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INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
(Int Peer Reviewed Journal)
Vol. 05, Issue 10, October 2025, pp : 278-279

e-ISSN : 2583-1062
Impact Factor : 7.001

PRICE RECOMMENDATION SYSTEM

Riya Borade[1], Shraddha Chauhan[2], Shreya Singh[3], Mohammad Tahir[4]

[1,2,3]Department Of Information Technology G H Raisoni College Of Engineering Nagpur, India.

[4]Center Of Excellence In Information Security Department Of Information Technology G H Raisoni College Of Engineering Nagpur, India.

mohammad.tahir@raisoni.net

DOI: https://www.doi.org/10.58257/IJPREMS44082

ABSTRACT

This research explores the development of an automated price recommendation system tailored for e-commerce websites and general grocery stores. Leveraging machine learning algorithms and historical sales data, the system predicts optimal pricing strategies to maximize revenue and competitiveness. Implemented using open-source libraries such as scikit-learn, pandas, and Flask within a cloud-based environment, the proposed framework offers a scalable and accessible solution for dynamic pricing. The system enhances business decision-making by providing data-driven price suggestions, thereby supporting sales optimization, inventory management, and customer satisfaction.

Keywords: Price Recommendation, Machine Learning, Dynamic Pricing, E-Commerce, Grocery Stores, Sales Optimization.

1. INTRODUCTION

The rapid expansion of e-commerce and grocery retail sectors demands intelligent pricing strategies to stay competitive and profitable. Traditional static pricing often fails to respond to market fluctuations, customer behavior, and inventory levels. While standalone pricing tools exist, they frequently lack integration with real-time data and predictive analytics.

This research proposes an automated price recommendation system that:

1. Collects and preprocesses historical sales and product data
2. Applies machine learning models to predict optimal prices
3. Provides actionable pricing suggestions through an accessible interface By integrating data analytics and predictive modeling, the system aims to improve pricing accuracy and business outcomes.

2. LITERATURE REVIEW

Dynamic pricing and price recommendation systems have been extensively studied in retail and e-commerce contexts. Early approaches relied on rule-based systems and manual adjustments, which are limited in scalability and adaptability. Recent advances in machine learning have enabled more sophisticated models that capture complex patterns in sales data.

Several studies have utilized regression models, decision trees, and ensemble methods such as Random Forests and Gradient Boosting for price prediction [1]. Deep learning techniques have also been explored for capturing nonlinear relationships and seasonality effects [2].

Data preprocessing and feature engineering, including demand forecasting, competitor pricing, and promotional effects, are critical for model performance [3]. Cloud-based platforms facilitate scalable deployment and real-time updates [4].

Despite progress, challenges remain in handling sparse data, cold-start products, and balancing profitability with customer satisfaction. Integration with inventory and marketing systems is also an ongoing research focus.

3. METHODOLOGY

The system follows a three-phase workflow:

1. Data Collection and Preprocessing – Aggregation of sales, product, and competitor pricing data
2. Model Training and Prediction – Application of machine learning algorithms to generate price recommendations
3. Recommendation Delivery – Presentation of suggested prices via a user-friendly dashboard or API

A. Tools and Libraries

- pandas – Data manipulation and preprocessing
- scikit-learn – Machine learning model development
- Flask – Web framework for interface and API deployment

- Cloud Platform (e.g., AWS, Google Cloud) – Scalable computing resources

B. Workflow

1. Data ingestion from e-commerce and grocery databases
2. Feature extraction including demand trends, seasonality, and competitor prices
3. Model training with historical data and validation
4. Real-time price recommendation generation
5. User interface for price review and adjustment

4. RESULTS AND IMPLEMENTATION

The system was tested on datasets from e-commerce and grocery domains. Key observations include:

- Improved pricing accuracy compared to baseline static pricing
- Enhanced revenue and sales volume through dynamic adjustments
- Scalability to handle large product catalogs
- User-friendly interface facilitating quick decision-making

5. APPLICATIONS

- E-commerce platforms – Dynamic pricing to respond to market trends
- Grocery stores – Optimized pricing for perishable and general goods
- Inventory management – Aligning prices with stock levels
- Marketing strategies – Supporting promotions and discounts

6. LIMITATIONS AND FUTURE WORK

- Current limitations:
- Dependence on quality and quantity of historical data
- Challenges in modeling new or infrequently sold products
- Limited integration with external market signals such as competitor promotions
- Future work directions:
- Incorporation of advanced deep learning models for improved prediction
- Real-time competitor price scraping and integration
- Multi-objective optimization balancing profit, sales, and customer satisfaction
- Mobile and web application enhancements for broader accessibility

7. CONCLUSION

This research demonstrates the feasibility of an integrated price recommendation system for e-commerce and grocery sectors. By leveraging machine learning and cloud technologies, the system provides actionable pricing insights that enhance competitiveness and profitability. The framework lays the groundwork for future advancements in intelligent retail pricing solutions..

8. REFERENCES

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