



# Recommendation System Application Development by using Association Analysis Apriori Algorithm

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- Background of the Study
  - Most companies and corporations are computer systems to handle their business transactions.
  - **Amazon and Netflix** can recommend product to their customers by analyze a huge of their data.
  - What is a **recommendation system**?
  - What is a **association analysis**?

### ➤ Problem Statement

- The analysis of shopping baskets has been very attractive to retailers in recent years.
- Advanced technology allowed them to collect information about and purchase from their customers.
- The analysis of their customer data are useful for understanding the purchasing behavior of retail businesses.
- Mining purchasing patterns allows retailers to better customize promotions and store settings.

- Aims and Objectives of the Study
  - Proposed the architecture of association item analysis for the recommendation system.
  - Developed and conducted experiments of recommendation system by using association analysis Apriori algorithm.
- Limitation and Scope
  - Focused on the propose architecture of association item analysis for recommendation system.
  - Conducted experiment of Apriori algorithm.

## ➤ Association Rules

- A model that identifies how data items are associated with each other.
- Structure of Rule: *If (Condition) Then (Result)*
- Support and Confidence measures the strength of rule.

$$\text{Support}(A) = \frac{\text{Transaction containing } A}{\text{Total Transactions}}$$

$$\text{Confidence}(A \Rightarrow B) = \frac{\text{support}(A \cup B)}{\text{support}(A)}$$

- Apriori algorithm
  - A well-known algorithm that is used for mining frequent itemsets for association rules.
  - Easy to understand and implement.
  - Can use on large itemsets.
- Recommendation System Techniques
  - Content-Based Recommendation
  - Collaborative Filtering Recommendation
  - Demographic Based Approach

## Literature Reviews – Cont.

- Chellatamilan and Suresh, 2011
  - Presented an idea for building a recommendation system for the e-Learning system.
  - Their proposed require gathering information from users.
- Abhishek Saxena, Navneet K Gaur, 2015
  - Proposed the recommendation system by using Apriori.
  - It won't require the customer's profile to recommend products.
  - Authors are not show the experimental with real life transaction data.



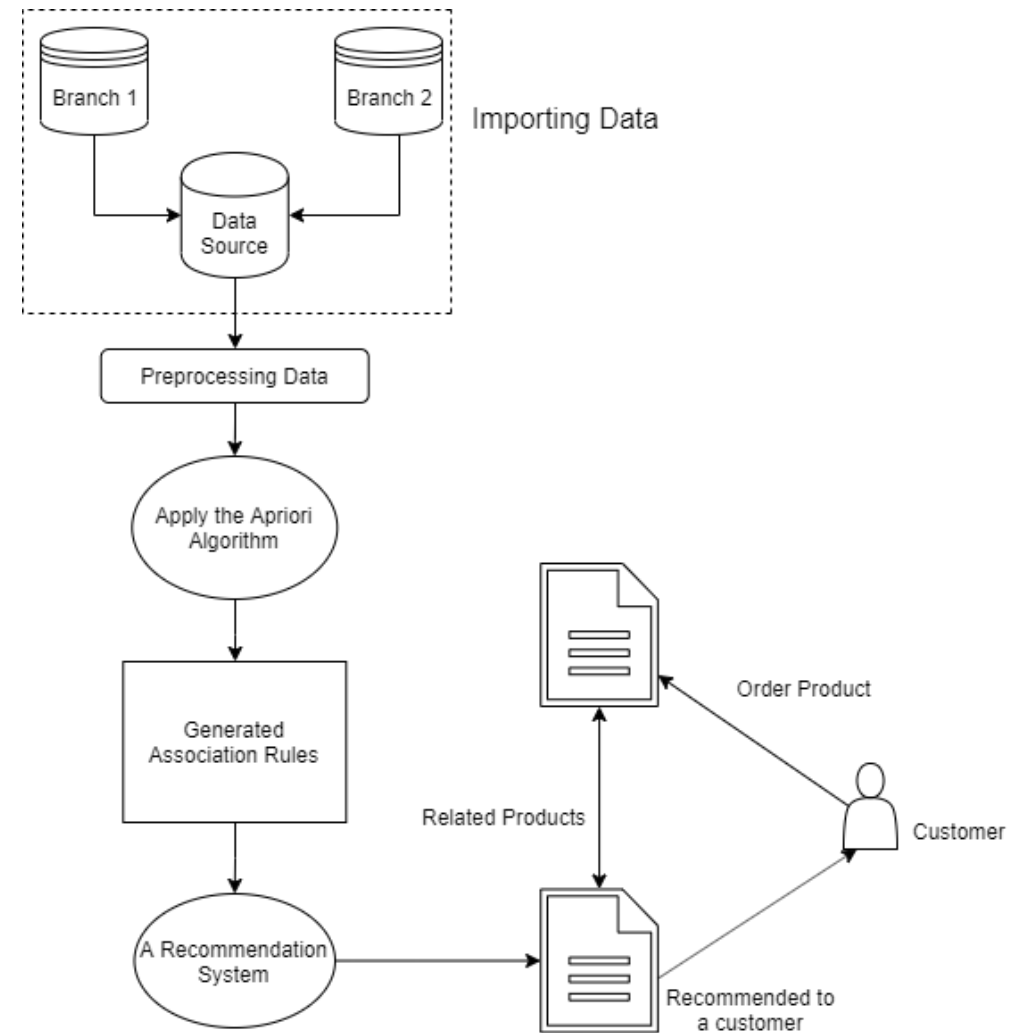
## Literature Reviews – Cont.

- Shadi, et al., 2018
  - Proposed a new recommender framework for requirements engineering.
  - They used Apriori algorithm to extract rules from user requirements data not transaction database.
- JinHyun, et al., 2016
  - Implemented the mobile coupon recommendation system.
  - Recommended coupons to the user based on the consumer usage pattern.

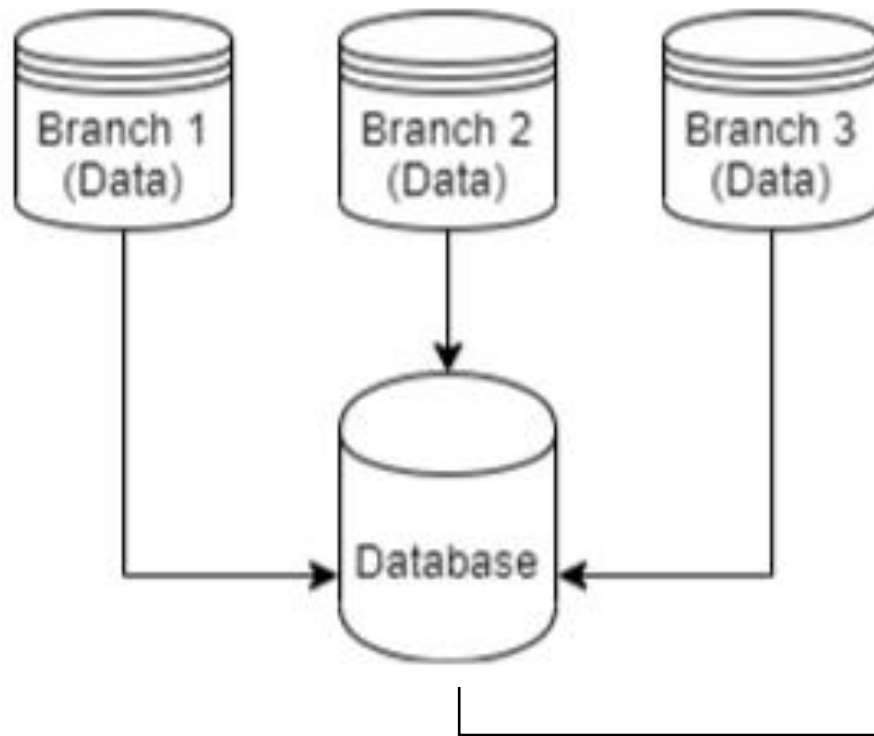
## Literature Reviews – Cont.

- Bendakir and Aimeur, 2006
  - Proposed a course recommendation system based on association rules for students.
  - It does not make use of a student's academic background.
- Aijaz, Tasleem, and Majid, 2018
  - Proposed technique for recommender system be using Opinion Based.
  - Because they used KNN for recommendation process so it make memory intensive.

- System Overview
  - Importing Data
  - Preprocessing Data
  - Apply the Apriori Algorithm
  - Generated Association Rules



### ➤ Importing Data



TID	Item
T1	ESPRESSO
T1	SUGAR
T1	NEWSPAPER
T2	ESPRESSO
T2	SUGAR
T2	COLA
...	...

### ➤ Preprocessing Data

- Converted historical transaction data into our algorithm formation.
- Labeled the item as a number.
- For example, ESPRESSO -> 1, SUGAR -> 2, NEWSPAPER -> 3 etc.

TID	Item	Item Label
T1	ESPRESSO, SUGAR, NEWSPAPER	1, 2, 3
T2	ESPRESSO, SUGAR, COLA	1, 2, 4
T3	ESPRESSO, SUGAR	1, 2
T4	CAPPUCCINO, CIGARETTES	5, 6
...	...	...

# Methodology – Cont.

## ➤ Apriori Algorithm

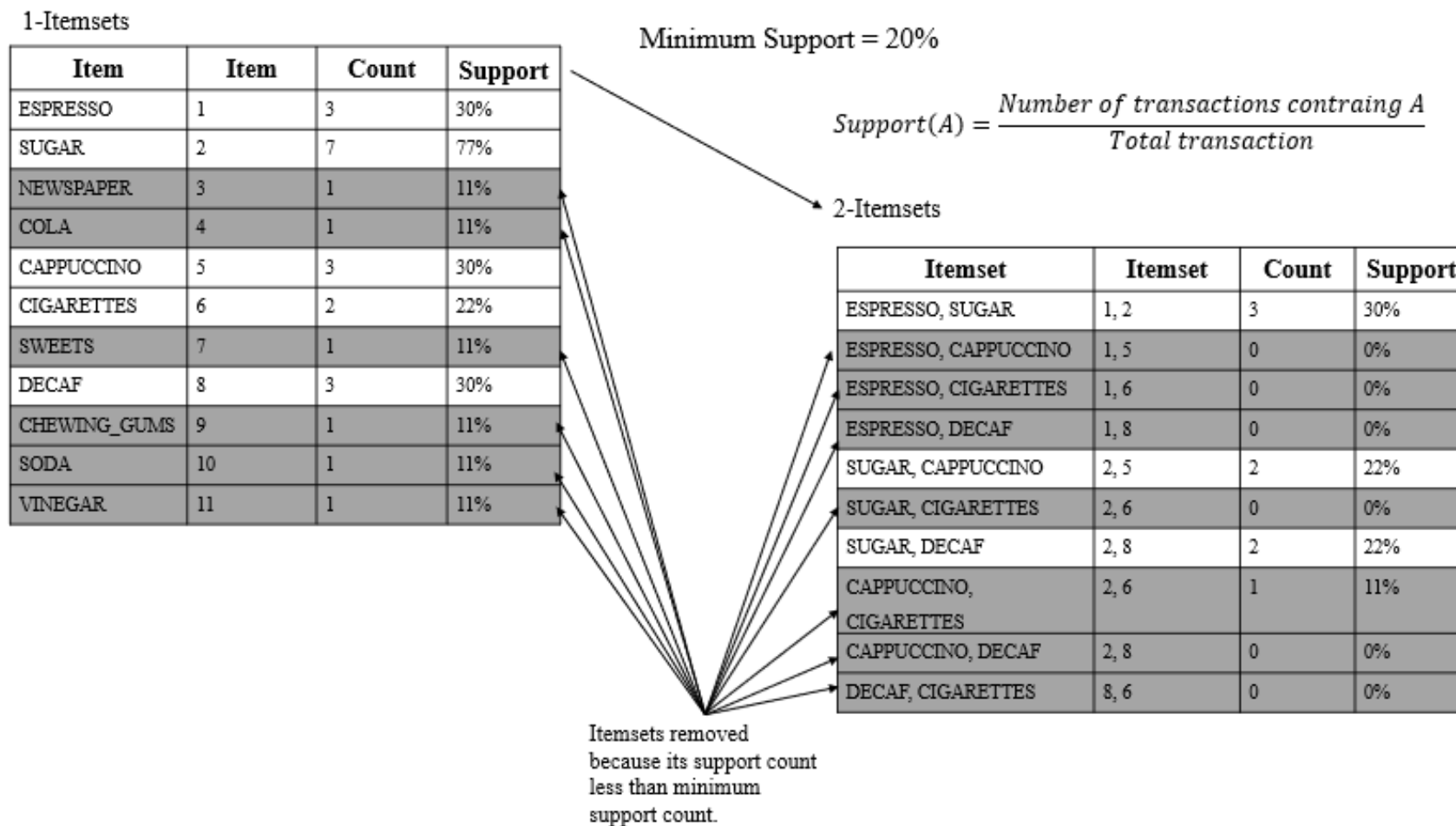
- The example customer purchase histories.

<b>TID</b>	<b>Items</b>	<b>Item Label</b>
T1	ESPRESSO, SUGAR, NEWSPAPER	1, 2, 3
T1	ESPRESSO, SUGAR, COLA	1, 2, 4
T1	ESPRESSO, SUGAR	1, 2
T1	CAPPUCCINO, CIGARETTES	5, 6
T1	CAPPUCCINO, SUGAR	5, 2
T1	CAPPUCCINO, SUGAR, SWEETS	5, 2, 7
T1	DECAF, SUGAR, CHEWING_GUMS	8, 2, 9
T1	DECAF, SODA, VINEGAR	8, 10, 11
T1	DECAF, SUGAR, CIGARETTES	8, 2, 6

# Methodology – Cont.

## ➤ Apriori Algorithm – Cont.

- The high level of frequent itemset generation for the Apriori.



### ➤ Association Rule Generation

Minimum Confidence = 60%

$$\text{Confidence}(A \Rightarrow B) = \frac{\sum \text{transaction contain } A \ \& \ B}{\sum \text{transactions contain } A}$$

Rules	Rules	Support	Confidence
$\{ESPRESSO\} \Rightarrow \{SUGAR\}$	$\{1\} \Rightarrow \{2\}$	$3/9 = 30\%$	$3/3 = 100\%$
$\{DECAF\} \Rightarrow \{SUGAR\}$	$\{8\} \Rightarrow \{2\}$	$2/9 = 22\%$	$2/3 = 66\%$
$\{CAPPUCCINO\} \Rightarrow \{SUGAR\}$	$\{5\} \Rightarrow \{2\}$	$2/9 = 22\%$	$2/3 = 66\%$



# Experiments

## ➤ Environmental Setup

- Processor: Intel(R) Core (TM) i5-5200U CPU @ 2.20GHz, 2201Mhz, 2 Core(s), 4 Logical Processor(s).
- RAM: 16.00 GB

## ➤ Datasets

<b>Name</b>	<b>Total transactions</b>	<b>Average no of items per transactions</b>
Dataset1	4,444	10
Dataset2	16,466	10

# Experiments – Cont.

## ➤ Results

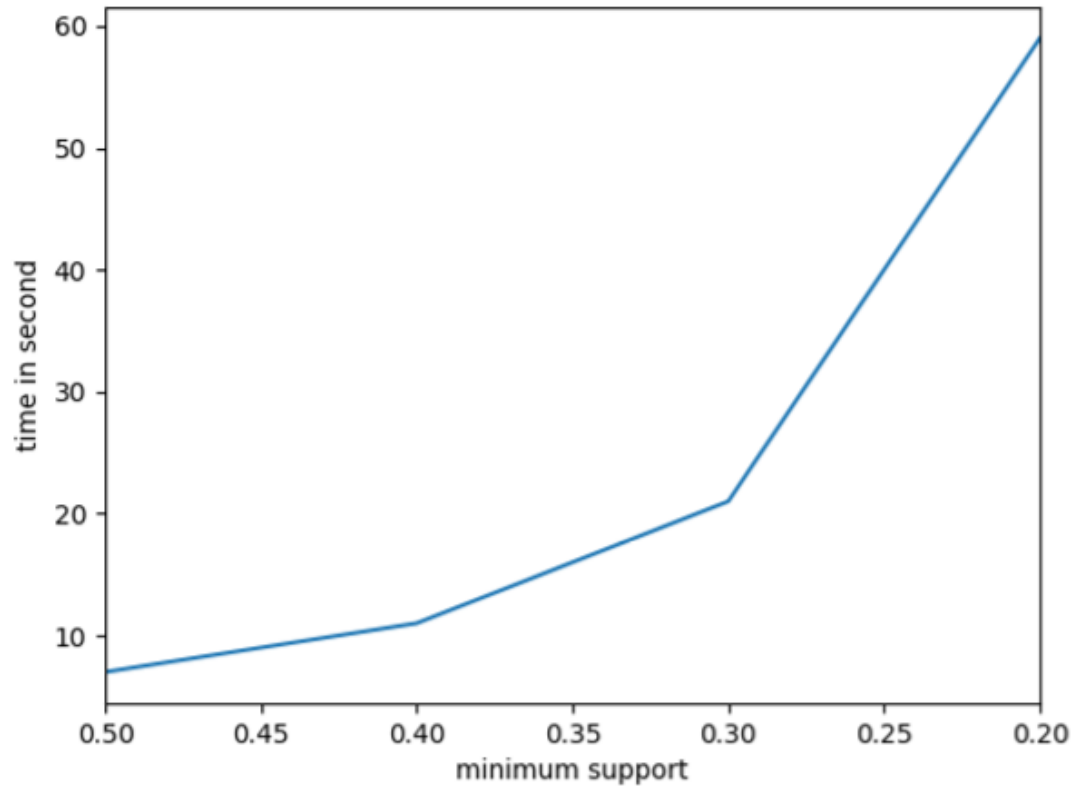


Figure 5. Response time of frequent itemset generation for Dataset1.

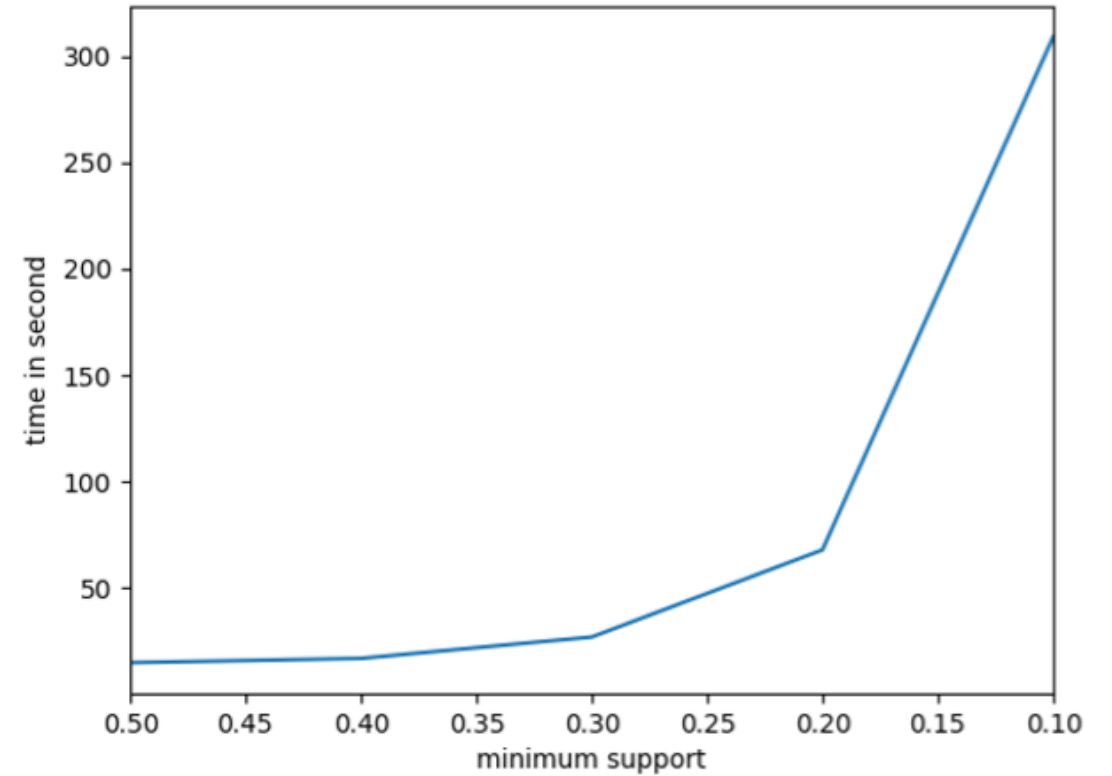


Figure 6. Response time of frequent itemset generation for Dataset2.

# Conclusions & Future Works

## ➤ Conclusions

- Proposed an architecture for association item analysis for RSs.
- Developed and conducted experiment of RS by using Association Analysis Apriori Algorithm.
- The results can provide recommended a new item to customers by understanding historical transaction data.

## ➤ Future Works

- Make a library for recommend product to customers by using association items from our proposed frameworks.

# Thank You