

Exercise 1: Pytorch Tutorial on GTSB Datasets

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1 Task 2

1.1 Preprocessing

- Transformations on the images:
 - Rescaling: 32×32
 - Mean subtraction. I used 0.5 as a first shot. Better practice would be to determine the mean of the image values beforehand and subtract it from the images but unfortunately I ran out of time before I could implement it.
 - Transform to Pytorch tensor
 - Splitting orig. training set: 80% training data and 20% validation data

1.2 Setup

| Batch Size | Epochs | Learning Rate | Optimizer | Architecture |
|------------|--------|---------------|-----------|--------------|
| 32 | 10 | 0.001 | SGD | see below |

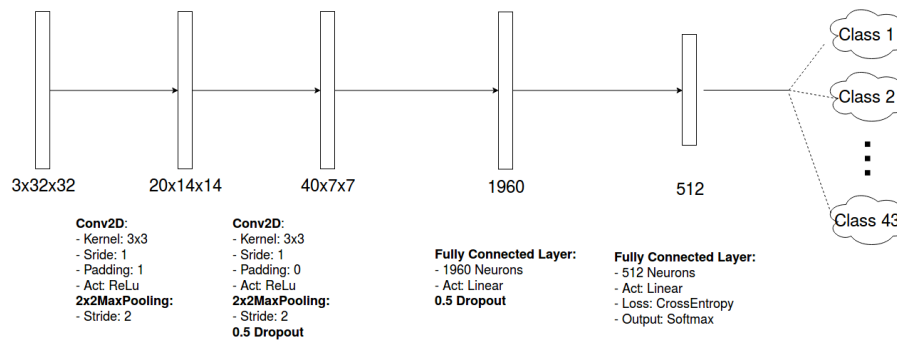
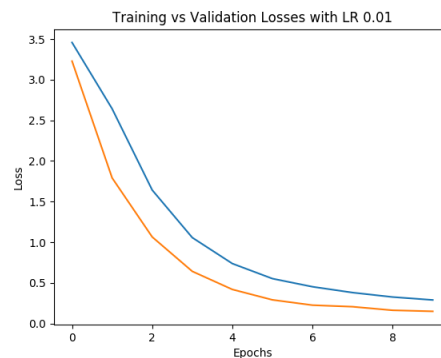
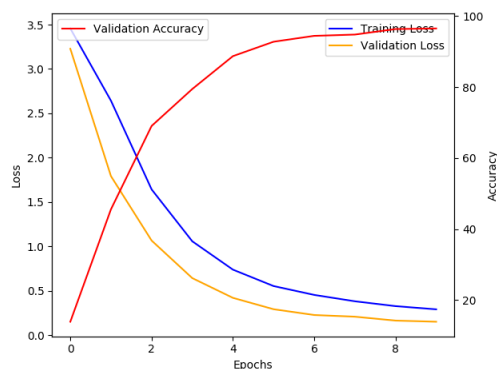


Figure 1: Used Architecture for task 2

1.3 Results

- Orange: Validation Loss
- Blue: Training Loss
- Red: Validation accuracy in percent

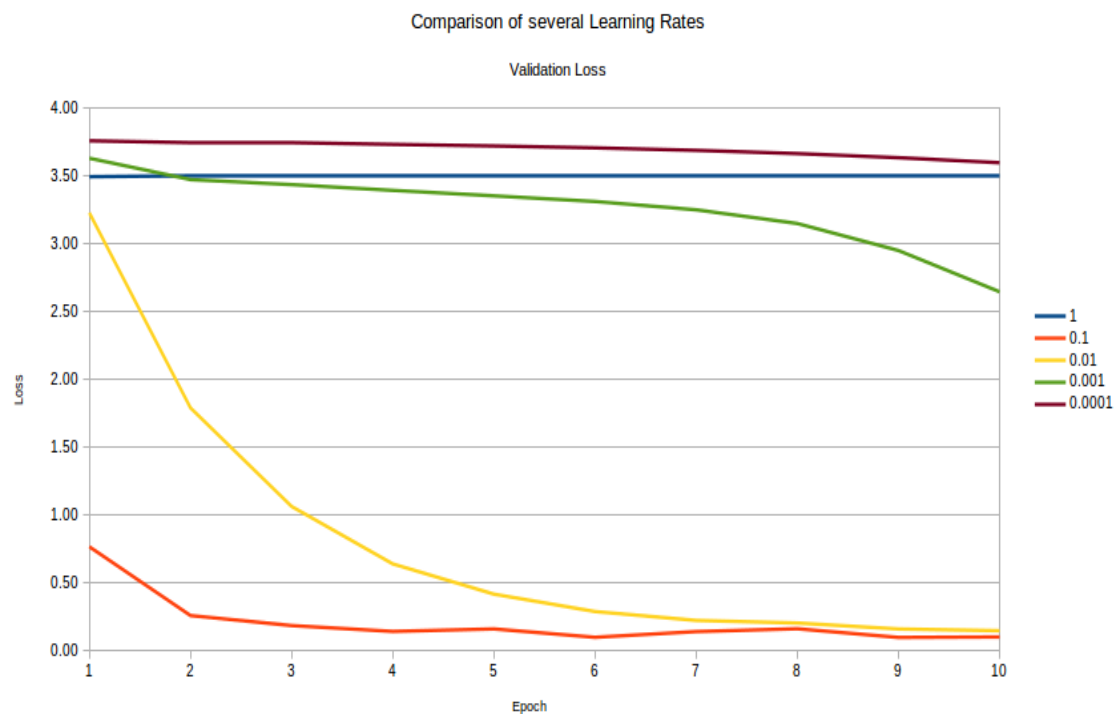
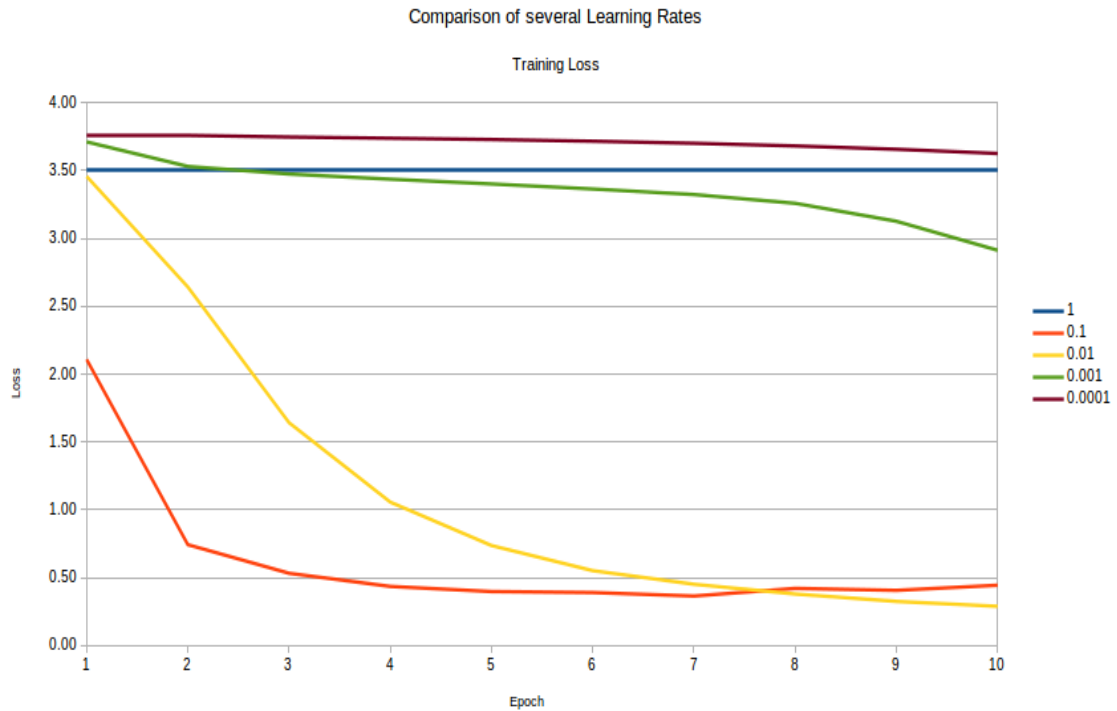


First conclusion: successful learning due to the non-divergence of training and validation loss with increasing validation accuracy.

2 Task 3

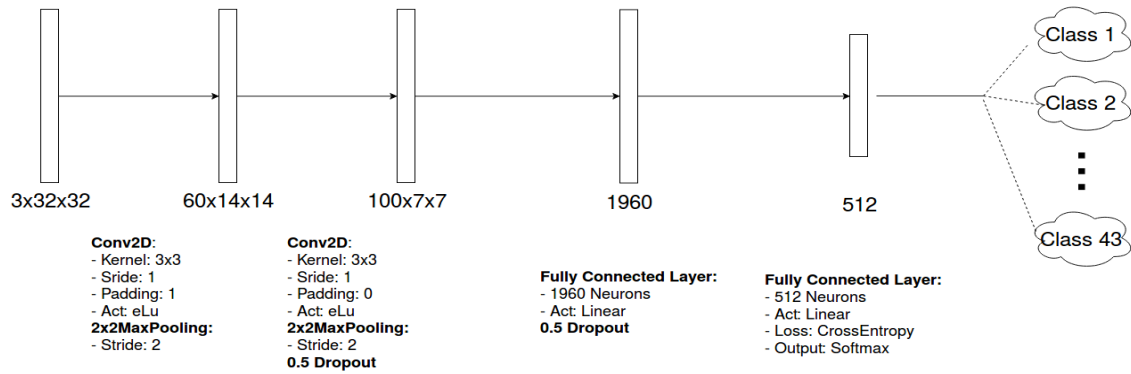
2.1 Different Learning Rates

From trying different learning rates one could see their different convergence characteristics. For this setup, 0.1 seems to be the most promising one due to rather quick convergence in training loss as well as in validation loss. Higher learning rates like 1 diverge quickly and thus cannot make it to convergence. On the other hand, if the learning rate is too small, e.g. 0.0001, the convergence will be very slow.



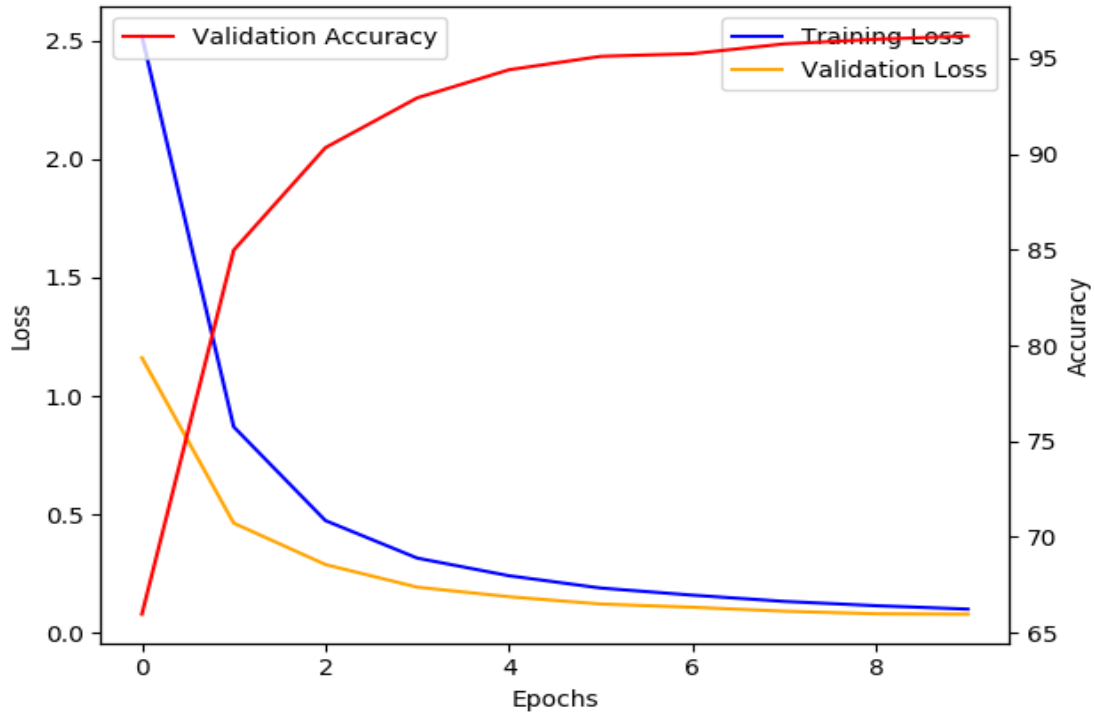
2.2 Modification of Architecture

- New Activation Function for Convolutions: ELU with $\alpha = 1.0$
- Batch size is now 256
- Learning rate is 0.01



2.3 Result of Modification

After changing the architecture, there is a slight change in convergence behavior: training and validation loss now seem faster to convergence approximately to the same point. With more epochs one could say more about it.



2.4 Application on the Test Data

I could not finish this task in the given time, due to several reasons:

- Shortage of time
- Getting familiar with Pytorch
- initial server downtime of the GTSB servers

This should be understood as an explanation, not as an excuse.