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## ENHANCING SHOPPING MALL REVENUE THROUGH REAL-TIME PERSONALIZED DIGITAL COUPON SYSTEMS: A DATA-DRIVEN APPROACH

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### ABSTRACT

With the development of big data and deep learning technology, big data and deep learning technology have also been applied to the marketing field, which was a part of business administration. Customer churn management is one of the most important areas of marketing. In this paper, we proposed a method to prevent customer churn and increase purchase conversion rate by issuing customized discount coupons to customers with high churn rate based on big data in real time. After segmenting customer segments with two-dimensional segment analysis, a real-time churn rate estimation model based on clickstream data was generated for each segment. After that, we issued customized coupons to our customers. Finally, we tested the conversion rate and sales growth. A two-dimensional cluster analysis-based churn rate estimation combined with a recommendation system was found to be significantly more useful than the respective simple models. Using this proposed model, it is possible to increase sales by automatically estimating the customer's churn probability and shopping propensity without the burden of marketing costs in the online shopping mall.

### 1. INTRODUCTION

With the development of big data and deep learning technology, big data and deep learning technology have also been applied to the

marketing field, which was a part of management. Also, growth in internet adoption has made digital coupons a popular promotional tool [1]. Customized digital coupon issuance is a very important topic in online commerce. This is because maintaining existing customers is a more important business issue than acquiring new customers [2]. Also, retaining existing customers is much more economically advantageous than acquiring new customers [3]. In fact, the acquisition cost of new customers is known to be five to six times higher than the maintenance cost of existing customers [4]. Companies that have effectively managed customer churn by improving customer retention are known to have a positive effect not only on the company's profitability but also on improving brand image by improving customer satisfaction [5].

. Customized coupon issuance research has traditionally been active in highly competitive and urgent sectors such as telecommunications, finance, distribution, and game industries, and has focused mainly on developing predictive models using machine learning and artificial intelligence technology [6]. Also, recently, AI-based marketing using big data analysis and deep learning is emerging. Such AI-driven targeting can save huge amounts of marketing costs and raise online sales provided that the targeting model succeeds in estimating customer responsiveness accurately [7].

In particular, in the case of online shopping malls, the average purchase conversion

rate is around 2%. Online shopping malls have the advantage of being easily accessed through the PC web or mobile web, but on the contrary, this advantage can be a disadvantage that it is easy to see and leave quickly. Therefore, even the slightest reduction of customer churn rate can lead to high conversions, which can lead to huge profits.

Unlike offline shopping malls, online shopping malls are easy to collect data. All online behavioral characteristics of customers can be collected in real time in the shopping mall's own DB. Therefore, it is possible to have a wealth of customer history data and to use it to understand customer tendencies. In conclusion, if you use rich customer historical data to infer behaviors and tastes, you can increase customer conversion rates without special promotions.

The easiest and most intuitive way is to issue personalized coupons to customers in real time. By selecting customers with a high risk of real-time churn and issuing real-time customized discount coupons, it is possible to increase sales by increasing the purchase conversion rate without burdening special expenses such as promotional events. And to put these strategies into action, you need an AI-powered strategy. After AI automatically learns the histories of customers, it is possible to properly issue coupons by identifying the behaviors and tastes of individual customers.

Among the AI methodologies, in particular, deep learning based strategies can be implemented. Deep learning learns a large amount of data to make an optimal decision, and the more data, the better the result. By learning a large amount of real-time log data accumulated in an online shopping mall, it is possible to predict customer behavior and taste. In particular, it is possible to create a more sophisticated model every day by updating and re-learning the

existing model with data that accumulates every day.

AI-based customized coupon issuance methods are largely divided into three: customer segmentation, customer churn prediction, and personalized recommendation.

Customer segmentation is an activity that categorizes customers according to their homogeneous customer characteristics, providing the basis for differentiated marketing activities by customer group [8]. Machine learning models used for customer segmentation were mainly used either supervised learning models such as decision trees or unsupervised learning models such as self-organizing maps (SOMs) or K-means models [9]. One of the key features of recent machine learning-based customer segmentation studies is that customer segmentation is being performed for related other marketing research purposes, such as customer churn prediction [10], [11]. Customer churn prediction is also one of the main marketing research topics based on machine learning. Not to mention the fact that effective churn prediction has been recognized as a critical research topic not only for marketing but also for enterprise-wide management strategy [4], with the increasing number of customer churn under a highly competitive modern business environment, many new model development studies have been conducted to successfully predict customer churn. In the past, there have been major studies to learn models using single algorithms such as decision trees, logistic regression, and artificial neural networks to predict customer deviations, however, in recent, more attempts have been made to develop ensemble models or hybrid models that interconnects different models [12]. Meanwhile, personalized recommendation systems are also one of the most active machine learning-based marketing research topics along with churn

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prediction [13]. Research on personalized recommendations applied to recommended services such as Amazon and Netflix is increasing. Personalized recommendation studies have been dominated by model development studies to enhance predictive performance itself [13], [14].

On the other hand, customized coupon issuance can contribute greatly to online shopping malls. In the case of an online shopping mall, real-time performance is required compared to an offline shopping mall because a large number of users come and go in an instant. Therefore, it is inappropriate to apply the traditional offline discount coupon issuance strategy online. Also, in online, a lot of log data can be collected much more than offline. Therefore, if you use the marketing method using AI, you can establish effective marketing strategies such as discount coupon issuance strategy in real time.

In most studies, the entire customer group is regarded as a group and AI prediction models are developed at once. In fact, however, customers have different behavioral characteristics due to unexplainable and different transaction patterns, so it is unreasonable to assume the entire customer as a single customer group. It will be much more powerful if AI models are established for each group who are sharing similar tendencies according to customer behavior. In this study, applying deep learning techniques to real-time click stream data, we find customers with high chance of churning rates and issue a coupon that suits customers' preferences. This study has the following significance: First, we segmented the customer and develop a suitable model for customer churn pre- diction for each segmentation. Second, we made a click stream-based real-time customer churn risk pre- diction model using deep learning models. Third, we improved the actual conversion rate by

issuing customized coupons in real shopping mall website.

Unlike other studies, the scientific contribution of this study was to analyze customers in real time using data collected in real time as well as going through three steps to prevent customer churn. Also, we applied our model to the actual shopping mall, demonstrating the economic effectiveness and efficiency of the three steps of our model.

## 2. LITERATURE SURVEY

**“What makes a consumer redeem digital coupons? Behavioral insights from grounded theory approach,”**

**P. Naval and N. Pandey,**

The growth in internet adoption has made digital coupons a popular promotional tool. However, the extant literature on digital coupons is at an embryonic stage and requires theory building. This study adopts an inductive grounded theory approach to explore the new horizons for digital coupon redemption. The results showed that the intention to search and subscribe is a key driver of redemption, while coupon proneness and coupon acquisition value are its dimensions. Social media reviews, past experience, privacy risk, and customization are more relevant today for coupon redemption. The study also proposes segmentation of coupon users into deal buyers, planners, and convenience seekers based on consumer behavior.

**“Market segmentation based on hierarchical selforganizing map for markets of multimedia on demand,”**

**C. Hung and C. F. Tsai,**

Customer relationship management (CRM) aims at understanding and measuring the true value of customers. Market segmentation is a general method for successful CRM. This paper focuses on approaches that provide a human manager with a visualized decision making tool for market

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segmentation. We propose a novel market segmentation approach, namely the hierarchical self-organizing segmentation model (HSOS), for dealing with a real-world data set for market segmentation of multimedia on demand in Taiwan. HSOS is able to give a human manager a general idea of market segmentation step by step, which can be considered as a potential alternative approach to other hierarchical cluster approaches for market segmentation.

### **“Finding the hidden pattern of credit card holder’s churn: A case of China,”**

**G. Nie,**

In this paper, we propose a framework of the whole process of churn prediction of credit card holder. In order to make the knowledge extracted from data mining more executable, we take the execution of the model into account during the whole process from variable designing to model understanding. Using the Logistic regression, we build a model based on the data of more than 5000 credit card holders. The tests of model perform very well.

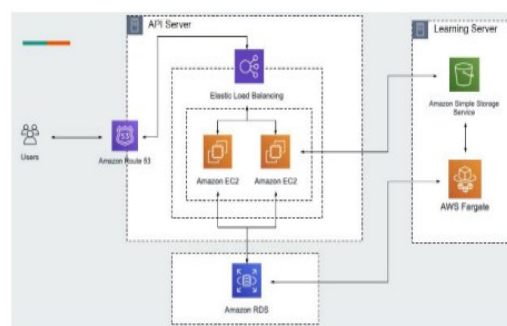
### **“Customer satisfaction cues to support market segmentation and explain switching behavior,”**

**A. D. Athanassopoulos,**

In this paper, customer satisfaction cues in retail banking services in Greece are examined. The study proposes an instrument of customer satisfaction that contains service quality and such other attributes as price, convenience, and innovation. The proposed framework of customer satisfaction was verified empirically yielding four distinct facets for business customers and five for individual customers. The performance implications of the customer satisfaction instrument are also explored. What is shown is that customer segments, in fact, yield statistically different satisfaction scores, which verifies the managerial value of customer segmentation practices. Finally, the facets of customer satisfaction as explanatory cues for the switching

behavior of individual and business customers were tested successfully.

## **3. SYSTEM ARCHITETURE**



## **4. EXISTING SYSTEM**

Customer segmentation is a starting point for marketing research. After grouping customers based on the characteristics of homogeneous customers, marketing strategies for each target segment can be done. Customer segmentation should not end in segmentation, but should be accompanied with subsequent marketing strategies. Companies that use customer segmentation techniques perform better by building differentiated and efficient marketing for each segment of customers. In addition, companies can gain a deeper understanding of customer preferences and requirements. Among various customer segmentation techniques, RFM methods are the most classical yet universally utilized methods. The RFM splits the purchasing behavior into three dimensions and scores each dimension. R is the last time since the last purchase, F is the total frequency of purchase, and M is the total purchase amount. The scores are calculated for each of the three dimensions. Subsequently, it constructs segments according to three dimensional classes [15], [16], [17], [18].

Along with traditional RFM methods, a lot of customer segmentation researches using machine learning have been conducted recently. When clustering using multiple variables, dimensionality reduction is often done. A representative dimensionality reduction technique using deep learning is the auto encoder. A typical example is the sequential method of applying cluster analysis after dimensionality reduction using an auto encoder [19]. Alternatively, modeling can combine dimensionality and clustering at the same time [20], [21].

The prediction and prevention of customer churn have always been studied as a key issue in loyalty management. The reason why companies are concerned with churn prediction is of two issues: the first reason is that a large number of customer churn affect the reputation and reliability of service providers. The second reason is that attaining a new customer costs five to six times than retaining an old customer. It is necessary to develop a churn prediction model that should catch deviating from normal purchase pattern [22]. Researches on customer churn are mainly based on

machine learning techniques rather than empirical studies through hypothesis verification [23]. Predicting churning customers fall under the classification problem where the given customer is classified as either churn or non-churn. Reference [24] proposed a framework for proactive detection of customer churn based on support vector machine and a hybrid recommendation strategy. While SVM predict E-Commerce customer churn, recommendation strategy suggests personalized retention actions. Reference [25] come up with a customer churn model that predict the possibility and time of churn. The model used Naïve Bayes classification and Decision Tree algorithm.

Reference [26] used LSTM model to predict customer churn prediction with clickstream data.

The personalized recommendation is one of the most actively conducted machine learning-based marketing research topics. In the past, personalized recommendation researches were mainly conducted using association analysis or purchase probability estimation for individual products [27]. However, in recent, collaborative filtering applied to recommended services such as Amazon and Netflix and contentbased techniques are the leading trend within the research field. Recently, hybrid methods or deep learning-based research combining various auxiliary processing techniques

has also been active [28]. Design of recommendation system depends on the objective of the system. Therefore, there exist a wide variety of techniques used in the recommendation system. Content-based and collaborative filtering systems are mostly used [29]. The other types of recommendation system like Knowledge-based recommendation system and constraint based recommendation system are also used [30], [31]. Classifier-based recommender systems like Decision tree, Neural networks, Naïve Bayes, MLP, KNN, SVM and Linear regression models are also used [32], [33], [34]. Clustering-based recommendations such as a K-means clustering algorithm is also used [35]. Recently, research on recommendation systems using deep learning has been active [36]. Recommendation systems using deep learning have strengths on nonlinear modeling, various formats of input data, and time series modeling. For example, [37] proposed a time-aware smart object recommendation system in the social Internet of Things. Reference [38] proposed a recommendation system that identifies and recommends the optimal location when opening a chain store. Reference [39] proposed a preference learning method from

heterogeneous information for store recommendation.

### Disadvantages

- The complexity of data: Most of the existing machine learning models must be able to accurately interpret large and complex datasets to detect Improving Shopping Mall Revenue.
- Data availability: Most machine learning models require large amounts of data to create accurate predictions. If data is unavailable in sufficient quantities, then model accuracy may suffer.
- Incorrect labeling: The existing machine learning models are only as accurate as the data trained using the input dataset. If the data has been incorrectly labeled, the model cannot make accurate predictions.

## 5. PROPOSED SYSTEM

In this study, applying deep learning techniques to real-time click stream data, we find customers with high chance of churning rates and issue a coupon that suits customers' preferences. This study has the following significance: First, we segmented the customer and develop a suitable model for customer churn pre- diction for each segmentation. Second, we made a clickstream-based real-time customer churn risk pre- diction model using deep learning models. Third, we improved the actual conversion rate by issuing customized coupons in real shopping mall website.

Unlike other studies, the scientific contribution of this study was to analyze customers in real time using data collected in real time as well as going through three steps to prevent customer churn. Also, we applied our model to the actual shopping mall, demonstrating the economic effectiveness and efficiency of the three steps of our model.

### Advantages

The proposed system generated RNN-based churn estimation models for each customer segment resulted from two-dimensional customer segmentation. After that, we issued customized product category coupons to customers who are at high risk of churn. Hybrid recommendation system is utilized for customized coupon issuance.

## 6. IMPLEMENTATION

### Modules

#### Service Provider

In this module, the Service Provider has to login by using valid user name and password. After login successful he can do some operations such as Train & Test Data Sets, View Trained and Tested Accuracy in Bar Chart, View Trained and Tested Accuracy Results, View Prediction Of Shopping Mall Revenue Type, View Shopping Mall Revenue Prediction Type Ratio, Download Predicted Data Sets, View Shopping Mall Revenue Prediction Type Ratio Results, View All Remote User

#### View and Authorize Users

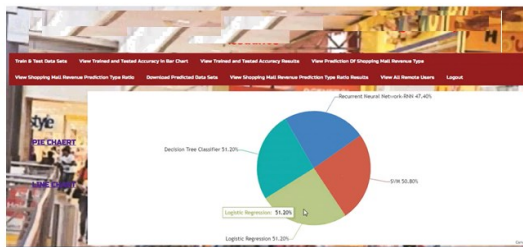
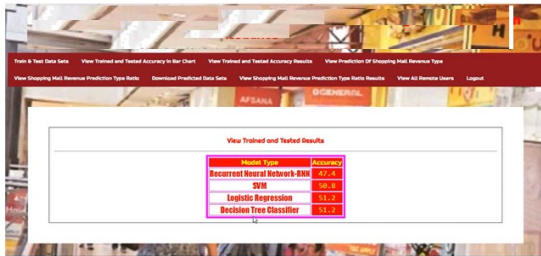
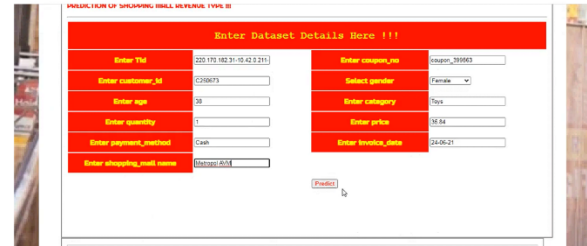
In this module, the admin can view the list of users who all registered. In this, the admin can view the user's details such as, user name, email, address and admin authorizes the users.

#### Remote User

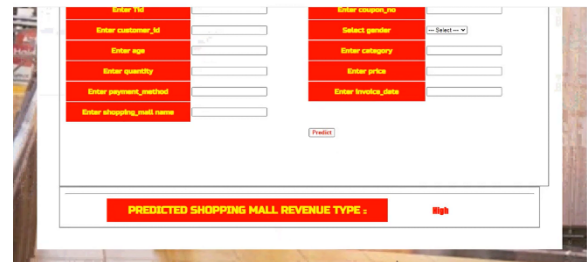
In this module, there are n numbers of users are present. User should register before doing any operations. Once user registers, their details will be stored to the database. After registration successful, he has to login by using authorized user name and password. Once Login is successful user will do some operations like REGISTER AND LOGIN Predict Shopping Mall

Revenue Prediction Type, VIEW YOUR PROFILE.

## 7. SCREEN SHOTS

| Enter Dataset Details Here !!! |                          |
|--------------------------------|--------------------------|
| Enter TId                      | 220117218231-10-42-0-211 |
| Enter customer_id              | C200075                  |
| Enter age                      | 38                       |
| Enter quantity                 | 1                        |
| Enter payment_method           | Cash                     |
| Enter shopping_cart_name       | ShoppingCart             |
| Enter coupon_id                | coupon_200002            |
| Select gender                  | Female                   |
| Enter category                 | Text                     |
| Enter price                    | 10.64                    |
| Enter invoice_date             | 24-06-21                 |



| Enter Dataset Details Here !!! |        |
|--------------------------------|--------|
| Enter TId                      |        |
| Enter customer_id              |        |
| Enter age                      |        |
| Enter quantity                 |        |
| Enter payment_method           |        |
| Enter shopping_cart_name       |        |
| Enter coupon_id                |        |
| Select gender                  | Female |
| Enter category                 |        |
| Enter price                    |        |
| Enter invoice_date             |        |

**Predict**

**Predicted Shopping Mall Revenue Type : High**

## 8. CONCLUSION

We identified previous e-commerce marketing approaches to derive user behavior prediction. A deep learning method for real time customer churn prediction showed an appropriate result. We applied our research to online shopping mall to raise conversion rate and sales. To check whether our experiment carry out monetary value, we developed a framework to measure the sales amount when used with segment model and personalized recommended digital coupon. We found that our model (scenario1) shows the best results. We found it is suitable for e-commerce online shopping mall to raise conversion rate and sales. Our study empirically showed that marketing, which was a field of management, could be solved more efficiently and quickly by applying big data and deep learning technology.

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