1. Executive Summary

This report presents the findings from an analysis of used car pricing data. Our primary goal was to identify the key factors influencing the price of used cars and develop predictive models to optimize pricing strategies. After evaluating several models, the **Random Forest Regressor** emerged as the most accurate, providing valuable insights into the attributes that affect used car prices.

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2. Business Objective

The dealership aims to:

1. **Understand key factors** influencing used car prices.
2. **Optimize pricing strategies** to remain competitive in the market.
3. Identify **features that consumers value most** to guide inventory decisions.

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3. Data Overview

- **Dataset Source:** Kaggle Used Car Dataset (426,000 cars)
- **Key Features Analyzed:**
    - **Numerical:** Price, Year, Odometer (Mileage)
    - **Categorical:** Manufacturer, Model, Fuel Type, Transmission, Condition, Location

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4. Modeling Approach

We tested several regression models to predict used car prices:

Model	Test RMSE	Test R^2
Linear Regression	$10,720.97	44.8%
Ridge Regression	$10,721.04	44.8%
Lasso Regression	$10,721.00	44.8%
Random Forest	**$5,301.48**	**86.5%**

Key Insight: The **Random Forest Regressor** significantly outperformed linear models, capturing complex relationships in the data and providing the most accurate predictions.

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5. Key Findings

The analysis identified the following **top factors** influencing used car prices:

1. **Car Age:** Newer cars command higher prices.
2. **Mileage (Odometer):** Lower mileage significantly increases value.
3. **Manufacturer & Model:** Premium brands (e.g., Toyota, Honda) and popular models retain value better.
4. **Condition:** Cars in 'like new' or 'excellent' condition are priced higher.
5. **Fuel Type:** Gasoline cars tend to be more desirable in certain regions.
6. **Transmission:** Automatic transmission can influence price, depending on market preferences.
7. **Location (State/Region):** Geographic demand impacts pricing, with some regions willing to pay more for specific cars.

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6. Recommendations

1. **Optimize Pricing Strategies:**
    - Use the **Random Forest model** to dynamically price cars based on their attributes.
    - Adjust prices for cars with **low mileage**, **newer models**, and **excellent condition** to reflect their higher value.
2. **Inventory Management:**
    - Focus on acquiring vehicles from **premium manufacturers** with **low mileage** and **good condition**.
    - Consider regional preferences when purchasing inventory to maximize resale value.
3. **Ongoing Model Refinement:**
    - Continuously update the model with **new sales data** to maintain accuracy.
    - Explore advanced models like **Gradient Boosting** for potential performance improvements.

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7. Conclusion

The Random Forest model provides a **robust, accurate tool** for predicting used car prices and understanding the key drivers of value in the used car market. By leveraging these insights, the dealership can **optimize pricing**, **refine inventory choices**, and remain competitive in the dynamic used car market.