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Customer Decision Support System

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Abstract - *E-commerce provides internet vendors with a vast quantity of data which can be leveraged to mine buying patterns of customers and derive useful insights into the data. This paper provides a prototype to provide a similar infrastructure for brick and mortar stores so they can use customer data in a decision support system to make various predictions about the buying habits of customers to strategize better through the insights derived from the system. The prototype works by crowdsourcing data from various stores and keeping track of each individual user through a loyalty program.*

Key Words: **BigData, Decision Support System, Data Mining, Business Intelligence, Pattern mining**

1.INTRODUCTION

The goal of the prototype presented in this paper is to provide a reliable and robust software system to provide insights about consumers to various shopkeepers and dealers participating in the program. It will help small businesses by suggesting ideal products to market to each costumer thereby increasing the chance of a successful sale. The Decision support system will also help predict the effectiveness of various freebies and discounts on increasing the probability of a successful sale.

Furthermore, the system will help predict the customer confidence i.e: the probability of a certain customer buying a certain product. This will be done by use of various parameters pertaining to the user demographic and historical buying patterns.

Additionally, the software will also help classify customers as high, medium and low priority based on the volume and frequency of their transactions.

1.1 Implementation

The prototype will use the following for its implementation:

Database: MongoDB
MongoDB is chosen for the prototype since it supports unstructured data. This is useful as various vendors' data can be in various formats.

Scripting language: Python
Python provides inbuilt libraries such as scikitlearn and numpy which is useful for data processing applications as required for this project.

2. Architecture

Decision support system will have the following modules:

1. Input stream: The data from the various small businesses will be uploaded via a web portal which will be an input stream to the databases.

2. Data cleaning module: This module will reduce the noise in the data and will identify various parameters to form uniform representations of the data. This helps with easier analysis and cleaning.

3. Databases: Three main databases will store the cleaned data:

a. Customer: This database stores customer information such as age, gender, unique id, prior knowledge, brand awareness, etc. And this database is updated by the system with each new purchase.

b. Products: This database stores various product parameters such as product unique ID, brand name, features, reviews, etc.

c. Transactions: This database will store each unique transaction done in the system. This helps to link product ID with Customer ID and is vital to mine buying patterns of each customer.

4. Business logic: This module stores the actual logic and contains the scripts for the algorithms used for data mining.

5. User Interface: This module is the display module and helps take input and provide output to the small businesses.

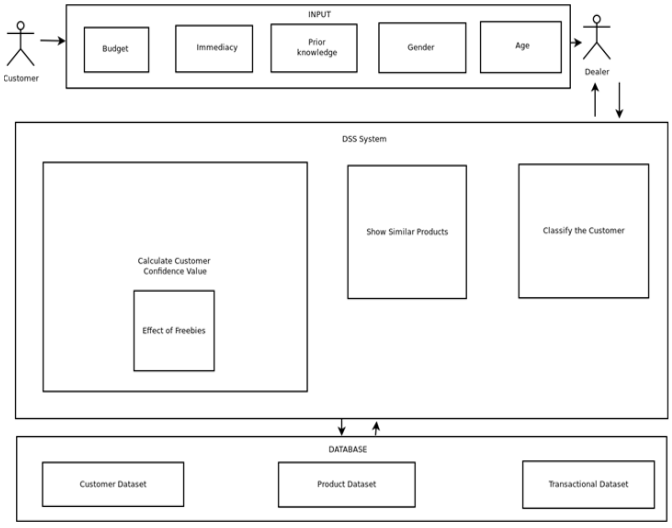

Fig -1: Architecture Diagram

3. Relevant mathematical model:

Input:
Datasets: x1, x2
- X1 = Transactional Dataset
- X2 = Product Dataset

Customer Data: =x1,x2,x3,x4,x5,x6,x7
-x1 = name
-x2 = age
-x3 = gender
-x4 = budget
-x5 = immediacy
-x6 = prior knowledge
-x7 =product choice

Output: x1, x2, x3, x4
-x1 = Confidence
-x2 = Class of Customer
-x3 = Effect of freebie on confidence
-x4 = products with maximum confidence

Success conditions:
-Customer confidence calculated successfully
-Correct error detection by error check.

4. Algorithms

The algorithms used for pattern mining will be as follows:

1. To find customer confidence:

Customer confidence is defined as the probability of a particular customer buying a particular product. This can be predicted by following the below assumptions:
a. The higher the number of alternatives, the lower the confidence in any single product.
b. The higher the prior knowledge of the product type, the lower will be the confidence.
c. The higher the reviews, the greater will be the confidence.
d. The better the brand perception of the product, the higher will be the confidence.

The steps for this algorithm are:

1. Narrow the list of products on sale down to the products within the customer range. Store this number as number of alternatives.
2. Find the prior knowledge of the customer about the product type by checking transaction datasets for previous transactions of the same type. Store this as prior knowledge. Assume default if no data exists for the customer.
3. Calculate the z-score of the product review rating as compared to other products in the shortlist.
4. Compute the number of successful sales of the product in the demographic of the customer to find a popularity score.
5. Use the above scores against normalized scores of the entire bell curve and compute the z-score. This will correspond to the customer confidence in the particular product.

2. To predict effect of freebies on customer confidence:

The algorithm will work with the following steps:

1. The freebie value will be calculated by discounting the freebie price from the initial price.
2. The confidence will be computed for both freebie price and for the freebie price.
3. The percent change between the confidence will be computed.
4. The percent changes for each of the discount offers will be computed by repeating steps 1 to 3.
5. The discount offer showing the greatest amount of change will be polled and count incremented for that offer.
6. Steps 1 to 5 will be executed on various products.
7. The offer with the highest polling will finally be chosen.

3. To classify customer by priority:

The algorithm works with the following assumption:

The high priority customers are the ones with a high purchase volume and a high purchase frequency
The medium priority customers are the ones with either a high purchase volume or a high purchase frequency.
The low priority customers are the ones with neither a high purchase volume nor a high purchase frequency.
The steps for the algorithm are as follows:
1. Analyse the demographic of the customer according to gender and age.

2. Perform slicing operation on the transaction database to isolate entries belonging to the demographic.
3. Find median purchase volume and median purchase frequency of the sliced demographic.
4. Increment count if chosen customer values exceed median values.
5. Assign priority according to count.

5. Results

The Customer Decision Support system thus helps make the power of analytics accessible to small businesses by crowdsourcing data. The prototype was successfully simulated to show efficient and anonymous sharing of data. Lower sales times were also reported when the prototype was tested under observation.

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