

# Causal Structure Complexity and Fine-Tuning Efficiency in Tabular Foundation Models

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 varying levels of causal structure complexity in synthetic data on the fine-tuning efficiency (measured in epochs or training time) of tabular foundation models evaluated on. 10 claims were extracted from source literature; 0 were independently verified against retrieved documents. An automated multi-reviewer quality assessment produced a score of 3.8/10. 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: What is the impact of varying levels of causal structure complexity in synthetic data on the fine-tuning efficiency (measured in epochs or training time) of tabular foundation models evaluated on benchmarks like TabPFN or TAB-MNIST?.

## 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 3.8/10.

## 3 Results

16 papers retrieved. 10 claims extracted; 0 independently verified. Quality review score: 3.8/10.

## 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) rely on in-context learning (ICL) for classification and regression tasks with structured data.	×	0.11
TFMs can produce high-quality predictions on new datasets in milliseconds when GPU-accelerated.	×	0.07
Training TFMs relies on generating diverse synthetic datasets constructed from structural causal models (SCMs).	×	0.07
All current publicly available, competitive TFMs have been pretrained on datasets generated from a fixed prior distribution.	×	0.06
Fixed priors in TFM training underrepresent certain regions of the parameter space, potentially degrading performance on some benchmarks.	×	0.07
State-of-the-art TFMs lag behind tree-based methods on some benchmarks.	×	0.05
The proposed RTFM algorithm applied to TabPFN V2 used only 90k additional training datasets.	×	0.11
Applying RTFM to TabPFN V2 significantly improved its ranking on several real-world tabular benchmarks.	×	0.10
In the described methodology, the estimated optimality gap could be computed in a matter of seconds when parallelized with 100 cores.	×	0.04
The methodology implementation used $n$ cores equal to the product of $n_{\text{nodes}}$ (20) and $e$ (7).	×	0.02

## References

- <http://arxiv.org/abs/2507.07829v1>

- <http://arxiv.org/abs/2603.10254v1>
- <http://arxiv.org/abs/2512.03307v1>