TIME SERIES FORECASTING IN THE INSURANCE SECTOR: A COMPARATIVE ANALYSIS OF FOUNDATION MODELS AND DEEP LEARNING

Simeon Monov, Zlatomila Mincheva, Nikolay Pavlov, Maria Dobreva

Abstract. *Forecasting methodologies for time series are increasingly shifting from specialized architectures designed for individual tasks toward large-scale pre-trained Time Series Foundation Models [1, 2]. Recent studies indicate that such models demonstrate strong cross-domain generalization and can reduce the cold-start problem associated with localized training on limited datasets [1, 2]. Despite these advantages, their effectiveness within highly specialized application domains, such as the insurance industry, remains insufficiently explored.*

This study presents a comparative evaluation of modern forecasting approaches applied to insurance-related time series data. The experimental framework employs two datasets: a publicly available health insurance claims dataset and a proprietary enterprise-level insurance dataset. Within this setup, traditional statistical baselines such as ARIMA are compared with modern Deep Learning architectures, including Long Short-Term Memory networks and Temporal Convolutional Networks [3], as well as a contemporary Time Series Foundation Model [1, 2].

The evaluation considers three primary dimensions: predictive accuracy during periods of elevated claim volatility, computational resources required for model training and adaptation, and the engineering effort needed for feature extraction and preprocessing. In addition, the study examines several TSFM adaptation strategies, including zero-shot forecasting, few-shot in-context learning, and full parameter fine-tuning. By systematically comparing these approaches across both public and proprietary datasets, the study provides a quantitative basis for assessing the trade-off between predictive performance and deployment complexity when applying foundation models to domain-specific forecasting tasks in the insurance sector.

Key words: Time Series Forecasting, Time Series Foundation Models, Deep Learning, Insurance Analytics, Empirical Evaluation, Model Adaptation, ARIMA, LSTM, TCM

Acknowledgments

The research is supported by project FP25-FMI-010 "Innovative interdisciplinary research in Informatics, Mathematics, and Pedagogy of Education" of the Scientific Fund of the Paisii Hilendarski University of Plovdiv, Bulgaria.

References

[1] Das, W. Kong, R. Sen, Y. Zhou, A Decoder-Only Foundation Model for Time-Series Forecasting, *arXiv preprint* arXiv:2310.10688, 2023

[2] F. Ansari et al., Chronos: Learning the Language of Time Series, *Transactions on Machine Learning Research (TMLR)*, 2024

[3] S. Bai, J. Kolter, V. Koltun, An Empirical Evaluation of Generic Convolutional and Recurrent Networks for Sequence Modeling, *Proc. of the 35th International Conference on Machine Learning (ICML)*, 2018

Simeon Monov[1,*], Zlatomila Mincheva[1], Nikolay Pavlov[1], Maria Dobreva[1]
[1] Paisii Hilendarski University of Plovdiv,
Faculty of Mathematics and Informatics,
236 Bulgaria Blvd., 4027 Plovdiv, Bulgaria
Corresponding author: `smonov@uni-plovdiv.bg`