

# Sales Forecasting Using Machine Learning

Internship Project

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Machine Learning Domain  
Implemented using Python (Google Colab)

# Introduction

- Sales forecasting predicts future revenue using historical data.
  - Helps businesses plan inventory, pricing, and marketing.
  - Machine Learning improves forecasting accuracy.
  - Data-driven decisions reduce business risks.

# Problem Statement

- Businesses face uncertainty in predicting sales.
  - Manual estimation methods lack precision.
  - Need for automated predictive modeling.
  - Goal: Build ML model for sales prediction.

# Project Objectives

- Develop a sales forecasting model.
  - Analyze impact of advertising and pricing.
  - Evaluate model using error metrics.
  - Generate business recommendations.

# Dataset Overview

- 24 months of sales data.
  - Features:
    - • Month
    - • Advertising Spend
    - • Price
    - • Sales (Target Variable)

# Exploratory Data Analysis

- Visualized monthly sales trend.
  - Observed fluctuations across months.
  - Advertising shows positive influence on sales.
  - Pricing impacts demand levels.

# Model Selection

- Linear Regression selected as baseline model.
  - Simple and interpretable algorithm.
  - Suitable for continuous value prediction.
  - Helps understand feature relationships.

# Model Training Process

- Dataset split into 80% training and 20% testing.
  - Model trained using Advertising Spend and Price.
  - Predictions generated on unseen test data.
  - Model performance evaluated.

# Model Evaluation Metrics

- Mean Absolute Error (MAE): 224.19
  - Mean Squared Error (MSE): 69843.81
  - MAE represents average prediction error.
  - MSE penalizes larger prediction errors.

# Interpretation of Results

- Average prediction error  $\approx 224$  sales units.
  - Model shows moderate prediction capability.
  - Performance can improve with more data.
  - Advanced models may enhance accuracy.

# Business Insights

- Higher advertising spend increases sales.
  - Pricing significantly impacts revenue.
  - Forecasting helps optimize inventory.
  - Supports data-driven strategic planning.

# Strategic Recommendations

- Increase marketing during low-demand months.
  - Optimize pricing strategies.
  - Continuously retrain model with new data.
  - Use forecasting for demand planning.

# Challenges & Limitations

- Small dataset (24 months).
  - Limited seasonal features included.
  - Random sample data used for demonstration.
  - Model simplicity limits complex pattern detection.

# Future Enhancements

- Implement Random Forest or XGBoost.
  - Incorporate holiday and seasonal data.
  - Apply time-series models (ARIMA/LSTM).
  - Deploy model as web application.

# Conclusion

- Machine Learning effectively predicts sales trends.
  - Model achieved MAE: 224.19 and MSE: 69843.81.
  - Provides actionable business insights.
  - Supports informed and strategic decisions.