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Prediction of Customers Buying Behavior using Machine Learning Techniques: A Review

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ABSTRACT - Now a day's technology is changing very rapidly. Due to this, the cost of technology is going down day by day and comes in the reach of common persons. The use of E-Commerce website on mobile phones is one of the very common activities performed by Internet users. The numbers of users on E-Commerce websites is also increasing day by day and each user needs Quality of services (QoS). To improve the QoS we must study the user's activities performed on E-Commerce sites and apply machine learning techniques on these activities to improve QoS and predict the online customers behavior. The factors which effects the online customers behavior on E-Commerce sites may be divided into three categories (i) Technology used and website design (ii) Customers personal data (iii) Offers/Services provided by E-Commerce site.

Technology used in E-Commerce sites includes website content arrangement, payment and website security including customers personal data security, Website response time, etc.. Technology available to online customers i.e. (Internet speed, devices available to users, etc.) also play an important role in online buying. Other than technology customers personal data like age, gender, social status, cultural value geographical positions, etc. and Offers/Services provided by E-Commerce site includes discounts available, cash on delivery (COD), Product return policy, attention given to customers, product compression facilities, product reviews available, fast search facility, range of products, security about not to leak customers personal data also play an important role to influence the online customers behavior. Different machine learning algorithms will be applied on these three categories to predict the online customers buying behavior. Tools like WEKA, Python and Clementine, etc. will be used to apply machine learning algorithms.

Keywords :- Customers Need, Customer Types, E-commerce, Offers, QoS, ROI, , Web Contents & Design

I. INTRODUCTION

Due to technology revolution and its cost reduction it comes into the reach of common mans. More and more persons are using technology in their day to day working. Use of E-Commerce sites on mobile phones are very common activity. Some well known E-Commerce sites are Amazon, Flipcart, Paytm, Google pay, Snap deal, EBay, etc. To attract the users these E-Commerce sites regularly offering more offers to the existing and new customers. Online marketing customers are having many advantages like comparison of many products, more discounted price, purchase at any time, delivery at home, cash on delivery (COD) facility, etc. Each activity done by users on E-Commerce site are automatically stored as data in electronic form for future use and reference. The data regularly stored in this fashion becomes big data. The machine learning, data mining and big data analytic tools can be applied on this data to extract the useful information. This information will be used by E-Commerce sites to improve the return on investment (ROI) and quality of services (QoS).

II. PROBLEM IDENTIFICATION

To improve the ROI, technology play an important role. Technology used in E-Commerce site have direct effect on online customers buying behavior. The customers will be attracted towards the websites having the good web content arrangement, payment security, website security including customers personal data security. Customers personal data includes age, gender, social status, cultural value, geographical positions, etc. The offers/services provided by E-Commerce site also have direct effect in attracting the more online customers. Offers/Services provided by E-Commerce sites includes discounts available, cash on delivery (COD), product return policy, attention given to customers, product comparison facilities, product reviews

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available, fast search facility, ranges of products, security about not to leak customers personal data, etc. The effects of different types of customers, customers need and services provided by E-Commers site including technology used will be studies by using different machine learning algorithms on these three categories to predict the online customers buying behaviors. The tools like WEKA, Python and Clementine, etc. will be used to apply different machine learning algorithms. The available dataset belongs to the product categories like Books, Electronics, Movies & TV, Clothing, Shoes, Jewelry, Sports, Cell Phones, Toys, Games, Beauty, Office Products, Baby, Musical Instruments, etc. The dataset contains the reviews data and metadata of each product. The review data having the range from 1 lacks to more than 100 lacks records.

The Example of sample review data (one record) is given as follows :-

{ "Reviewer_ID": "Z8ABCD6K9QWE4B", "Asin": "0000012345", "Reviewer_Name": "Mr. XYZ", "helpful": [3, 4], "Review_Text": "I buy this for my boy friend who plays the piano. He loves music. This is Great purchase for me on lowest price than market price.", "Overall": 5.0, "Summary": "Heavenly Highway Hymns", "UnixReviewTime": 1252800000, "ReviewTime": "09 13, 2009" }

Where :

- Reviewer_ ID :- ID of the Reviewer
- Asin :- ID of the product
- Reviewer_Name :- Name of the Reviewer
- helpful :- Helpfulness rating of the review
- Review_Text :- Reviewers Comments about product
- Overall :- Overall rating of the product
- Summary :- Summary of the review
- UnixReviewTime :- Time of the review (Unix Time)
- ReviewTime :- Time of the review (raw)

The available data will further be categorize from different angels of studies like gender wise, age wise, product wise, security wise, web content wise, site response time wise, site search time wise, etc. to studies the effect of one or more attributes on others. Keeping in view this categorization of data the machine learning algorithms will be applied to study the online customer buying behavior.

III. Review of Literature

[1] **Sahar F. Sabbeh (2018)** apply the machine learning techniques to improve the quality of services (QoS). To analyze customers personals and behavioral data to increase the customers retention rate CRM systems used machine learning models. The performance of different machine learning techniques used includes Discriminate Analysis, instance-based learning (k-nearest neighbors), Decision Trees (CART), Logistic Regression, ensemble-based learning techniques (Random forest, Ada Boosting trees and Stochastic Gradient Boosting), Support Vector Machines, Naïve Bayesian, etc. are compared and result shows that both random forest and ADA boost outperform all other techniques with accuracy 96%.

[2] **Madasu Bhaskara Rao et al (2018)** Considering the gender(female) of the customer a study on the factors that influence female online shopping behavior is conducted. The research is descriptive and exploratory in nature. The female consumers is considered dependent variable towards online shopping. The independent variables are taken as demography (age, education, marital status, occupation, monthly income, nature of employment, frequency of online purchase, etc.), convenience, time effectiveness, website design/features, security and social media influence. The independent variables have effect on dependent variables.

[3] **Ardra Muralidharan et al (2018)** Study the consumers buying behavior and identify certain factors that affect the purchasing behavior of customers on online shopping. The factors such as demography factor, brand loyalty, review and recommendation celebrity endorsement, product ads etc. influence the customers buying behavior. This study incorporated expectancy value theory and attribution theory. expectancy value theory suggest that people are determined and attribution theory tries to explain the regions for people behavior.

[4] **Pushpak Singhal et al (2018)** Make a study on consumer behavior by using Buyer Black Box Model. The study analyses the various factors that affect the online shopping behavior of the customers. The various discounts, easy payment facilities, easy return facility, timely and express delivery have an effect on customers buying behavior. The three aspects that are generally considered by online customers are Reduced search cost, discounts, ease of purchase.

[5] **C. Arul jothi et al (2017)** Shows that social media is widely used in sharing of experience in the field of entertainment, networking, sharing of new brands. Social media is also used to share reviews and opinion that effects the user buying behavior.

[6] **Hemalatha J et al (2017)** Establish a relationship between three parameters – consumer prudence, consumer shopping experience and consumer satisfaction. The study confirms the positive relationship between these three parameters. A structural equation model (SEM) was formulated to understand the consumer behavior. The study used Analysis of a Moment Structures (AMOS) and SEM.

[7] **Ugonna, Ikechukwu A et al (2017)** A study of the influence of three factors i.e. efficient online marketing, on-time delivery and effective

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communication on consumer buying behavior is conducted.

[8] **Angita Yolanda et al (2017)** Conduct a study of cultural factor on consumer behavior and found that cultural factor is having 26.14% influence on online marketing while psychological factor is having 26.5% influence on offline marketing.

[9] **Beril Durmus et al (2017)** A survey was conducted on 635 online users. The study shows that information risk, financial risk, product risk and Word of Mouth (WOM) intensity have an effect on online customer trust and trust has an effect on online purchase intention.

[10] **Lakshmi.S (2016)** Shows that customer buying behavior are influenced by different factors such as culture, social class, references group relation, family, salary level and salary independency, age, gender etc. effects the consumer buying behavior.

[11] **Prof. Pritam P. Kothari et al (2016)** Identify the five components which affect consumer perceptions about online purchasing these five components are cognition, sensed usefulness, comfort of use, sensed an enjoyment and security.

[12] **Caroline Lo et al (2016)** Studies the online user activity and purchasing behavior. A time varying user purchasing intent model build. The long term purchasing user intent to save and click through on more contents. The time of purchase shift towards searches.

[13] **Zan Mo et al (2015)** Collected the online reviews and use it in the study. The S-O-R (Stimulus-Organism- Response) model is used to study the influence of product reviews on consumer purchase behavior. The statistical results show that the favorable reviews, rating, graphical reviews, appended and cumulative reviews have an influence on online consumer purchase behavior. The adverse reviews and services rating are not significant.

[14] **Amjad Hidaib et al (2015)** To develop an accurate efficient churn prediction model three hybrid models studies. The first model uses the k-means algorithm for data filtering and multilayer perceptron artificial natural networks (MLP-ANN) for prediction. The second model uses the hierarchical clustering with MLP-ANN. The third model uses self organizing maps (SOM) with MLP-ANN. The compression with other models shows that three hybrid models out performed single common models.

[15] **Mamta Chawala et al (2015)** The online buying behavior is divided into many attitude like formation, intention, adoption and continuation, etc. The important factors that influence the online customer buying behavior are attitude, motivation, trust, risk, demographics, website, etc.

[16] **Vipul B. Patel et al (2015)** By considering the shopping enjoyment, perceived risk and trust as a major factor a study is conducted on online shopping behavior. The study shows that customer attitude has a positive influence on intentions to continue purchasing online. On the other hand, shopping enjoyment and trust have a positive relationship with customers attitude.

[17] **Lim Yi Jin et al (2014)** A quantitative research is conducted on 600 internet users of different age groups, gender and backgrounds. The Perceived usefulness and trust are found having the influence on online shopping behavior of customers.

[18] **Hana Uzun et al (2014)** Seven hypotheses were formulated regarding customers previous experience with E-Commerce. The result of this study shows a relation between satisfaction with online services and customers intention to buy in the future.

[19] **Robert Ravnik et al (2014)** A study is conducted by using different machine learning algorithms and comparison between these. The study shows that 88.6% classification accuracy predict by using support vector machines (SVM).

[20] **Norazah Mohd Suki et al (2013)** A study is made on online shopping environment by considering the product characteristics, confidence and promotional offers. The study shows that product characteristics and confidence heavily influence the online consumers buying behavior followed by promotional offers.

[21] **Mohammad Hossein Moshref javadi et al (2012)** A study is made by considering the different factors that affect the on online shopping behavior of customers. A complicated socio-technical phenomenon includes too many factors. The regression analysis was used on the data to test hypothesis. The study shows that financial and non-delivery risk adversely affects the online shopping behavior.

IV. FINDINGS

The followings are the findings with respect to customers types, customers needs and factors that affects the customers behavior.

A. With respect to sales the online customers can be categorized in the following groups.

1. New Customers
2. Potential Customers
3. Discount Customers
4. Impulsive Customers
5. Loyal Customers
6. Inactive/ Silent Customers

B. The following are the most common needs of the customers.

1. Security
2. Good web contents

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3. Fast searching facility
4. Functionality
5. Price
6. Convenience
7. Experience
8. Design
9. Reliability
10. Performance
11. Efficiency
12. Compatibility
13. Empathy
14. Fairness
15. Transparency
16. Control
17. Options
18. Information

C.The factors which effects the customers behavior on E-Commerce sites may be divided into three category's.

1. Technology and Website Design
2. Customers Personal Data
3. Offers/Services provided by E-Commerce sites.

The different machine learning algorithms will be applied on above said A, B & C by using WEKA, Python and Clementine tools to predict the online customers buying behavior. Different E-Commerce websites put the data in open domain for research purpose. The researchers use this data in research and find the hidden facts and figures for future use. One direction of research is to predict the online customer buying behavior. The nature of prediction of online customer buying behavior problem is very dynamic. Therefore, no single solution for this problem is available. According to the data available and study performed by the different researchers different solutions suggested.

V. CONCLUSION

Prediction of online customers buying behavior is very dynamic problem in nature. The E-Commerce site wants to improve Returns on Investment (ROI). The ROI depends on number of online customers and their needs. ROI also depends on Quality of Services (QoS) provided by E-Commerce sites. To improve ROI the E-Commerce sites / Firms are doing research on customers past activities performed by online customers on E-Commerce web site. This data is also available in open domain for research purpose. The research may be performed by observing the effects of customers need on purchasing, effect of technology on business, effects of customers personal data (i.e. age, gender, cultural values, financial position, etc) on online purchasing, effects of offers given by E-Commers sites to the online customers, etc.

VI. RESULT

As a result the problem "*prediction of customers buying behavior using machine learning techniques*" is divided into four parts (i) problem characteristics (ii) data characteristics (iii) findings/observations after use of machine learning algorithms

(i) Problem Characteristics is explained using the following table

Aim / Object	Nature of Problem	Target Audience	Data Type & Source
Improve Return on Investment (ROI) by predicting the online customers behavior.	Very Dynamic. No single solution is available to this problem.	Online Customers.	Secondary data will be used. Amazon public domain data.

(ii) Data Characteristics is explained using the following table

Category of data	No. of records available	Available Attributes
Data belongs to different categories like Books, Electronics, Movies & TV, Clothing, Shoes, Jewelry, Sports, Cell Phones, Toys, Games, Beauty, Office Products, Baby, Musical Instruments, etc. are available for study.	Number of available records vary from 1 lacks to more than 100 lacks	Reviewer_ ID => ID of the Reviewer Asin => ID of the product Reviewer_Name => Name of the Reviewer helpful => Helpfulness rating of the review Review_Text => Reviewers Comments Overall => Overall rating of the product Summary => Summary of the review UnixReviewTime => Review Unix Time ReviewTime => Time of the review (raw)

(iii) Findings/Observations after use of machine learning algorithms on available data is explained using the following table

Tools	Data Categorization	Study
Tools like WEKA, Python, Clementine, etc. will be used to apply different machine learning algorithms.	Data will be divided into different categories like customer wise, review wise, gender wise, age wise, etc.	Effect of one or more category on others will study and accordingly online customer buying behavior will be predicted.

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