



# SavvyShoper - Smart Grocery Recommender and Price Comparison System Using Machine Learning

Arunadevi S. Khaple<sup>1</sup>, Gayatri C. Mhaisne<sup>2</sup>, Gayatri N. Musmade<sup>3</sup>, Omkar A. Narawde<sup>4</sup>,  
Pratik A. Nayakwadi<sup>5</sup>

<sup>1</sup>Assistant Professor, Department of Computer Engineering, Zeal College of Engineering & Research, Pune (MH), India

<sup>2,3,4,5</sup>Student, Department of Computer Engineering, Zeal College of Engineering & Research, Pune (MH), India

**Abstract:** The rapid growth of e-commerce has made consumer reviews, opinions, and shared experiences vital sources of information that reflect customer preferences. These reviews are invaluable for developing recommender systems, which help guide potential buyers towards preferred products. However, the complexity of extracting and utilizing textual data poses a significant challenge in formalizing a comprehensive mechanism for selecting and retrieving relevant opinions from the vast amount of information available. This paper introduces a novel recommender system based on consumer product reviews, proposing a prioritizing mechanism to enhance the selection and retrieval of opinions. The system's effectiveness is demonstrated through a case study involving the recommendation of digital cameras, showcasing how this method can effectively utilize consumer reviews. The proposed approach provides a significant improvement in the ability to analyze and leverage user-generated content in recommender systems. As e-commerce continues to expand, these systems have become essential tools for both businesses and consumers, simplifying the process of managing business transactions online and making informed purchasing decisions through tailored recommendations based on customer feedback.

**Keywords:** Personalized Product Suggestion, Price Comparison, Discount Tracking, Review Analysis.

## I. INTRODUCTION

The Smart Grocery Recommendation System revolutionizes online grocery shopping by providing tailored product suggestions and enabling price comparisons across various retailers. Utilizing advanced deep learning techniques, this system efficiently identifies and matches items from multiple sources, ensuring users have access to the most competitive prices available.

By analyzing individual user preferences, shopping habits, and past behavior, the system crafts a personalized shopping journey that enhances the overall user experience. The price comparison functionality not only helps users save money but also consolidates shopping from different stores into a single, user-friendly platform.

With its deep learning capabilities, the system improves the accuracy of product recommendations and simplifies the shopping process. Ultimately, the Smart Grocery Recommendation System is designed to make online grocery shopping more convenient and budget-conscious, allowing users to effortlessly find the best deals without the need to navigate through numerous websites.



**II. OBJECTIVES**

The Smart Grocery Recommendation System is set to create a sophisticated deep learning model that efficiently matches grocery items across diverse platforms. This system will emphasize real-time price comparisons, pulling data from multiple retailers to help users secure the best deals. By providing personalized recommendations based on each user's preferences and past shopping habits, the system aims to elevate the online grocery shopping experience.

The core goal is to make online grocery shopping straightforward and user-friendly. It will also assist users in saving money through enhanced price comparisons, ensuring affordability. With scalability in mind, the system is designed to accommodate various platforms and extensive product inventories. Over time, it will continually refine its recommendations, improve the user experience, and adapt to the changing needs of consumers.

**III. LITERATURE REVIEW**

**Table 1:** Literature Survey

Sr. No.	Title	Year	Objective	Methodology	Advantages	Future Scope
1	An Online Recommendation System Using Deep Learning for Textile Products	2020	Develop a recommendation system for textile products utilizing deep learning.	The proposed model employs a Convolutional Neural Network (CNN) architecture to recommend textile patterns by evaluating color compatibility.	Enhances Recommendations by focusing on color compatibility yields more relevant pattern suggestions.	Involves integrating real-time feedback to refine recommendations.
2	Product Comparison Website using Web scraping and Machine learning.	2023	Implement a customized algorithm that analyzes price, features, and user ratings.	Involves utilizing a web crawler to gather data, a web scraper that extracts HTML information for analysis, along a relevance filter to eliminate irrelevant results, and a personalized recommendation system.	Evaluate data from various e-commerce sites, for best deals through product comparisons.	Could enhance the accuracy of recommendations by analyzing complex user behaviors and preferences.
3	Exploring the Landscape of Hybrid Recommendation System in E-Commerce : A Systematic Literature Review	2024	To explore hybrid recommendation systems (HRS) in e-commerce and their role in enhancing customer experience.	A systematic literature review of HRS approaches, challenges, and algorithm combinations in e-commerce over the last six years	HRS improves recommendation accuracy and addresses limitations like data sparsity and cold start problems.	Future research could focus on integrating advanced AI techniques to further enhance personalization and transparency in recommendation systems

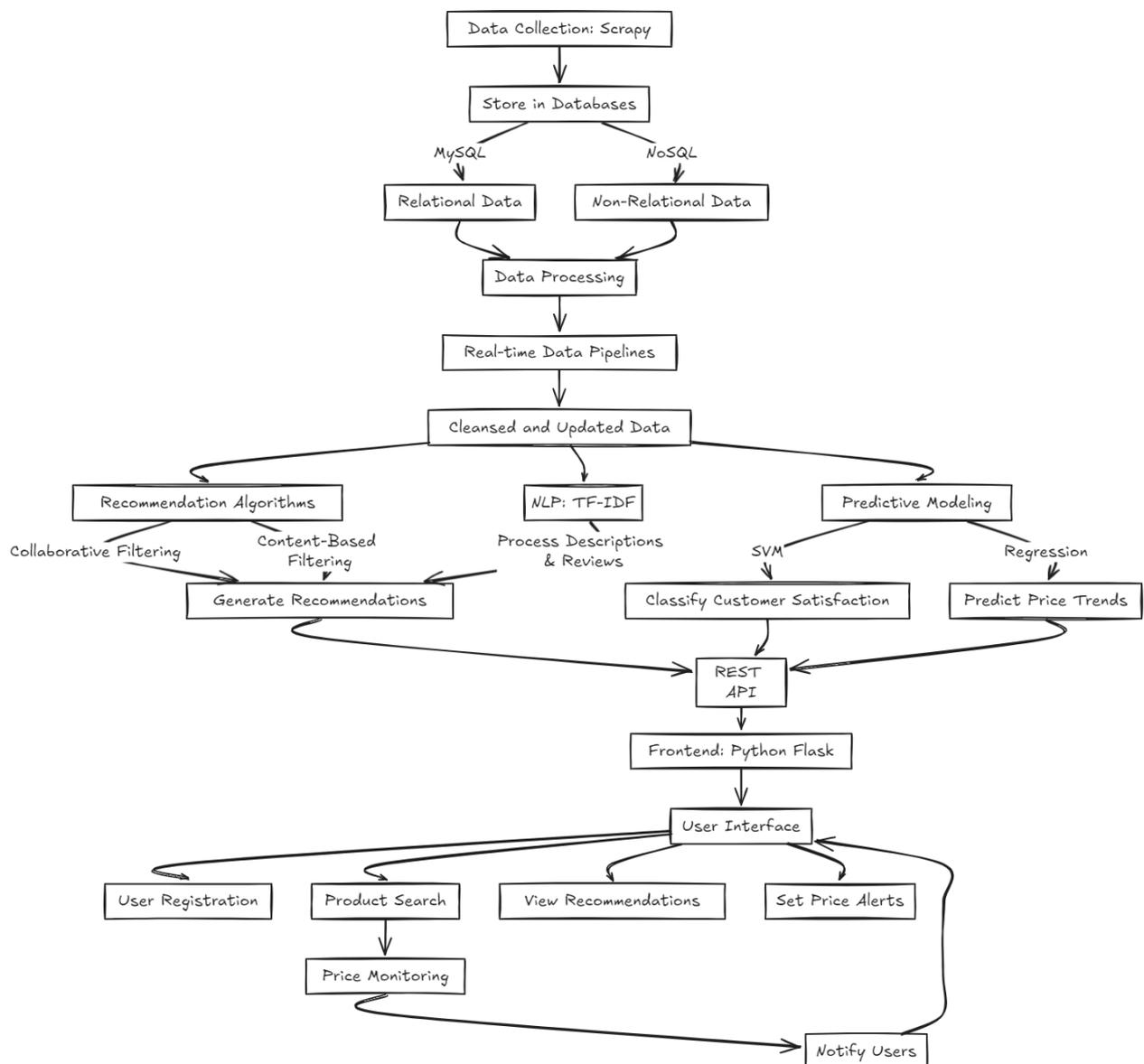


4	E-commerce Price Comparison Website Using Web Scraping	2023	To provide a product comparison website that scrapes data from multiple e-commerce platforms, allowing users to compare prices, features, and ratings of products.	Involves using web crawling and scraping techniques to automate the extraction of pricing data from online retailers, facilitating quick and precise price comparisons.	Using Web scraping automates the collection of pricing data from multiple retailers, providing users with up-to-date price comparisons that reflect the current market.	Could enhance the price comparison by incorporating advanced features such as real-time price alerts and personalized recommendations.
5	Implementation of Online Grocery Recommendation System by using Python Flask & Machine Learning	2022	The system recommends grocery products based on users' purchase history and similar local area buying patterns.	uses MySQL database management, and collaborative filtering techniques (slope one and min-hash) for personalized recommendations	A "special basket" feature is added to address individual user needs, offering essential items customized for different user profiles.	Could be Optimized in mobile accessibility, crucial as more users shop via smartphones and tablets.
6	Online Grocery Recommendation System	2022	Create a grocery site with personalized product recommendations using machine learning.	Use PCA and K Means clustering on customer data to suggest products.	Enhances user experience and boosts sales through tailored recommendations.	Expand with more advanced algorithms and broader customer data integration.
7	An Algorithm for Recommending Groceries Based on an Item Ranking Method	2021	Create a bulk grocery recommendation system based on potential recipes	Recommends items by matching basket contents to relevant food subcategories.	Efficient, no reliance on user ratings.	Enhance recipe matching and expand food categories.
8	Product Recommendation System for Supermarket	2020	Create a system to recommend products based on customer needs.	Collaborative filtering and association rule mining for regular customers.	Provides accurate, personalized recommendations	Enhance with advanced algorithms and AI integration
9	A Novel Web Scraping Approach Using the Additional Information Obtained From Web Pages	2020	To propose a novel web scraping approach that enhances time efficiency using additional information from web pages.	Utilize string-based methods and additional metadata without constructing a DOM tree.	Improves extraction time by 60 times compared to traditional DOM-based methods.	Adapting the approach to handle dynamic content like Ajax requests efficiently



10	Dynamic Discount Pricing in Competitive Marketing	2019	Maximize marketing profit through dynamic discount pricing in competitive environment	Utilize a competitive WOM propagation model integrated with optimal control for pricing strategies.	Enhances profit over static pricing strategies by leveraging real-time consumer behavior.	Explore applications across diverse industries and evolving digital marketing landscapes.
----	---	------	---	---	---	---

**IV. PROPOSED SYSTEM DESIGN**



**Figure 1: Proposed Block Diagram**





For developing Savvy Shopper, a price comparison and personalized recommendation platform, encompasses a structured approach focused on five main components: Data Collection, Recommendation Algorithms, Natural Language Processing (NLP), Predictive Modelling, and API Integration. The application is designed to offer an intuitive interface for users to compare prices and receive tailored product suggestions from various e-commerce platforms, emphasizing scalability and real-time data processing.

At its core, the frontend is developed using the Python Flask framework, chosen for its simplicity and flexibility, managing user authentication, product search, recommendation display, and price alerts across multiple devices. The backend serves as the application's backbone, consisting of an API Gateway that routes user requests, a Business Logic Layer that processes these requests and manages user sessions, and a Recommendation Engine that employs a hybrid system combining collaborative filtering, content-based filtering, and machine learning techniques to deliver personalized suggestions. The Data Layer manages both structured and unstructured data using a combination of MySQL and NoSQL databases, facilitating efficient storage and retrieval.

Effective data collection is critical for enabling price comparisons and personalized recommendations. Web scraping with Scrapy is utilized to gather structured data from various e-commerce sites, including product names, prices, availability, and user reviews, ensuring a comprehensive dataset for analysis. The recommendation engine itself relies on collaborative filtering to analyse user behaviour and identify similarities among users, while content-based filtering suggests products based on their attributes and user profiles.

To enhance user experience further, essential NLP techniques are implemented, including text vectorization methods like TF-IDF, which convert product descriptions and reviews into numerical formats for effective analysis. Predictive modelling techniques, such as Support Vector Machines (SVM) and regression analysis, are employed to classify customer satisfaction and forecast price trends, allowing for adjustments in recommendations based on anticipated behaviours.

Finally, the integration of REST APIs enables seamless communication between the frontend and backend, facilitating real-time access to product data and user preferences. This allows Savvy Shopper to deliver timely price comparisons and customized recommendations, enhancing user engagement and satisfaction in the grocery sector.

## V. FUTURE SCORE

The future scope of the Smart Grocery Recommendation and Price Comparison System will involve expanding its capabilities to support more diverse product categories and integrating with a wider range of retailers and e-commerce platforms. The system will incorporate advanced machine learning models to provide even more accurate and personalized recommendations, adapting to changing user preferences over time. It will also include enhanced features such as predictive analytics, allowing users to anticipate price fluctuations and upcoming deals. Furthermore, the system will aim to integrate voice search and virtual assistants for a seamless, hands-free shopping experience. As user data grows, it will improve its ability to provide hyper-personalized recommendations and ensure real-time quality checks based on customer reviews.



Additionally, the system will focus on global scalability, allowing it to cater to users from different regions and optimize product recommendations across international markets.

## VI. OUTPUT

The anticipated outcomes of the Smart Grocery Recommendation and Price Comparison System focus on enhancing user convenience by delivering personalized grocery suggestions tailored to individual preferences and shopping history. Users will experience substantial cost savings through real-time price comparisons from multiple platforms, ensuring they access the best available deals.

By streamlining the online shopping process, the system aims to boost customer satisfaction, making grocery shopping more efficient and intuitive. Leveraging deep learning algorithms for accurate product matching will facilitate dependable comparisons, while customized recommendations will promote increased user engagement. Ultimately, the system is designed to make grocery shopping more efficient, convenient, and affordable for all users.

## VII. CONCLUSION

To wrap up, the Smart Grocery Recommendation and Price Comparison System is set to revolutionize the way people shop for groceries online. By utilizing advanced deep learning techniques, the system will deliver customized product suggestions and real-time price insights, along with evaluations of product quality based on user reviews. This innovative approach simplifies the shopping experience by tailoring recommendations to match individual preferences and purchasing patterns while ensuring users find the best prices available across various retailers.

Furthermore, the inclusion of quality assessments derived from customer feedback will help shoppers make more informed decisions about the products they choose. By significantly cutting down the time and effort involved in locating the best deals and highest-rated items, the system promises to enhance convenience, boost customer satisfaction, increase sales for retailers, and create a more effective and user-friendly online grocery shopping journey.

## REFERENCES

- [1] W. Zhou, P. Y. Mok, Y. Zhou, Y. Zhou, J. Shen, Q. Qu, and K. P. Chau, "Fashion recommendations through cross-media information retrieval," *J. Visual Commun. Image Represent.*, vol. 61, pp. 112–120, 2019.
- [2] L. Zhao, Z. Lu, S. J. Pan, and Q. Yang, "Matrix factorization for movie recommendation," in *IJCAI*, pp. 3945–3951, July 2016.
- [3] P. Covington, J. Adams, and E. Sargin, "Deep neural networks for YouTube recommendations," in *Proceedings of the 10<sup>th</sup> ACM Conference on Recommender Systems*, pp. 191–198, September 2016.
- [4] L. Jiang, Z. Wu, Q. Zheng, and J. Liu, "Learning deep web crawling with diverse features," in *2009 IEEE/WIC/ACM International Joint Conference on Web Intelligence and Intelligent Agent Technology*, vol. 1, pp. 572-575. IEEE, 2009.
- [5] S. Philip, P. Shola, and A. Ovy, "Application of content-based approach in research paper recommendation system for a digital library," *International Journal of Advanced Computer Science and Applications*, vol. 5, no. 10, 2014.



- [6] F. J. M. Shamrat, Z. Tasnim, A. S. Rahman, N. I. Nobel, and S. A. Hossain, "An effective implementation of web crawling technology to retrieve data from the World Wide Web (WWW)," *International Journal of Scientific & Technology Research*, vol. 9, no. 01, pp. 1252-1256, 2020.
- [7] M. Balabanović, "An adaptive web page recommendation service," in *Proc. 1<sup>st</sup> Int. Conf. Auto. Agents (AGENTS)*. New York, NY, USA: Association for Computing Machinery, 1997, pp. 378–385.
- [8] F. O. Isinkaye, Y. O. Folajimi, and B. A. Ojokoh, "Recommendation systems: Principles, methods and evaluation," *Egyptian Informat. J.*, vol. 16, no. 3, pp. 261–273, Nov. 2015.
- [9] J. B. Schafer, J. Konstan, and J. Riedl, "Recommender systems in e-commerce," in *Proc. 1st ACM Conf. Electron. Commerce*, 1999, pp. 158–166.
- [10] L. R. Julian and F. Natalia, "The use of web scraping in computer parts and assembly price comparison," in *2015 3rd International Conference on...*, 2017. [Online]. Available: IEEE Xplore.
- [11] A. V. Saurkar, K. G. Pathare, and S. A. Gode, "An overview on web scraping techniques and tools," *International Journal on Future Trends in Computing and Communication*, 2018.
- [12] G. N. Chandrika, S. Ramasubbareddy, and K. Govinda, "Web scraping for unstructured data over web," in *Embedded Systems and Intelligent Technologies*, 2020. Springer.
- [13] Y.-M. Huang and S.-X. Du, "Weighted support vector machine for classification with uneven training class sizes," in *Machine Learning and Cybernetics*, 2005. Proceedings of 2005 International Conference on, vol. 7. IEEE, 2005.
- [14] Y.-J. Wu and W.-G. Teng, "An enhanced recommendation scheme for online grocery shopping," in *2011 IEEE 15<sup>th</sup> International Symposium on Consumer Electronics (ISCE)*, 2011. [Online]. Available: <http://ieeexplore.ieee.org/document/5973860/>.
- [15] Y. Hu, Y. Koren, and C. Volinsky, "Collaborative filtering for implicit feedback datasets," in *2008 Eighth IEEE International Conference on Data Mining*, 2008, pp. 263–272.

