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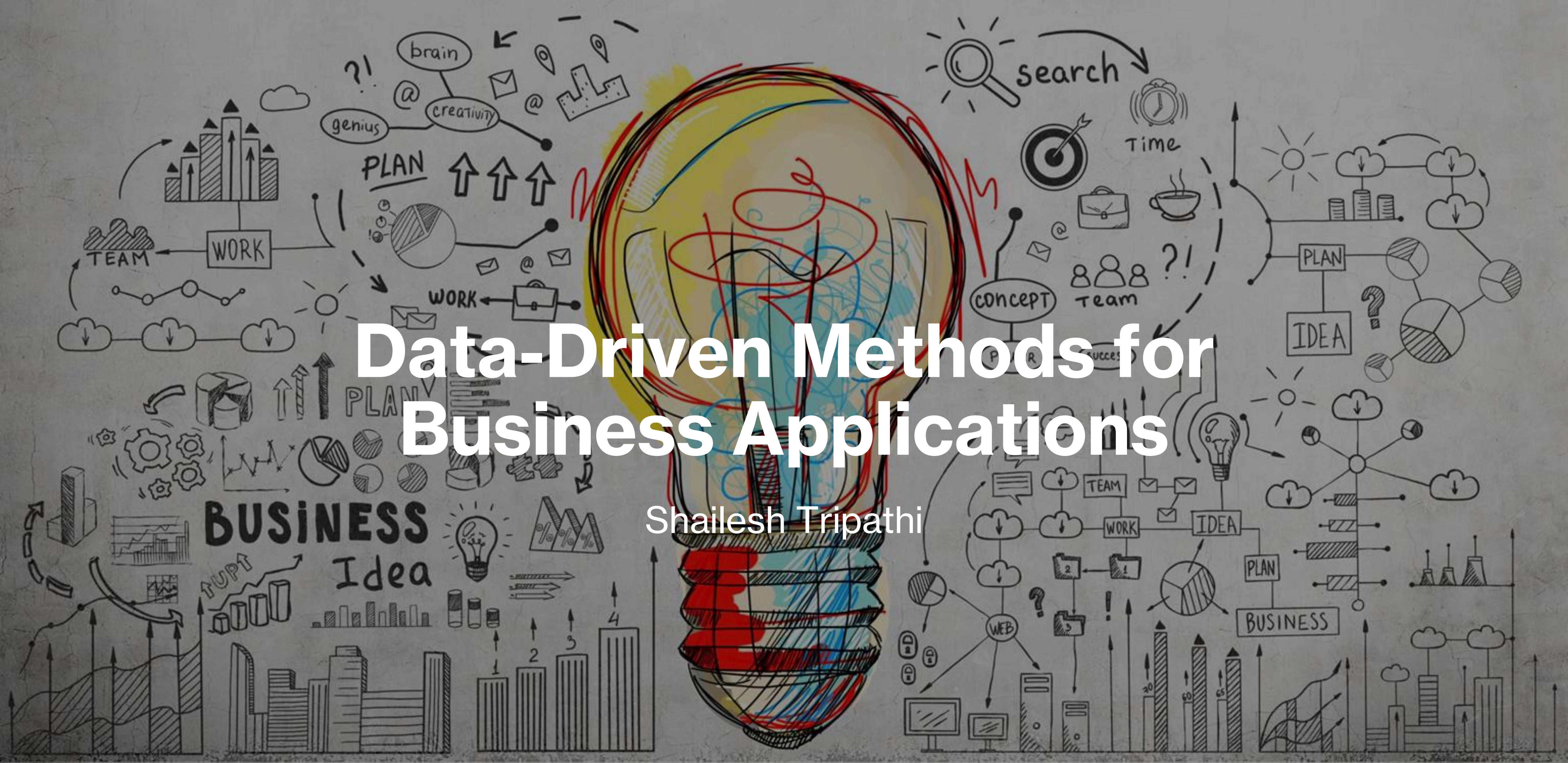
Shailesh Tripathi

Data-Driven Methods for Business Applications

Shailesh Tripathi



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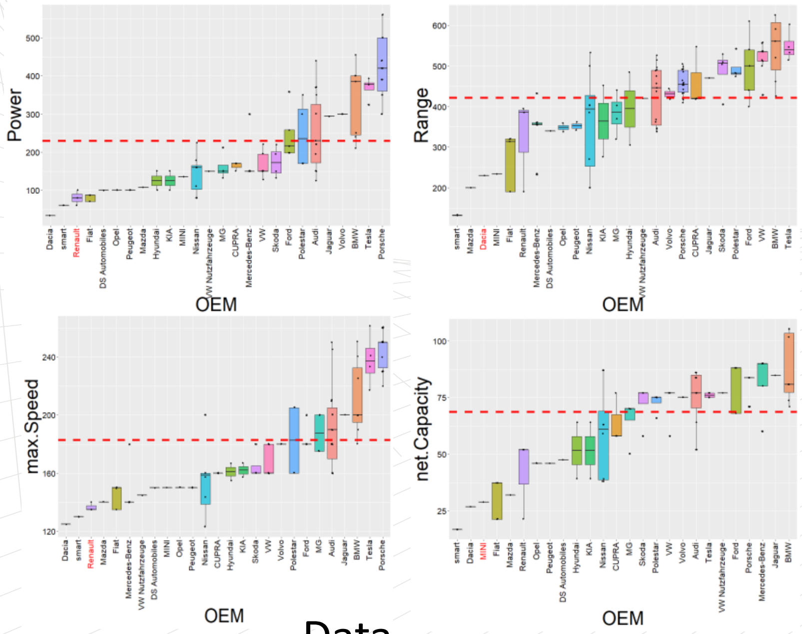
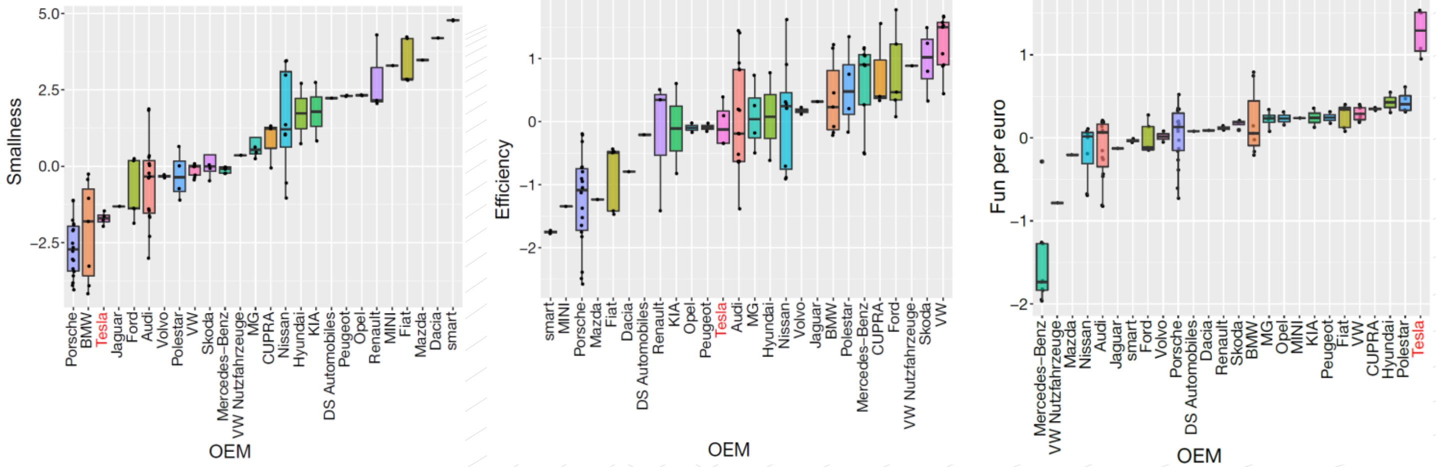
Data-driven methods and applications

- **Reducing complexity:** Leverage **Principal Component Analysis** (PCA) for dimensionality reduction, capturing key insights for interpretable features, segmentation, and trend analysis
- **Understanding complex relationships**: Apply **cross-impact analysis** to identify key drivers and understand the factors influencing business outcomes
- **Controlling production processes:** Implement **predictive control** in production and manufacturing to manage production processes with fluctuating input variables like raw material quality variation, and tool wear, while ensuring high-quality output standards
- **Reimagining energy storage:** Optimize energy cost using **energy-aware scheduling** with integrated planning for inventory, labor, and investment for sustainable outcomes
- **Enhancing business decisions:** Harness **natural language processing techniques** by extracting meaningful insights from unstructured text data for semantic interpretation and automated analysis

Reducing complexity

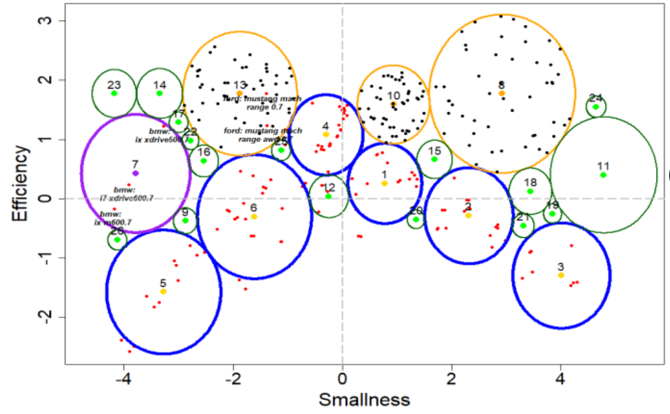


Data



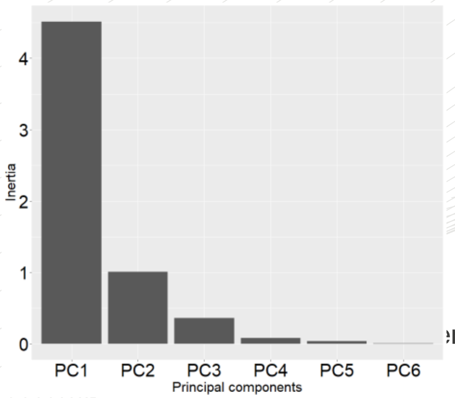
New interpreted features

Jodlbauer, H., Tripathi, S., Bachmann, N., & Brunner, M. (2024). Unlocking hidden market segments: A data-driven approach exemplified by the electric vehicle market. *Expert Systems with Applications*, *254*, 124331.



Clustering

PCA



	Price	Range	Power	max.Speed	net.Capacity	gross.Capacity
PC1	-0.4	-0.35	-0.43	-0.41	-0.42	-0.43
PC2	-0.44	0.53	-0.37	-0.38	0.38	0.33
PC3	-0.36	0.61	0.12	0.46	-0.34	-0.4
PC4	0.67	0.47	-0.11	-0.45	-0.24	-0.24
PC5	0.27	-0.02	-0.81	0.52	-0.02	0.1
PC6	0.06	-0.04	-0.06	0.03	0.71	-0.7

→ **Smallness**

→ **Efficiency**

→ **Fun per euro**

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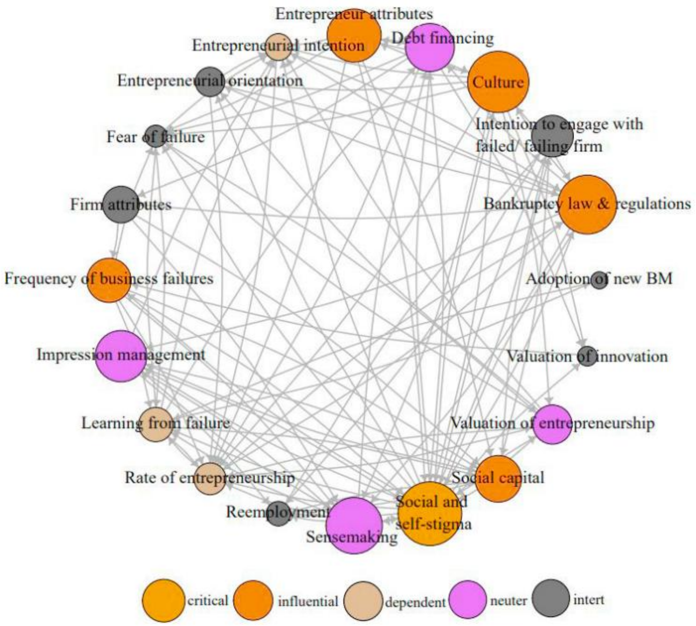
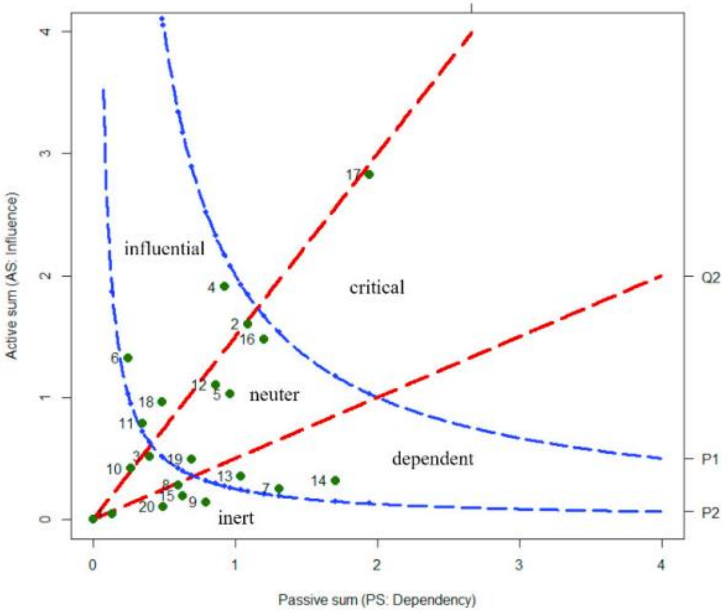
Understanding complex relationships

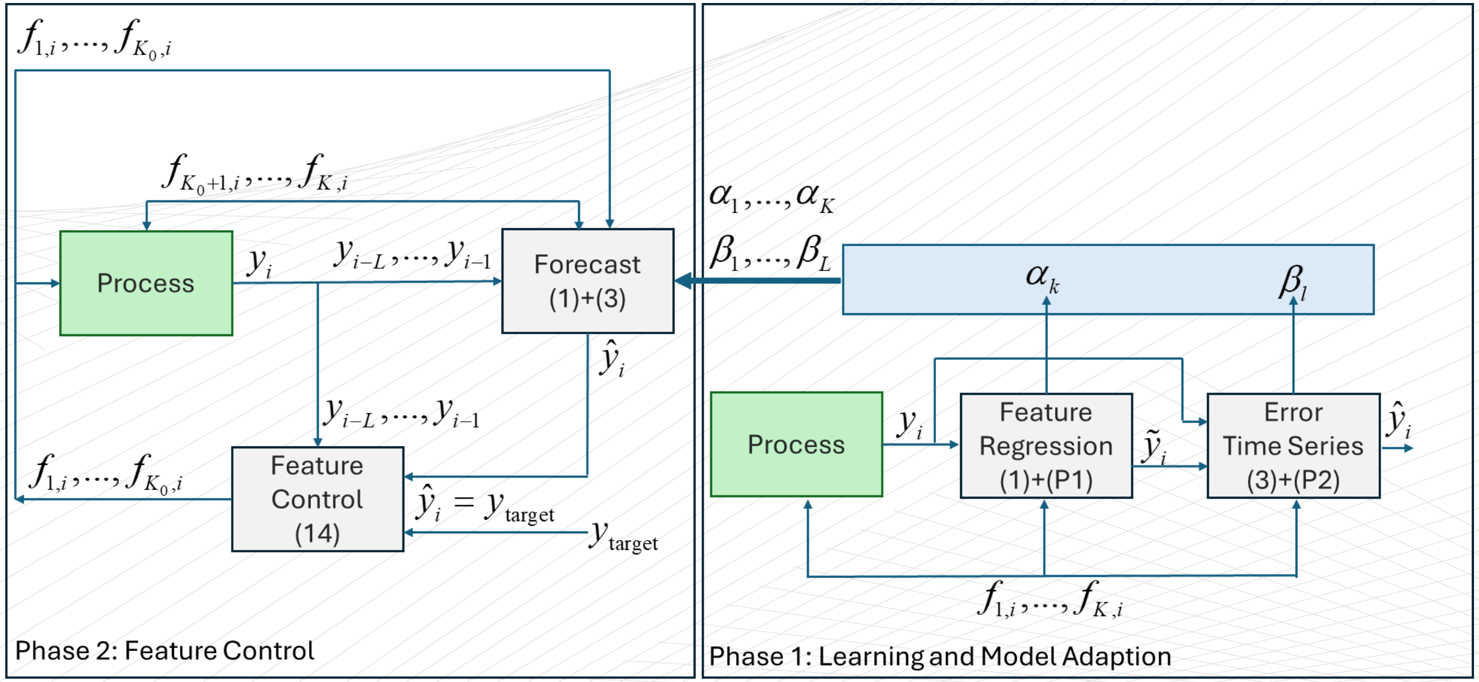




Variable
Adoption of new business model (BM) (#1)
Bankruptcy law & regulations (#2)
Culture (#4)
Debt financing (#5)
Entrepreneur attributes (#6)
Entrepreneurial intention (#7)
Entrepreneurial orientation (#8)
Fear of failure (#9)
Firm attributes (#10)
Frequency of business failures (#11)
Impression management (#12)
Intention to engage with failed/ failing firm (#3)
Learning from failure (#13)
Rate of entrepreneurship (#14)
Reemployment (#15)
Sensemaking (#16)
Social capital (#18)
Valuation of entrepreneurship (#19)
Valuation of innovation (#20)
social and self-stigma (#17)

Bachmann, N., Tripathi, S., Brunner, M., Jodlbauer, H., & Piereder, A. (2024). Cross-Impact Analysis of Entrepreneurial Failure and Business Model Innovation: Navigating the Impact of Societal Perceptions. Procedia Computer Science, 232, 2639-2653.

Controlling production processes



Adaptive Model Based Predictive Control

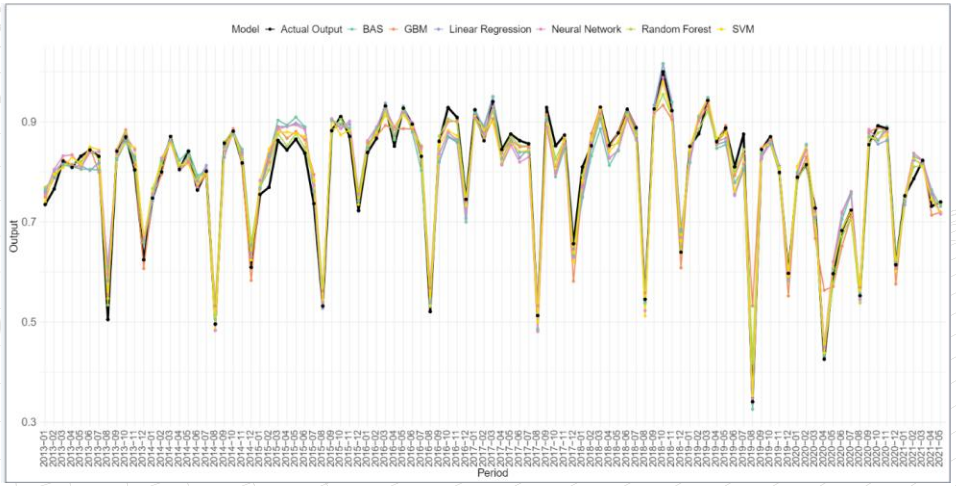
Reimagining energy storage

- **Direct Use of Electricity for Production**: Instead of storing electricity in traditional storage systems, we proposes using it directly for manufacturing energy-intensive, storable products through optimized, energy-aware production scheduling.

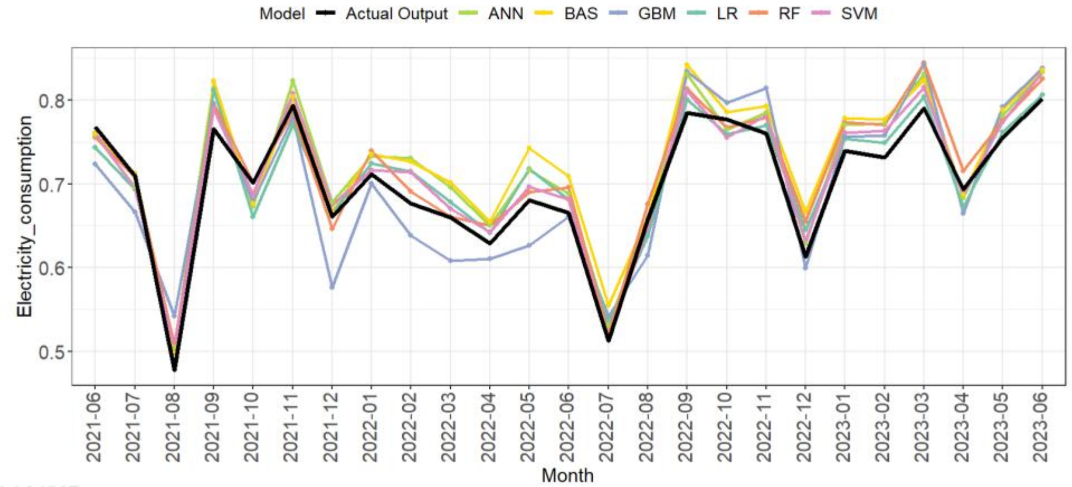
- **Integrated Cost-Minimizing Optimization Model**: A yearly planning model is developed that minimizes overall costs—including electricity, inventory, labor, and investment—by activating production during low electricity price periods.

- **Sustainability and SDG Alignment**: The approach enhances energy-efficient production and aligns with key Sustainable Development Goals (SDGs 7, 8, and 12) by promoting affordable energy use, sustainable production, and economic growth.

Reimagining energy storage



Forecsting energy demand

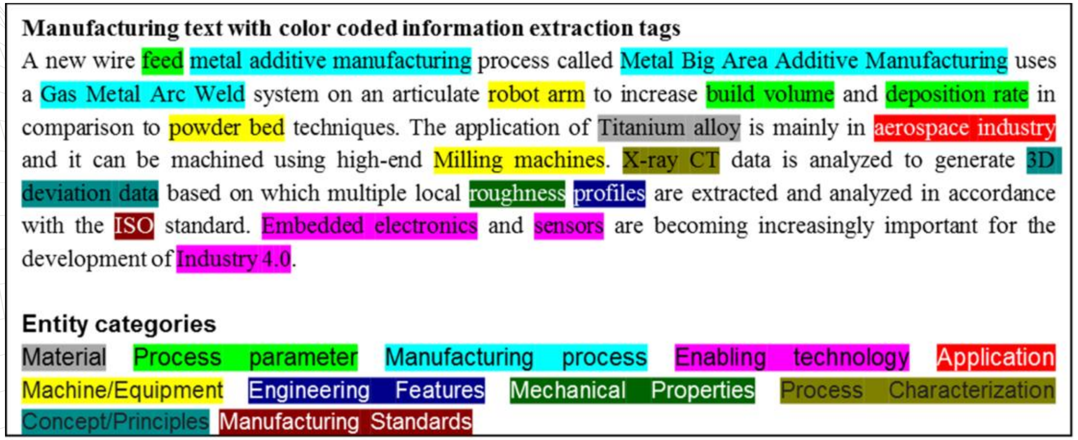


Features	LR	RF	GBM	SVM	ANN	BAS
Casted_tons	100.0	78.4	100.0	100.0	100.0	100.0
Planned_time	16.2	100.0	28.0	96.7	30.3	6.8
A2_shifts	38.3	35.9	33.8	96.2	61.3	20.8
A4_shifts	83.7	49.8	64.4	93.9	91.3	100.0
Ok_tons	40.1	65.9	0.0	90.5	38.9	99.7
Casted_pieces	1.6	46.3	8.3	85.8	42.4	11.7
A1_shifts	0.0	59.3	43.7	85.7	41.2	6.8
Ok_pieces	30.7	28.3	3.2	82.6	32.0	28.8
A3_shifts	33.9	20.3	6.8	73.1	41.9	10.3
Internal_scrap_pieces	8.3	14.8	18.9	62.3	15.3	7.8
Working_days	13.3	11.4	10.3	44.6	50.2	30.6
A5_shifts	14.3	4.7	2.0	34.8	19.3	9.6
External_scrap_pieces	18.3	0.6	12.8	23.9	0.0	7.4
Working_hours	39.4	1.8	2.7	17.1	34.4	93.1
A6_shifts	23.4	0.0	2.3	0.0	36.6	14.4

Relative feature importance for different models on a scale from 0 to 100

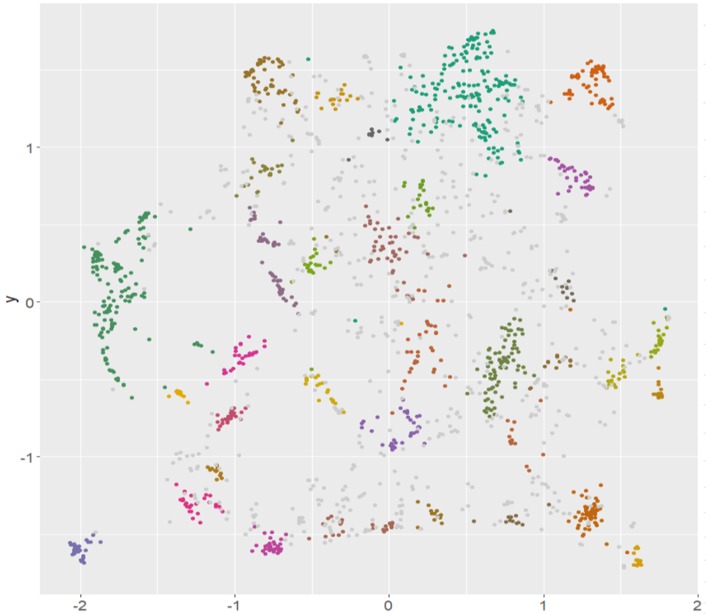
Strasser, S., Wimmer, C., Tripathi, S., & Jodlbauer, H. (2024). *Enhancing operational efficiency in energy-intensive industries through AI: A case study of electricity demand forecasting in foundries*.

Enhancing business decisions (Text analysis)



information extraction from manufacturing process science domain literature using named entity recognition

Ref: Kumar, A., & Starly, B. (2022). "FabNER": information extraction from manufacturing process science domain literature using named entity recognition. *Journal of Intelligent Manufacturing*, *33*(8), 2393-2407.

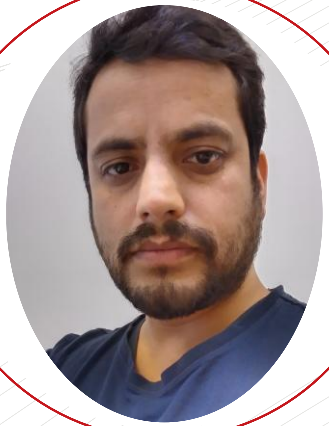


Two-dimensional projection of document embeddings and BERTopic-identified topics (color-coded) for sustainability and AI related topics

Tripathi, S., Bachmann, N., Brunner, M., Rizk, Z., & Jodlbauer, H. (2024). Assessing the current landscape of AI and sustainability literature: Identifying key trends, addressing gaps and challenges. Journal of Big Data, 11(1), 65.

- Understanding of Sustainability Concerns through Textual Data Analysis
- Improving, innovating services, and personalizing the customers' experience

Contact Information



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