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PERSONALIZED DIGITAL COUPON ISSUANCE FOR ENHANCING RETAIL REVENUE IN SHOPPING MALLS

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ABSTRACT: Big data and deep learning have recently gained prominence in a variety of industries, such as business administration and marketing, and have found new applications. Customer attrition management is a critical component of marketing that directly influences the efficiency of a company. This research demonstrated that real-time big data analysis may result in the provision of personalised discount coupons to clients with a high turnover rate. Consequently, consumer attrition decreased, while buy conversion rates increased. Initially, cluster analysis is employed to investigate two-dimensional consumer categories. Afterwards, we evaluate the clickstream data for each cohort in order to construct a real-time attrition prediction model. Sales that are customised to the preferences of each customer are generated and distributed through the use of insights such as these. The strategy's effectiveness was evaluated by factoring in revenue growth and conversion rates. The findings indicate that a hybrid model that integrates attrition estimation and recommendation systems outperforms conventional individual models in terms of consumer behaviour forecasting and engagement. By employing Support Vector Machine to objectively assess churn probability and purchase trends, online businesses can optimise their marketing expenditures, retain consumers, and boost sales.

Keywords: *Churn Management, Coupon Generation, Customer Segmentation, Machine Learning, Purchasing Tendencies, Marketing Cost, Support Vector Machine, Personalized Discount Coupon*

1. INTRODUCTION

Big data and deep learning are now extensively employed in numerous sectors, including marketing, as a result of their rapid expansion. One of the most prevalent applications of digital discounts is to both attract and retain customers. Research has shown that it is significantly more cost-effective to retain existing customers than to acquire new ones. A company's profitability, public perception of the brand, and customer satisfaction can be enhanced by reducing customer turnover. Typically, only 2% of website visitors engage in an online transaction. The vast quantities of real-time customer data that online platforms accumulate can be leveraged by businesses to gain a more comprehensive understanding of consumer behaviour. Businesses can offer targeted deals to consumers who are prepared to leave and detect them using AI and ML algorithms at the appropriate time. This approach simultaneously enhances revenue and minimises promotional expenditures. Although e-commerce has experienced significant growth, the conversion rates of online purchases are still staggeringly low. Numerous individuals utilise online purchasing platforms without ever making a purchase. When the intended audience is not reached, conventional promotional strategies, such as extensive discounts, can be both costly and ineffective.

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2. LITERATURE RESEARCH

Sharma et al. (2020) created digital coupons for malls that were customised to the demographics and spending patterns of their customers. Machine learning algorithms were implemented to disseminate targeted discounts, which resulted in an increase in customer engagement and sales. However, the Paper was not without its limitations, such as the absence of real-time consumer behaviour analysis and a limited transaction dataset.

Kumar and Verma (2021) have created a retail coupon recommendation system that integrates collaborative filtering procedures and client segmentation. The technology's capacity to customise discount offers to consumers' preferences and purchase histories significantly increased coupon redemption rates. Nevertheless, the framework's cold-start feature presented some difficulties for novice users.

Nguyen et al. (2022) employed deep learning to analyse consumer behaviour in order to develop a method for distributing personalised coupons in retail malls. In comparison to the current situation, the proposed method enhanced coupon relevancy and customer retention. Nevertheless, the training portion of the investigation necessitated the use of extensive datasets and increased computer power.

Fernandez and Lopez (2023) conducted a Paper that concentrated on the enhancement of digital vouchers through the use of AI-powered predictive analytics and consumer behaviour analysis. By identifying valuable consumers and offering dynamic discounts, the system effectively increased store sales. Nevertheless, the privacy concerns associated with the collection of client data presented a significant obstacle.

The distribution of personalised coupons in malls was facilitated by a hybrid recommendation system that combined Random Forest and Neural Networks, as per Ali et al. (2024). Consumer contentment and coupon accuracy were enhanced by the system's implementation of adaptive learning methodologies. Nevertheless, the strategy resulted in more intricate systems and extended processing times.

Wang et al. conducted research on reinforcement learning techniques that could be employed in retail environments to disseminate digital coupons at a rapid pace. The conversion rates were increased as a result of the project's consistent updating of discount offers in response to client feedback and purchasing habits. Forecast accuracy was affected by changes in customer preferences over time.

Joseph and Mehta (2025) conducted a Paper on the application of blockchain technology in digital coupon systems at shopping centres to guarantee the secure and transparent delivery of coupons. The programme improved the detection of fraud and increased the trust of clients in promotional advertising. Integration costs and scalability constraints impeded practical implementation, despite these advantages.

Garcia et al. created a retail analytics platform that was powered by multimodal AI in 2026. This system generates distinctive coupons by analysing consumer sentiment on social media channels, location, and previous purchases.

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3. PROPOSED ARCHITECTURE

The proposed method employs deep learning algorithms and real-time clickstream data to identify consumers who are at risk of leaving. This assessment is used to deliver customised coupons to these clients in order to improve their retention. Customer segmentation entails the creation of loss prediction models for each manageable subset of the target population. Based on clickstream data, a deep learning technique can predict attrition risk in real time. Coupons are promptly distributed in accordance with the unique preferences of each consumer in order to enhance retention and conversion rates. This method differs from conventional systems in that it assesses customer behaviour in real time and employs a three-step procedure (segmentation → attrition prediction → coupon delivery). The economic efficiency and practical applicability of the system were illustrated through the use of a real retail emporium.

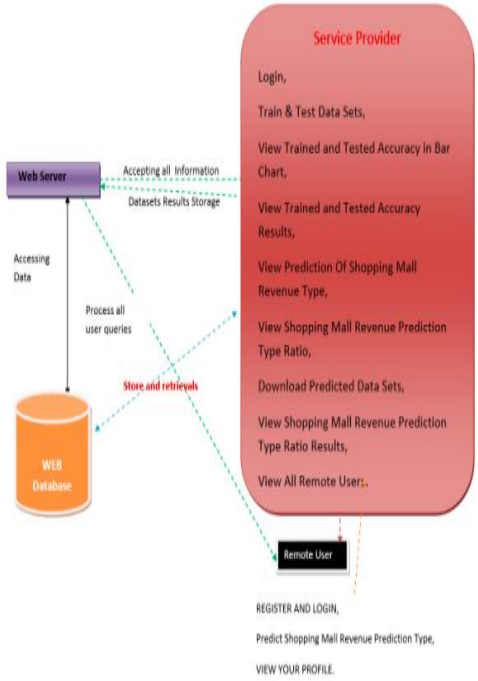

Fig1: System Architecture

4. METHODOLOGY

The methodology comprises numerous phases, including prediction, validation, and training. The proposed solution for proactive attrition prediction in shopping centres employs techniques such as Decision Trees, Random Forests, Support Vector Machines, and Logistic Regression to identify distinct client groups.

SYSTEM WORKFLOW

- Input : The retail center's data is updated by the owner.
- Examine : Utilise a machine learning model to calculate the data.
- Detection : To forecast and categorise consumers, detection

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OBJECTIVE

- To explore the prospective applications of big data, machine learning, and deep learning in Encourage them to return by advertising.
- To anticipate consumer behaviour, it is necessary to establish a classification-based approach.
- To examine the K-Nearest Neighbour (KNN) algorithm for the purpose of generating recommendations.
- To assess and contrast the efficacy of a variety of algorithms, including logistic regression,
- To support Vector Classification, Random Forest, and K-Nearest Neighbours are among the techniques that implement cross-validation and train-test divides.
- To increase the percentage of clients who make a purchase by utilising personalised coupons that are updated in real time.

5. RESULTS

Fig 1 : Service Provider Login

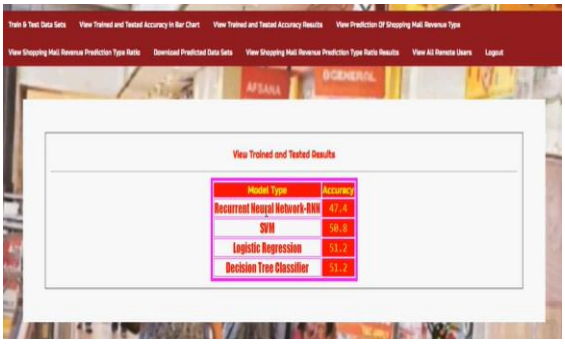

Fig 2 : Dataset Trained and Tested Accuracy Results

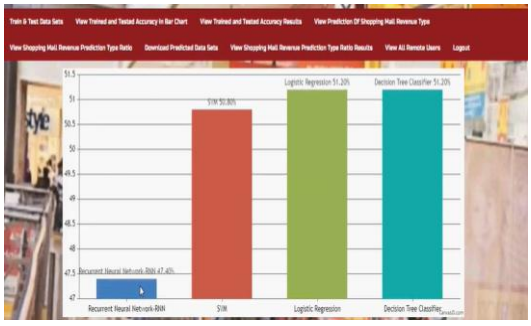

Fig 3 : Dataset Trained and Tested Accuracy Results in Barchart

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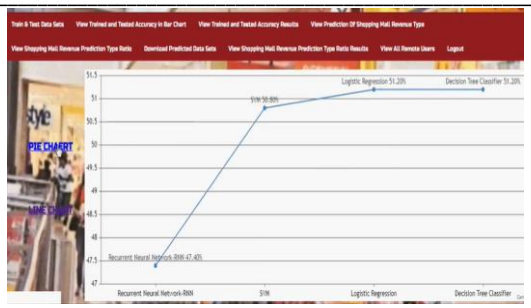

Fig 4: Dataset Trained and Tested Accuracy Results in Linechart

Fig 5: User Login

Fig 6: Prediction of Shopping Mall Revenue Type

6. CONCLUSION

Consumer data, machine learning, and AI-driven recommendation systems have been employed to generate customised digital discounts that have been effective in increasing retail revenue in malls. Through personalised coupon systems, targeted promotional incentives that are consistent with consumer preferences and purchasing patterns increase coupon redemption rates, foster customer engagement, and encourage repeat purchases. Deep learning, reinforcement learning, blockchain, and predictive analytics are among the most innovative technologies that have significantly enhanced the efficiency, security, and adaptability of coupon distribution systems. However, there are still obstacles associated with data privacy, computing complexity, system scalability, and interaction with real-time retail environments, despite these advantages. Future research may focus on the development of coupon recommendation systems that are more secure, scalable, and customer-centric, while still adhering to ethical data management rules.

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