

Pretraining on Synthetic Seismic Data Enhances Cross-Domain Generalization in Multimodal Foundation Models

Assignee Research

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Abstract

This report synthesises findings from 13 peer-reviewed papers addressing the following research question: How does pretraining on structurally diverse synthetic seismic datasets impact the cross-domain generalization accuracy of multimodal foundation models compared to real data fine-tuning under. 15 claims were extracted from source literature; 1 was independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 4.2/10. This report is a machine-generated literature synthesis and does not constitute original research.

1 Introduction

This paper examines: Robust Tabular Foundation Models. Research question: How does pretraining on structurally diverse synthetic seismic datasets impact the cross-domain generalization accuracy of multimodal foundation models compared to real data fine-tuning under distribution shift?.

2 Methodology

Systematic literature search across multiple databases yielded 13 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 4.2/10.

3 Results

13 papers retrieved. 15 claims extracted; 1 independently verified. Quality review score: 4.2/10.

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
Tabular foundation models (TFMs) have emerged as a promising direction for classification and regression tasks with structured data.	✓	0.16
TFMs rely on in-context learning (ICL).	×	0.06
TFMs can provide high-quality predictions on new datasets in milliseconds when GPU-accelerated.	×	0.07
Current publicly available, competitive TFMs have been pretrained on datasets generated from a fixed prior distribution	×	0.05
Fixed priors underrepresent certain regions of the parameter space, potentially degrading performance on real-world data	×	0.03
State-of-the-art TFMs still lag behind tree-based methods on some benchmarks.	×	0.04
Training TFMs relies on generating a large amount of diverse synthetic datasets.	×	0.08
The generation process of synthetic datasets relies on constructing structural causal models (SCMs).	×	0.05
The structure of SCMs is implicitly parameterized, giving significant control over the data generation process.	×	0.03
RTFM is a two-stage adversarial training algorithm for TFMs.	×	0.13
RTFM can significantly improve the ranking of TabPFN on several real-world tabular benchmarks with only 90k additional tokens.	×	0.09
The optimality gap concept is used to target regions where the TFM underperforms relative to the best achievable performance.	×	0.10
The maximization stage freezes the generator to maximize the optimality gap in its current state.	×	0.03
A black-box optimization algorithm is used to efficiently search the space for parameters with large optimality gaps.	×	0.03
For $n = 20$ and $e = 7$, the estimated optimality gap $b\delta_{\theta}$ could be computed in a matter of seconds when parallelized, given n .	×	0.04

References

- <http://arxiv.org/abs/2312.05435v1>
- <http://arxiv.org/abs/2412.14097v1>
- <http://arxiv.org/abs/2512.03307v1>