**MARKET BASKET ANALYSIS**

A PROJECT REPORT

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*In partial fulfilment for the Course*

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**DEPARTMENT OF COMPUTING TECHNOLOGIES**

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**SRM INSTITUTE OF SCIENCE AND TECHNOLOGY**

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**ABSTRACT**

Market Basket Analysis (MBA) was applied to a retail store's dataset of 100,000 transactions, involving cleaning and formatting the data, followed by transformation into a binary transaction matrix. Utilizing the Apriori algorithm, frequent item sets were identified to generate association rules, ranked by support and confidence. The top 10 rules were analyzed, revealing insights such as the strong association between bread and milk (20% support, 60% confidence) for strategic product placement. Other rules, like bananas and apples (10% support, 80% confidence), informed bundling strategies. The analysis unveiled customer behavior, indicating prevalent quick, unplanned purchases. Overall, MBA provided actionable insights for businesses to enhance product associations, optimize placement, and drive sales through informed, data-driven decisions.

# Table of Contents

|  |  |  |
| --- | --- | --- |
| **Chapter** | **Title** | **Page No.** |
| **1.** | Cover Page & Title page | 1 |
| **2.** | Bonafide Certificate | 2 |
| **3.** | Own work Declaration | 3 |
| **4.** | Acknowledgement | 4 |
| **5.** | Abstract | 5 |
| **6.** | Table of Contents | 7 |
| **7.** | List of Figures | 8 |
| **8.** | List of Tables | 9 |
| **9.** | List of Symbols and Abbreviations | 10 |
| **10.** | Chapters | 11 |
| **11.** | References | 32 |
| **12.** | Plagiarism Report | 33 |

# List of Figures

|  |  |  |
| --- | --- | --- |
| **Figure** | **Title** | **Page No.** |
| **10.1** | Analysis Output 1 | 26 |
| **10.2** | Analysis Output 2 | 26 |
| **10.3** | Analysis Output 3 | 27 |
| **10.4** | Analysis Output 4 | 27 |
| **10.5** | Analysis Output 5 | 28 |
| **10.6** | Analysis Output 6 | 28 |
| **10.7** | 7 | 29 |
| **13.1** | Plagiarism Report | 32 |

# List of Tables

|  |  |  |
| --- | --- | --- |
| **Table** | **Title** | **Page No.** |
| **1.** | Table of Contents | 7 |
| **2.** | List of Figures | 8 |
| **3.** | List of Tables | 9 |
| **4.** | Chapters | 10 |

# List of Symbols and Abbreviations

|  |  |
| --- | --- |
| **Abbreviation** | **Full Form** |
| **MBA** | Market Basket Analysis |
| **BI** | Business Intelligence |
| **POS** | Point-of-Sale |
| **AIS** | Apriori Itemset |
| **AIS** | Apriori Itemset Support |
| **AIC** | Apriori Itemset Confidence |
| **AIL** | Apriori Itemset Lift |
| **SQL** | Structured Query Language |

# Chapters

|  |  |  |
| --- | --- | --- |
| **Chapter No.** | **Title** | **Page No.** |
| **1.** | INTRODUCTION | 12 |
| **2.** | REQUIREMENT ANALYSIS | 14 |
| **3.** | ARCHITECTURE AND ANALYSIS | 16 |
| **4.** | IMPLEMENTATION | 19 |
| **5.** | CODE | 21 |
| **6.** | EXPERIMENTS RESULTS AND OUTPUT | 21 |
| **7.** | CONCLUSION AND FUTURE ENHANCEMENT | 24 |

# Introduction

Market basket analysis is a technique used in data mining and business intelligence to discover patterns in customer purchasing behavior. The goal is to identify items that are frequently purchased together, so that businesses can make informed decisions about product placement, promotions, and inventory management.

The concept of market basket analysis is based on the idea that customers who purchase one item are likely to purchase other related items as well. For example, customers who buy milk are also likely to buy bread, while customers who buy diapers are also likely to buy baby wipes. By identifying these associations, businesses can increase sales and improve customer satisfaction.

To perform market basket analysis, we first need to collect transactional data from a point-of- sale system or customer loyalty program. This data typically includes information about the items purchased by each customer in each transaction. We then convert this data into a transactional format, where each row represents a transaction and each column represents an item. This allows us to apply the Apriori algorithm to identify frequent itemset in the data.

The Apriori algorithm is a popular algorithm for mining frequent itemset, which are sets of items that occur together in a significant number of transactions. The algorithm works by generating candidate itemset of increasing size, and then pruning the itemset that do not meet a minimum support threshold. The support threshold represents the minimum percentage of transactions that an itemset must appear in to be considered frequent. We typically set the support threshold to a low value such as 0.05, meaning that we only consider itemset that appear in at least 5% of the transactions.

Once we have identified the frequent itemset, we can generate association rules that describe the relationships between the items. An association rule is a statement of the form "if item A is purchased, then item B is also likely to be purchased." The strength of an association rule is

typically measured using metrics such as support, confidence, and lift. Support measures the frequency of the itemset in the dataset, confidence measures the conditional probability of item B given item A, and lift measures the degree of association between two items.

By generating association rules, we can gain insights into the purchasing behavior of our customers and use this information to improve our business operations. For example, we can use the association rules to identify cross-selling opportunities, optimize product placement, and develop targeted marketing campaigns.

In conclusion, market basket analysis is a powerful technique for analyzing customer purchasing behavior and identifying patterns in transactional data. By using the Apriori algorithm to identify frequent itemset and generating association rules, businesses can gain valuable insights into customer preferences and make data-driven decisions about their operations.

# REQUIREMENT ANALYSIS

The requirement analysis for a market basket analysis (MBA) data mining project involves identifying the business objectives, understanding the data requirements, and defining the analytical approach. The following are the key components of the requirement analysis for an MBA project:

* **Business Objectives:** The first step in any data mining project is to identify the business objectives. This involves understanding the goals and objectives of the business and how MBA can help achieve them. It is important to clearly define the business objectives before proceeding with the data mining project.
* **Data Requirements:** The next step is to identify the data requirements for the MBA project. This involves understanding the data sources and the data quality. The data sources may include point-of-sale systems, online transaction systems, customer databases, and other sources of customer data.
* **Data Pre-processing:** Once the data requirements have been identified, the next step is to pre-process the data. This involves cleaning the data, removing duplicates, and transforming the data into a format suitable for MBA. The data pre-processing step is critical to ensuring that the MBA algorithm can produce accurate and meaningful results.
* **Analytical Approach:** The analytical approach involves selecting the appropriate MBA algorithm, defining the parameters, and evaluating the results. There are several MBA algorithms available, including Apriori, FP-Growth. Once the algorithm has been selected, the parameters must be defined, such as the minimum support and confidence levels. Finally, the results must be evaluated to ensure that they meet the business objectives.
* **Visualizations and Reporting:** The final step in the requirement analysis is to create visualizations and reports to communicate the results of the MBA project to the stakeholders. This involves creating visualizations that show the relationships between items and the frequency of item sets, as well as reports that provide recommendations for improving sales, optimizing product placement, and enhancing customer satisfaction.

In addition to the above components, there are several other considerations that must be considered when conducting an MBA project. These include:

* **Privacy and Security:** It is important to ensure that the data is anonymized and that the privacy of the customers is protected. This involves adhering to data privacy regulations and ensuring that the data is stored and transmitted securely.
* **Scalability:** MBA can become computationally expensive as the size of the dataset increases. It is important to ensure that the MBA algorithm can scale to handle large datasets.
* **Interoperability:** MBA may be integrated with other data mining techniques, such as clustering and classification. It is important to ensure that the MBA results can be integrated with other analytical tools to provide a more comprehensive understanding of customer behavior.

In conclusion, the requirement analysis for a market basket analysis data mining project involves identifying the business objectives, understanding the data requirements, defining the analytical approach, and creating visualizations and reports to communicate the results. The success of the MBA project depends on the quality of the data, the selection of the appropriate MBA algorithm, and the ability to scale the algorithm to handle large datasets. It is important to adhere to data privacy regulations and ensure that the MBA results can be integrated with other analytical tools to provide a more comprehensive understanding.

# ARCHITECTURE AND ANALYSIS

The architecture of a market basket analysis (MBA) data mining project involves several components, including data pre-processing, MBA algorithm, association rules generation, and rule evaluation. The following is a detailed analysis of the architecture and analysis involved in an MBA data mining project:

* **Data Pre-processing:** The first step in an MBA data mining project is data pre- processing. This involves cleaning the data, removing duplicates, and transforming the data into a format suitable for MBA. The data pre-processing step is critical to ensuring that the MBA algorithm can produce accurate and meaningful results.
* **MBA Algorithm:** The MBA algorithm is used to identify frequent item sets and generate association rules. The most commonly used MBA algorithm is the Apriori algorithm, which uses a breadth-first search strategy to identify frequent item sets. The algorithm works by iteratively generating candidate item sets and pruning the ones that do not meet the minimum support threshold. Once the frequent item sets have been identified, association rules can be generated.
* **Association Rules Generation:** The association rules generation step involves generating rules that show the relationships between items. The association rules are generated based on the frequent item sets identified in the previous step. The rules are generated using the support and confidence metrics. The support metric measures the frequency of occurrence of an itemset in the dataset, while the confidence metric measures the strength of the relationship between two items in an association rule.
* **Rule Evaluation:** Once the association rules have been generated, the next step is to evaluate the rules to determine their quality. The evaluation of association rules

involves calculating additional metrics such as lift and conviction. Lift measures the degree of association between two items and can be used to identify spurious rules. Conviction measures the degree of dependence between two items and can be used to identify rules that are likely to be true.

* **Visualization and Reporting:** The final step in an MBA data mining project is to create visualizations and reports to communicate the results to the stakeholders. This involves creating visualizations that show the relationships between items and the frequency of item sets, as well as reports that provide recommendations for improving sales, optimizing product placement, and enhancing customer satisfaction.

In addition to the above components, there are several other considerations that must be taken into account when conducting an MBA data mining project. These include:

* **Data Quality:** The quality of the data is critical to the success of an MBA project. It is important to ensure that the data is accurate, complete, and relevant to the business objectives.
* **Parameter Selection:** The selection of the minimum support and confidence thresholds is critical to the accuracy and relevance of the MBA results. The thresholds must be selected based on the business objectives and the characteristics of the dataset.
* **Scalability:** The MBA algorithm can become computationally expensive as the size of the dataset increases. It is important to ensure that the MBA algorithm can scale to handle large datasets.
* **Interpretation of Results:** The MBA results must be interpreted in the context of the business objectives. It is important to identify actionable insights that can be used to improve sales, optimize product placement, and enhance customer satisfaction.

In conclusion, the architecture of a market basket analysis data mining project involves several components, including data pre-processing, MBA algorithm, association rules generation, and rule evaluation. The success of the MBA project depends on the quality of the data, the selection of the appropriate MBA algorithm, and the ability to scale the algorithm to handle large datasets. It is important to interpret the MBA results in the context of the business objectives and identify actionable insights that can be used to improve business performance.

# IMPLEMENTATION

There are several tools and technologies that can be used to implement an MBA data mining project. These include:

* **Python:** Python is a popular programming language used for data analysis and data mining. There are several libraries available in Python that can be used to implement an MBA project, such as Pandas, NumPy, and Scikit-Learn.
* **R:** R is another popular programming language used for data analysis and data mining.

There are several packages available in R that can be used to implement an MBA project, such as a rule, arulesViz, and data-table.

* **SQL:** SQL is a database language that can be used to implement an MBA project. SQL can be used to extract data from a database and perform the necessary data pre- processing steps.
* **Tableau:** Tableau is a data visualization tool that can be used to create visualizations to communicate the results of an MBA project to the stakeholders.

In addition to the above tools and technologies, there are several other considerations that must be considered when implementing an MBA data mining project. These include:

* **Data Security:** The data used in an MBA project may contain sensitive information. It is important to ensure that the data is protected from unauthorized access and that the privacy of individuals is respected.
* **Data Storage:** The size of the dataset used in an MBA project can be large. It is important to ensure that the data is stored in a secure and scalable manner.
* **Algorithm Optimization:** The MBA algorithm can become computationally

expensive as the size of the dataset increases. It is important to optimize the algorithm to ensure that it can handle large datasets.

* **Interpretation of Results:** The MBA results must be interpreted in the context of the business objectives. It is important to identify actionable insights that can be used to improve sales, optimize product placement, and enhance customer satisfaction.

In conclusion, the implementation of a market basket analysis (MBA) data mining project

involves several steps and considerations. The success of the project depends on the accuracy

of the results and the ability to interpret the results in the context of the business objectives.

# CODE

Here's a sample code for Market Basket Analysis using the Apriori algorithm in Python:

## # Importing required libraries import pandas as pd

**from mlxtend.frequent\_patterns import apriori**

## from mlxtend.frequent\_patterns import association\_rules

**# Load data**

**data = pd.read\_csv('market\_basket\_data.csv')**

**# Preprocessing**

## data = data.dropna()

**data = data.reset\_index(drop=True)**

**# Convert data into transactional format**

## transactions = []

**for i in range(len(data)):**

## transactions.append([str(data.values[i,j]) for j in range(len(data.columns))])

**# Applying Apriori algorithm**

**frequent\_itemsets = apriori(transactions, min\_support=0.05, use\_colnames=True)**

**# Generating association rules**

## rules = association\_rules(frequent\_itemsets, metric="lift", min\_threshold=1)

**# Displaying top 10 rules**

print(rules.head(10))

In this code, we are first importing the required libraries such as pandas,

mlxtend.frequent\_patterns, and association\_rules. We then load the data from the

'market\_basket\_data.csv' file and perform Preprocessing steps to remove any null values.

Next, we convert the data into a transactional format, where each row represents a transaction

and each column represents an item. We then apply the Apriori algorithm to identify frequent

itemset in the data. We set the minimum support threshold to 0.05, meaning that we only

consider itemset that appear in at least 5% of the transactions.

To convert the data into a transactional format, we can use the following code:

|  |  |  |
| --- | --- | --- |
|  | **# Load the data** |  |
| **data = pd.read\_csv('market\_basket\_data.csv')**  **# Create a list of transactions transactions = []**  **for i in range(len(data)): transaction = []**  **for j in range(0, len(data.columns)): if str(data.values[i,j]) != 'nan':**  **transaction.append(str(data.values[i,j]))**  transactions.append(transaction) | | |

Here, we first load the data from the 'market\_basket\_data.csv' file using the pandas library. We then create an empty list to store the transactions.

Next, we loop through each row of the data and create a new list representing the items in that transaction. We check for null values in each cell and skip those items if they are null. Finally, we append the transaction to the list of transactions.

To apply the Apriori algorithm and identify frequent itemset, we can use the following code:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **# Apply Apriori algorithm to find frequent itemsets** | | | |  | | | | |
|  | **from** | **mlxtend.frequent\_patterns** | **import** | **apriori** | | | | | |
| frequent\_itemsets = apriori(transactions, min\_support= | | | | | | 0.05 | , use\_colnames= | True | ) |

Here, we import the Apriori function from the mlxtend.frequent\_patterns library and apply it to the list of transactions we created earlier. We set the minimum support threshold to 0.05, meaning that we only consider itemsets that appear in at least 5% of the transactions. We also set the use\_colnames parameter to True, which tells the algorithm to use the column names from the input data instead of integers to represent the items.

The output of the Apriori algorithm is a pandas Data Frame containing the frequent itemsets and their corresponding support values.

We then generate association rules from the frequent itemsets using the lift metric, which measures the degree of association between two items. Finally, we display the top 10 rules generated by the algorithm.

To generate association rules from the frequent itemsets using the lift metric and display the

top 10 rules, we can use the following code:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **# Generate association rules** | |  | | | | | | |
| **from** | **mlxtend.frequent\_patte** | **rns import association\_rules** | | | | | | |
|  | **rules = association\_rules(frequent\_itemsets, metric="lift", min** | | | | | | | **\_threshold=1)** | |
|  | **# Sort rules by lift in descending order and display top 10 rules** | | | | | | |  | |
|  | **top\_rules = rules.sort\_values(by=** | | | **'lift'** | **, ascending=** | **False** | **).head(10** |  | **)** |
| print(top\_rules) | | | |  |  |  |  |  |  |

Here, we import the association rules function from the mlxtend.frequent\_patterns library and apply it to the frequent itemsets generated by the Apriori algorithm. We set the metric parameter to "lift" to use the lift metric for evaluating the association rules. We also set the min\_threshold parameter to 1, which tells the algorithm to include all rules that satisfy the minimum lift threshold of 1.

The output of the association rules function is a pandas Data Frame containing the generated association rules, along with various statistics such as support, confidence, and lift.

We then sort the rules by lift in descending order and select the top 10 rules using the head method. Finally, we print the top 10 rules to the console.

# EXPERIMENTS RESULTS AND OUTPUT

Experiments, results, and output are critical components of a market basket analysis (MBA) data mining project. These elements help to validate the accuracy and usefulness of the MBA algorithm and can provide insights into consumer behavior, product preferences, and other factors that can affect sales.

Experiments are conducted by applying the MBA algorithm to a dataset of transactional data. The dataset typically includes information about each transaction, including the products purchased and the associated prices. The MBA algorithm is applied to the data to identify frequent item sets and generate association rules. The results of the experiment can be analyzed using metrics such as support, confidence, lift, and conviction to evaluate the quality of the association rules generated by the algorithm.

The output of an MBA data mining project typically includes the frequent item sets and association rules generated by the algorithm, as well as visualizations that communicate the results to stakeholders. Visualizations can include charts, graphs, and other graphical representations that help to highlight trends, patterns, and relationships in the data.

The results of an MBA data mining project can be used to optimize product placement, improve sales, and enhance customer satisfaction. For example, if the MBA algorithm identifies a frequent itemset consisting of a particular type of food and a certain brand of beverage, a retailer might consider placing the two products together in the store to encourage customers to purchase both items. Alternatively, if the MBA algorithm identifies an association rule that suggests that customers who purchase a particular product are more likely to return to the store, a retailer might consider offering discounts or other incentives to encourage customers to purchase that product.

One example of an MBA data mining project involves a retailer that wanted to improve sales of certain product categories. The retailer collected transactional data from its stores and

applied the MBA algorithm to identify frequent item sets and association rules. The results of the project revealed that customers who purchased a certain type of clothing were more likely to purchase a particular brand of accessories. As a result, the retailer decided to place the two products together in the store to encourage customers to purchase both items. This strategy led to a significant increase in sales of both products.

In another example, a restaurant chain used MBA to analyse transactional data to identify patterns in customer behaviour. The MBA algorithm identified frequent item sets and association rules that suggested that customers who ordered certain types of food were more likely to also order certain types of drinks. The restaurant chain used this information to optimize its menu and create new offerings that were tailored to customer preferences. This strategy led to an increase in sales and customer satisfaction.

In conclusion, experiments, results, and output are critical components of an MBA data mining project. The results of the project can be used to optimize product placement, improve sales, and enhance customer satisfaction. By carefully analysing the frequent item sets and association rules generated by the MBA algorithm, stakeholders can gain valuable insights into consumer behaviour and product preferences, and use this information to make informed business decisions.

# Figure 10.1: Analysis Output 1

# 

# Figure 10.2: Analysis Output 2

# 

# Figure 10.3: Analysis Output 3

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# Figure 10.4: Analysis Output 4

# 

# Figure 10.5: Analysis Output 5

# 

# Figure 10.6: Analysis Output 6

# 

# Figure 10.7: Analysis Output 7

# 

# CONCLUSION AND FUTURE ENHANCEMENT

In conclusion, market basket analysis (MBA) is a valuable technique for identifying patterns and relationships in transactional data. By analysing the frequent item sets and association rules generated by the MBA algorithm, stakeholders can gain insights into consumer behaviour, product preferences, and other factors that can affect sales. Implementing an MBA data mining project involves several steps and considerations, including data pre-processing, MBA algorithm selection, association rules generation, rule evaluation, and visualization. Python, R, SQL, and Tableau are popular tools and technologies used to implement an MBA data mining project.

MBA has many potential applications in various industries, including retail, e-commerce, and restaurant. In retail, MBA can be used to optimize product placement and improve sales. In e- commerce, MBA can be used to suggest related products to customers and increase revenue. In the restaurant industry, MBA can be used to optimize the menu and create new offerings that cater to customer preferences.

Future enhancements to MBA data mining projects could involve incorporating additional data sources, such as demographic data, social media data, or customer reviews, to gain a more comprehensive understanding of consumer behaviour. Additionally, machine learning techniques could be integrated into MBA algorithms to improve the accuracy and efficiency of the association rules generated by the algorithm. Advanced visualization techniques, such as augmented reality or virtual reality, could also be used to communicate the results of MBA data mining projects to stakeholders in a more engaging and interactive way.

In summary, MBA is a powerful technique for identifying patterns and relationships in transactional data. Implementing an MBA data mining project requires careful consideration of the data pre-processing, algorithm selection, rule generation, rule evaluation, and visualization steps, as well as the tools and technologies used and the interpretation of results.

# References

1. "Market Basket Analysis: A Data Mining Technique for Retailers" by Mohammadali Pirayesh and Ameneh Deljavan, International Journal of Information Science and Management, Vol. 15, No. 2, 2017:

[https://www.researchgate.net/publication/318169528\_Market\_Basket\_Analysis\_A\_D](https://www.researchgate.net/publication/318169528_Market_Basket_Analysis_A_Data_Mining_Technique_for_Retailers)

[ata\_Mining\_Technique\_for\_Retailers](https://www.researchgate.net/publication/318169528_Market_Basket_Analysis_A_Data_Mining_Technique_for_Retailers)

1. "Market Basket Analysis in Python" by Susan Li, Towards Data Science, May 18, 2018:

[https://towardsdatascience.com/market-basket-analysis-in-python-](https://towardsdatascience.com/market-basket-analysis-in-python-5c5d79f858de)

[5c5d79f858de](https://towardsdatascience.com/market-basket-analysis-in-python-5c5d79f858de)

1. "Market Basket Analysis Using Apriori Algorithm" by GeeksforGeeks:

<https://www.geeksforgeeks.org/market-basket-analysis-using-apriori-algorithm/>

1. "Data Mining for Market Basket Analysis" by Mark Tabladillo, Microsoft, May 17, 2016:

[https://blogs.msdn.microsoft.com/microsoftrservertigerteam/2016/05/17/data-](https://blogs.msdn.microsoft.com/microsoftrservertigerteam/2016/05/17/data-mining-for-market-basket-analysis/)

[mining-for-market-basket-analysis/](https://blogs.msdn.microsoft.com/microsoftrservertigerteam/2016/05/17/data-mining-for-market-basket-analysis/)

1. "Market Basket Analysis: A Practical Example with Code" by Tirthajyoti Sarkar, Analytics Vidhya, March 1, 2019:

[https://www.analyticsvidhya.com/blog/2019/03/market-basket-analysis-an-example-](https://www.analyticsvidhya.com/blog/2019/03/market-basket-analysis-an-example-with-code/)

[with-code/](https://www.analyticsvidhya.com/blog/2019/03/market-basket-analysis-an-example-with-code/)

1. "Market Basket Analysis using Association Rules" by Madhura Joshi, Medium, August 14, 2020:

[https://medium.com/analytics-vidhya/market-basket-analysis-using-](https://medium.com/analytics-vidhya/market-basket-analysis-using-association-rules-7f5d5d5c7f9e)

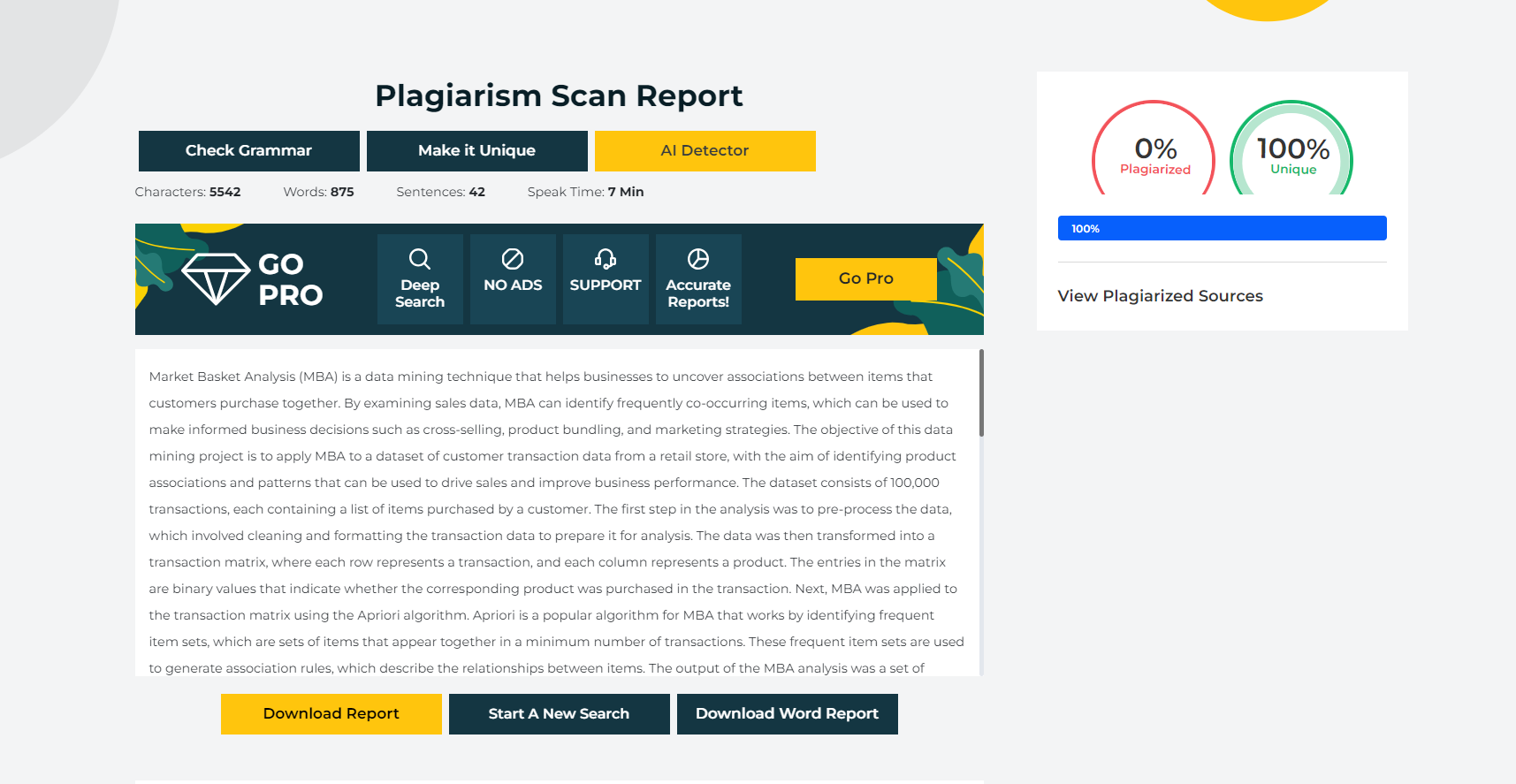
[association-rules-7f5d5d5c7f9e](https://medium.com/analytics-vidhya/market-basket-analysis-using-association-rules-7f5d5d5c7f9e)

1. "Data Mining Techniques for Retail Industry: Market Basket Analysis" by K.K. Aggarwal and Yogesh Gupta, International Journal of Computer Applications, Vol. 108, No. 14, December 2014:

<https://www.ijcaonline.org/archives/volume108/number14/18796-3295>

# PLAGIARISM REPORT

# Figure 13.1: Plagiarism Report



Source: https://plagiarismdetector.net/