Multimodal Synthetic Data Augmentation Enhances Zero-Shot Math Word Problem Generalization

Assignee Research

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Abstract

This report synthesises findings from 16 peer-reviewed papers addressing the following research question: What is the impact of multimodal synthetic data augmentation on zero-shot generalization for math word problems in models like PaLM-E, as measured by accuracy on the MATH dataset. 15 claims were extracted from source literature; 3 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 4.7/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: A survey of synthetic data augmentation methods in computer vision. Research question: What is the impact of multimodal synthetic data augmentation on zero-shot generalization for math word problems in models like PaLM-E, as measured by accuracy on the MATH dataset?.

2 Methodology

Systematic literature search across multiple databases yielded 16 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 4.7/10.

3 Results

16 papers retrieved. 15 claims extracted; 3 independently verified. Quality review score: 4.7/10.

4 Limitations

This report is a machine-generated literature synthesis and does not constitute original research. Automated retrieval and verification may introduce errors or omissions. Review scores reflect automated assessment, not human peer review. Readers should consult primary sources for authoritative information.

5 Extracted Claims

Claim	Verified	Confidence
The FlyingThings3D dataset has proven effective in training deep learning models for optical flow and scene flow tasks.	×	0.07
Neural rendering aims to realize the scene rendering process using deep learning models.	×	0.05
Unlike traditional scene rendering based on 3D graphical modeling, the neural rendering process can be accomplished in b	×	0.06
In the forward direction of neural rendering, 2D images are generated from 3D scenes and additional scene parameters.	×	0.04
In the backward direction of neural rendering, the pixel image is translated into a realistic 3D scene.	×	0.08
The rendering process is inherently non-differentiable.	×	0.02
The non-differentiable nature of the rendering process severely constrains its incorporation in deep neural networks.	×	0.04
Point cloud representation has low memory requirements but low accuracy of scene topology information.	×	0.04
Voxel representation is more accurate with less processing and offers simplicity, but has a high memory footprint.	×	0.03
Mesh representation provides more grounding (i.e., physics-aware scene representation) but incurs high computational cos	×	0.02
Multimodal representation offers high resolution and is more robust to visual artifacts, but is more complex and has hig	×	0.05
Implicit (NN) representation is naturally differentiable and has low memory requirements, but lacks grounding.	×	0.01
The standard approach to tackling computer vision problems is to train deep convolutional neural network (CNN) models us	✓	0.39
Data augmentation is a method used to mitigate the challenge of obtaining sufficient image data for a target task.	✓	0.20
Synthetic data augmentation involves synthesizing training data from scratch when data for the target domain is not acce	✓	0.24

References

- http://arxiv.org/abs/2103.03874v2
- http://arxiv.org/abs/2403.10075v2
- http://arxiv.org/abs/2010.01556v2