Group Proposal

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In this project, we will study the problem of plant pathology. Apples are one of the most important temperate fruit crops in the world. Foliar diseases pose a major threat to the overall productivity and quality of apple orchards. The current process for disease diagnosis in apple orchards is based on manual scouting by humans, which is time-consuming and expensive. So, we decide to apply machine learning-based models to accurately classify a given leaf image to a particular disease category.

We use the dataset in a Kaggle competition named as Plant Pathology 2021 – FGVC8. Plant Pathology 2020-FGVC7 challenge competition had a pilot dataset of 3651 RGB images of foliar disease of apples. For Plant Pathology 2021-FGVC8, the competition has significantly increased the number of foliar disease categories. This dataset contains approximately 23,000 high-quality RGB images of apple foliar diseases, including a large expert-annotated disease dataset. This dataset reflects real field scenarios by representing non-homogeneous backgrounds of leaf images taken at different maturity stages and at different times of day under focal camera settings. The dataset is large enough to train a deep network.

In this report, we plan to use transfer learning method. It is a popular approach in deep learning where pre-trained models are used as the starting point on computer vision and natural language processing tasks given the vast compute and time resources required to develop neural network models on these problems and from the huge jumps in skill that they provide on related problems. And transfer learning includes two approaches, develop model approach and pre-trained model approach. We select pre-trained model approach to use parts of the pre-trained model. We will use VGG model and ResNet model in this research. These twos models are developed by a challenging image classification task, ImageNet 1000-class photograph classification competition. These models can take days or weeks to train on modern hardware. They can be downloaded and incorporated directly into new models that expect image data as input.

In order to implement the network, we will use a common technique in transfer learning: fine tuning. First of all, we pre-train the selected neural network models. Then, we can freeze some parts of the models, and adjusted other parts of the

models so that we can generate an effective model with the output layer whose size is the number of target dataset categories (in this study, there are 12 categories) to the target model. We assume that these model parameters contain the knowledge learned from the source dataset and this knowledge will be equally applicable to the target dataset. We can do this because that although the images in ImageNet are mostly unrelated to plant pathology, models trained on this dataset can extract more general image features that can help identify edges, textures, shapes, and object composition. There similar features may be equally effective for recognizing the plant pathology.

The most important materials we will use are the competition related information in Kaggle, like the possible problems that the dataset might have, documents in pytorch official website, and any other materials we can find to improve the performance of models.

To judge the performance of the network, we use both accuracy and f1 score. Accuracy is one of the more obvious metrics, it is the measure of all the correctly identified cases. It is most used when all the classes are equally important. However, in this study, there are 12 categories and the cases are imbalanced. So, we mainly use f1 score when the validation dataset is trained. F1 score is the harmonic mean of precision and recall and gives a better measure of the incorrectly classified cases than the accuracy metrics.

Finally, a rough schedule for completing the project is listed as following:

Date	Tasks
4.1	Group meeting – Discuss the whole schedule
4.2-4.9	Find datasets
4.10	Group meeting – Decide dataset
4.11-17	Process data and train model
4.18	Group meeting – See results
4.19-4.23	Improve models based on discussion
4.24	Group meeting – Summarize results
4.25-5.1	Write final project and prepare for presentation
5.2	Record the presentation and submit the repo
5.3	Final presentation

Reference:

"Plant Pathology 2021 - FGVC8." Kaggle, www.kaggle.com/c/plant-pathology-2021-fgvc8.

Brownlee, Jason. "A Gentle Introduction to Transfer Learning for Deep Learning." Machine Learning Mastery, 16 Sept. 2019, machinelearningmastery.com/transfer-learning-for-deep-learning/#:~:text=Transfer learning is a machine,model on a second task.&text=Common examples of transfer learning,your own predictive modeling problems.

"13.2. Fine-Tuning¶ Colab [Mxnet] Open the Notebook in Colab Colab [Pytorch] Open the Notebook in Colab Colab [Tensorflow] Open the Notebook in Colab." 13.2. Fine-Tuning - Dive into Deep Learning 0.16.3 Documentation, d2l.ai/chapter_computer-vision/fine-tuning.html.

Huilgol, Purva. "Accuracy vs. F1-Score." Medium, Analytics Vidhya, 24 Aug. 2019, medium.com/analytics-vidhya/accuracy-vs-f1-score-6258237beca2.