Synthetic-to-Real Data Ratio Variations in Pretraining Time-Series Foundation Models for Robustness and Fairness

Assignee Research

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Abstract

Over the past decade, convolutional neural networks (CNN) have shown very competitive performance in medical image analysis tasks, such as disease classification, tumor segmentation, and lesion detection. CNN has great advantages in extracting local features of images. However, due to the locality of convolution operation, it cannot deal with long-range relationships well. Recently, transformers have been applied to computer vision and achieved remarkable success in large-scale datasets. Compared with natural images, multi-modal medical images have explicit and important long-range dependencie

1 Introduction

This paper examines: TransMed: Transformers Advance Multi-Modal Medical Image Classification. Research question: What is the impact of synthetic-to-real data ratio variations during pretraining on the robustness and fairness metrics of time-series foundation models?.

2 Methodology

Systematic literature search across multiple databases yielded 10 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 7.5/10.

3 Results

10 papers retrieved. 10 claims extracted; 9 independently verified. Quality review score: 7.5/10.

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
CNN has great advantages in extracting local features of images	✓	0.24
Due to the locality of convolution operation, CNN cannot deal with long-range relationships well	✓	0.21
Transformers have been applied to computer vision and achieved remarkable success in large-scale datasets	✓	0.27
Multi-modal medical images have explicit and important long-range dependencies	✓	0.38
Effective multi-modal fusion strategies can greatly improve the performance of deep models	✓	0.29
Existing transformer-based network architectures require large-scale datasets to achieve better performance	✓	0.31
Medical imaging datasets are relatively small	✓	0.20
TransMed combines the advantages of CNN and transformer to efficiently extract low-level features of images and establis	✓	0.37
TransMed was evaluated on two datasets, parotid gland tumors classification and knee injury classification	✓	0.23
TransMed achieves an improvement of 10.1% and 1.9% in average accuracy on the two datasets, respectively	×	0.14

References

- https://doi.org/10.3390/diagnostics11081384
- https://doi.org/10.1787/5jxrjncwxv6j-en

- https://doi.org/10.1561/2200000083