Study on Applying SGD Optimizer for PCGCv2

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PCGCv2 의 확률적 경사 하강 옵티마이저 적용에 관한 분석

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Abstract

This paper introduces a method for potentially improving the qualities of PCGCv2 [1] by switching its conventional optimizer. To achieve the potential improvement, we have replaced the existing ADAM optimizer with the SGD optimizer [2] and trained the PCGCv2 model by using the shapenet dataset for 100 epochs. Through the experiment, we have observed that although the SGD optimizer cannot significantly improve the performance of PCGCv2 overall, there exists some points where the SGD optimizer outperforms ADAM. Therefore, the results of this research have certain references for exploring the performance improvement of PCGCv2 by other optimizers in the future.

Ⅰ. Introduction

MPEG (Moving Picture Experts Group), which is part of the ISO/IEC (International Organization for Standardization and International Electrotechnical Commission), is responsible for creating and publishing standards for various technical fields, and compressing 3D point clouds is one of them. Several standards exist for efficiently compressing 3D point clouds, and AI-3DGC (AI-based 3D Graphics Coding) currently in its exploration phase is a standard for compressing point clouds using learning-based methods. One of the models being studied is PCGCv2, a geometric compression framework based on sparse convolution jointly invented by Nanjing University and OPPO.

As PCGCv2 shows good performance, we tried a different optimizer to carry out experiments on PCGCv2 and further study the model. While the ADAM optimizer was used in the previous PCGCv2, we use the SGD optimizer because in general, although convergence is faster with ADAM, SGD is known to generalize better[3]. In this paper, we summarize experimental results of compression using PCGCv2 on various point cloud datasets, but using SGD optimizer instead of ADAM optimizer.

Ⅱ. Method

Based on the PCGCv2 model, we have switched the optimizer from ADAM to SGD. We have trained this model with the new optimizer on Shape-net dataset [4] for 100 epochs each. Seven different models were made, each trained on different alpha and beta values listed in table 1. The alpha parameter contributes to the PSNR of the reconstructed point cloud while the beta parameter contributes to the BPP of the compressed bitstream. These models were each tested on six different test data listed on table 2.

Table 1 Environment Settings

Alpha	Beta
0.5	1
0.75	1
1	1
1.5	1
2	1
4	1
6	1

Table 2 Test Data

class	Test Data
Solid	longdress_vox10_1300
	loot_vox10_1200
	redandblack_vox10_1550
	soldier_vox10_0690
	dancer_vox11_00000001
Sparse	Staue_Klimt_vox12
	Egyptian_mask_vox12

Ⅲ. Experimental Results

The results shown in the figure 1 and figure 2 below demonstrate the comparison between the conventional PCGCv2 using ADAM and the modified PCGCv2 using SGD. The Y axis shows D1 and D2 PSNR values, which are the metrics used for evaluating geometric quality of a point cloud. The X axis shows the BPP of the compressed bitstream.

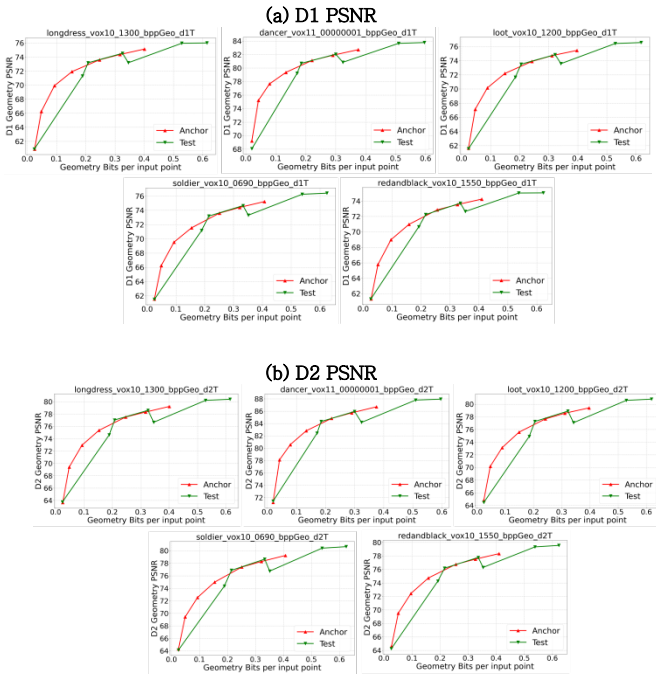

Figure 1. Performance comparison using rate-distortion curves for solid contents

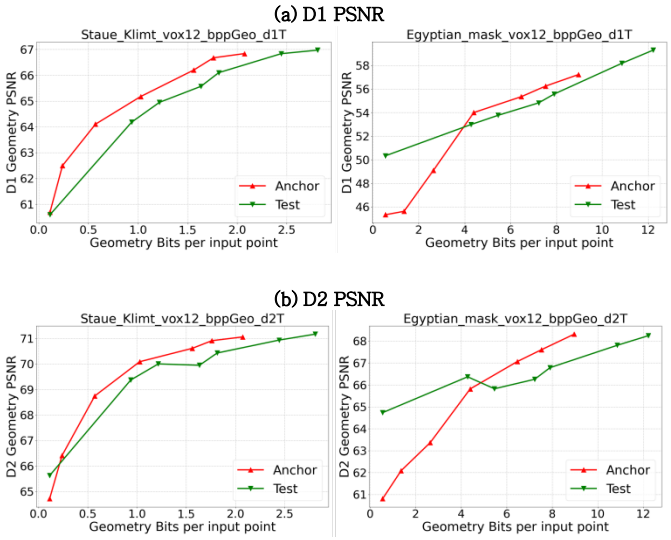

Figure 2. Performance comparison using rate-distortion curves for sparse contents

Ⅳ. Conclusion

We conducted experiments by applying the SGD optimizer on the PCGCv2 model instead of the traditional method of using the ADAM optimizer. We found that the SGD optimizer did not improve the performance of PCGCv2 compared to conventional method. However, there exist several points where the SGD optimizer outperforms ADAM, and it is also apparent that making use of SGD eventually converges in a higher PSNR point although more memory is required. Putting these results into account, and also considering the fact that SGD usually outperforms ADAM when given more training time, we believe that the results obtained in this work is encouraging, and that there can be potential improvement in PCGCv2's performance when using various types of optimizers instead of the conventional ADAM.

ACKNOWLEDGMENT

This research was supported by the This research was supported by the MSIT(Ministry of Science and ICT), Korea, under the ITRC (Information Technology Research Center) support program (IITP-2021-0-02046) supervised by the IITP(Institute for Information & communications Technology Promotion).

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