

exercise 01 - Morteza Soltanpour 4149938, Driton Goxhufi 4233242

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1 Network design (1+2+2+2+2+1=10 Points)

- a)
- b) Theoretical questions about the training function in the exercise:
 - 1. Why is it necessary to divide the data into batches?
 - i. memory issues, depending on the dataset, a graphic card cant handle a full dataset at a time.
 - ii. faster iterations and feedback of learning(network) progression
 - 2. What is an epoch?
 - i. an epoch is one whole iteration through the Dataset. e.g. if we have a dataset of 20 datapoints = N and use batches of 5 datapoints = B --> $N/B = 4$ Iterations = 1 Epoch.
 - 3. What do lines 43 to 48 do?
 - i. we calculate the prediction of a batch by the current network(output of the network) and save all predictions into the variable "batch_out"
 - ii. compute the difference between the prediction of the network and the ground truth which results in the loss through a cross entropy calculation
 - iii. after that we backpropagate the loss through the network and do a optimize(update) step and adjust the weights in the network
- c) Which values do the three controls take?
 - 1. steer [-1, 0, 1] for right
 - 2. gas: [0.5, 0.0]
 - 3. brake: [0.8, 0.0]
- e) Can you achieve better results when changing the hyper-parameters?can you explain this?
 - 1. Yes you can achieve better results
 - 2. We changed these hyperparameters:
 - i. epochs: increasing the number of epochs increases the time for the network to learn from data. reached limits after >500 epochs because of convergence.
 - ii. Batchsize: the Idea was to Increase the batchsize to the max of memory capacity. It should improve the (update)steps of the optimizer.
 - iii. Learning rate: as we increased the batchsize, we were able to increase the learning rate aswell and do bigger learning steps. Because theoretically, the network can calculate a better gradient with a bigger batch of samples.
- f) what is 'good' training data?
 - i. good training data is, when your dataset covers all situations in the task.
 - ii. balanced classes is good too.
- 1. Is there any problem with only perfect imitations?
 - i. yes, because the network doesn't know how to behave if he is out of the track.
 - 1) perfect imitations doesnt tell the network how to act with a failure.

2. Network Improvements (2+2+2+2+2=10 Points)

- a) The method extract_sensor_values provides information about true speed of the vehicle, 4 abs sensors, the position of the wheels "steering" and gyroscope...what ever that means xD
 - i. the performance change in a way, that the car is driving slower than before. the performance
- b) compare classificationnetwork with multiclassnetwork:
 - i. multiclassnet > classnetwork
- e) Fine-tuning
 - i. we tried batchnormalization
 - ii. changing network architecture
 - 1) adding more layers

- 2) increasing featuremaps(depth of convlayers)
- iii. CONCLUSION:
 - 1) it improves!!

