learning: reduce training data to 10-20 images/class

In addition, you are encouraged to develop your own novel method which can be novel in any aspect, e.g., model structure, training strategy, or any point in the above list. I expect you can achieve the performance at least with accuracy 90% on the following two datasets. Note that any annotation information (e.g., bounding) should NOT be used for test images in model evaluation. You may learn more recent advances in fine-grained classification from https://paperswithcode.com/task/fine-grained-image-classification .

CUB200 Bird Dataset: http://www.vision.caltech.edu/datasets/cub_200_2011/

Stanford Dogs Dataset at http://vision.stanford.edu/aditya86/ImageNetDogs/

Alternative Main Project: Project created by yourself

If you do not prefer the above main project, you may explore and create your own project. You need to discuss with your tutor (me :)) to check whether your own project is worth doing or not. Note that you should include all the points listed above in your own project. Also note that you must NOT choose any of your previous or current projects for other classes or for research tasks in professors' labs.

Important dates:

Week 4 (2023.03.18): form your team, 2-3 members per team;

Week 10 (report-v1): initial results with baseline methods; finish the first 4 points in the list;

Week 15 (report-v2): finish the first 7 points in the list; proof-of-concept results of your own ideas;

Week 19 (report-v3): finish all the points in the list; comprehensive experimental results; final report together with source code.

In Report v1-v2: partial information for introduction, related work, method, initial experimental results of baseline methods and your own idea.

In addition, each team can make **three appointments** with me to discuss your project, around 1-2 weeks before submitting your report v1-v3.