IMPLEMENTATION OF ASSOCIATION RULES USING APRIPORI ALGORITHM FOR ANGKRINGAN

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ABSTRACT

Angkringan is a culinary business that is often found, especially in Surakarta and Yogyakarta in particular and Central Java in general. Most angkringan include small and medium enterprises (SMES). Food and drink merchandise mapping is an important thing in angkringan. In this research, food and drink mapping was carried out at several snack bars in Jebres sub-district, Surakarta city using word clouds and the Apriori algorithm. The word cloud will produce the dominant food and beverage itemsets which will then be processed using the Apriori algorithm. The results of mapping with the Apriori algorithm for food yield support(tempeh) = support (tofu) = 95 which is the highest. Relationship value between dominant itemsets: Confidence(tempeh, tofu → satay, milkfish rice, quail egg, bakwan) = 21. Results for drinks have the highest support value for tea, support(tea) = 100. Relationship value between dominant itemsets: Confidence(tea → coffee, milk, ginger) = 15.

KEYWORDS Association rule, Angkringan, Apriori algorithm, culinary, small and medium enterprise

INTRODUCTION

Angkringan is a typical Indonesian culinary business, originating from Surakarta and Yogyakarta. If viewed from the capacity and size of the business, angkringan is classified as SMES (small and medium enterprise). The angkringan business has now expanded throughout Indonesia (Lestari et al., 2022). The development of angkringan also develops according to the times and technology. Angkringan's typical culinary menu usually includes packaged rice and various fried snacks and drinks such as tea, ginger, coffee and others. Most of the angkringan are in the form of street vendors, although some are in the form of stalls or restaurants. The sustainability of the angkringan business also depends on innovation and service convenience. Many factors influence this, such as the use of technology, the implementation of digitization, data utilization, culinary menu

innovation, marketing mix, ease of transaction processing and others (Lestari et al., 2022), (Fajar & Rismayati, 2021).

The development of data science has led to a wider application of this field. Almost all life midwives cannot be separated from data. The application of data science in the culinary field is also quite a lot. Applications in the culinary field are generally profit predictions, food stocks, best selling menu predictions, cost estimation, profit estimation, customer segmentation and mapping, customer and menu associations and so on. The application of data science in the culinary field is also closely related to the marketing mix, especially the store atmosphere (Sumarlinda et al., 2022), (Lestari & Sumarlinda, 2021), (Ardakania et al, 2018). Data mining is a process to obtain important information that is very useful from information that was previously unknown and knowledge obtained from valuable and understandable information from data. Data mining, which is known as pattern recognition, is a processing method to find hidden patterns to be processed into new knowledge and knowledge and information from data and results for future decisions. Data mining can also be referred to as a very large data processing system, which plays a role in several fields in the world, namely finance, industry, transportation, weather, and technology. In data mining there are also methods that can be used, including prediction, classification, clustering, regression and association methods (Husein et al, 2022).

The association rule or association analysis is a data mining technique for finding association rules between a combination of items. An example of an association rule from purchasing analysis in a supermarket is knowing how likely it is that a customer buys coffee together with milk. With this knowledge, supermarket owners can arrange the placement of their goods or design marketing campaigns using discount coupons for certain product combinations (Liu, 2023), (Siva et al., 2019). Association analysis became famous because of its application to analyze the contents of shopping baskets in supermarkets. Association analysis is also often referred to as market basket analysis. The Apriori algorithm aims to find frequent itemsets that run on a set of data. In the k-iteration, all itemsets that have k items will be found, called k-itemset. The main characteristic of the Apriori algorithm is that all subsets of a frequent itemset are also members of frequent itemsets (Mujianto et al., 2019), (Siva et al., 2019), (Umbarkar & Nandgaonkar, 2015).

In this study, the association data mining method was applied, namely the Apriori algorithm for culinary identification at angkringan. The aim of this study is to map the dominant culinary types sold at angkringan and the relationships between culinary items. The association comparison is not between transactions but from several angkringan in Kecamatan Jebres, Surakarta city.

RESEARCH METHOD

This study aims to map the dominant and interrelated culinary types in angkringan. This study applied the association rule using the Apriori algorithm. Culinary data on several angkringan were mapped which are strong and which are interrelated and can be found a lot. The stages of the research are shown in Figure 1 below:

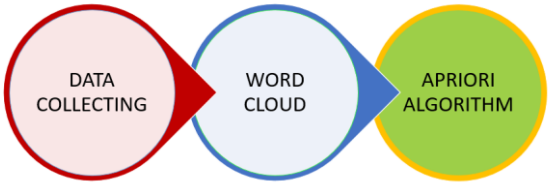

Figure. 1 Research Stage

The research stage begins with collecting data, which is collecting culinary data that several angkringan sell in Jebres sub-district, Surakarta city. Data acquisition used 20 samples of angkringan which recorded their culinary menu, both food and drinks. Culinary data is then processed to be used for further processing. The dataset after processing is shown in table 1.

Tabel 1. Food and Drink at the Angkringan

ID Angkringan	Food	Drink
Data 01	milkfish rice, stir-fried rice, fried rice, tofu, tempeh, bakwan, satay, meatballs, curry rice, soto, mushroom rice	tea, ginger, orange, coffee, milk, chocolate
Data 02	stir-fried rice, anchovy rice, grilled-chicken rice, tofu, tempeh, fried banana, meatball, satay, quail eggs, sausages	tea, orange, ginger, milk, coffee, turmeric tamarind, beras kencur, tarik tea
Data 03	chicken rice, stir-fried rice, anchovy rice, milkfish rice, fried rice, arem-arem, wajik, crackers	tea, ginger, orange, coffee, milk
Data 04	stir-fried rice, milkfish rice, fried rice, cap cay rice, orak arik rice, tempeh, tofu, risoles, sausages, fried bananas, martabak, offal	tea, orange, milk, coffee, chocolate
Data 05	stir-fried rice, milkfish rice, garang asem, egg rice, cap cay, tumpeng vegetables, tempeh, tofu, bakwan, dimsum, sausage, meatballs, satay, nuggets	tea, orange
Data 06	stir-fried rice, milkfish rice, fried rice, anchovy rice, tempeh, tofu, bakwan, fried bananas, satay, quail eggs	Orange, tea, coffee, ginger
Data 07	milkfish rice, stir-fried rice, tofu, tempe, fried bananas, satay, sausages, quail eggs	tea, ginger, coffee, ginger
Data 08	stir-fried rice, milkfish rice, tempeh, tofu, bakwan, fried bananas, sausages, satay	tea, orange, coffee, ginger
Data 09	stir-fried rice, fried rice, milkfish rice, anchovy rice, tempeh, tofu, meatballs, fried cassava, satay, quail eggs	tea, orange, coffee, ginger
Data 10	stir-fried rice, chicken noodles, milkfish rice, tofu, tempeh, bakwan, satay, quail eggs	tea, coffee, ginger
Data 11	milkfish rice, stir-fried rice, tempeh, tofu, bakwan, fried banana, satay, quail eggs	tea, orange, ginger

Data 12	noodles, egg rice, fried rice, catfish rice, chicken rice, crackers, tempeh, tofu	tea, ginger, coffee, chocolate
Data 13	milkfish rice, stir-fried rice, egg rice, tofu tempeh, bakwan, satay	tea, coffee, orange, milk
Data 14	milkfish rice, stir-fried rice, vegetable rice, tempeh, tofu, quail eggs, satay	tea, coffee, orange, milk
Data 15	stir-fried rice, vegetable rice, noodles, tempeh, tofu, bakwan, satay, quail eggs, sausages	tea, coffee, milk
Data 16	stir-fried rice, vegetable rice, chicken rice, crackers, risoles, donuts, fried bananas, sausages, satay, quail eggs, tempeh, tofu	tea, coffee, milk
Data 17	vegetable rice, chicken rice, tempeh, tofu, bakwan, quail eggs	tea, coffee, orange, milk
Data 18	egg rice, milkfish rice, noodles, tofu, tempeh, satay, quail eggs, crackers, milkfish rice	tea, coffee, orange, milk
Data 19	chicken rice, milkfish rice, egg rice, stir-fried rice, tempeh, tofu, fried bananas, satay, bakwan, tempura, quail eggs	tea, coffee, orange, milk
Data 20	curry rice, vegetable rice, milkfish rice, tempeh, tofu, satay	tea, coffee, orange, milk

The next stage is to create a word cloud for culinary types of food and drink. A word cloud for food is used to map what foods are predominantly sold in angkringan. The drink word cloud is also used to map what drinks are predominantly sold in angkringan. The results of this word cloud are then mapped with an association function using the Apriori algorithm. In the Apriori algorithm it is known as support and confidence. The formula for support and confidence is as below (Liu, 2023):

$$Support(A \rightarrow B) = \frac{n(A \cap B)}{n(S)} \quad (1)$$

$$Support(A \rightarrow B, C) = \frac{n(A \cap B \cap C)}{n(S)} \quad (2)$$

$$Confidence(A \rightarrow B) = \frac{n(A \cap B)}{n(A)} \quad (3)$$

$$Confidence(A \rightarrow B, C) = \frac{n(A \cap B \cap C)}{n(A)} \quad (4)$$

With :
n(A) = number of itemset A; n(B) = number of itemset B; n(S) = number all itemset. A is antecendent and B, C are consequent.

RESULT AND DISCUSSION

The culinary dataset on angkringan which consists of food and drinks were mapped which are mostly sold in angkringan and are strongly related to one another. The dataset after processing was then made into a word cloud. The results of the food word cloud are as shown in Figure 2 and the results of the drinks word cloud are as shown in Figure 3 below.

Figure. 2 Word Cloud of Food

Figure. 3 Word Cloud of Drinks

From the word cloud of food in Figure 2, it can be seen that the dominant foods are tempeh, tofu, satay, milkfish rice, bakwan and quail egg. As for word cloud of drinks, in Figure 3 the dominant drinks are tea, coffee, ginger, milk and orange. The dominant food and drink in the word cloud results were then processed using the Apriori algorithm. The results of the calculation of support for food at the angkringan are as shown in table 2.

Tabel 2. Support (S) of Food Itemset

S(tempeh)	S(tofu)	S(satay)	S(milkfish rice)	S(quail egg)	S(bakwan)
95	95	80	75	60	50

The value of support (S) and confidence (C) between itemsets are:
S(tempeh→tofu) = 95; C (tempeh→ tofu) = 100;
Because value of C (tempeh→ tofu) = 100 so C (tempeh→ X) = C (tofu→ X) = C (tempeh, tofu→ X);
S (tempeh, tofu→ satay) = 80; C (tempeh, tofu→ satay) = 84;
S (tempeh tofu→milkfish rice) = 70; C (tempeh, tofu → milkfish rice) = 74;
S (tempeh, tofu→quail egg) = 60; C (tempeh, tofu→quail egg) = 63;
S(tempeh, tofu→bakwan) = 50; C (tempeh, tofu→ bakwan) = 53;
C (satay→ milkfish rice) = 50; C (satay→ quail egg) = 44;
C (satay→ bakwan) = 56; C (milkfish rice→ quail egg) = 53;
C (milkfish rice→ bakwan) = 53; C (quail egg→ bakwan) = 50;

S (tempeh, tofu, satay, milkfish rice) = 65; C (tempeh→ tofu, satay, milkfish rice) = 68;
S (tempeh, tofu, satay, milkfish rice, quail egg, bakwan) = 20;

C (tempeh→ tofu, satay, milkfish rice, quail egg, bakwan) = 21.

The results of the calculation of support for food at the angkringan are as shown in table 3.

Tabel 2. Support (S) of Drinks Itemset

S(tea)	S(coffee)	S(orange)	S(milk)	S(ginger)	S(chocolate)
100	90	75	60	50	15

The value of support (S) and confidence (C) between itemsets are:
S (tea → coffee) = C (tea→ coffee) = 90;
S (tea → orange) = C (tea→ orange) = 75;
C (tea → milk) = 60;
C (tea → chocolate) = 15;
C (coffee → orange) = 66.7;
C (coffee → ginger) = 50;
C (orange → milk) = 66.7;
C (orange → chocolate) = 13,3;
C (milk → chocolate) = 16.7;
C (tea → ginger) = 50;
C (tea → chocolate) = 15;
C (coffee → milk) = 66.7;
C (coffee → chocolate) = 16.7;
C (orange → ginger) = 40;
C (milk → ginger) = 25;
C (ginger → chocolate) = 22.2;

S (tea→ coffee, milk) = C (tea→ coffee, milk) = 60;
S (tea→ coffee, orange) = C (tea→ coffee, orange) = 60;
S (tea→ coffee, ginger) = C (tea→ coffee, ginger) = 45;
S (tea→ coffee, milk, ginger) = C(tea→ coffee, milk, ginger) = 15.

The results of applying the Apriori algorithm, it was found that tempeh, tofu, satay and milkfish rice were the dominant food items sold in angkringan. Tempeh and tofu have the same support and confidence. These two foods are quite closely related and interrelated. The results of applying the Apriori algorithm for beverages produced tea that has the highest support and confidence. In fact, tea has a support and confidence value of 100. Apart from tea, there are coffee, milk and ginger which are dominant and related to each other.

The ssociation rule with Apriori algorithm is useful for angkringan sales transaction data to be analyzed so that patterns can be found in the form of items that tend to appear together in a transaction. The stages in the Apriori algorithm technique mentioned above will find patterns. Furthermore, the pattern found can be used to design an effective sales or marketing strategy, namely by placing items that are often purchased together into an adjacent area, designing the appearance of items in the catalog, designing discount coupons (to be given to customers who buy certain items), designing sales of items in package form, and so on. Association rule technique as a technique in extracting information in databases, has been widely used to perform analysis of data to estimate business patterns and trends that can assist in business development.

CONCLUSION

The Apriori algorithm, which is an association rule method, can map itemsets from sales data. The mapping results can be used for decisions and subsequent business processes. The application of word clouds in data processing is carried out to determine which itemsets are more dominant. The dominant itemsets resulting from the word cloud are mapped using the Apriori algorithm. Implementation of the Apriori algorithm on several angkringan in Jebres sub-district, Surakarta city resulted in tempeh and tofu being

the dominant itemset in food, followed by tempeh, tofu and satay. Mapping drinks tea is the dominant itemset followed by coffee, orange, milk and ginger.

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