Project: Comparison of SimCLR with Contrastive Learning using StyleTransfer

All scripts and pretrained models can be found in this repository: https://github.com/JonasMiksch/Research_Project_SimCLR.git

1 Project Description

In the following the results of the project to compare the effect of SimCLR and Contrastive Learning by using Style Transfer on the ArtDL dataset [1] are listed. To apply the method of SimCLR the tutorial [2] was used and recreated. Because of ressource limitations the batch size was, compared to the original method, decreased from 256 to 40. To implement the Style Transfer and compare it to the SimCLR approach, the same framework was used. With the difference that the various data augmentations used in the pretraining of SimCLR were replaced by the Style Transfer algorithm Adaptive Convolutions (AdaConv) [3]. For the finetuning the learning rate was adapted to 0.0025.

2 Results of the original SimCLR - Method

The following table shows the results of the original SimCLR Method after finetuning.

	train-set	test-set	validation-set
accuracy	0.75	0.71	0.67

Most images were predicted to be in class 9. This might be the result of a class imbalance. Therefore a Weighted Random Sampler with the following result was used to counter this problem.

	train-set	test-set	validation-set
accuracy	0.61	0.50	0.49

While the number of predictions that didn't belong to class 9 increased the overall accuracy decreased.

[1] https://paperswithcode.com/dataset/artdl

[2] https://pytorch-lightning.readthedocs.io/en/latest/notebooks/course$_UvA - DL/13 - contrastive - learning.html$

[3] https://github.com/RElbers/ada-conv-pytorch

Classification Report of the Validation-Set after Finetuning

	precision	recall	f1-score	support
0	0.80	0.27	0.40	30
1	0.30	0.14	0.19	98
2	0.51	0.29	0.37	117
3	0.37	0.21	0.26	97
4	0.50	0.07	0.12	14
5	0.77	0.22	0.34	90
6	0.25	0.06	0.09	52
7	0.38	0.08	0.13	118
8	0.61	0.36	0.45	56
9	0.72	0.96	0.82	1189
accuracy			0.68	1861
macro avg	0.52	0.27	0.32	1861
weighted avg	0.63	0.68	0.62	1861

Figure 1: Pretraining-Curve of the SimCLR-Method

3 Results of the Style Tranfer-Method

The following table shows the results of the Style Transfer Method after finetuning on the ArtDL dataset.

	train-set	test-set	validation-set
accuracy	0.64	0.64	0.64

All images were predicted to be in class 9. The results when using a Weighted Random Sampler were following

	train-set	test-set	validation-set
accuracy	0.56	0.55	0.55

Although the Style Transfer approach performed worse than the original method, the accuracy of validation and test test was higher when using a Weighted Random Sampler.

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Classification Report of the Validation-Set after Finetuning

              precision    recall  f1-score   support

           0       0.00      0.00      0.00        30
           1       0.00      0.00      0.00        98
           2       0.00      0.00      0.00       117
           3       0.00      0.00      0.00        97
           4       0.00      0.00      0.00        14
           5       0.00      0.00      0.00        90
           6       0.00      0.00      0.00        52
           7       0.00      0.00      0.00       118
           8       0.00      0.00      0.00        56
           9       0.64      1.00      0.78      1189

    accuracy                           0.64      1861
   macro avg       0.06      0.10      0.08      1861
weighted avg       0.41      0.64      0.50      1861
```

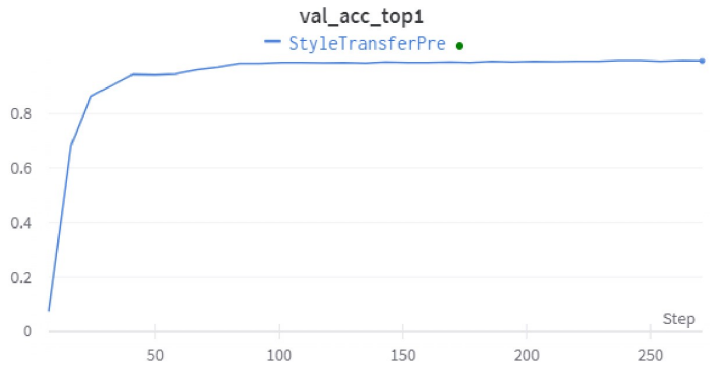

Figure 2: Pretraining-Curve of the SimCLR-Method