International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Savvyshoper - Smart Product Recommender and Price Comparison System Using Machine Learning

Nilam Honmane[1], Gayatri Mhaisne[2], Gayatri Musmade[3], Omkar Narawde[4], Pratik Nayakwadi[5]

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

2,3,4,5Students, Department of Computer Engineering, Zeal College of Engineering & Research, Pune (MH), India

---

Abstract - In today's digital era, e-commerce has transformed the way consumers shop, offering a vast range of products across multiple platforms Although online shopping offers convenience, the variation in product prices and listings across platforms can cause confusion and inefficiencies for consumers trying to find the best deals. This work introduces an advanced e-commerce price comparison platform that leverages web scraping technologies to collect real-time product and pricing information from a variety of leading online marketplaces. By consolidating and interpreting this data, the system empowers users to make better-informed purchasing choices. Moreover, the solution integrates a recommendation engine that analyses users' search behaviours and browsing patterns to deliver personalized product suggestions.

Through the fusion of dynamic price comparison and intelligent recommendations, the platform seeks to simplify the online shopping journey, helping users efficiently locate affordable and relevant products.

Key Words: Personalized Product Suggestion, Price Comparison, Web Scrapping, E-commerce optimization

1.INTRODUCTION

SavvyShopper is designed to improve the online shopping journey by delivering personalized product suggestions and real-time price comparisons across multiple e-commerce platforms. With the rapid growth of online shopping, consumers often struggle with inconsistent pricing, varying product details, and an overwhelming selection of options.

SavvyShopper solves these challenges by using advanced machine learning and asynchronous web scraping to gather live product information, such as prices, discounts, and user reviews, from major e-commerce sites like Amazon, Flipkart, and eBay. By analyzing user preferences, past purchasing behavior, and shopping habits, the platform offers a tailored shopping experience that helps users easily discover the best products at the most competitive prices.

As e-commerce platforms continue to expand, consumers enjoy broader access to a wide range of products. However, navigating the fragmented pricing, specifications, and reviews across different platforms can be difficult, often leading to less-informed purchasing decisions. SavvyShopper overcomes these obstacles by creating a unified system that combines machine learning and web scraping to provide real-time price comparisons and personalized product recommendations, making online shopping more efficient and user-friendly.

At the core of SavvyShopper is a robust hybrid recommendation engine that combines collaborative and content-based filtering to deliver precise and relevant product suggestions. Additionally, the system employs predictive analytics to forecast price trends, assisting users in making more informed purchasing decisions. The web platform is developed using both Python Flask and Django frameworks, ensuring a responsive, scalable, and user-friendly interface. Through continuous learning and model updates based on user interactions, SavvyShopper progressively enhances its recommendation accuracy. Ultimately, the system aims to make online shopping more seamless, cost-effective, and user-centric by integrating multiple e-commerce

2. Body of Paper

2.1 METHODOLOGY

The system follows a structured methodology involving data collection through web scraping, followed by preprocessing and storage using a hybrid database. Personalized recommendations are generated using collaborative and content-based filtering, supported by machine learning models. ML techniques process user reviews, while predictive analytics forecast price trends. A Python Flask-based interface integrates APIs to ensure real-time interactions between users and backend services, delivering accurate recommendations and up-to-date price comparisons.

Data Collection through Web Scraping

Real-time product information—including prices, specifications, and customer reviews—is collected from platforms like Amazon, Flipkart, and eBay using Python libraries such as BeautifulSoup and Scrapy. The system is designed to comply with platform APIs and adhere to ethical standards during data extraction.

Data Preprocessing and Storage

The collected data is cleaned to address missing entries, inconsistencies, and duplicate records. Once processed, the information is stored in a scalable SQL database (SQLite), enabling efficient retrieval and management. A structured database schema is implemented to align product attributes across various platforms, facilitating smooth and accurate comparisons.

Recommendation Engine

The recommendation engine employs a hybrid approach combining collaborative filtering and content-based filtering. A deep neural network, trained on user interaction data, predicts product relevance based on browsing history and preferences. The model is fine-tuned using TensorFlow to optimize recommendation accuracy.

Price Comparison Algorithm

The system aggregates pricing data and applies a weighted comparison algorithm to rank products based on cost, discounts, and user ratings. Real-time updates ensure the reliability of comparisons, even during dynamic pricing events like flash sales.

User Interface

A Python Flask-based web application, integrated with RESTful APIs, delivers real-time price comparisons and recommendations. The interface is optimized for responsiveness using Bootstrap and JavaScript, ensuring accessibility across devices.

2.2 MODELING AND ANALYSIS

SavvyShopper is designed as a modular system with four core components:

- **Data Collection Module**: Employs Scrapy for asynchronous web scraping, minimizing latency and handling high-volume data extraction.
- **Data Processing Module:** Combines SQLite for efficient storage and retrieval. Data normalization ensures consistency across platforms.
- **Recommendation Module:** Integrates collaborative filtering (via matrix factorization), content-based filtering, and deep learning (using a multi-layer perceptron with dropout layers) to generate personalized suggestions. SVM regression supports price prediction.
- **User Interface Module:** A Flask-based web application provides an intuitive interface for price comparisons and recommendations, with API-driven real-time updates.

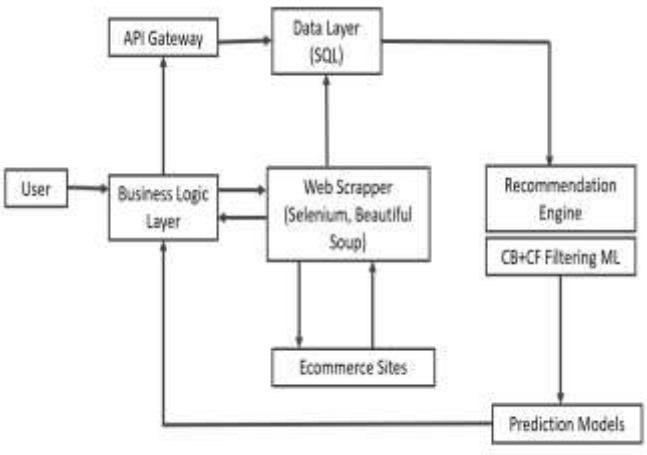

Figure 1: Architecture of SavvyShopper System

The architecture diagram illustrates the data flow from scraping to recommendation, highlighting the integration of machine learning, and database components.

2.3 RESULTS AND DISCUSSION

The system successfully delivers personalized recommendations and real-time price comparisons across multiple platforms. It significantly reduces user effort in finding quality products at competitive prices. Testing showed enhanced accuracy in recommendations through hybrid filtering and effective price predictions using machine learning models. User feedback indicated improved shopping convenience and satisfaction. Overall, the integration of web scraping, and predictive analytics ensures a reliable, efficient, and user-friendly shopping experience.

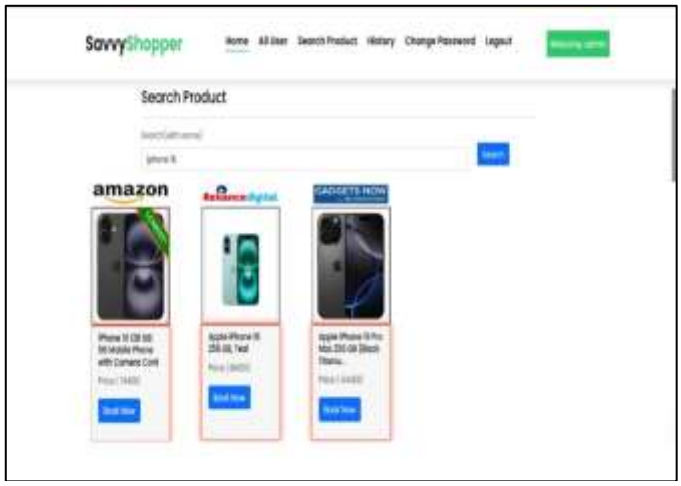

Figure 2: Product Comparison Results

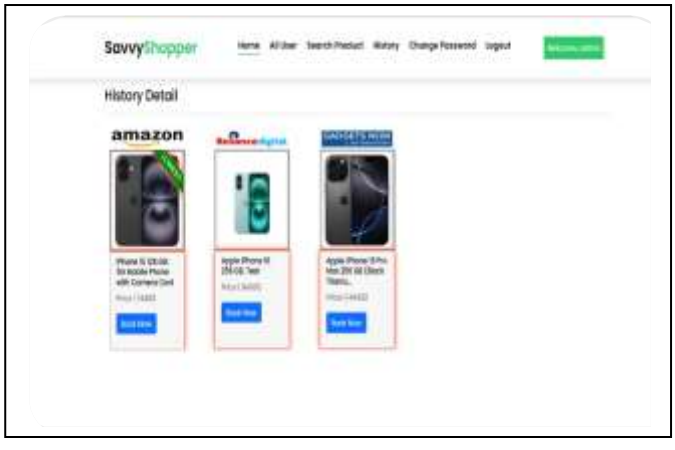

Figure 3: Product Comparison History

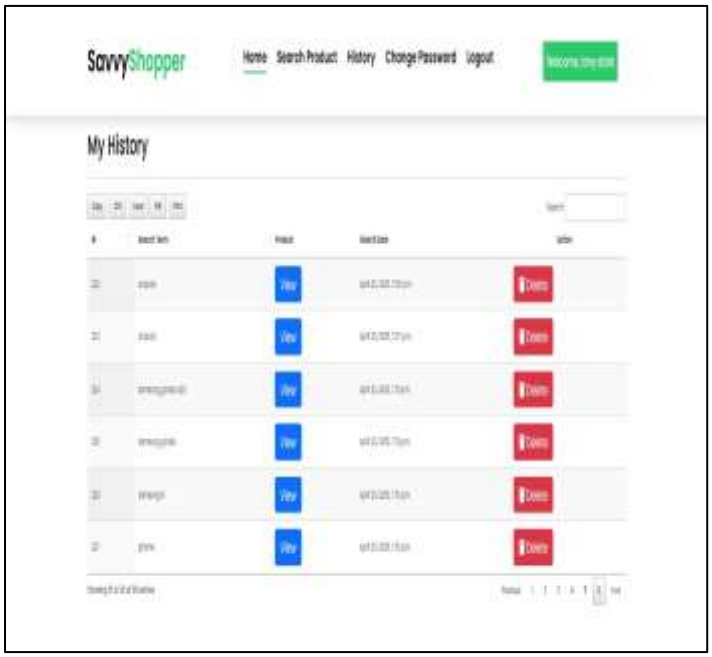

Figure 4 : User Search History

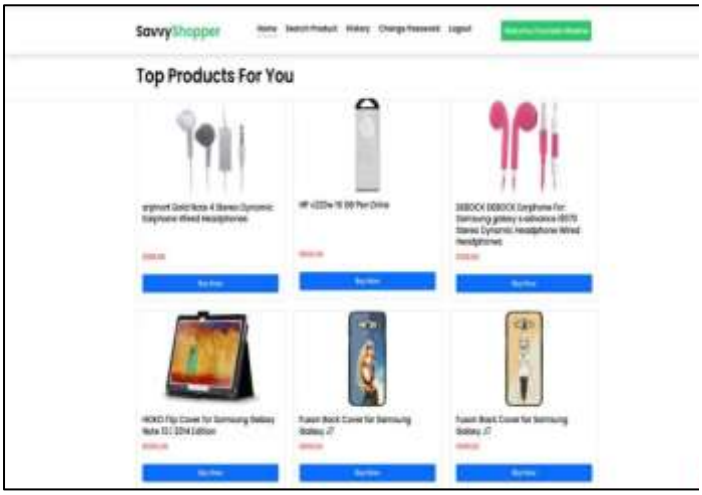

Figure 5 : Personalized Recommendations.

3. CONCLUSIONS

In conclusion, the Smart Product Recommendation and Price Comparison System enhances online shopping by offering personalized suggestions and real-time price insights. By integrating advanced machine learning, and predictive analytics, the system empowers users to make informed, cost-effective decisions. It simplifies the shopping experience, promotes user satisfaction, and ensures access to quality products at the best prices across multiple platforms..

ACKNOWLEDGEMENT

The authors would like to acknowledge the Department of Computer Engineering, Zeal College of Engineering & Research, Pune, for their valuable guidance, technical support, and encouragement throughout the research and development of this project.

REFERENCES

[1] 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.

[2] G. N. Chandrika, S. Ramasubbareddy, and K. Govinda, "Web scraping for unstructured data over web," in Embedded Systems and Intelligent Technologies. Springer, 2020.

[3] 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.

[4] 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.

[5] 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.

[6] P. Covington, J. Adams, and E. Sargin, "Deep neural networks for YouTube recommendations," in Proc. 10th ACM Conf. Recommender Systems, pp. 191–198, Sept. 2016.

[7] L. Zhao, Z. Lu, S. J. Pan, and Q. Yang, "Matrix factorization for movie recommendation," in Proc. IJCAI, pp. 3945 3951, July 2016.

[8] F. O. Isinkaye, Y. O. Folajimi, and B. A. Ojokoh, "Recommendation systems: Principles, methods and evaluation," Egyptian Informatics Journal, vol. 16, no. 3, pp. 261–273, Nov. 2015.
[9] S. Philip, P. Shola, and A. Ovye, "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.

[10] Y.-J. Wu and W.-G. Teng, "An enhanced recommendation scheme for online grocery shopping," in Proc. 2011 IEEE 15th Int. Symp. Consumer Electronics (ISCE), 2011. [Online]. Available: http://ieeexplore.ieee.org/document/5973860/

[11] Y. Hu, Y. Koren, and C. Volinsky, "Collaborative filtering for implicit feedback datasets," in Proc. 2008 Eighth IEEE Int. Conf. Data Mining, 2008, pp. 263–272.

[12] L. Jiang, Z. Wu, Q. Zheng, and J. Liu, "Learning deep web crawling with diverse features," in Proc. 2009 IEEE/WIC/ACM Int. Joint Conf. Web Intelligence and Intelligent Agent Technology, vol. 1, pp. 572–575, IEEE, 2009.

[13] Y.-M. Huang and S.-X. Du, "Weighted support vector machine for classification with uneven training class sizes," in Proc. 2005 Int. Conf. Machine Learning and Cybernetics, vol. 7, IEEE, 2005.

[14] J. B. Schafer, J. Konstanz, and J. Riedl, "Recommender systems in e-commerce," in Proc. 1st ACM Conf. Electronic Commerce, 1999, pp. 158–166.

[15] M. Balabanović, "An adaptive web page recommendation service," in Proc. 1st Int. Conf. Autonomous Agents (AGENTS), New York, NY, USA: Association for Computing Machinery, 1997, pp. 378–385.