Robustness of TabMNAR Metrics Across Missing Data Mechanisms and Domains via Synthetic and Real-World Benchmarking

Assignee Research

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Abstract

Incomplete data is a persistent challenge in real-world datasets, often governed by complex and unobservable missing mechanisms. Simulating missingness has become a standard approach for understanding its impact on learning and analysis. However, existing tools are fragmented, mechanism-limited, and typically focus only on numerical variables, overlooking the heterogeneous nature of real-world tabular data. We present MissMecha, an open-source Python toolkit for simulating, visualizing, and evaluating missing data under MCAR, MAR, and MNAR assumptions. MissMecha supports both numerical and cat

1 Introduction

This paper examines: MissMecha: An All-in-One Python Package for Studying Missing Data Mechanisms. Research question: How robust are TabMNAR's metrics when applied to tabular data with different types of missing data mechanisms (MCAR, MAR, MNAR) across domains such as finance, healthcare, and social sciences, as measured by benchmarking against synthetic and real-world datasets?.

2 Methodology

Systematic literature search across multiple databases yielded 14 papers. Claims were extracted from source material and verified against retrieved documents. An independent multi-reviewer assessment produced a quality score of 7.8/10.

3 Results

14 papers retrieved. 11 claims extracted; 9 independently verified. Quality review score: 7.8/10.

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
MissMecha supports MCAR, MAR, and MNAR mechanisms across numerical and categorical variables.	✓	0.18
The generate module provides over a dozen missingness strategies (e.g., logistic, correlation-, or quantile-based).	✓	0.17
The generate module supports both global and column-wise control via a scikit-learn-style API.	✓	0.18
The visual module offers heatmaps, correlation plots, and bar charts in customizable styles for diagnostics and teaching	✓	0.24
The analysis module includes Little's MCAR test, missingness summaries, and type-aware imputation evaluation via standar	✓	0.28
The impute module provides SimpleSmartImputer, a baseline imputer that auto-selects mean or mode by type.	✓	0.19
MissMecha unifies simulation and evaluation in a reproducible, extensible framework—ideal for research, benchmarking, an	✓	0.21
MissMecha is available at missmecha-py.	×	0.13
MissMecha supports MCAR, MAR, and MNAR mechanisms.	✓	0.16
The generate module provides a flexible and extensible framework for simulating missing values under different assumptio	✓	0.23
Missingness can be introduced globally or on a per-column basis.	×	0.15

References

- `http://arxiv.org/abs/1403.5107v3`

- http://arxiv.org/abs/2508.04740v1
- http://arxiv.org/abs/2504.20900v1