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MAGAZINE

Forecasting demand when the market changes: Afliant’s AI models put to the test with FBK

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As part of AI-MATTERS, FBK validated Afliant's forecasting models and tested the latest generation of deep learning to estimate sales, even with sparse or irregular data.

Knowing in advance how much of a product will sell is the first step toward effective inventory management: it allows companies to reduce stock without running out of products. A single missing component can halt production lines in industrial plants, leading to major economic and logistical consequences. This is a daily challenge for businesses—and one that artificial intelligence can help address, provided the models still perform when data lacks a regular pattern.

This need sparked a collaboration between Afliant and the Data Science for Industry and Physics (DSIP) unit at FBK’s Center for Digital Industry, developed under the European project AI-MATTERS between July 2025 and February 2026. Co-funded by the Digital Europe Programme, AI-MATTERS is a network of Testing and Experimentation Facilities (TEFs) that supports companies in testing and validating artificial intelligence and robotics solutions for manufacturing. In Italy, the project hub is coordinated by MADE Competence Center I4.0 and includes FBK and Reply.

Afliant is a Trento-based tech company that designs digital platforms, integrates systems, and develops data- and AI-driven products for various industries. Its proprietary solutions include Mantissa, a demand estimation platform that optimizes reordering and supply chain processes. Mantissa’s forecasting models were central to the collaboration with FBK, structured around two AI-MATTERS services: “Validation of AI models for time series forecasting and anomaly detection in the manufacturing sector” and “Time series forecasting.”

when sales don’t follow the rules

For many products, from consumer goods to semi-finished goods sold by large wholesalers, historical sales data is enough to accurately predict demand fluctuations. In other sectors, however, the market operates differently: seasonal peaks can be hard to anticipate, historical records may be brief, and returns, demo products, and promotions add further variability. The resulting time series

exhibit erratic and irregular trends, making accurate forecasts difficult even for well-established models.

The project had two main objectives: to verify the reliability of Afliant's existing models against benchmark datasets, and to experiment with new AI techniques to reduce forecasting errors in the most challenging scenarios.

From benchmarks to deep learning

The project unfolded across four phases:

In the initial phase, FBK researchers analyzed the models available on the Mantissa platform and tested them against various public benchmark datasets from scientific literature. The selected time series covered different timeframes, items, and retail locations, reflecting the scenarios Afliant encounters in its everyday operations.

Classical statistical models served as a baseline, evaluated alongside state-of-the-art error metrics. Normalizing these metrics against a reference model allowed for a fair comparison across datasets with vastly different trends and complexity levels.

In the second phase, the team explored cutting-edge deep learning architectures for sales forecasting. Each model was evaluated for both accuracy and runtimes (training and forecast generation speed)—two decisive factors for production-ready solutions.

Results and outlook

Validation confirmed that Mantissa's models are overall competitive with traditional statistical models. On a supply chain dataset featuring 23 years of historical data and strong seasonality, Mantissa's models achieved significantly better results, demonstrating a superior ability to automatically capture long-term trends compared to baseline statistical models.

The analysis also enabled FBK to outline key guidelines for the platform's ongoing development, including:

- Adopting a progressive model retraining procedure
- Introducing simpler statistical models as fallbacks for anomalous time series (e.g., those with frequent missing values)

Experiments with deep learning models yielded architectures and paradigms that can complement those currently implemented in Mantissa.

One example is Chronos-2 (released by Amazon), one of the first foundation models for time series. Able to process incomplete data, these models are pre-trained on diverse, heterogeneous data across multiple sectors—such as energy and retail—as well as on synthetic datasets. Their primary advantage is out-of-the-box utility without the usual training phase. While this approach works well for regular series, its full potential is unlocked through fine-tuning adapted to specific scenarios. However, fine-tuning requires time and computing resources that aren't always available. For this reason, the team also evaluated more compact architectures (such as TiDE) that deliver strong performance even under hardware constraints.

At the project's conclusion, Afliant gains an independent evaluation of its models, a suite of benchmark datasets, and code for the advanced models developed by FBK. These deliverables

provide a solid foundation for enhancing the accuracy and reliability of Mantissa’s forecasts, particularly in unpredictable market conditions.

The collaboration between Afliant and Fondazione Bruno Kessler demonstrates how AI-MATTERS services empower companies to validate their AI solutions alongside leading researchers—mitigating risk and accelerating innovation.

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