

# Executive Summary: Unmasking the True Drivers of Car Sales

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## Executive Summary

The automotive industry is rapidly transforming due to changing consumer preferences, economic pressures, and evolving design philosophies. This analysis investigates the key drivers of car sales performance, combining detailed vehicle specifications, consumer sentiment, and machine learning insights to provide actionable recommendations for automotive manufacturers.

## Objective

The primary goal of this study is to determine the factors that most significantly influence car sales, including practical attributes (e.g., price, fuel efficiency, and engine power), aesthetic elements (e.g., vehicle design and "facial expressions"), and temporal trends. By identifying these determinants, we aim to help car manufacturers optimize their product offerings and marketing strategies.

## Approach

This project leverages a comprehensive dataset consisting of car specifications, historical sales data, and consumer sentiment analyses. Our methodology integrates statistical models such as Ordinary Least Squares (OLS), Random Forests, Backpropagation Neural Networks (BPNN), and recurrent neural network (RNN) to uncover patterns in the data. We also incorporate sentiment analysis of car reviews and image-based emotion classification of vehicle designs.

## Key Findings

- **Practical Features Drive Sales:** Key attributes such as fuel efficiency (measured by MPG), engine power, and price have the most significant impact on car sales. Vehicles offering a balance between performance and affordability dominate the market.
- **Minimal Impact of Vehicle "Facial Expressions":** Contrary to initial hypotheses, the perceived emotions in car designs (e.g., "angry," "happy," or "sad") play a limited role in influencing sales. While certain aggressive designs align with performance-oriented models, functionality remains a more critical driver.

- **Brand-Specific Design Trends:** Manufacturers exhibit distinct design strategies. For example, Asian automakers like Honda and Toyota increasingly favor "angry" expressions, reflecting a shift toward more assertive and performance-driven aesthetics. European brands maintain a more conservative design philosophy.
- **Temporal Market Dynamics:** Car sales have shown an upward trend over the years, driven by rising consumer demand and changing vehicle preferences. The growing emphasis on fuel efficiency and sustainability underscores the importance of green technologies.

## Implications for Manufacturers

The findings of this study provide several actionable insights for car manufacturers:

- **Focus on Fuel Efficiency and Sustainability:** Prioritize investments in fuel-efficient and low-emission vehicles to cater to environmentally conscious and cost-sensitive buyers.
- **Balance Performance and Affordability:** While high engine power attracts performance-oriented consumers, affordability remains a key factor for mass-market appeal.
- **Leverage Brand Identity through Design:** Manufacturers should continue differentiating themselves through design philosophies that align with their target market. For instance, assertive front-end designs can strengthen a brand's presence in the performance vehicle segment.
- **Incorporate Consumer Sentiment:** Integrate feedback from consumer reviews and ratings into product development and marketing strategies to enhance alignment with market demands.

## Limitations and Future Directions

While this study identifies critical predictors of car sales, additional factors such as regional economic conditions, dealer-level incentives, and marketing expenditures were not included. Future research incorporating these variables could provide a more holistic understanding of sales dynamics. Additionally, leveraging larger datasets and advanced time-series models can further improve the predictive accuracy of our findings.

## Conclusion

This analysis highlights that functionality, affordability, and environmental considerations are the primary drivers of car sales. While design elements contribute to brand differentiation, they are secondary to practical attributes. By aligning product offerings with consumer priorities and market trends, manufacturers can enhance competitiveness and achieve sustainable growth in an evolving automotive landscape.