

Conflict-Indexed Demand Forecasting in War Zones Using LSTM and Checkpoint-Aware Features

Shaymaa Safadi

Gaziantep University
Türkiye

safadishaymaa@gmail.com

Nadjib Brahimi

Rennes School of Business
France

Mohanad Rezek

Assistant Professor
Faculty of Administrative and Finance
Palestinian Territory

Mohammad Kouali

Assistant Professor
Palestine Ahliya University
Palestinian Territory
mkouali@paluniv.edu.ps

Abstract

Accurate demand forecasting in conflict-affected humanitarian supply chains is hindered by sparse needs assessments and checkpoint logs that offer limited temporal detail and little predictive value. This study proposes an LSTM-based forecasting model for humanitarian logistics in active war zones, where demand surges, checkpoint closures, and weather disruptions interact dynamically. The main contribution is a three-stream feature engineering framework that integrates conflict-event data from GDELT (Global Database of Events, Language, and Tone), a normalized conflict-intensity index with trainable event-type weights, and weather variables transformed into logistics-relevant disruption indicators. All features are normalized and converted into supervised sequences using a sliding-window approach. The model is evaluated using one year of operational data from the Bab al-Hawa humanitarian corridor in northern Syria and compared with Moving Average and ARIMA benchmarks. Against ARIMA, the proposed model reduces humanitarian workload RMSE by 4.6%, while maintaining superior forecast stability across the full 14-day planning horizon. Results indicate that the proposed approach improves forecast stability across the planning horizon while preserving location-level heterogeneity across 32 distribution centers. These findings suggest that conflict-indexed, domain-specific features are a key driver of robust demand forecasting in volatile humanitarian settings and can support more proactive rolling-horizon logistics planning.

Keywords

LSTM; humanitarian logistics; demand forecasting; conflict intensity; supply chain disruption.