Recommendation Engine for Mobile-Commerce Product using Heuristic Algorithm

Shanti Verma[*1], Kalyani Patel[2]

[*1]Assistant Professor, L.J. Institute of Computer Applications, Ahmedabad, Gujarat, India

[2]Assistant Professor, K.S. School of Business Management, Ahmedabad, Gujarat, India

ABSTRACT

Now days every age group people use online shopping to complete their daily needs. In this research proposal researcher tries to improve TAM model of Mobile commerce for searching of product. For that researcher first conduct an online survey using Google forms to find the factors associated with mobile commerce. By performing statistical analysis researcher calculate load factors associated with these factors which will used to update the class relationship of defined ontology of product for mobile commerce. Researcher will tries to compare various heuristic search algorithms and find out the best algorithm for defined ontology. Finally researcher will try to apply query based search for available ontology and updated ontology and prove that search results are better in updated ontology. The research proposal finally provides output as a recommendation engine for mobile commerce based on heuristic approach.

Keywords: Online Shopping, Survey, Analysis, Mobile Commerce, Ontology, Heuristic Search

I. INTRODUCTION

I am a Full time PhD. Candidate of Gujarat Law Society (GLS) university, Ahmedabad, India. I have started my PhD work in July 2015 with primary data collection for smart phone and Mobile commerce usage in India using Google forms. I have collected 335 responses in major states of India like Uttar Pradesh, Gujarat, Maharashtra, Karnataka and Madhya Pradesh. The primary data collection method is questionnaire. The mode of filling this questionnaire is through Google Forms. The target audiences are smart phone users who do mobile shopping.

Several cross-tabulations have been used in the questionnaires in order to simultaneously record the responses across more than one variable/response sets for meaningful analysis of the concerned issues. As the data available for various mobile commerce websites are in binary form, there is a strong need to collect primary data.

There are two types of search algorithms: Blind and uninformed, used for ontology based product structure. I have done a comparative study and found that Heuristic search algorithms which are part of uninformed algorithms provide optimized results than blind search algorithms. There are various heuristic algorithms available in market. Most cited heuristic algorithms are Travelling salesman Problem (TSP), A*, Ant Colony optimization and Genetic algorithms (GA).

Currently I try to compare above four algorithms for my training data set/ontology and find which best suited algorithm for my work is. After choosing the Algorithm, I try to add some relationship in the available product ontology and check is there is any improvement in search results after updating in ontology. I have finalized my research topic. My research proposal topic is "Heuristic Search based recommendation engine for product of mobile commerce".
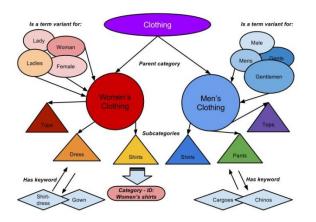
Figure 1. Example of M-commerce product (Cloth) Ontology

II. CONTEXT AND MOTIVATION

In India number of mobile phone users grows with rapid rate due to low cost mobile phones with better configuration and fast data access in low cost. Due to availability, personalization and location based services mobile commerce is used in India by every age people. In India younger age people (below 35) is 75% which plays important role in the growth of online shopping users. There are various key factors which plays important role in success of Mobile commerce. These are accessibility, entertainment, reliability, mobility, externality and reciprocity [11]. By the end of year 2017 it will be expected that 3 billion Smartphone's and 1 billion tablet users Worldwide [15]. This implies that Mobile commerce is hot topic for future research.

The research on Mobile-commerce buying behavior trends aims to contribute in the following areas: The research provides findings and suggestions useful for online shopping applications providers for providing recommendation of product. The research tries to establish the relationship between Mobile users buying behavior and demographics. The main objective of this research is tried to update the class relationship of product ontology which is helpful to provide better search in mobile-commerce environment.

III. LITERATURE REVIEW

3.1 Related Work- Mobile-Commerce
Mobile commerce is a platform where user can purchase product with the use of mobile device connected through wireless data connection [11]. The difference between online shopping and mobile shopping is that in mobile shopping customer use handheld (mobile) devices while in online shopping they can use both mobile and fixed devices like pc [12]. In Smartphone's we see that technology is upgraded day by day with minimum cost. With effect that mobile commerce market is now in boom and major companies are investing in that [13]. Traditional shopping model are applicable only for personal computer users. For mobile shopping different models are used such as Technology acceptance model (TAM) [14]. In mobile shopping users get better offers on product as compared to traditional shopping with effect number of users who uses

3.2 Related Work- Ontology
As the number of internet users grows exponentially, size of database of World Wide Web (WWW) also grows exponentially. It is very difficult to search in huge database manually [5]. So organization of database is major concern as one query has different meaning but we want the correct result. Patil,

Aradhana R., and Amrita A. Manjrekar was combined the concepts of Ontology, text feature extraction and hierarchical clustering to provide proper information retrieval [6]. Now a day's web pages are the major sources of text documents for example: Digital Library. To apply searching there is a need of homogenous cluster of text. Harmony search is a algorithm which is based on heuristic function which produce optimized result of given query [7]. Kuznetsov, V. A., V. A. Mochalov, and A. V. Mochalova proposed an algorithm which automatically updates the ontology basing using some expert rules and logical inference. They use the PHREK algorithm for frequent pattern matching [8]. If we want to create ontology we must aware about rules, relationships and attributes of classes very precisely. Cheng, Bo, Shengda Zhong, and Junliang Chen proposed an expert system for multimedia conferencing management [9].

3.3 Related Work- Heuristic search algorithms
Heuristic search is a technique of artificial intelligence which is used for problem solving. Traditional search algorithms like BFS and DFS produce very slow results, while heuristic algorithms provide quick and precise result of given query. Heuristic algorithms are generally used for recommendation system which used collaborative filtering to provide precise result.

Peñaranda, Cristian, et al. proposed recommendation system for online cooking recipe based on ontology [10]. There are various researchers who work on extracting the text and converting it in ontology based representation. Then there is a need to apply heuristic algorithm like harmony search, A* and simulated Annealing for the problem defined to achieve precise result of query.

IV. STATEMENT OF THESIS/PROBLEM

The research is related to the computer science branch. In the thesis researcher try to satisfy the following hypothesis for the primary data analysis to show the relationship between different attributes of mobile shopping:

H1: There is no significant relationship between Gender and expenditure done in mobile shopping.

H2: There is a significant relationship between category of item purchased and payment method opted by Indian consumer in mobile shopping.

H3: There is no significant difference between population means of gender.

H4: There is no significant difference between population means of yearly income.

H5: There is no interaction between gender and yearly income.

After completing the primary analysis researcher try to develop ontology of product for mobile shopping. Using MATLAB tool they try to identify the best heuristic search algorithm for the defined ontology of product. Generally heuristic search algorithms used Euclidean distance and Manahan distance to find the goal in graph. In this research, researcher tries to modify heuristic function and associate load factor to find the result of defined query

V. TEST OF HYPOTHESIS

To test the hypothesis authors collect the 335 responses of mobile shopping customers using Google forms and apply various statistical methods like Chi-square test, ANOVA, correlation etc.

H1: There is no significant relationship between Gender and expenditure done in mobile shopping [2]
Authors take expenditure done in mobile shopping and Gender of consumer to test the H1 and get the below

results of Chi-square test.
chisq.test(tab, correct=T)
Pearson's Chi-squared test   data: tab
X-squared = 4.2519, df = 4,   p-value = 0.373
The results of study show that Gender is dependent on the expenditure done in mobile shopping at 95% significance.

H2: There is a no significant relationship between category of item purchased and payment method opted by Indian consumer in mobile shopping [3].
Authors take two questions from questionnaire.
1) Type of product purchased
2) Payment method opted to purchase that product.

To test H2 authors apply chi-square test of independence and get the below results.

Pearson's Chi-squared test   data: tab
X-squared = 50.862, df = 28,   p-value = 0.005174
The results of test have P-value 0.005174 which is less than 0.05. It shows the rejection of H2.
These results conclude that there is a relationship between category of item purchased and payment method opted for that product.

H3: There is no significant difference between population means of gender [4].
To test H3 authors apply two way ANOVA to find association between demographic factor gender with income of consumer in mobile shopping. The following results come in the form of ANOVA table given below

SOURCE	SUM OF SQUARES	DF	MEAN SQUARES	F	SIG	H_0
Gender	8.46	1	8.4585	6.0690	0.01427	Accepted H1

The results of above table shows the significance value of 0.01427 which is less than 0.05, means acceptance of H3. We can conclude from above that the there is no impact of gender on yearly income.

H4: There is no significant difference between population means of yearly income [4].
To test H4 authors apply two way ANOVA to find association between demographic factor gender with

income of consumer in mobile shopping. The following results come in the form of ANOVA table given below

SOURCE	SUM OF SQUARES	DF	MEAN SQUARES	F	SIG	H_0
yearly income	84.44	4	21.10890	15.1458	2.294e-11	Accepted H4

Results from above table we may conclude that there is a there is no impact of yearly income on gender of mobile commerce consumers.

H5: There is no interaction between gender and yearly income.

SOURCE	SUM OF SQUARES	DF	MEAN SQUARES	F	SIG	H_0
gender *yearly income	2.88	4	0.7209	0.5173	0.72310	Rejected H5

From the above table we conclude that there is no influence of gender and yearly income towards shopping habit

VI. RESEARCH GOALS & METHODS

To collect primary data for satisfy the defined hypothesis in previous section researcher conduct an online survey about "usage and perception of *Indian* customer for Mobile commerce". Main aim to conduct survey is to find out some important parameters that should be included in Mobile commerce model. From the survey we conclude that page navigation, payment method, organization of product, image based search should be improved. Researcher selects the parameter organization of product that should be improved in TAM of m-commerce. For that researcher want to update ontology of product To apply the search mechanism in ontology, from literature I found that Heuristic search is better .I decide to first develop my heuristic function and apply various heuristic algorithm such as best first search, Beam search and A* and compare the results. After comparison I want to find out the best suited algorithm for my heuristic function using tool MATLAB. Then I try to propose an improved TAM model for M-commerce. To complete the thesis researcher proposed a flow of research as a flow chart representation. In this flow chart researcher present a stepwise approach to complete thesis. There is always probability that our defined hypothesis not satisfied. For that researcher provides alternatives to satisfy the defined hypothesis.
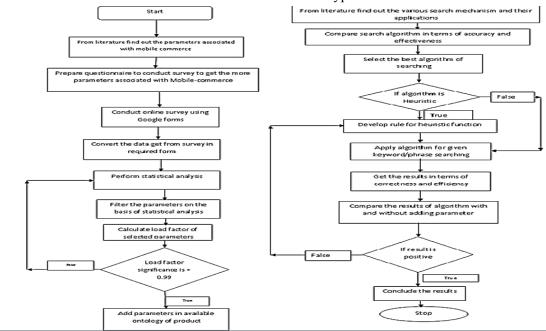
Figure 2. proposed flow of research

VII. DISSERTATION STATUS

Now a day's Indian online market is very competitive. To sustain in market it is very important to satisfy customer needs. As a part to analyze this researcher conduct an online survey to know the customer perception about mobile shopping and smart phone usage. From the collected data researcher published contribute the following research paper which are published in IEEE/Springer and presented in international conference.

1. Survey of smart phone and mobile commerce usage in India [1].
2. Impact of consumer gender on expenditure done in Mobile shopping using test of independence [2].
3. Dependency between type of product purchased and payment method opted by Indian consumer in mobile shopping [3].

Association between shopping habit and demographics of mobile commerce users in India using two-way ANOVA [4].

To provide the better recommendation of product in mobile shopping, researcher find out the heuristic algorithms provide optimal result than blind search algorithms.

Researcher now try to do a comparative study to heuristic search algorithms like TSP, A*, Genetic algorithm and try to find out the best searching algorithm for ontology of product for mobile commerce. After finalize the algorithm, researcher try to update the ontology class relationship and prove that after changing the relationship the search algorithm gives better results than previous ontology of product.

This result is helpful to update the technology acceptance model (TAM) of mobile commerce. Till now I have completed draft version of three chapters of my thesis, which are 1) Introduction to research 2) Mobile-Commerce and user behavior analysis and 3) Role of Recommendation system in Mobile shopping.

VIII. EXPECTED CONTRIBUTIONS

The expected outcome researcher wants from this research is to develop a heuristic approach based search engine for mobile commerce product. For searching researcher tries to use statistical approach i.e. load factor based search.

IX. REFERENCES

[1]. Prof Shanti verma, Dr. Kalyani patel. "Survey on smart phone and mobile commerce usage in India." IEEE International advance computing conference (IACC-2017). IEEE, 2017.

[2]. Kalyani patel, Shanti verma. "Impact of Consumer Gender on Expenditure done in Mobile shopping using Test of Independence." Second International Conference on ICT forSustainable Development (ICT4SD-2016). Springer Proceedings Book-LNNS Series, 2016.

[3]. Verma, Shanti, and Kalyani Patel. "Dependency between type of product purchased and payment method opted by Indian consumer in Mobile shopping." Cloud Computing, Data Science & Engineering-Confluence, 2017 7th International Conference on. IEEE,2017.

[4]. Kalyani patel Shanti verma "Impact of Consumer Gender on Expenditure done in Mobile shopping using Test of Independence" , Second International Conference on ICT for Sustainable Development (ICT4SD-2016. Springer ProceedingsBook-LNNS Series, 2016.

[5]. Muthukumar, S., and N. Muthu. "The Indian kaleidoscope: emerging trends in M-Commerce."

[6]. Sanjivani Mahor, Sourabh Jain "M-Commerce with Process of Knowledge Discovery" International Journal of Computer Technology and Electronics Engineering (IJCTEE) Volume 1 , Issue 2 page 150-154

[7]. Gan Teck Wei, Shirly Kho, Wahidah Husain, Zurinahni Zainol, " A Study of Customer Behaviour Through Web Mining" Journal of Information Sciences and Computing Technologies Volume 2, Issue 1 2015 page 103-107

[8]. Gupta, Rajan, and Chaitanya Pathak. "A Machine Learning Framework for Predicting Purchase by Online Customers based on Dynamic Pricing."Procedia Computer Science 36 (2014): 599-605.

[9]. Turkyilmaz, Ceyda Aysuna, Sakir Erdem, and Aypar Uslu. "The Effects of Personality Traits and Website Quality on Online Impulse Buying." Procedia-Social and Behavioral Sciences 175 (2015): 98-105.

[10]. Gohary, Ali, and Kambiz Heidarzadeh Hanzaee. "Personality Traits as Predictors of Shopping Motivations and Behaviors: A Canonical Correlation Analysis." Arab Economic and Business Journal 9.2 (2014): 166-174.

[11]. Chiang, I-ping, and Yi-Shiang Liao. "Exploring the key success factors of mobile commerce in Taiwan." Advanced Information Networking and Applications Workshops (WAINA), 2012 26th International Conferenceon. IEEE, 2012.

[12]. Wu, Jen-Her, et al. "Falling in love with online shopping carnival on singles' day in China: An uses and Gratifications perspective." Computer and Information Science (ICIS), 2016 IEEE/ACIS 15th International Conference on. IEEE, 2016.

[13]. Naili, Mohamed, Abdelhak Boubetra, and Abdelkamel Tari. "Mobile Commerce Websites Ranking." NGMAST. 2014.

[14]. Li, Qiang, et al. "Multi-Classes Feature Engineering with Sliding Window for Purchase Prediction in Mobile Commerce." 2015 IEEE International Conference on Data Mining Workshop (ICDMW). IEEE, 2015.

[15]. Seth, Earley. "Mobile Commerce: A Broader Perspective." IT Professional 16.3 (2014): 61-65.