KI DELTA LEARNING
Scalable AI for Automated Driving

About the Ambiguity of Data Augmentation for 3D Object Detection

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WP 3.2

Use-Case in Delta Learning

In this working package 3.2 the effects of different organization of the training process for neural networks are examined. Valeo specifically looks at the influence of data augmentation methods, that are widely used during training. Data augmentation allows existing datasets to be artificially enlarged and made more diverse. Valeo focuses on the task of 3D object detection on point cloud data as an important task in the pipeline towards autonomous driving.

Technical Problem

Data augmentation is considered an important step in the training strategy of 3D object detectors on point clouds to increase the overall performance and robustness. The question arises as to the impact as well as the transferability of different augmentation policies.

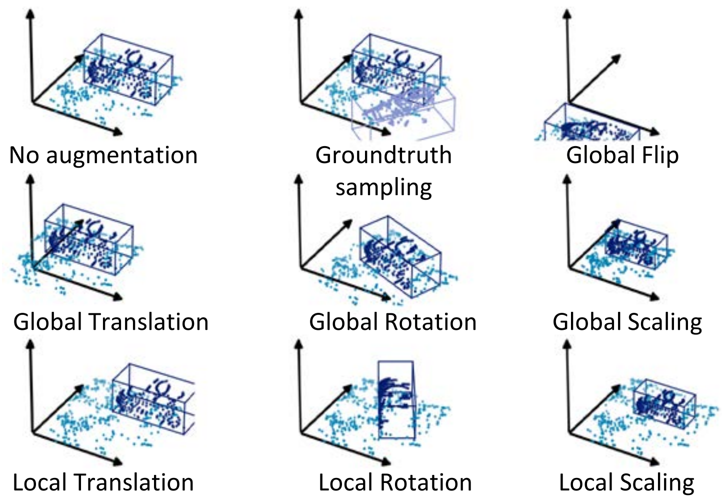

Figure 1: Illustration of the different augmentation methods for a minimal example

Technical Solution

Valeo performed a series of elaborate experiments with four different networks, namely PointPillars, PointRCNN, PartA2 and 3DSSD, covering the current state of the art for 3D object detectors on point clouds. Furthermore, the well respected Kitti and nuScenes datasets were utilized for the experiments. Thus, not only the influence of different augmentation policies can be researched but also the delta shift between network architectures as well as different datasets. The augmentation methods used for the experiments are the ones most commonly used for training 3D object detectors in the current state of the art. They are illustrated for a minimal example in figure 1.

Evaluation

Table 1 shows an exemplary excerpt of the results on the Kitti dataset. It can be seen, that the influence of data augmentation is clearly dependent on the network architecture. Thus, some networks benefit greatly from a full augmentation, while for others the effect is negligible. The same goes for the impact of single augmentation methods, where some yield a large positive effect for one network and a negative effect for another.
The same ambiguity was seen in other experiments as well. By the experiments it was concluded that there is no general optimal augmentation policy, but the policy depends on the network and dataset at hand.

Networks

Augmentation Method	PointPillars	PointRCNN	PartA2	3DSSD
no Augmentation	58.72	78.24	75.43	61.51
	0.00	0.00	0.00	0.00
full Augmentation	**76.71**	**78.73**	**79.62**	**78.69**
	17.99	0.49	4.18	17.18
+ groundtruth sampling	59.85	78.04	76.00	75.73
	1.13	-0.20	0.57	14.22
+ local translation	54.40	77.70	78.08	55.71
	-4.32	-0.54	2.64	-5.80

Table 1: Results for Kitti moderate Car mAP on validation split with no augmentation and some augmentation methods applied on its own. The best results for each network are marked in bold. Colored values are the difference to no augmentation.

Valeo

Partners

External partners

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