Forecasting in the AI Era: Advantages, Challenges, and the Shift in the Forecaster's Role

Nitzi Roehl, Ph.D.

Sr. Manager Analytical Consulting

Outline

TRENDS IN THE ROLE OF THE FORECASTER

AI IN RETAIL AND CPG DEMAND FORECASTING

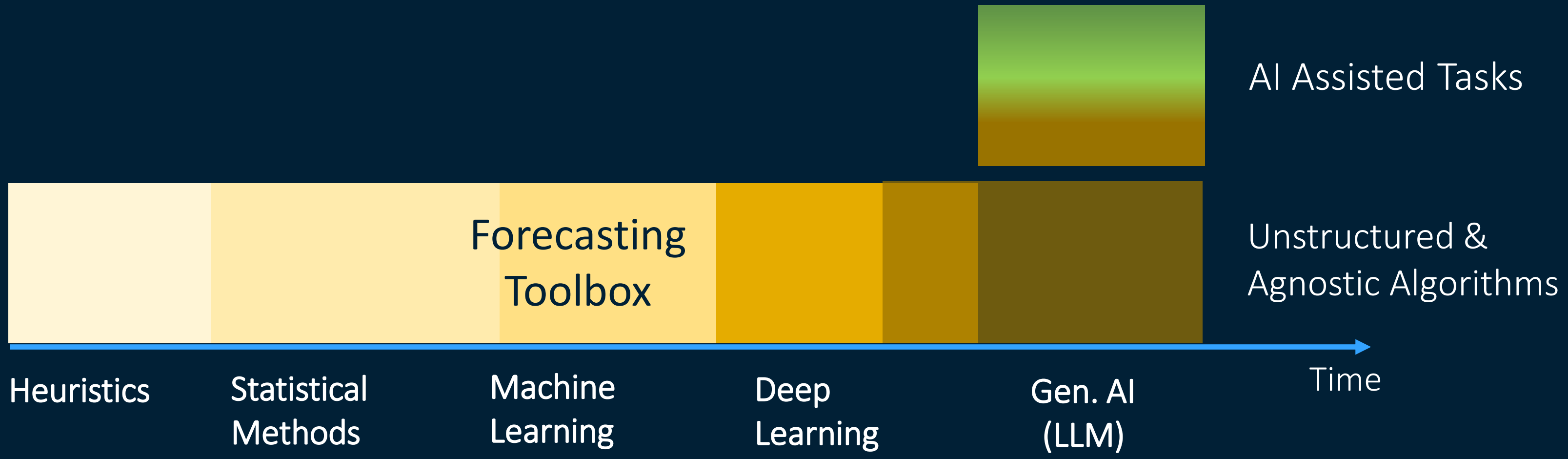
PRACTICAL CONSIDERATIONS & WAYS FORWARD

Trends in the Role of the Forecaster

The Emergence of AI

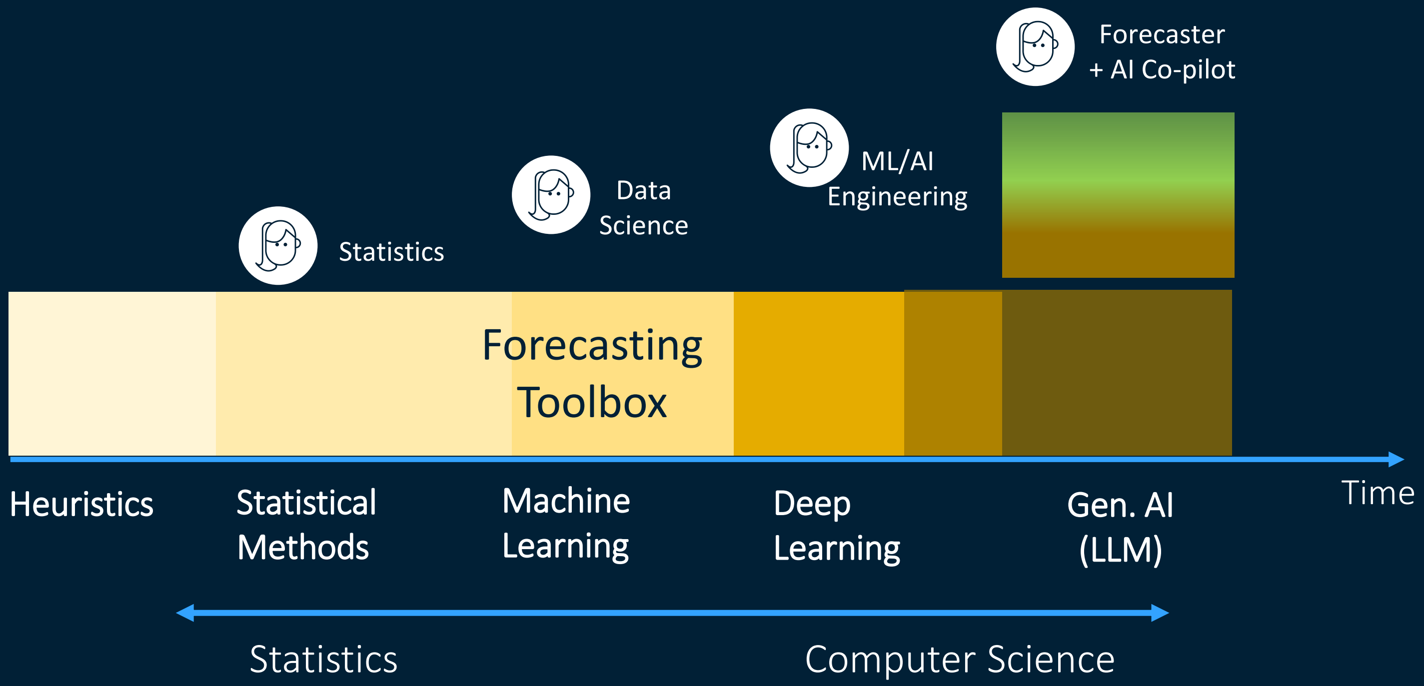
The Emergence of AI in Forecasting

Beyond the Toolbox



Trends in the Role of the Forecaster

The Shift in the Skills of the Forecaster



The Role of the Forecaster Today

More than just Model Building

Data Engineer/ Integration

Process Automation

Forecaster

Business Validation

Business User

Business Decisions

Data cleansing:
- Duplicate removal
- Rounding
- Null values removal
- Timeseries extension
- ....

Data enrichment:
- Understand data & business problem
- Define forecasting strategy/approach
- Feature Engineering
- Outlier handling

Build models:
- Pipelines creation
- Hyperparameters tuning
- Model Selection
- Adjust forecasts

Monitoring:
- Track performance
- Explain forecasts

Tune Forecasts:
- Propose model changes
- Roll-out changes

Upstream Processes → Preprocessing → Forecasting → Postprocessing & Reporting → Downstream Processes

Trends in the Forecaster’s Role

Skills that Will Grow in Importance

Data Engineer/ Integration

Process Automation

Forecaster
+ AI Co-pilot

Business Validation

Business User

Business Decisions

Innovation

Data cleansing:
- Duplicate removal
- Rounding
- Null values removal
- Timeseries extension
- ....

Data enrichment:
- Understand data & business problem
- Define forecasting strategy/approach
- Feature Engineering
- Outlier handling

Build models:
- Pipelines creation
- Hyperparameters tuning
- Model Selection
- Adjust forecasts

Monitoring & Reporting:
- Track performance
- Explain forecasts/Facilitate adoption

Tune Forecasts:
- Propose model changes
- Supervise roll-out of changes

Upstream Processes → Preprocessing → Forecasting → Postprocessing & Reporting → Downstream Processes

sas

Some Experiences From the Field

AI in Retail and CPG Demand Forecasting

Retail and CPG Demand Forecasting

Main Challenges

LIMITED HISTORY

Products are becoming more and more short lived.

NEW PRODUCT PROLIFERATION

Varying lengths of series with increase in new product launches.

INTERRELATED TIME SERIES

Highly correlated series, organized in a hierarchical structure (cannibalization and halo effects)

IMPORTANCE EXTERNAL FACTORS

Demand is influenced by multiple business and economic factors, and calendar related events

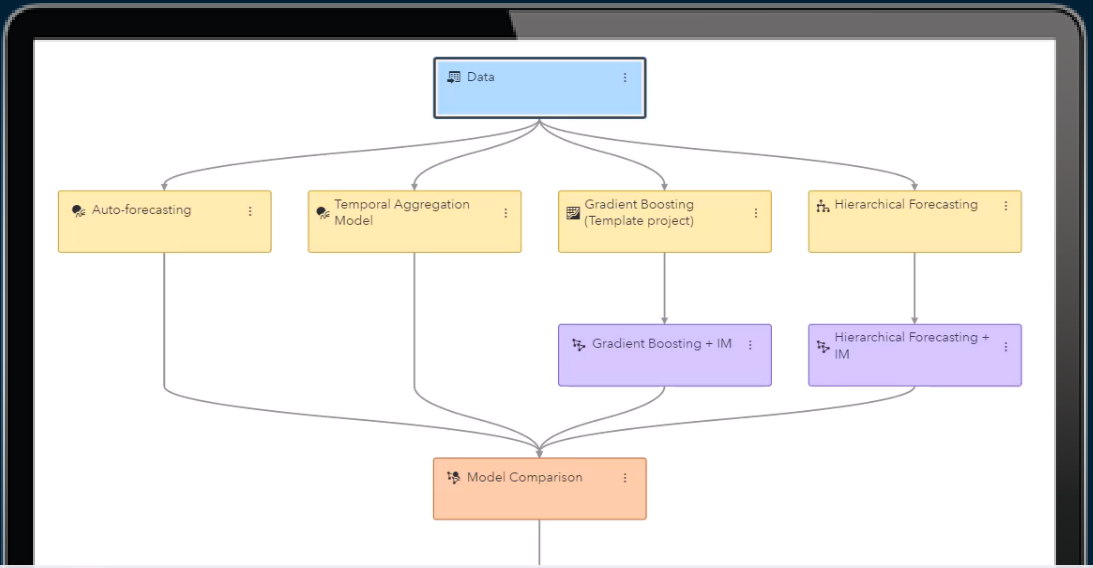
LARGE SCALE PROBLEM

Large catalog of products w/ multiple dimensions (product, location, customer) and forecast granularities

SPARSITY and NOISE

Intermittency, low volume and elevated noise at the detailed forecast levels

Use Case #1: Operational Forecasting at a Large CPG Company



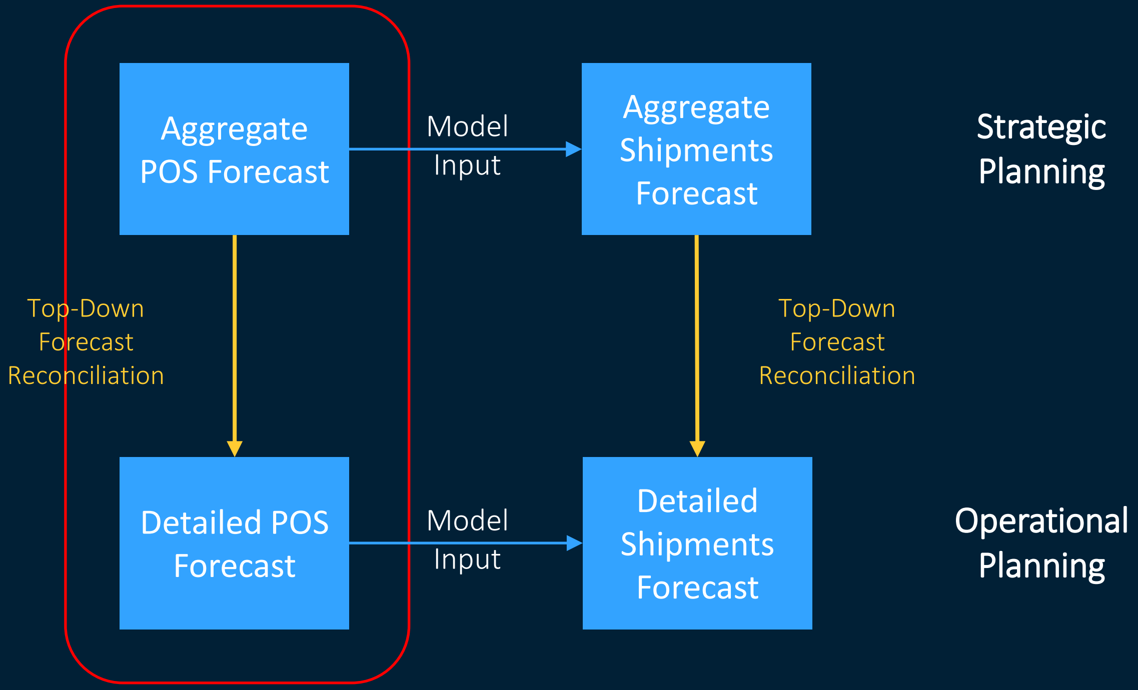
- Shipments forecast
- Product(UPC)/DC/Customer/Week level
- GBM augmented with statistical methods
- Recursive implementation
- Covariates: promotions, discontinuation and holiday events
- Temporal effects

Model Comparison

Champion	Model Name	Status	WMAE	WMAPE	WMASE	WASE	WRMSE	WAPE
★	Gradient Boosting + IM	Successful	504.2337	12.4303	0.2867	0.6895	768.9309	0.1663
	Auto-forecasting	Successful	896.9781	45.5625	11,631,096.9907	1.1033	1,179.3615	0.3295
	Hierarchical Forecasting + IM	Successful	952.6966	51.2297	0.5930	1.0913	1,235.3588	0.3453
	Temporal Aggregation Model	Successful	788.1415	56.3225	0.6937	1.1473	1,056.7853	0.3380

Use Case #2: Consumption-Based Forecasting in CPG

Multilevel Forecasting Process

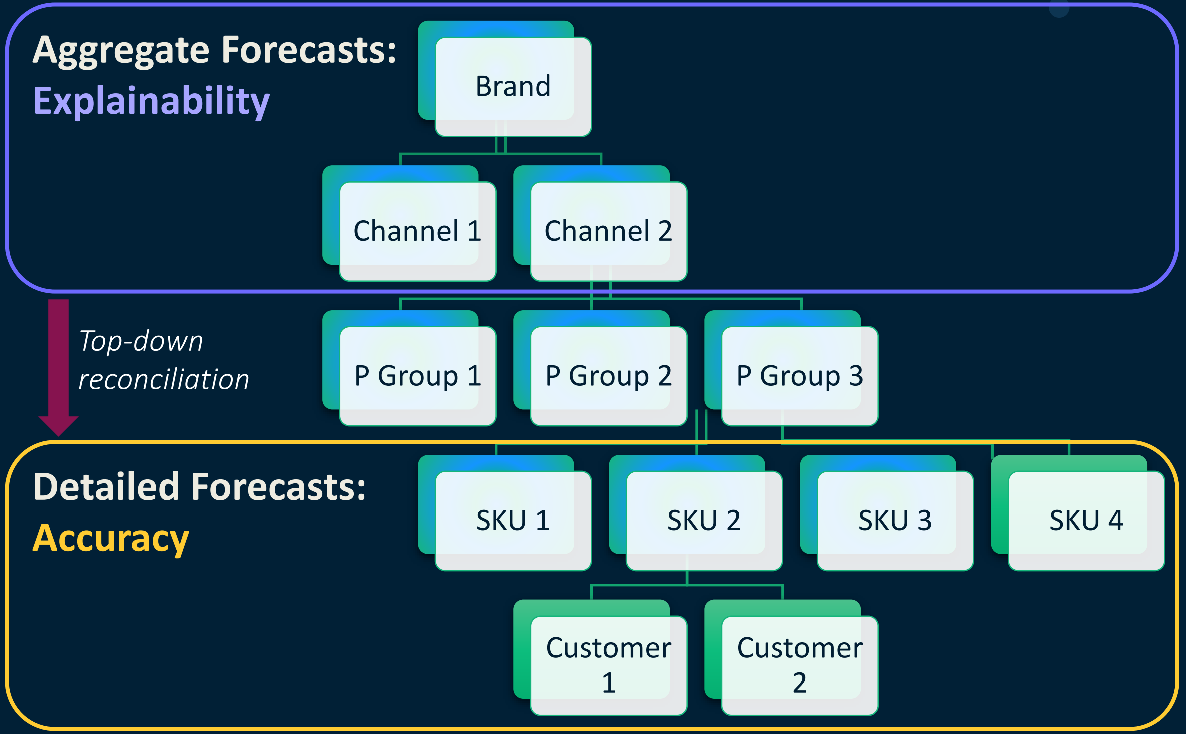


POS Forecast

One Size Does Not Fit All

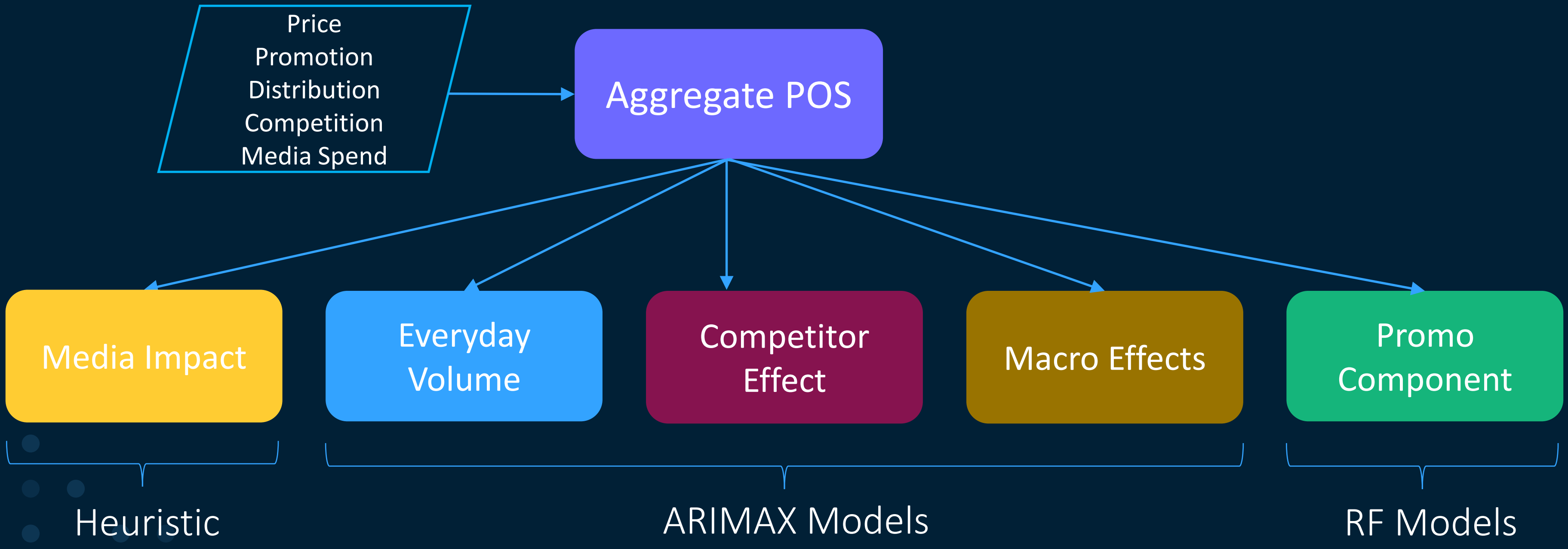
- Hybrid (TS+ML) forecast models
- Balance accuracy + explainability
- Adjust for hierarchical differences

Hybrid



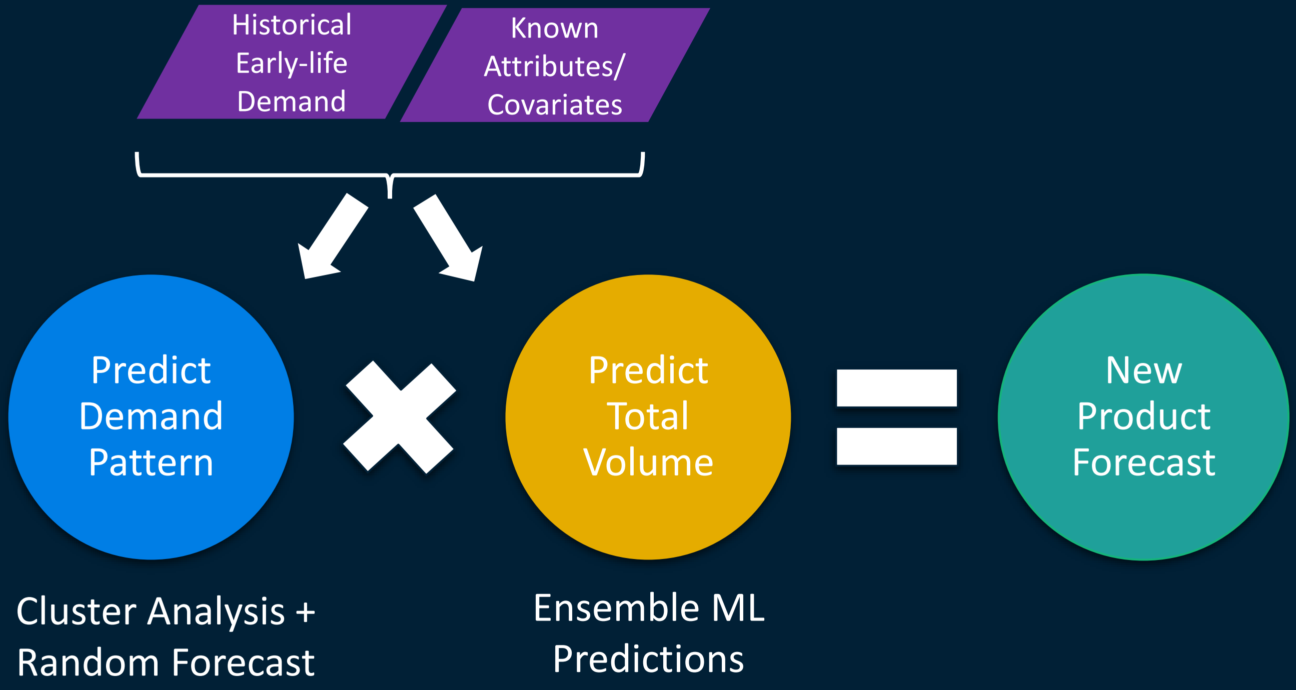
Aggregate POS Forecast

What are the key factors that explain consumer demand?



Use Case #3: New Product Launch in Retail

A ML-Based Approach



AI in Retail and CPG Demand Forecasting

Key Findings & Practical Challenges

- Predominance of tree-based methods
- Global Models/cross-learning
- Hybrid Approaches & Ensemble
- One size does not fit all
- Interpretability vs Accuracy
- Not as many DL based implementations

- Data readiness/availability
- Companies' analytical maturity
- Implementation complexity
- Computational resources/costs
- Trust/Adoption issue

AI in Time Series Forecasting

Path Forward

- Technology Advancements
- Reduce Implementation Costs
- Enterprise Adoption

- More research on interpretable DL based models
- Forecasting with Attention
- Pre-trained/Foundation Model for forecasting
- Real-word applications of DL based methods across different domains
- Forecasting practitioner strategic role in the last mile

Q&A

Thank you!

Nitzi.Roehl@sas.com

sas.com

Suggested References

AI in Forecasting

Makridakis, S. , Spiliotis, E., & Assimakopoulos, V. (2020). The M5 accuracy competition: Results, findings, and conclusions. Research Gate

Makridakis, S., et al. (2023). Statistical, machine learning and deep learning forecasting methods: Comparisons and ways forward, Journal of the Operational Research Society, 74:3, 840-859.

Tim Januschowski , Yuyang Wang, Kari Torkkola, Timo Erkkilä, Hilaf Hasson & Jan Gasthaus (2022) Forecasting with trees. International Journal of Forecasting 38: 1473-1481

Bryan Lima, Sercan O. Arık , Nicolas Loeffb , and Tomas Pfister. Temporal Fusion Transformers for Interpretable Multi-horizon Time Series Forecasting, International Journal of Forecasting, 37(4):1748-1764, 2021.

Konstantinos Benidis et al. (2022). Deep Learning for Time Series Forecasting: Tutorial and Literature Survey. ACM Computing Surveys, Volume 55 Issue 6 Article No.: 121, pp 1–36.

Spiros Potamitis & Michele Trovero & Joe Katz, 2023. "A Glimpse into the Future of Forecasting Software," Foresight: The International Journal of Applied Forecasting, International Institute of Forecasters, issue 71, pages 50-54, Q4.

Michele Trovero & Spiros Potamitis, 2023. "How Will Generative AI Influence Forecasting Software?," Foresight: The International Journal of Applied Forecasting, International Institute of Forecasters, issue 71, pages 55-61, Q4.