AML 2018: Semester Exam (Practical – Part 1)

8:30 am to 5:30 pm, 19th to 21st Dec 2018

NOTES:

1. This question paper is to be completed by 20th Dec 2018, 2:30 pm. The remaining time is to be used to solve Part 2 of the examination.
2. You are required to demonstrate your progress after every milestone checkpoint and send the final deliverables to panantharama@alum.iisc.ac.in
3. Refer the paper for details and ideas for addressing part 1: http://crcv.ucf.edu/data/Selfie/papers/acmmm15/Selfie.pdf

Part 1: Image Classification using Transfer Learning

Scope of this project:

The scope of this problem statement pertains to Image Classification and regression using the principles of Transfer Learning

Objectives of this project

- Implement classifier and regression models (multitask learning) using Resnet50 backbone
- Use data augmentation and experiment on different mechanisms to achieve the best possible accuracy levels
- Visualize convolution layers: given a layer id, visualize the filters and activations

Problem Statement:

The problem at a high level can be summarized as comprising two parts. Using the selfie dataset available from University of Central Florida (UCF):

(a) Predict the "popularity score" of a selfie given the image (Regression Problem)
(b) Classify the image in to the given categories (e.g: age group)

Detailed Steps:

1. Download the dataset from http://crcv.ucf.edu/data/Selfie/ or from the shared folder at: https://drive.google.com/file/d/1q4yyOCV_KUPWjbvB2i1tdVrhwfhZ5Sdq/view?usp=sharing
2. Unzip and expand the tar file and set up the dataset on your machine
3. Go through the README file in the root folder of the dataset. This gives the field names and format.
4. The file selfie_dataset.txt provides the ground truth information. You can quickly inspect the dataset.
5. As a first task we will use the dataset to predict the following attributes:
    a. Input is the image itself. This is 306x306x3 dimensional.
    b. The outputs are:
        i. is_female
        ii. baby
        iii. child
        iv. teenager
        v. youth
        vi. middle_age
        vii. senior
6. Before you work on the classifier for the above, you are required to analyze and visualize the dataset across the 7 attributes mentioned in 5(b).
7. **Checkpoint#1**: Use Pandas to view the dataset.
    a. Display first 10 records and last 10 records
    b. Compute the data distribution across each of these attributes and show them with a bar graph
    c. Report: Is the data distribution balanced or skewed? If skewed, where do you see the data imbalance? Can you use data augmentation to offset the imbalance if any?
8. Split the dataset in to training and validation. Choose a convenient split, say 85% training and 15% validation.
9. Design an architecture to perform the classification. You are required to use Resnet50 as the backbone stack. Refer Keras documentation for details. You can remove the top layer and plug in your layers. Use Imagenet weights.
10. To start with use only a small subset of the data so that you can verify your architecture, saving and loading models, incremental training etc.
11. **Checkpoint#2**: You are required to demonstrate the training outputs that include the mean loss for training and validation during the training. You should observe that the training loss and validation loss decrease with training steps.
12. Scale the dataset to larger sizes, ensure that the validation accuracies go up. Tune and get a reasonable baseline, say over 70% accuracy.
13. **Checkpoint#3**: Create test cases: Take a selfie of each individual in your group or others, ensure you have both genders (male, female) and test your classifier with this real world

data. You could also use the selfies from public internet (say Instagram, Facebook, Flickr etc) and show the outcome to the faculty.

14. Measure the accuracy and report
15. Add more functionality to your classifier. You should now predict all the attributes available in the dataset except for the popularity_score.
16. **Checkpoint#4:** Demonstrate the complete classifier to the faculty
17. Now, we will predict the popularity_score using 2 techniques:
    a. Given the image, predict the popularity score along with all the attributes
    b. Given the image, predict only the attributes and in then using both the image and predicted attributes, predict the popularity_score. This is a 2 step process.
    c. Measure the accuracy in terms of mean squared error (as this is a regression problem)
18. Pick about 10 images from public internet, say Instagram. Within your own group, discuss and come with a popularity score for each of these test images. Now, run your machine on the same images and get the predicted values. Compare your rating of popularity_score with machine predicted.
19. **Checkpoint#5:** Demonstrate the outcomes of Steps 17 and 18 as above. You are welcome to take the pictures of faculty and compute our scores! (Just in jest: Your exam score will be directly proportional to the prediction you arrive at!)
20. **Optional:** Visualize the layer filters and demonstrate. Are there any insights you are able to get from these visualizations?

Deliverables

- Code that implements all the required steps
- Report that discusses your results, approach, details of the tests done and screenshots of relevant information (such as training/validation accuracies)
- The evaluation relies on reports as an evidence besides the personal inspection/evaluation by the faculty during the exam. Hence the reports have a strict deadline of 21st December 18, 2018, 6 pm IST