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MATH. - NATURWISS. FAKULTÄT
FACHBEREICH INFORMATIK
KOGNITIVE SYSTEME · PROF. A. ZELL

Deep Learning

Assignment 9

Assignment due by: 12.01.2021, Discussions on: 19.01.2021

Question 1 Kaggle Challenge: Compete on an image denoising task.

We created a Kaggle machine learning challenge, in which you have to denoise images with a Convolutional Neural Network. For this challenge you are allowed to work in teams of two, but nobody may participate in more than one team. Since training a sophisticated network on the provided dataset takes a lot of computation power, we recommend to use the TCML-Cluster to train your networks. Select **only one** user account per person here: `https://tinyurl.com/2p95kkmj`. The documentation of the TCML-Cluster, including a tutorial of how to train a network, is found here: `https://tinyurl.com/yyje2e37`.
The Kaggle challenge hosting a leaderboard, the competition data, and some example code is is found here: `https://tinyurl.com/c54zhks6`.

The provided code generates a file 'predictions/kaggle_predictions.csv', which includes the denoised image predictions of your network for each test set image. This file has to be submitted to the Kaggle challenge where your accuracy on the test set is calculated and ranked.

In this challenge you are given a set of augmented images, where each image contains the same object but with a different rotation. Your goal is, to remove the augmentations to yield the original object with the correct rotation on a black background.
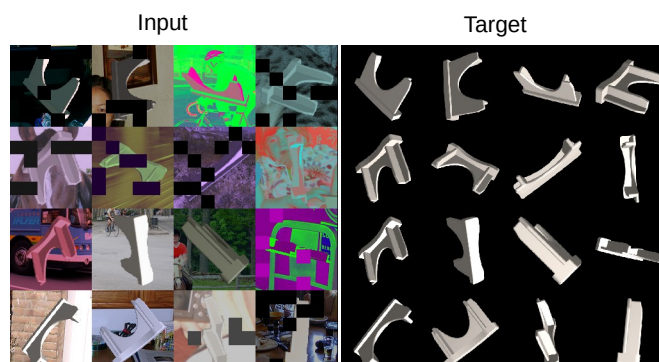
(a) Get used to Tensorboard, which is a tool to visualize and analyze DNN structures and their training process. Extend the given code such that the average training loss, evaluation loss per epoch get visualized in Tensorboard. Train the given example for 5 epochs and include screenshots of the plot of each metric. In addition visualize the computational graph and provide a screenshot.

(b) Take part in the Kaggle challenge. Your code should periodically print out the progress your network is making. The name of your kaggle group has to be **the concatenation of your last names** separated by an underscore. You are not allowed to use any additional image sources and any pretrained weights. Your architecture can be related to commonly used architectures but

you have to implement it yourself. Direct copies of existing architectures are prohibited. The top 5 teams will get (9/7/5/3/1) bonus exam points (9 points is equal to 1 full grade).

(c) Document your results. Add a short explanation of your chosen architecture and a documentation of your training procedure. This should at least include a description of the architecture, the used hyperparameters, the used optimizer, any data augmentation and normalization techniques, plots of the training and evaluation losses over epochs, and the final test loss.

Hints:

- You are allowed to change all parts of the code if it provides you some benefits.
- Some keywords for better performance are: Autoencoder, Data Augmentation, Learning Rate Decay, DropOut, Batch Normalization, Skip Connections, Data Normalization, Deconvolutions, Input Normalization, Pixel Loss Bootstrapping.
- Look at papers about Augmented Autoencoders for 3D poses.
- In Kaggle an example .sbatch file is provided to run your code on the TCML-Cluster. Note that you have to increase the time tag and that you have to set the partition tag to 'day' for longer trainings.
- Try to mount your cluster directory with sshfs, since using scp to copy your files is cumbersome. In addition, if you use sshfs you can use Tensorboard on your local machine to visualize and analyze your training process.