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Application of Data Mining in FP-Growth Algorithm to Determine Customer Purchasing Patterns of Geprek Chicken

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Abstract

The FP-Growth data mining algorithm used in the study to determine customer shopping patterns at Ayam Geprek Purwokerto shop. Focusing on identifying repeat purchase events, this research aims to improve the marketing strategy and operational efficiency of Ayam Geprek Purwokerto shop. With an in-depth understanding of customer preferences and shopping habits, this research provides valuable insights for business owners in customizing menu offerings and layouts that can significantly increase sales. The results of this purchase analysis provide an in-depth understanding of consumer preferences and help determine the right course of action to improve Ayam Geprek Purwokerto's business. This study shows that using the FP-Growth algorithm to analyze customer buying patterns can significantly improve the efficiency and effectiveness of Ayam Geprek Purwokerto. By understanding common buying patterns, business owners can increase inventory design more effective promotion strategies, and improve customer satisfaction. The research shows that this can be a useful guide for business owners to create more targeted and effective marketing strategies to increase business. Thus, this research significantly increases the understanding of consumer shopping habits in the food industry, especially in the Ayam Geprek Purokerto shop.The results of this study are expected to be the basis for developing smarter and more effective marketing strategies to improve the competitiveness of food companies. In addition, this research encourages further use of data mining in optimizing inventory management and marketing strategies for the food industry.

Keywords: Data Mining,FP Growth, Algorithm, Ayam Geprek Purwokerto,Frequent Itemsets

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1. Introduction

In this fast-paced digital era, technology has become an important key in the advancement of various industries, including the food industry. The development of food industry technology brings various benefits, such as operational efficiency, improved customer experience and promotion of innovation in product offerings (Iqbal, 2011). Food sales is an industry that is very important in everyday life. The food industry has grown significantly in recent years, and there are many variations of food on the market, one example is ayam geprek purwokerto.

Ayam Geprek Purwokerto is not only known for its spicy and appetizing geprek chicken dish, but also offers a variety of other menus that are no less delicious, ranging from rib soup, soto betawi, fried cabbage, various preparations of catfish, tofu, tempeh and so on. Ayam Gerepk Purwokerto also sells various package menus starting from the price of 18,000 thousand to 23,000 thousand. From the sales transaction data of ayam geprek purwokerto can be used as a reference to analyze purchasing patterns so that sales can increase slightly using the FP-Growth algorithm. The main purpose of applying the FP-Growth algorithm to the gerpek purwokerto chicken food stall is to identify frequent purchase transaction patterns, such as what foods are often purchased or are in demand by customers.

FP-Growth (Frequent Pattern Growth) is a data mining algorithm that aims to identify patterns that occur regularly in a data set (Dewi & Suarna, 2024). FP-Growth can also be used to identify consumer purchasing habits and predict what customers will buy based on their purchase history (Dewi & Suarna, 2024). This allows companies or business managers to develop more effective marketing and sales strategies (Suhada et al., 2020). By using transaction data of ayam geprek purwokerto sales, by knowing the buying habits of food menus that are often purchased together, shop owners can more

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easily design menu layout recommendations according to customer buying habits. The technique used for this research is data mining.

Data mining is the process of collecting data processing with the aim of extracting information from data (Mustofa, 2021). The process of collecting and extracting data can be done using software with the help of statistical calculations, mathematics, or artificial intelligence technology (FTIK, 2024).

Data mining can also help increase business satisfaction by predicting market needs and increasing business success. Companies can make more effective decisions in developing more effective business strategies (Dewi, 2022).

Research conducted by Lintang Mugi Lestari dana Iffan Ali (2023) uses the FP-Growth algorithm to determine the sales patterns that often occur at Ellia Umami stores. The results of this study indicate that the FP-Growth algorithm can help stores increase profits by knowing the sales patterns that often occur (Lestari, 2023).

The results of research conducted by Satria Suhada (2020) using the FP-Growth algorithm to determine consumer purchasing patterns at ahass cibadak show that the FP-Growth algorithm can assist companies in increasing profits by understanding consumer purchasing patterns that often occur (Karsito & Sari, 2018).

The application of the FP-Growth algorithm to determine the buying pattern of sales transactions at the kgs risky montor shop the results of this study show that the FP-Growth algorithm can help the shop in increasing sales by knowing the buying patterns of transactions that often occur (Utama et al., 2020).

In the research conducted as described above, the FP-Growth algorithm has been used by showing success in improving more efficient purchasing patterns and determining product placements that are more in line with buyers' shopping habits. With the right type of product placement, it is expected to increase customer satisfaction and increase sales and turnover of Ayam Geprek Purokerto in the coming years.

2. Methods

2.1. Observation

The observation method is a data collection technique that is applied by directly and systematically observing the phenomenon under study. Qualitative research uses observation methods to understand and collect information about behavior, habits, and human interactions in the natural environment. Observation can be participatory, where the researcher participates in the activities observed, or non-participatory, namely the researcher only observes from the outside without participating in these activities (Qotrun, 2024). in data collection is done by means of direct observation to the purwokerto geprek chicken shop to produce findings. In this process, researchers can accurately learn about sales data or transaction data by direct observation or going to the field.

2.2. Literature Study

Putaka study research method or also known as qualitative method is a data collection technique used by observing and analyzing previously published sources such as journals, books, and scientific articles. In this study, researchers did not collect data directly through observation or interviews, but rather concentrated and synthesized existing information (Azis, 2023).

2.3. Design stage

In the research conducted as described, the FP-Growth algorithm has been used by showing success in improving more efficient purchasing patterns and determining product placements that are more in line with buyers' shopping habits. With the right type of product placement, it is expected to increase customer satisfaction and increase sales and turnover of Ayam Geprek Purokerto in the coming years.

There is a process of stages in designing Knowledge Discovery in Data. The stages are as follows:

a. Data Cleaning

   Data cleaning is a data preparation process that involves analyzing to remove or change incorrect, incomplete, irrelevant, or incorrect data. Unnecessary or unhelpful information in data analysis can hinder the analysis process or provide inaccurate results. Data cleaning involves more than just removing typos or syntax errors. It is especially important when preparing data before data analysis or machine learning modeling, as dirty data can confuse analysis results and interfere with the decision-making process (Fariza, 2022).

b. Data Selection

In data selection, researchers must select data that is in accordance with the research objectives and ensure that the selected data does not contain noise or irrelevant data. The selected data is then stored in a separate file from the database, so that the data used in the data mining process is not mixed with other data (Jagoan Hosting Team, 2023).

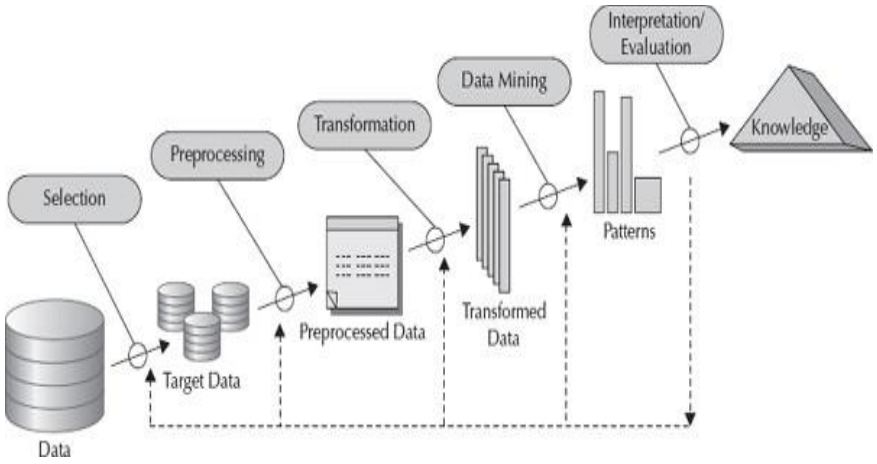


Figure 1. Knowledge Discovery in Database Process

c. Data Integration

This stage involves merging data or unifying existing data in the database into one, so that different data can be used effectively and efficiently in analysis (Suhada et al., 2020).

d. Data Transformation

The process of improving the structure and format of data to make it easier to use in analysis and decision-making (Arta et al., 2016).

e. Data Mining

The process of finding interesting patterns or information in selected data using data mining techniques such as Association Rule and FP-Growth (Harahap & Nastuti, 2019).

f. Evaluation

Evaluation is done to determine the reliability of a model on the algorithm, both in terms of similarity, performance, complexity, and processing time (Nurfadilah, 2022).

3. Results and Discussion

Research on the application of the FP-Growth algorithm in Purwokerto geprek chicken shops shows a significant impact in identifying frequently recurring product purchase patterns. The algorithm successfully found product combinations that are often purchased together, such as "White Rice" which is often paired with "Chicken Breast" and "Iced Tea". These results provide an in-depth understanding of customer preferences and items that are strongly linked in transactions. This information allows store owners to better understand their customers' shopping habits and use it to devise more effective business strategies.

In addition, the results of this purchase pattern analysis are very useful for inventory management strategies. By knowing which products are often bought together, store owners can organize stock more efficiently and ensure popular products are always available. For example, the placement of frequently bought products together in close proximity can increase shopping convenience for customers and encourage impulse purchases. Furthermore, stores can create combo packs based on popular product combinations, thereby increasing the appeal of the offer and sales potential.

The knowledge gained from this research is also useful in developing more effective promotional strategies. Promotions can be focused on products that are frequently purchased together to increase total purchases and customer satisfaction.

By customizing offers based on analysis data, stores can provide a more personalized and satisfying shopping experience. In conclusion, the application of the FP-Growth algorithm provides valuable insights that assist stores in strategizing inventory, customizing product offerings, and developing more targeted promotions, thereby overall improving operational efficiency and customer satisfaction. The following is a description of the results of the FP-Growth algorithm recommendation research on sales trends at the Ayam Geprek Purwokerto shop as follows:

3.1. Data Pre-Processing

The process of transforming highly diverse and unstructured raw data into a more understandable format. This process involves the use of computer and statistical analysis techniques to examine and analyze data and determine patterns and trends that may not be immediately apparent to humans (Oliver, 2023).

a. Initial sales data

Table 1. Initial Transaction

Transactions	Item
1	*Paket komplit paha,ayam dada,tahu,nasi putih*
2	*Paket komplit dada, ayam paha, tempe, nasi putih, sop iga*
3	*Ayam Dada, Ayam Paha, Tahu, Terong Goreng, Nasi Putih*
4	*Lele, Kol Goreng, Jukut, Nasi Putih, Sop Iga*
5	*Tempe, Terong Goreng, Jukut, Nasi Putih, Soto Betawi*
6	*Ayam Paha, Tahu, Nasi Putih, Paket Hemat Ayam*
7	*Paket Komplit Paha, Terong Goreng, Jukut, Sop Iga*
8	*Paket Komplit Dada, Lele, Kol Goreng, Sop Iga, Soto Betawi*
9	*Ayam Dada, Terong Goreng, Nasi Putih*
10	*Ayam Paha, Tahu*

b. Sales data after changed

Table 2. Sales data after changes

Transactions	*Paket Komplit Paha*	*Paket Komplit Dada*	*Ayam Dada*	*Ayam Paha*	*Tahu*	*Tempe*	*Lele*	*Kol goreng*	*Terong Goreng*	*Jukut*
1	1	0	1	0	1	0	0	0	0	0
2	0	1	0	1	0	1	0	0	0	0
3	0	0	1	1	1	0	0	0	0	0
4	0	0	0	0	0	0	1	0	0	1
5	0	0	0	0	0	1	0	1	1	0
6	0	0	0	1	1	0	0	0	0	0
7	1	0	0	0	0	0	0	1	1	1
8	0	1	0	0	0	0	1	0	0	0
9	0	0	1	0	0	0	0	1	1	0
10	0	0	0	1	1	1	0	0	0	0

3.2. Data Selection / Data Cleaning

It is an important process in data management, especially data mining. Data selection involves collecting relevant and appropriate information for the purpose of analysis, while data cleansing involves removing errors, unnecessary data, and inaccurate data. The process of data cleaning shown on Figure 2.

3.3. Attribute Select Result

In the process described, an image like the one below will be created, where the transaction table is omitted because it is considered unimportant or unnecessary. The result of attribute select presented on Table 3.

3.4. Transformation

The next step is to transform or change the data type of the data set into numerical to binominal variables because this purchase pattern data only has two data types, namely 1 and 0 which are repeated, so the data is converted into binominal format. The result of transformation presented on Table 4.

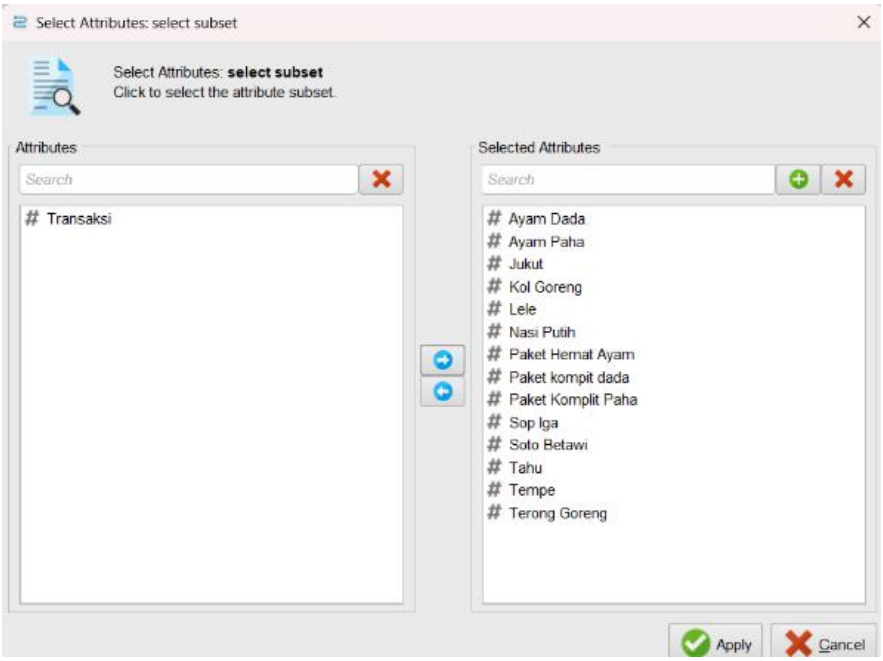


Figure 2. Data cleaning stage or cleaning process

Table 3. Attribute select result

Row No	*Paket Komplit Paha*	*Paket Komplit Dada*	*Ayam Dada*	*Ayam Paha*	*Tahu*	*Tempe*	*Lele*	*Kol. Goreng*	*Terong Goreng*	*Jukut*
1	1	0	1	0	1	0	0	0	0	0
2	0	1	0	1	0	1	0	0	0	0
3	0	0	1	1	1	0	0	0	0	0
4	0	0	0	0	0	0	1	0	0	1
5	0	0	0	0	0	1	0	1	1	0
6	0	0	0	1	1	0	0	0	0	0
7	1	0	0	0	0	0	0	1	1	1
8	0	1	0	0	0	0	1	0	0	0
9	0	0	1	0	0	0	0	1	1	0
10	0	0	0	1	1	1	0	0	0	0

Table 4. The result of transforming sales data to binominal form

Row No	*Paket Komplit Paha*	*Paket Komplit Dada*	*Ayam Dada*	*Ayam Paha*	*Tahu*	*Tempe*	*Lele*	*Kol. Goreng*	*Terong Goreng*	*Jukut*
1	True	False	True	False	True	False	False	False	False	False
2	False	True	False	True	False	True	False	False	False	False
3	False	False	True	True	True	False	False	False	False	False
4	False	False	False	False	False	False	True	False	False	True
5	False	False	False	False	False	True	False	True	True	False
6	False	False	False	True	True	False	False	False	False	False
7	True	False	False	False	False	False	False	True	True	True
8	False	True	False	False	False	False	True	False	False	False
9	False	False	True	False	False	False	False	True	True	False
10	False	False	False	True	True	True	False	False	False	False

3.5. Algoritma FP-Growth

The FP-Growth algorithm is one of the alternative algorithms used to determine the set of data that often appears in a data set (Munanda & Monalisa, 2021) . The next process is to enter the minimum support required for this research, namely, using min support (0.95) and min confidence (0.8) with a maximum number of items: (1000000).

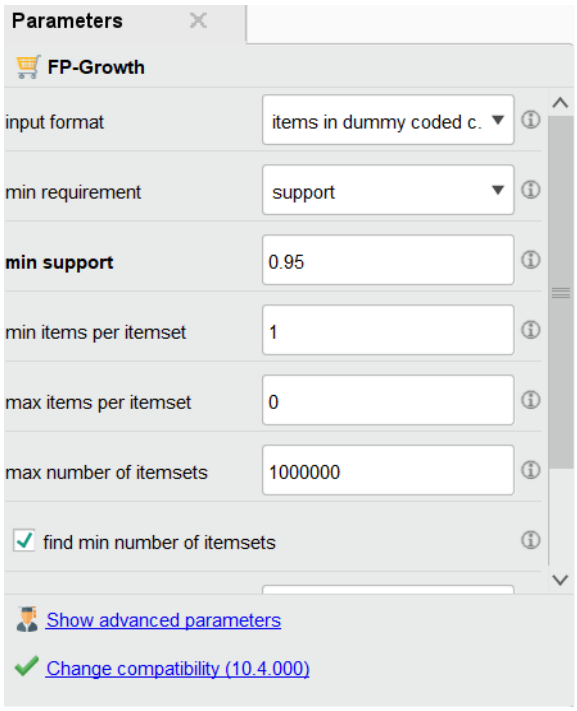


Figure 3. Min support

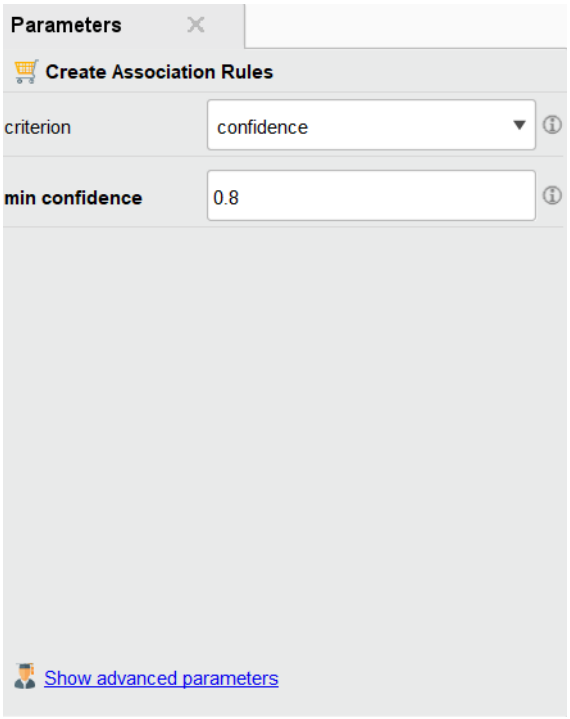


Figure 4. Min confidence

3.6. Data Mining

After all the data is guaranteed to be accurate, the next step is data mining techniques.

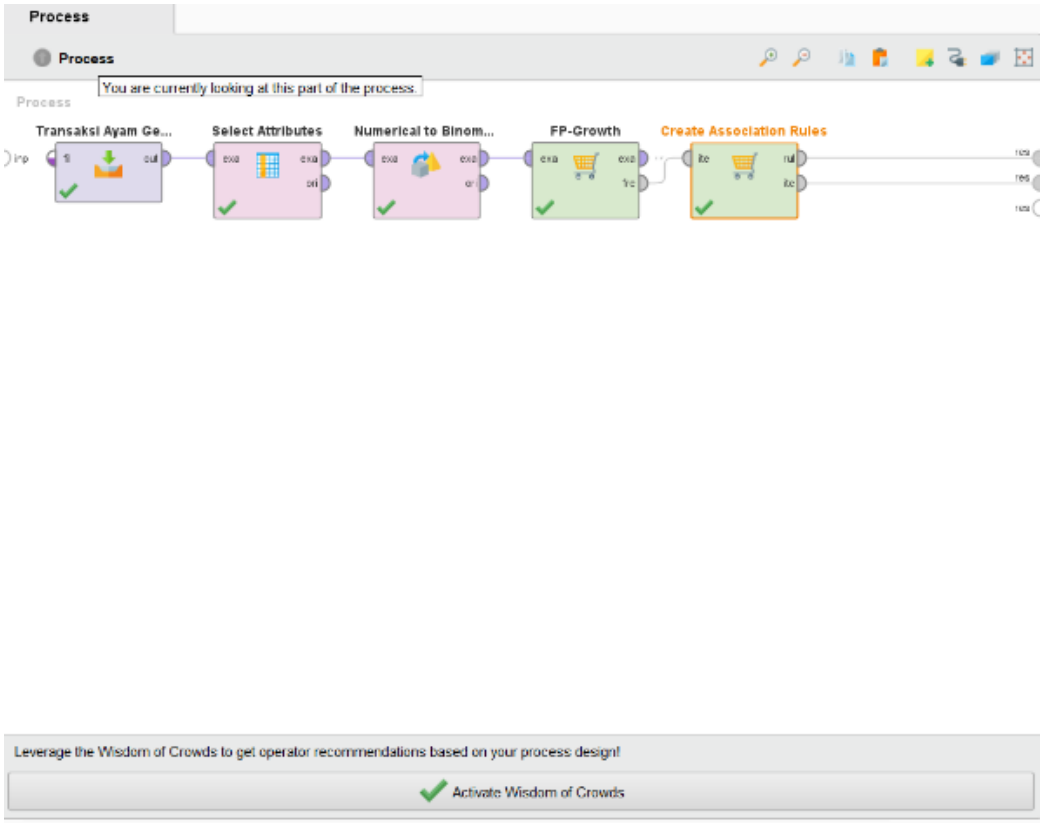


Figure 5. Data mining model

The figure shows the workflow of the process to generate association rules using the data mining tool. The following is a step-by-step explanation of the process:

a. Fried Chicken Transactions (Import Data)

   This step involves importing transaction data. A check mark indicates that the data import has been successfully completed.

b. Select Attributes (Select Attributes)

   In this step, relevant attributes of the imported data will be selected for analysis. Attributes may include various items purchased in the transaction, customer information, etc. A check mark indicates that this step has also been successfully completed.

c. Convert Numeric to Binominal

   This step converts numeric data into binomial (binary) form. In the context of association rule mining, this often means converting the data into a format where each attribute represents the presence or absence of an item in a transaction. For example, instead of recording the quantity of an item, the system records whether the item was purchased (1) or not (0). A check mark indicates that this conversion has been successfully completed.

d. FP-Growth (FP-Growth)

   The FP-Growth algorithm is used for frequent pattern mining. It efficiently identifies frequent itemsets in a dataset, i.e. groups of items that often appear together in transactions. A check mark indicates that the FP-Growth algorithm has been successfully executed.

e. Creating Association Rules

The last step is to create association rules from the identified frequent itemsets.

3.7. Interpretation/ evaluation

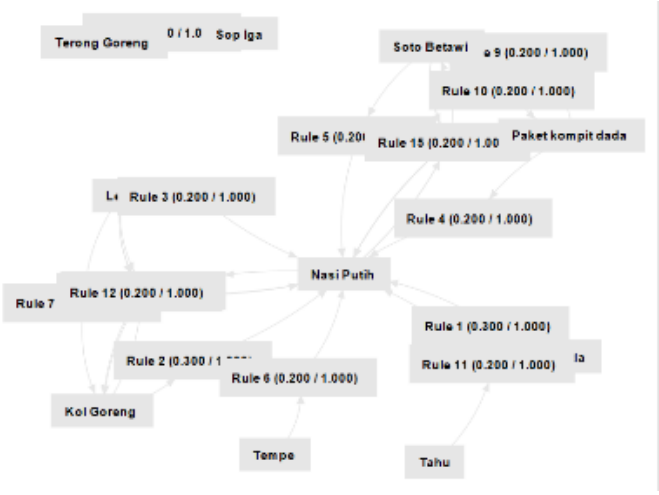


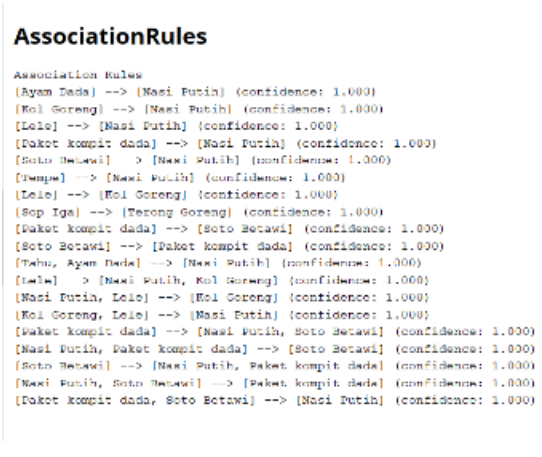
Figure 6. RapitMiner Graph

The figure shows a visualization of the association rules associated with various food items and their relationship with "White Rice". Each node represents an item, and the connecting lines (or edges) depict the association rules with their respective confidence levels and support values.

The following is a detailed interpretation of the visualization:

The support value indicates the frequency of transactions containing the item in question. All confidence values of 1,000 indicate that these items, when present in a transaction, always include "White Rice." This analysis is useful for understanding buying patterns and can help in inventory management or targeted marketing strategies.

3.8. Description Association Rule



AssociationRules

```
Association Rules
[Ayam Dada] --> [Nasi Putih] (confidence: 1.000)
[Kol Goreng] --> [Nasi Putih] (confidence: 1.000)
[Lele] --> [Nasi Putih] (confidence: 1.000)
[Paket kompit dada] --> [Nasi Putih] (confidence: 1.000)
[Soto Betawi]  --> [Nasi Putih] (confidence: 1.000)
[Tempe] --> [Nasi Putih] (confidence: 1.000)
[Lele] --> [Kol Goreng] (confidence: 1.000)
[Sop Iga] --> [Terong Goreng] (confidence: 1.000)
[Paket kompit dada] --> [Soto Betawi] (confidence: 1.000)
[Soto Betawi] --> [Paket kompit dada] (confidence: 1.000)
[Tahu, Ayam Dada] --> [Nasi Putih] (confidence: 1.000)
[Lele]  --> [Nasi Putih, Kol Goreng] (confidence: 1.000)
[Nasi Putih, Lele] --> [Kol Goreng] (confidence: 1.000)
[Kol Goreng, Lele] --> [Nasi Putih] (confidence: 1.000)
[Paket kompit dada] --> [Nasi Putih, Soto Betawi] (confidence: 1.000)
[Nasi Putih, Paket kompit dada] --> [Soto Betawi] (confidence: 1.000)
[Soto Betawi] --> [Nasi Putih, Paket kompit dada] (confidence: 1.000)
[Nasi Putih, Soto Betawi] --> [Paket kompit dada] (confidence: 1.000)
[Paket kompit dada, Soto Betawi] --> [Nasi Putih] (confidence: 1.000)
```

Figure 7. Description Association Rule

The image displays a set of association rules with their respective confidence levels, which are all at 1,000. Association rules are a common outcome of market basket analysis, identifying relationships between items in transaction data. Each rule indicates that the presence of a certain item in a transaction implies the presence of another item with a high degree of confidence.

Here is a breakdown of the association rules shown:

This rule shows that whenever certain items are bought together, there is 100% confidence that "Nasi Putih" (white rice) is also included in the transaction. This indicates that "White Rice" is a common or essential item in this transaction.

4. Conclusion

In research on the application of the FP-Growth algorithm to the purchasing patterns of chicken geprek purwokerto, the FP-Growth algorithm successfully identifies purchasing patterns that often recur or occur when purchasing food. This it can be concluded that the application of the FP-Growth algorithm can improve the efficiency and effectiveness of the purokerto geprek chicken shop significantly.

The relationship pattern obtained from the data of the purwokerto geprek chicken shop with minimum support (0.95) and min confiden (0.8) indicates that when customers buy chicken breast, the buyer will also buy the white rice menu, so that the buyer will buy the food menu purchased simultaneously.

Based on the results of research conducted with the FP-Growth algorithm to analyze customer purchasing patterns at the purwokerto geprek chicken shop, the following are recommendations for suggestions that can be applied:

- Menu development:

Designing food menus based on frequent purchase patterns can increase sales and operational efficiency.

- Stock availability analysis:

Use purchasing pattern analysis to optimize inventory management. By understanding what food items are most in demand, business owners can manage stock more efficiently and reduce the risk of running out of goods.

- Marketing strategy development:

By developing promotional strategies or special offers that are more attractive to potential customers. By implementing the recommendations above, it is hoped that Ayam Geprek Purokerto business owners can improve their business performance, strengthen relationships with buyers, and achieve successful long-term purchasing patterns.

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Finally, I would like to thank the readers and other researchers who have utilized the results of this study. I hope that the findings and insights I have shared will significantly advance the field and inspire future researchers. In this way I hope to have a broader positive impact on society and the world of science.

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