**Approach**

**Search correlation of epoch and batch-size which leads to higher accuracy**

In order to find a high accuracy, we try to find the correlation between the epoch and batch-size with the standard configuration of the “cifar10\_cnn.py”. We run the program with different values for epoch and batch-size. For epoch we choose 10, 25, 50, 75 and 100. A high batch size requires much memory, thus in order to fit the data into the graphic memory we take 8, 16, 32, 64 and 128 for the batch size.

We ran the program with the different configurations for epoch and batch-size and stored the accuracy for train and test set in a stylesheet. We can see in Figure 1 that with increasing epochs the accuracy of the CNN with batch size 8 decreases, which tells us, that from epochs greater than 10 the model starts to overfit on the trainings data.

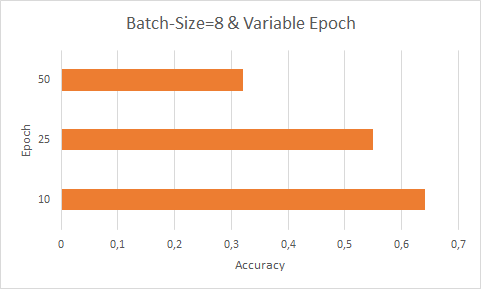


Figure 1 Cifar10\_cnn.py trained with batch size 8 and variable epochs.

For batch size 16 we observe, that the accuracy starts to increase from 10 epochs to 20 epochs, but overfits at 50 epochs Figure 2. Figure 3 depicts that for batch size 32 the highest accuracy can be achieved with 75 epochs. When we analyze Figure 1 and Figure 2 we see that for small batch sizes the highest accuracy is reached with small epochs, thus for batch size 8 and 16 we will not be able to increase the accuracy further by increasing the epoch. However, for batch size 32 we get a good accuracy, where the model achieved the best result with 75 epochs and overfit at 100 epochs, thus we will use batch size 32 in further test in order to increase the accuracy.

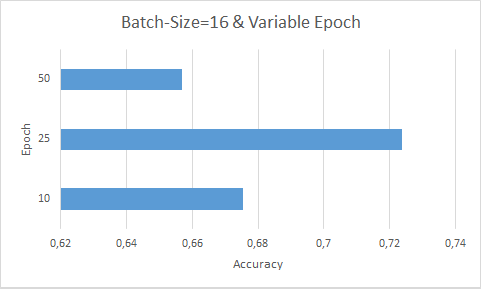


Figure 2 Cifar10\_cnn.py trained with batch size 16 and variable epochs.

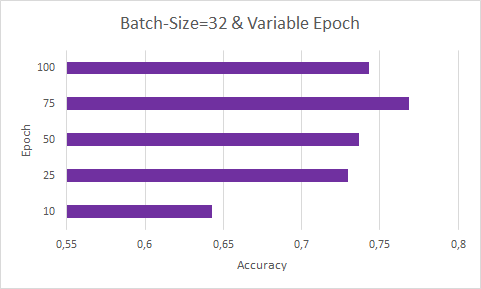


Figure 3 Cifar10\_cnn.py trained with batch size 32 and variable epochs.

As our goal is to find the highest accuracy, we discard the configuration with small accuracy. Figure 4 shows all the different configuration and its accuracy, which helps us to compare them and decide which configuration to discard. The best accuracy could be achieved for batch size 64 with epoch 100, where the accuracy is 0.7902, but also batch size 32 and 128 reached a high accuracy. As the accuracy for batch size 8 and 16 is lower in contrast to 32, 64 and 128 we discard them.

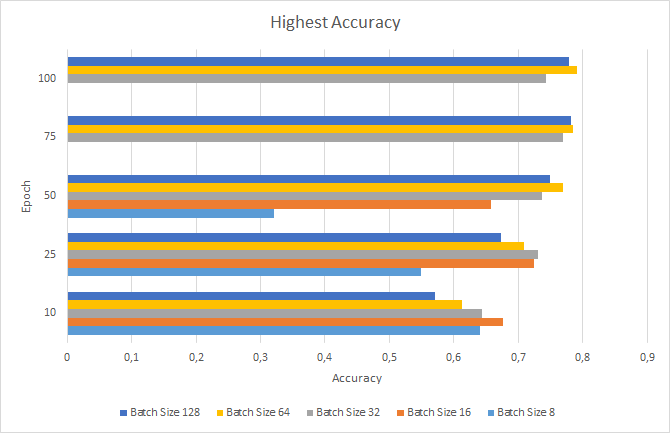


Figure 4 Accuracy of Cifar10\_cnn.py with different configurations for epoch and batch-size.

**Search correlation of number of filters in the convolution layer**

We continue our experiment with the batch sizes 32, 64 and 128, by trying out to find the optimal number of filters for the convolution layers. First, we will run the program with only 10 epochs and if we detect an increase in the accuracy, then we apply it to epoch 75 or 100.

Increasing the number of the filters of the first and second convolution layer to 64 and 128 we could observe an increase of the accuracy for batch sizes 32, 64 and 128 as shown in Figure 5, this means by increasing the number of filters more features could be extracted, which helps our model to make better prediction. As the highest accuracy for batch size 32 was with 75 epochs, which can be seen in Figure 4, we use higher number of filters to train the CNN.

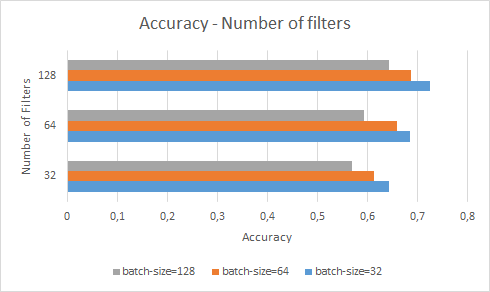


Figure 5 Accuracy of the model with different number of filters. Model trained with 10 iterations.