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DIGITAL MARKETING INFORMATION SYSTEMS FOR RECOMMENDATION PROMOTION PRODUCT USING APRIORI ALGORITHM

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ABSTRACT

The information technology currently influences the world of trade and sale and purchase transactions, in the beginning a transaction requires a meeting place between sellers and buyers, the media is currently ineffective because it causes sales not optimal because of limited space and promotional media, the use of information media in the form of e-commerce media is able to provide choices of types of goods with different categories of goods, e-commerce information systems can be used to classify the types of products or goods most sold and able to as references and giving discounts to customers, each database of goods sales will be analyzed using Apriori algorithm and FP-Growth, from the data the system will automatically provide information about the most sold items that will be used as product recommendations to be given to customers.

Keywords: Information Systems, Product Recommendations, Apriori Algorithm, Fp-Growth

INTRODUCTION

Technological advancement in the field of information systems has had a major impact on several sectors, the most influential was the trade sector, at first this sector still relies on traditional methods where a sales transaction process must be carried out at a certain place and time, this method has several weaknesses a product category that we see very much limited and lack of information on promotional items given by the seller, the seller himself will experience difficulty if data and categories of goods are provided in very large numbers, the current modern concept useable technology information that not only serves as a means sales but also functions as a digital marketing process and product promotion, the seller will aid to analyze sales data from every purchase transaction made online, this

system is able to provide accurate and able information used by sellers as a promotional strategy and giving discounts that are automatically revealed and changed by system every time.

PROCESSING DATA

On transaction data sales information system will increase every day and get bigger the system of transactions that are carried out manually is required Excellent data recording system so that data does not damaged or lost added to the number of categories of goods many, while the E-Commerce information system is used by combining Apriori the algorithm can record and read transaction data according to the type of goods purchased by the customer, This algorithm works by reading all item categories able to monitoring customer behavior so that the goods promoted ones can be different for each customer and method this is usually called a market basket analysis [1] [2].

1. Fold-growth is successfully implemented because duration of execution, scalability, reliability, and utilization of Fold-growth memory is better than FP-Growth.
2. The number of frequent item sets initially increases diverging as the length of the pattern has been obtained, then at the culmination the number of patterns will decrease due to the convergence of the maximum pattern formation.
3. Determination of a minimum support used for measure the threshold of a transaction pattern on a sales system, the calculation used usually from 20 - 50%, the calculation will be resulting number of data pairs or rules.
4. The greater the average transaction goods items in a, the greater the duration of execution for the same minimum support and the earlier the convergence for maximum pattern formation.

On multi-process sales data analysis using Apriori methods, algorithms able to process and read data faster and accurate because the system requires twice for scanning process, scanning procedures based on determining the amount of data sales called k-Itemset taken from each customer's sales data, in the process found several data pairs or rules with and able to speed up data search time up to 67.38% [3].

Determining the value of confidence in a scanning process data will affect the fast computer process and this Apriori algorithm only requires small memory allocation during the analysis process, the reading of the data becomes faster and more efficient required standard memory to be installed on a computer because it will affect the calculation and the system computing [4].

On several experiments conducted on a scanning system with Apriori the algorithm is easy to useable and implement, this method can be combined with the associate pattern method for analysis interrelation data from a sales data which will determine the k-Itemset value, on the amount of data FP-Growth pattern will map the number of goods transactions with different value and itemset according transaction frequency, FP-Growth doesn't process two time on a database so saves time computing and fast in analyzing most best-selling items used able for promotion [5].

Apriori calculation requires creating contender to get visit itemsets. Be that as it may, the FP-Growth calculation produces up-and-comers empower to deal with in light of the fact that it utilizes the idea of tree improvement in looking for visit itemsets. That is the thing

that causes the FP-Development calculation to be quicker than the Apriori calculation. The quality of FP-Growth calculation is the information structure utilized is a tree called FP-Tree. By utilizing FP-Tree & FP-Growth calculation can straight forwardly separate successive Itemset from FP-Tree. Removing continuous itemset utilizing the FP-Development calculation will ready to producing an information tree structure or called FP-Tree. The FP-Development strategy can be partitioned into 3 fundamental procedure [6].

The affiliation rule is FP-Development. The quest for visit itemset with the FP-Development calculation isn't by producing up-and-comers however by utilizing the idea of tree advancement. Not with standing the Apriori remembered for this gathering are the technique for summed up rule acceptance and hash based calculation. Decides that express the relationship between a few properties are frequently called fondness investigation or market bin examination. Affiliation investigation or affiliation rule mining is an information mining procedure for finding acquainted principles between mixes of things. A case of the acquainted standard of buying examination at a grocery store is realizing how likely it is that a client purchases bread along with milk. With this information the grocery store proprietor can mastermind the position of merchandise or structure an advertising effort by utilizing markdown coupons for specific blends of products. The affiliation rule method comprises of two phases, including the quest for the mix of the most every now and again happening things (visit itemset search) and the standard age stage that has been shaped from visit item-set [7] [8].

RESEARCH METHODS

Apriori is a calculation that is very notable in directing regular thing set ventures utilizing the affiliation rule method. The Apriori calculation utilizes information about incessant thing set that has been recently known to process data in a business information exchange. The Apriori calculation is utilized to decide up-and-comers who may show up on a thing buy or deals exchange by focusing on least help. The two principle forms did in the Apriori calculation are as per the following [9].

1. Join (merger).
In this procedure everything is joined with different things until no more blends are shaped.
2. Prune (pruning).
In this procedure the after joined things were then cut utilizing the base help indicated by the client.

Affiliation decide is one technique that intends to discover designs that regularly show up among numerous exchanges, where every exchange comprises of a few things, so this strategy will bolster the arrangement of advancement proposals and deals limits through the disclosure of examples between things in exchanges that happen on result of offer. Association rules (affinity analysis) or affinity analysis with regard to the study of " buy white or together" for example a transaction in a supermarket, for example someone can buy a product coffee also buy sugar. In this case it means that coffee is bought together with sugar, because it originally came from the customer's transaction base on database to determine a product [10].

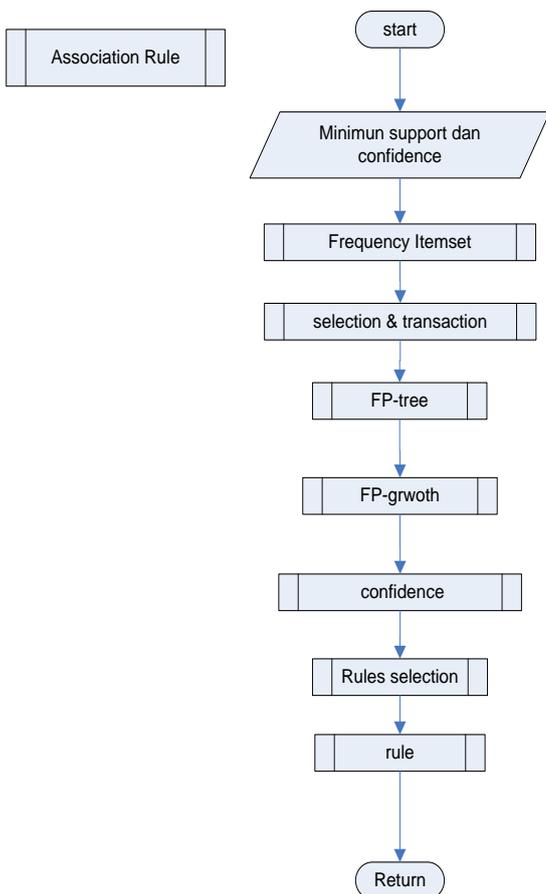


Figure 1. The Process of Rule Search Stages With Algotima Fp-Growth

Affiliation decides need to give that data as assuming at that point or on the off chance that - connections. This standard is determined from the probalistic information affiliation investigation otherwise called the information mining process. Especially in the affiliation investigation called high recurrence design examination, the significance of the acquainted guideline design ready to dictated by two boundaries, to be specific help and certainty, specifically the introduction of a blend of these things. In the database and sure have solid connection between things in affiliated principles that meet the base help prerequisites and certain to least sure [11]. In a large rule that needs to be increased support and confidence that may be developed rules that are sufficient interrelation between items in the antecedent and Consequent, To measure the strength of this association pattern, it is used support and confident measurements, as discussed above, support is the rule of a pattern of a product sold in a transaction pattern.

$$Support(X, Y) = \frac{Support\ count\ of\ XY}{Total} \tag{1}$$

Formula Description (1):

- Support (X, Y) = total support containing items X and Y
- Support Count of (X, Y) = minimum support X and Y
- Total = total transaction amount

Number of transactions that contain antecedent and confident with the number of transactions, confident is the ratio between the number of transactions that include all items

$$Confidence(X|Y) = \frac{Support(XY)}{Support(X)} \dots\dots\dots(2)$$

Formula Description (2):

- Confidence = total transactions containing X and Y
- Support (X, Y) = total support containing X and Y
- Support = calculation of support containing.

In transactions where item X is possible there is also item Y in it, notated, where X and Y are disjoint itemset, a collection of these transactions called itemset, denoted by I_k ($k = 1, 2, \dots, m$). If there is an itemset that has as many items as k, then it is called k-itemset. This association rule will produce rules that determine how big the relationship between X and Y and the two measures needed for these rules are support and confidence [12].

Frequent Itemset

The first step in the association rule is to produce all item-set that allows items that appear with m-items to be 2 items-set, which means two combinations of items purchased simultaneously. Because of the amount of computation to calculate frequent itemset comparing each candidate itemset with each transaction, there are several approaches to reduce time computing one of them with Apriori algorithm.

Table 1.1 Implementation And Testing

| NO | Rules | 4 item-set | 4 -item set | Support | Confident |
|----|-------|---------------------------|---------------------------|---------|-----------|
| 1 | 1040 | BIOSTAR TA890GXE | ASUS RAMPAGE II GENE | 0.27 | 1 |
| 2 | 1041 | ASUS RAMPAGE II GENE | ASUS RAMPAGE II GENE | 0.27 | 1 |
| 3 | 1042 | ASUS P7P55D | BIOSTAR ATI PCI EX HD4850 | 0.27 | 1 |
| 4 | 1043 | ASUS P5QL SE | BIOSTAR ATI PCI EX HD4850 | 0.27 | 1 |
| 5 | 1044 | ASUS BRAVO 9500 | BIOSTAR ATI PCI EX HD4850 | 0.27 | 1 |
| 6 | 1045 | BIOSTAR ATI PCI EX HD4850 | BIOSTAR TA890GXE | 0.27 | 1 |
| 7 | 1046 | DIGITAL ALLIANCE | AMD ATHLON II X3 450 | 0.27 | 1 |
| 8 | 1047 | AMD SEMPRON 140 BOX AM3 | AMD ATHLON II X3 450 | 0.27 | 1 |
| 9 | 1048 | AMD ATHLON II X3 450 | Biostar TA890GXE | 0.27 | 1 |
| 10 | 1049 | AMD PHENOM II X6 1055T | Biostar TA890GXE | 0.27 | 1 |
| 11 | 1050 | Biostar TA890GXE | Biostar TA890GXE | 0.27 | 1 |

in table 1.1 is a calculation process by using an apiori algorithm on data items that will be entered in a database with a dataset of more than 5000 data, support and confident calculation of the number of transactions is calculated by measuring the confidence level between 60 to 90%, from the confident value produces calculations rules of data relations up to 1500 rules.

Table 1.2 Results Of Weighting Data

| Code | Biostar TA890GXE | ASUS RAMPAGE II GENE | ASUS P7P55D | ASUS BRAVO 9500 |
|------|------------------|----------------------|-------------|-----------------|
| p001 | 0 | 1 | 1 | 1 |
| ... | 0 | 1 | 1 | 0 |
| ... | 0 | 1 | 1 | 0 |
| ... | 1 | 1 | 0 | 0 |
| ... | 0 | 0 | 0 | 1 |
| ... | 0 | 1 | 1 | 1 |
| ... | 1 | 0 | 0 | 1 |
| ... | 0 | 0 | 1 | 1 |
| ... | 1 | 1 | 0 | 1 |

In Table 1.2 is the result of data filtering from all transaction data, the data is then given a value of one in each purchase transaction pattern, the calculation is used to read the relation of the table and the relationship between the purchased data.

```

<?php
// Add dataset & Item set
foreach ($item as $value) {
    $total_per_item[$value] = 0;
    foreach($Transaction as $item_Transaction) {
        if(strpos($item_Transaction, $value) !== false) {
            $total_per_item[$value]++;
        }
    }
}
?>

```

Figure 2. results of calculation of the itemset derived in the source code

Figure 2 is a form of Apiori algorithm calculated by PHP programming language. In the code, every incoming transaction will enter the amount of sales data in each itemset, if there is an entry, it will be set to True and if an empty transaction will be set to False

```

// Add Itemset data , Itemset 1,Itemset 2,Itemset 3..
for($i = 0; $i < $item1; $i++) {
    for($j = $i+1; $j < $item2; $j++) {
        $item_pair = $item[$i].'|'.$item[$j];
        $item_array[$item_pair] = 0;
        foreach($Transaction as $item_Transaction) {
            if((strpos($item_Transaction, $item[$i])
            !== false) && (strpos($item_Transaction, $item[$j]) !== false)) {
                $item_array[$item_pair]++;
            }
        }
    }
}
?>

```

Figure 5. Apiori calculation results derived from the source code

In Figure 5. is a process of subtracting the algorithm algorithm in source code using PHP programming, in that code the amount of transaction data will be multiplied by the total number of transactions recorded in the database, from the number of transactions it will produce a number of rules or data pairs.

| Tambah Produk | | | | | | |
|---------------|---------------------------|------------|-----------|------|--------------|--|
| NO | NAMA PRODUK | BERAT (KG) | HARGA | STOK | TGL. MASUK | AKSI |
| 1 | Biostar TA890GXE | 3.00 | 1.082.000 | 4 | 08 Juli 2011 | Edit Hapus |
| 2 | ASUS RAMPAGE II GENE | 3.00 | 2.820.000 | 5 | 08 Juli 2011 | Edit Hapus |
| 3 | ASUS P7P55D | 3.00 | 1.700.000 | 5 | 08 Juli 2011 | Edit Hapus |
| 4 | ASUS P5QL SE | 3.00 | 909.000 | 5 | 08 Juli 2011 | Edit Hapus |
| 5 | ASUS BRAVO 9500 | 2.00 | 766.000 | 4 | 08 Juli 2011 | Edit Hapus |
| 6 | Biostar ATI PCI EX HD4850 | 2.00 | 900.000 | 7 | 08 Juli 2011 | Edit Hapus |
| 7 | DIGITAL ALLIANCE | 3.00 | 329.000 | 10 | 08 Juli 2011 | Edit Hapus |
| 8 | AMD SEMPRON 140 BOX AM3 | 3.00 | 346.000 | 7 | 08 Juli 2011 | Edit Hapus |
| 9 | AMD ATHLON II X3 450 | 3.00 | 718.000 | 5 | 08 Juli 2011 | Edit Hapus |
| 10 | AMD PHENOM II X6 1055T | 3.00 | 1.555.000 | 4 | 08 Juli 2011 | Edit Hapus |

Figure 6. Results of adding item data by Apriori in the admin menu

in figure 6. is the process of adding goods transaction data on the admin menu, in the application the admin data has an authority to add or delete item data, the item data will automatically be connected to the Apriori system where each data calculation will be calculated based on the number of types purchased on each transaction the number of itemsset per transaction.



Figure 7. results in the addition of item data by a priori in the admin menu

in figure 7 is the process of implementing item data published on an information system for selling goods, the item data will appear on the web menu automatically becoming a favorite product according to the number transactions stored on the database



Figure 8. results of adding item data by Apriori in the admin menu

in figure 8 is the type of data items imported by admin then the data will appear in the information system, the amount that appears will alternate according to the number of datasets into database.

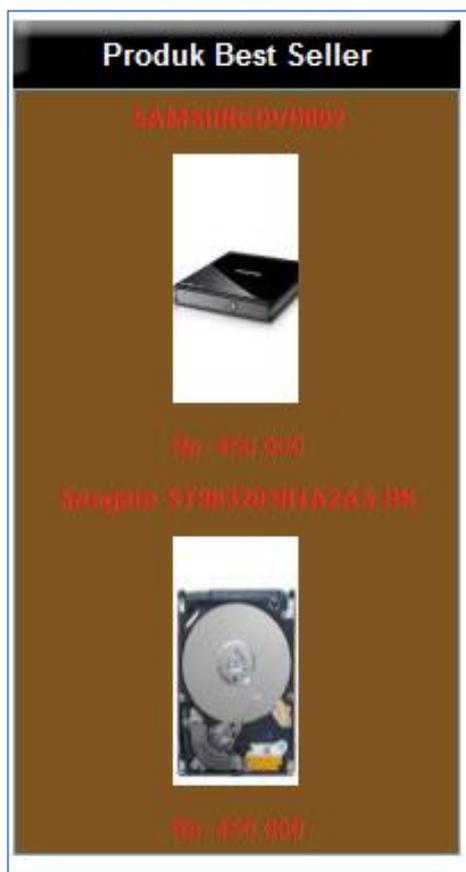


Figure 9. The results of the appearance of the best seller products

In figure 9 is the process of the emergence of product sales data that goes into the best-selling products sold, the system will display data automatically based on the results of Apriori data processing

CONCLUSION

Apriori algorithm able to produce product promotion recommendations based on sales transactions. Apriori is very dependent on the number of patterns of the type of goods purchased that exist in each transaction (itemset). In this research, the minute up limit value can't be more than four, because most transaction data are in one type of transaction. The FP-tree that is formed can indeed utilize transaction data that has the same items so that computer memory usage becomes less and the process of searching for itemset frequencies becomes faster using the FP-Growth algorithm, the transaction data process so it is more efficient compared a priori. FP - Growth is a basic algorithm for the development of new algorithms because it has the advantage of scanning data un scanning data repeatedly, automatically selecting the product to be used for the promotion strategy section is easily calculated by the system and will change every day in accordance with the frequency of sales transaction, This is methods very useful if we calculate types of data items with different categories of goods and are very numerous and the strategy is able to improve number transaction.

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