Homework4

11/12/2023

100/100 Points

Attempt 1

Review Feedback
11/12/2023

Attempt 1 Score:
100/100

Add Comment

Anonymous Grading: **no**

Unlimited Attempts Allowed

Details

This assignment is designed to give you practical programming experience with pretrained neural networks for computer vision (CV) and natural language processing (NLP). Please carefully read all the instructions below. Do not hesitate to use Slack and Inscribe Q&A community (right-hand side menu on Canvas) to ask questions.

You can complete this assignment individually or in a group (up to 4 members) - note that unlike previous assignments this one does not have an individual portion. To select your group (even if you work individually) go to *People* section in Canvas and select *Groups*. There, you can join the desired group *(please do not create your own groups, but join one of the groups that we created)*. Please communicate with your colleagues before forming the groups.

Your assignment should be submitted by uploading your code (in the form of a **Jupyter Notebook (.ipynb) AND pdf copy of the files** – so we can make comments directly on the file) to Canvas (you can upload one notebook and pdf file per each of two questions). **Be sure to run the file before committing so that we can directly see your results (please double-check the file you uploaded to make sure it is the right file and that all the results are visible).** Please mention all the resources that were used to solve the problem (e.g., websites, books, research papers, other people, etc.). To complete the assignment, you can use any Python (or R) package that you want, but we recommend using Scikit-Learn and Tensorflow or Pytorch.

Question 1. [50 points]

Use transfer learning for large image classification, going through these steps:

1. Take at least 100 images per class with at least 3 classes using your phone/camera (e.g. take photos of different types of trees, flowers or animals). Display 5 examples from each class. **[10 points]**
2. Split the images into a training set, a validation set, and a test set**. [5 points]**
3. Build the input pipeline, including the appropriate preprocessing operations, and add data augmentation. **[10 points]**

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Attempt (https://iu.instructure.com/c

5. Train from scratch (without pretraining) a deep neural network that contains convolutional layers on this dataset (the one you created in part 3). Report classification accuracy and give a few examples of correct/incorrect classification (show a few images that were correctly/incorrectly classified). Note: The objective of this question is to illustrate that training deep networks from scratch requires a lot of data so it is ok if your classification accuracy is low. **[15 points]**

Question 1. Competition! [up to 20 points]

If you feel adventurous, take a pretrained neural network (it doesn't have to be the same one you used earlier in Q1) and fine-tune it on 240 randomly chosen images from the set of 360 rock images we used in HW3. Use the remaining 120 images for validation to help you choose the best hyperparameters. To do fine-tuning, the layer prior to the output layer should have 8 neurons (the output layer will have 3 neurons since we have 3 rock categories). Compute the correlation coefficients between the network data and human data for each of 8 neurons (similar to HW3, using procrustes analysis) using the images from the validation set (120 images). Then, compute the correlation coefficients for the 120 images from the test set (do not use the test set to tune the hyperparameters). Report each of the 8 correlation coefficients and your average correlation coefficients (please mark in the bold with large font so we can easily find it).

Prizes: We will sort your assignments by the average correlation coefficient and award bonus points to the top 5 teams (20 points for the winner, 16 points 2nd place, 12 points 3rd place, 8 points for 4th place and 4 points for 5th place - points will be given to each member of the time). In addition, if you rank among the top teams and your results look good, you can continue working on it, and we can write a research paper together and present it at a conference (e.g., **https://cognitivesciencesociety.org/cogsci-2024/ (https://cognitivesciencesociety.org/cogsci-2024/)**).

Few suggestions: it won't be easy to get a significant correlation. Architectures like ResNet are not likely to work. Vision transformers might be worth a shot. There are plenty of pretraiend models here: **https://huggingface.co/models?pipeline_tag=image-classification&sort=trending (https://huggingface.co/models?pipeline_tag=image-classification&sort=trending)** . You will probably want to have an efficient way to explore the hyperparameters. For example, you can use tools like Keras Tuner or submit a bunch of jobs to the cluster with various parameter configurations.

Question 2. [50 points]

1. Create your own dataset for text classification. It should contain at least 1000 words in total and at least two categories with at least 100 examples per category. You can create it by scraping the web or using some of the documents you have on your computer (do not use anything confidential) or ChatGPT. **[15 points]**
2. Split the dataset into training (at least 160examples) and test (at least 40 examples) sets. **[5 points]**
3. Fine tune a pretrained language model capable of generating text (e.g., GPT) that you can take

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very helpful: https://huggingface.co/docs/transformers/training). Report the test accuracy. Discuss what could be done to improve accuracy. **[30 points]**

View Rubric

Select Grader

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Rubric (1)

Criteria	Ratings		Pts
Q1.1.Create dataset with 3 classes view longer description	10 to >0 pts Full Marks	0 pts No Marks	10 / 10 pts
Q1.2.Train Validate Test set view longer description	5 to >0 pts Full Marks	0 pts No Marks	5 / 5 pts
Q1.3.Building a Pipeline and data augmentation view longer description	10 to >0 pts Full Marks	0 pts No Marks	10 / 10 pts
Q1.4.Fine tuning model, reporting accuracy, give examples view longer description	10 to >0 pts Full Marks	0 pts No Marks	10 / 10 pts
Q1.5.Building a model, reporting accuracy, give examples view longer description	15 to >0 pts Full Marks	0 pts No Marks	15 / 15 pts
Q2.1.Create dataset for text classification view longer description	15 to >0 pts Full Marks	0 pts No Marks	15 / 15 pts
Q2.2.Train and Test set creation view longer description	5 to >0 pts Full Marks	0 pts No Marks	5 / 5 pts

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Rubric (1)

Criteria	Ratings	Pts
accuracy, give examples view longer description		
		Total Points: 100

	File Name	Size	
	aml4-q2.pdf	51.4 KB	
	final-aml...mit-1.pdf	1.6 MB	

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