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Stream Processing for Association Rule to Generate Student Dataset using Apriori Algorithm

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Abstract: ***Analytical techniques have been used for many years to analyse and predict academic achievement from various perspectives. One of the most challenging problems for higher education is predicting students' paths through the education system. Many factors influence successful student outcome prediction in the early course stage. Apriori algorithm techniques use a variety of methods to find out and collect based on stored data patterns student information. Colab and Python applications are used in this project to predict each student based on characteristics in the given dataset. Each student's information is included in the dataset. Because it arrives as it is being created, received real-world data is referred to that as streaming data.***
Keywords: Stream Processing, Kafka, Apriori Algorithm, Data mining, Student Dataset

I. INTRODUCTION

Data mining is an important part of educational today's organizations, as well as one of the most important research areas, with the goal of extraction of useful information from huge datasets of data. Educational data mining (EDM) is an important research field that can predict future useful information from educational datasets in order to improve academic outcomes, better understand, and assess students' active learning. Data mining is the process of extracting information from massive amounts of data. To put it another way, data mining is the process of trying to extract knowledge from data. Knowledge discovery refers to the technique of learning from data collection (KDD). We can make educated guesses based on the data provided. we have used Apriori algorithm and LinkedIn generated Apache Kafka, which is an accessible stream platform. It was later given to the Apache Foundation and accessible in 2011. Real-time processing of data streams: Take immediate action on knowledge and insight from actual data streaming platforms such as Kafka. Make your data scientists available: By attaching to the broker to discover data, train designs, deploy them to producers, monitor them, and They become more self-sufficient throughout the development lifecycle if they are quickly re-trained on new data. Apriori Algorithm :The Apriori is a popular method for mining frequently occurring item sets for Logic association rules. Apriori employs a “bottom up” approach in which frequent subsets are expanded one at a period. Kafka:LinkedIn created Apache Kafka, an open-source stream platform. It was later transferred to the Apache Foundation and accessible in 2011.

II. LITERATURE SURVEY

Dr. Vikesh Kumar & Samrat Singh [1] Data mining is a powerful tool for improving academic performance. Educational Data Mining is concerned with developing new methods for extracting information from educational data sets that can be used for decision making in the educational system.

M. Goyal and R. Vohra [2] Data analysis is vital for decision support in any industry, including manufacturing and education. While data mining techniques such as clustering, decision trees, and association are applied to higher education processes, this can help to improve student performance, life cycle management, course selection, retention rate, and grant fund management.

Seema Purohit and Neelam Naik [4]. Quality higher education is required for the country's growth and development. One of the pillars of higher education is professional education. Data mining techniques seek to uncover hidden knowledge in existing educational data, forecast the future, and apply it to the benefit of higher education institutions and students.

K. Rajeswari, Suchita Borkar [7]. Education Data mining is an interesting area that has a major impact on predicting students' academic performance. The performance of students is evaluated in this paper using the association rule mining algorithm. There has been research done on evaluating student performance based on various attributes. Important rules are generated in our study to measure the correlation between various attributes, which will help in enhancing the student's academic performance.

M. Tiwari, Randhir Singh, and Neeraj Vimal [8]. Educational institutions are important parts of our society, and they play an important role in the nation's growth and development. Predicting student performance in educational settings is also important. Personal, social, as well as psychological factors all effect a student's academic performance.

III. PROPOSED METHODOLOGY

The Apriori had a significant issue with various scan results through entire data set. It took a lot of spacetime. The change in our paper implies that we really do not scan the database structure to add up the support for each attribute. This is accomplished by keeping track of the minimum support count and comparing it to the support of each attribute. An attribute's support is only counted until it reaches its minimum support value. It is not necessary to know the support for just an attribute up to that point. This feature is achieved by using a value called flag in the technique. When the value of flag changes, the loop is divided and the benefit for support is recorded.

IV. PROBLEM DEFINITION

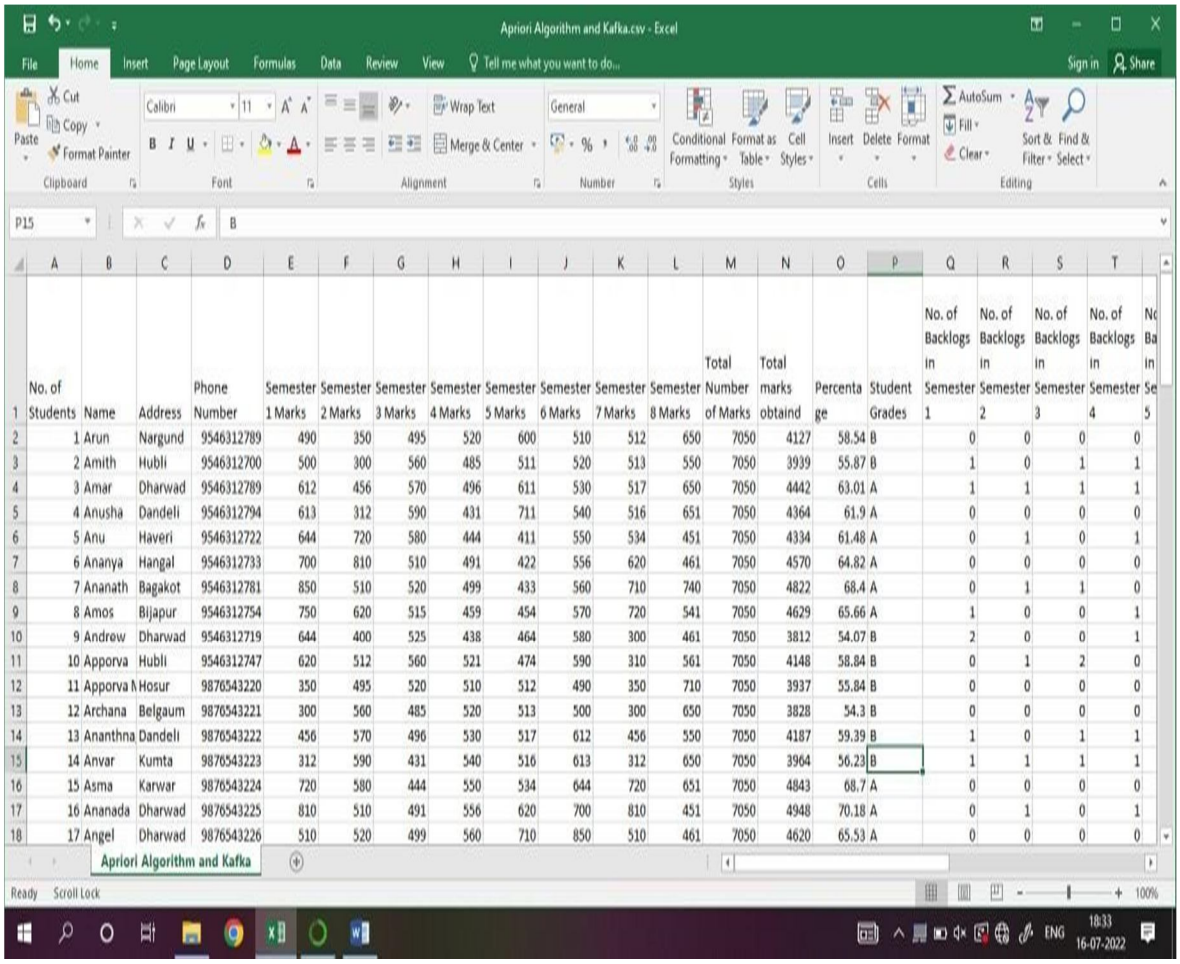
Create centralized dataset to improve the capability of level-wise frequent generation student dataset, an vital Apriori property is being used, which aids in reducing the search time. space. All subsets of a frequent student dataset should be common (Apriori property).

V. DATSET DESCRIPTION

The followings are the steps involves design and dataset.

We have chosen a dataset and attributes: created dataset contains the analysis of each students from 1 to 8 semester. The dataset contains 105 instances and 35 attributes. The data file has to be in either in 'CSV' format.

Here is the sample of our dataset which is in 'CSV' format



No. of Students	Name	Address	Phone Number	Semester 1 Marks	Semester 2 Marks	Semester 3 Marks	Semester 4 Marks	Semester 5 Marks	Semester 6 Marks	Semester 7 Marks	Semester 8 Marks	Total Number of Marks	Total marks obtaind	Percentage	Student Grades	No. of Backlogs in Semester 1	No. of Backlogs in Semester 2	No. of Backlogs in Semester 3	No. of Backlogs in Semester 4	No. of Backlogs in Semester 5
1	Arun	Nargund	9546312789	490	350	495	520	600	510	512	650	7050	4127	58.54	B	0	0	0	0	
2	Amith	Hubli	9546312700	500	300	560	485	511	520	513	550	7050	3939	55.87	B	1	0	1	1	
3	Amar	Dharwad	9546312789	612	456	570	496	611	530	517	650	7050	4442	63.01	A	1	1	1	1	
4	Anusha	Dandeli	9546312794	613	312	590	431	711	540	516	651	7050	4364	61.9	A	0	0	0	0	
5	Anu	Haveri	9546312722	644	720	580	444	411	550	534	451	7050	4334	61.48	A	0	1	0	1	
6	Ananya	Hangal	9546312733	700	810	510	491	422	556	620	461	7050	4570	64.82	A	0	0	0	0	
7	Ananath	Bagakot	9546312781	850	510	520	499	433	560	710	740	7050	4822	68.4	A	0	1	1	0	
8	Amos	Bijapur	9546312754	750	620	515	459	454	570	720	541	7050	4629	65.66	A	1	0	0	1	
9	Andrew	Dharwad	9546312719	644	400	525	438	464	580	300	461	7050	3812	54.07	B	2	0	0	1	
10	Apporva	Hubli	9546312747	620	512	560	521	474	590	310	561	7050	4148	58.84	B	0	1	2	0	
11	Apporva N	Hosur	9876543220	350	495	520	510	512	490	350	710	7050	3937	55.84	B	0	0	0	0	
12	Archana	Belgaum	9876543221	300	560	485	520	513	500	300	650	7050	3828	54.3	B	0	0	0	0	
13	Ananthna	Dandeli	9876543222	456	570	496	530	517	612	456	550	7050	4187	59.39	B	1	0	1	1	
14	Anvar	Kumta	9876543223	312	590	431	540	516	613	312	650	7050	3964	56.23	B	1	1	1	1	
15	Asma	Karwar	9876543224	720	580	444	550	534	644	720	651	7050	4843	68.7	A	0	0	0	0	
16	Ananada	Dharwad	9876543225	810	510	491	556	620	700	810	451	7050	4948	70.18	A	0	1	0	1	
17	Angel	Dharwad	9876543226	510	520	499	560	710	850	510	461	7050	4620	65.53	A	0	0	0	0	

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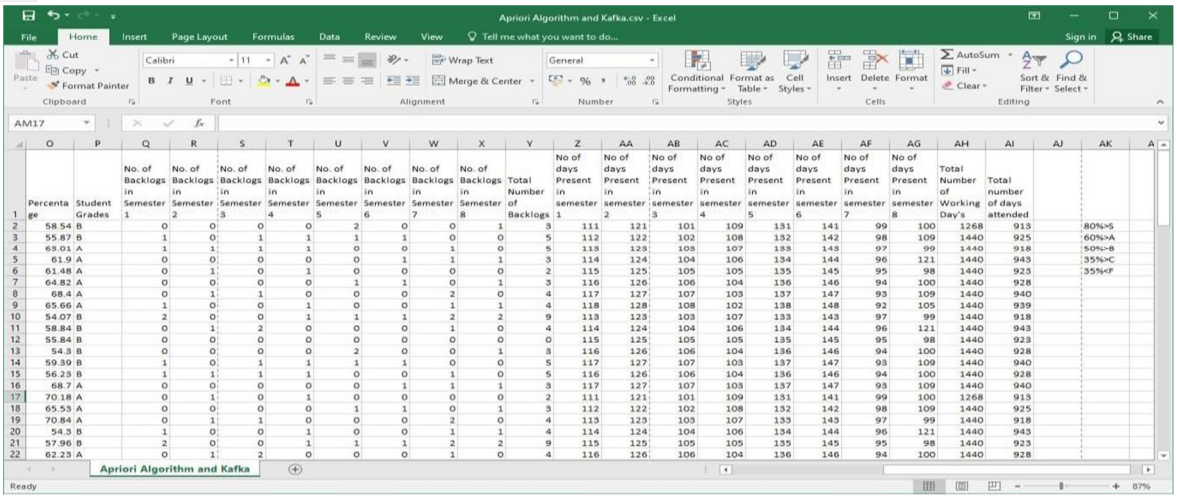

Fig 1. Student dataset

VI. EVALUATION METRICS

The Apriori algorithmic rule is that it assumes all elements of a frequently occurring item set to be frequent.
Similarly, for any sporadic item set, all its supersets should even be sporadic.
Support
Confidence
List
Conviction
Support- The amount of support for a law X => Y is calculated by dividing the number of transaction data that fulfil the law, N (X=>Y), by the total number of transactions, N.
(X=>Y) Support =N (X=>Y) / N
The frequency of activities that each of the rule's LHS and RHS hold true is thus the support. The bigger and more powerful the information that each type of event occurs along, the higher the support.
Support of item x is nothing however the quantitative relation of {the variety|the amount|the quantity} of transactions within which item x seems to the full number of transactions.
Support = Support = = 0.66667
Confidence is calculated by dividing the number of transaction data that fulfils the guideline N (X=>Y) by the transactions that consist the rule's body, X.
(X=>Y) Confidence = N (X=>Y) / N (X)
The belief is that the RHS will hold true if the LHS proves true. A high likelihood that the LHS event will end up there in RHS event assumes feat or apply statistical dependence.
Lift- The lift of the rule X => Y is the deviation of the full rule's support from the Support assumed below self rule given the support systems of the LHS (X) and also the Right hand side (Y).
Lift = self-assurance (X=>Y) / help (Y)= help (X=>Y) / help (X). support (Y)
Lift is a measure of the impact that information from the LHS has on chances of The RHS being true. Then raise is a value that provides data on the increase in likelihood of the "then" (subsequent RHS) half handed the "if" (antecedent LHS) half.
Lift is exactly one: There was no outcome (LHS and RHS independent). There is no connection between Events.
Greater than one lift: Positive outcome (if the LHS holds true, the RHS of operational risk management is more likely to hold true). Positive relationship between events
Lift is less than one: Negative outcome (whenever the LHS holds good, the RHS is less likely to hold true). Dependence between events that is negative.
Leverage is the amount of extra examples covered by both the element and also the outcome that is greater than what would be required if the cause and outcome were independent of each other, and finally. lev(X,Y) = supp(X,Y) sup(X) (Y)
Conviction is a live, related to Leverage, that mechanisms the departure from freedom. conv(X
Y) = supp(X)(1-supp(Y)) / supp(X) - supp(X) (X,Y)

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VII. SYSTEM DESIGN

System design at the first stage we have problem statement once the problem statement defines the the what we are carring out for the project is defined we collect the student dataset which predicate and analysis the performance of each student once it is done by data is preprocessed Data preprocessing, that defines Any type of processing performed on original data to prepare it for further data processing is referred to as data preparation. Filters that convert the data in ways can be defined in the preprocess section. At the third stage we have data Data cleanup and data translation options Software is an information management technique involving ingesting an ongoing data stream and rapidly analysing, filtering, transforming, or improving the data in real time. Classification and relationship describe how components and object types will be further defined by linking to sources of information.

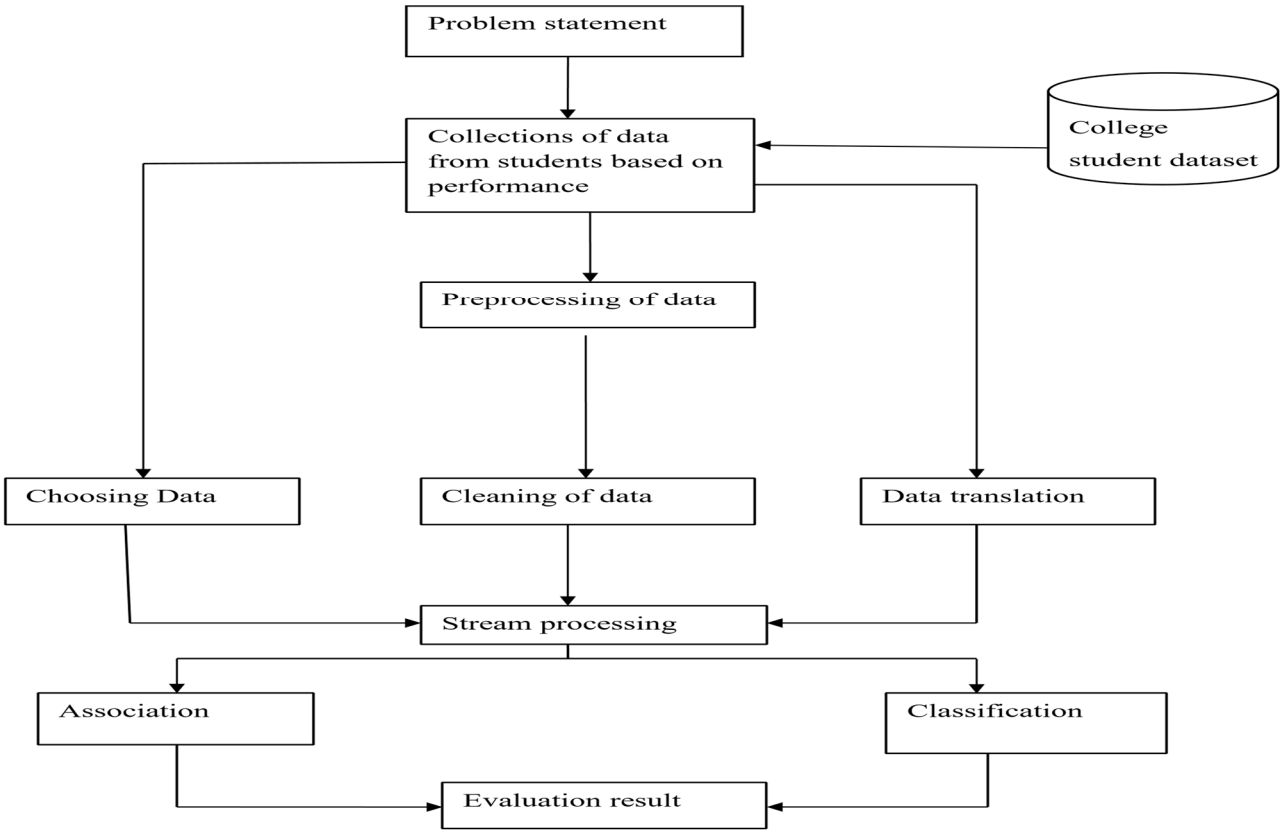
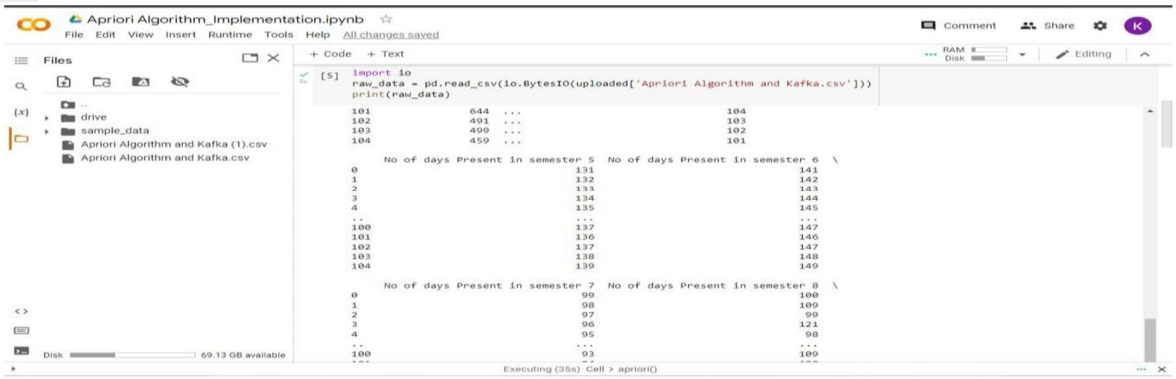
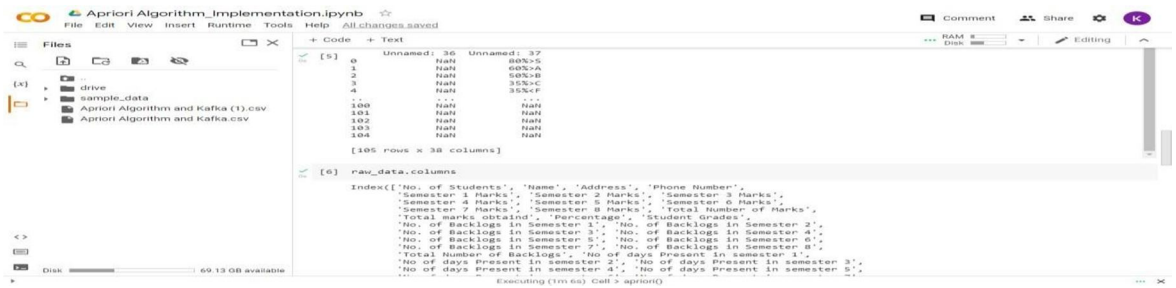


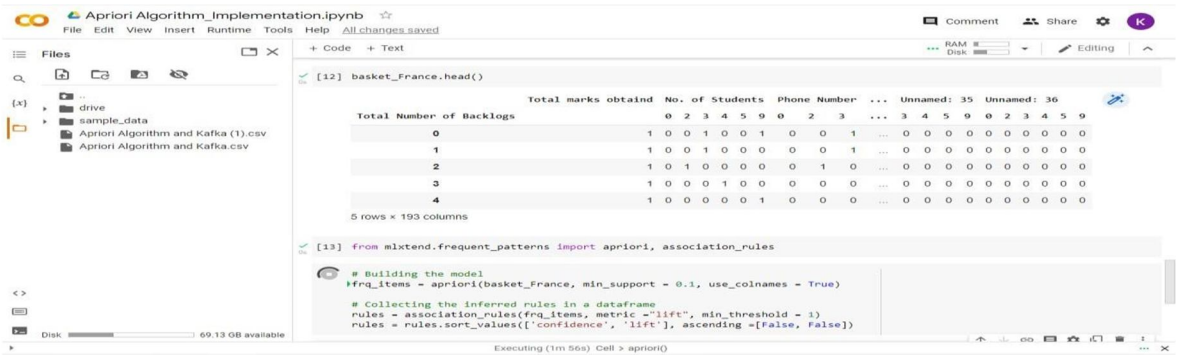
Figure 2: System Design

VIII. PERFORMANCE ANALYSIS

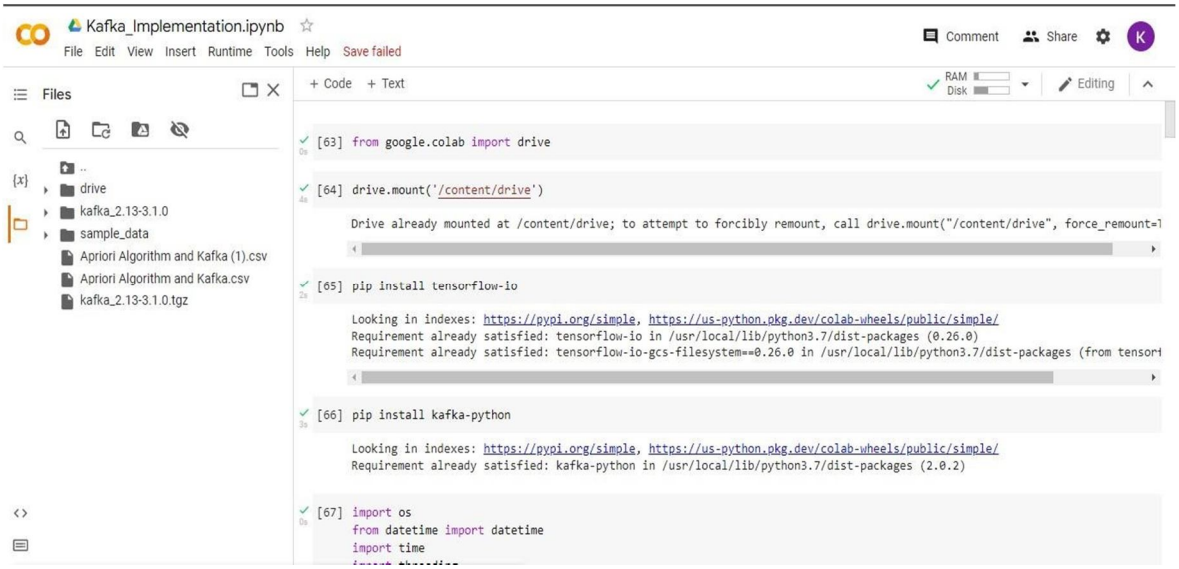
Fig 3 Shows the apriori algorithm to predict and analysis of student dataset and Kafka Implementation...

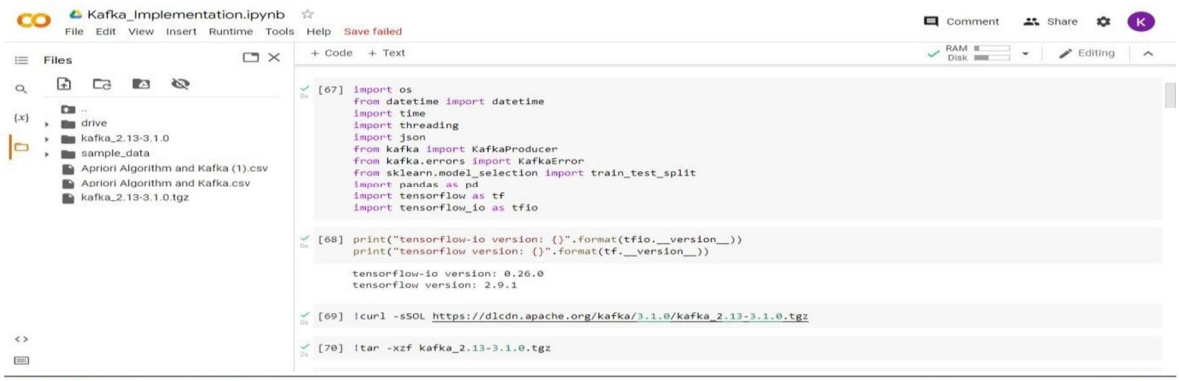






Perform stream processing: Use any open source project such as TensorFlow, NumPy, SciPy, or Matplotlib, making it easy to run machine learning models on streaming data. The following figure shows Streaming data with kafka.

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sample_data
Apriori Algorithm and Kafka (1).csv
Apriori Algorithm and Kafka.csv
kafka_2.13-3.1.0.tgz
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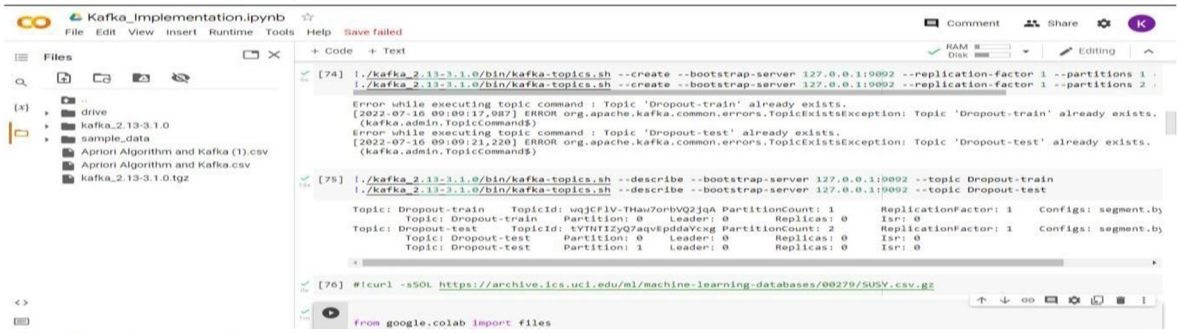
[67] import os
from datetime import datetime
import time
import threading
import json
from kafka import KafkaProducer
from kafka.errors import KafkaError
from sklearn.model_selection import train_test_split
import pandas as pd
import tensorflow as tf
import tensorflow_io as tfio
[68] print("tensorflow-io version: {}".format(tfio.__version__))
print("tensorflow version: {}".format(tf.__version__))
tensorflow-io version: 0.26.0
tensorflow version: 2.9.1
[69] !curl -sSOL https://dlcdn.apache.org/kafka/3.1.0/kafka_2.13-3.1.0.tgz
[70] !tar -xzf kafka_2.13-3.1.0.tgz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sample_data
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Apriori Algorithm and Kafka.csv
kafka_2.13-3.1.0.tgz
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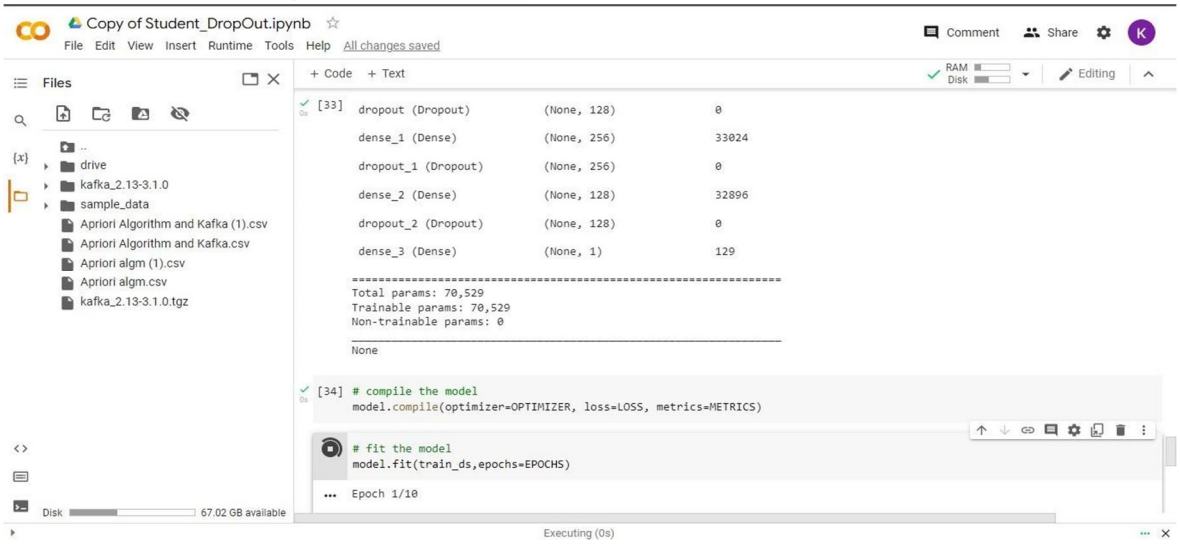
Editing
[74] !./kafka_2.13-3.1.0/bin/kafka-topics.sh --create --bootstrap-server 127.0.0.1:9092 --replication-factor 1 --partitions 1 \
!./kafka_2.13-3.1.0/bin/kafka-topics.sh --create --bootstrap-server 127.0.0.1:9092 --replication-factor 1 --partitions 2 \
Error while executing topic command : Topic 'Dropout-train' already exists.
[2022-07-16 09:09:17,987] ERROR org.apache.kafka.common.errors.TopicExistsException: Topic 'Dropout-train' already exists.
(kafka.admin.TopicCommand$)
Error while executing topic command : Topic 'Dropout-test' already exists.
[2022-07-16 09:09:21,220] ERROR org.apache.kafka.common.errors.TopicExistsException: Topic 'Dropout-test' already exists.
(kafka.admin.TopicCommand$)
[75] !./kafka_2.13-3.1.0/bin/kafka-topics.sh --describe --bootstrap-server 127.0.0.1:9092 --topic Dropout-train
!./kafka_2.13-3.1.0/bin/kafka-topics.sh --describe --bootstrap-server 127.0.0.1:9092 --topic Dropout-test
Topic: Dropout-train TopicId: wqjCFlV-THaw7orbVQ2jqA PartitionCount: 1 ReplicationFactor: 1 Configs: segment.by
Topic: Dropout-train Partition: 0 Leader: 0 Replicas: 0 Isr: 0
Topic: Dropout-test TopicId: tYTNTIZyQ7aqvEpddaYcxg PartitionCount: 2 ReplicationFactor: 1 Configs: segment.by
Topic: Dropout-test Partition: 0 Leader: 0 Replicas: 0 Isr: 0
Topic: Dropout-test Partition: 1 Leader: 0 Replicas: 0 Isr: 0
[76] #!curl -sSOL https://archive.ics.uci.edu/ml/machine-learning-databases/00279/SUSY.csv.gz
from google.colab import files


Kafka_Implementation.ipynb
File Edit View Insert Runtime Tools Help Save failed
Comment Share
Files
drive
kafka_2.13-3.1.0
sample_data
Apriori Algorithm and Kafka (1).csv
Apriori Algorithm and Kafka (2).csv
Apriori Algorithm and Kafka.csv
kafka_2.13-3.1.0.tgz
+ Code + Text
RAM Disk
Editing
[91] OPTIMIZER="adam"
LOSS=tf.keras.losses.BinaryCrossentropy(from_logits=True)
METRICS=['accuracy']
EPOCHS=10
[92] # design/build the model
model = tf.keras.Sequential([
tf.keras.layers.Input(shape=(NUM_COLUMNS,)),
tf.keras.layers.Dense(128, activation='relu'),
tf.keras.layers.Dropout(0.2),
tf.keras.layers.Dense(256, activation='relu'),
tf.keras.layers.Dropout(0.4),
tf.keras.layers.Dense(128, activation='relu'),
tf.keras.layers.Dropout(0.4),
tf.keras.layers.Dense(1, activation='sigmoid')
])
print(model.summary())
Model: "sequential_1"
Layer (type) Output Shape Param #
dense_4 (Dense) (None, 128) 4480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[33] dropout (Dropout) (None, 128) 0
dense_1 (Dense) (None, 256) 33024
dropout_1 (Dropout) (None, 256) 0
dense_2 (Dense) (None, 128) 32896
dropout_2 (Dropout) (None, 128) 0
dense_3 (Dense) (None, 1) 129
Total params: 70,529
Trainable params: 70,529
Non-trainable params: 0
None
[34] # compile the model
model.compile(optimizer=OPTIMIZER, loss=LOSS, metrics=METRICS)
# fit the model
model.fit(train_ds,epochs=EPOCHS)
Epoch 1/10
Disk 67.02 GB available
Executing (0s)

IX. CONCLUSION

We use the apriori algorithm in this paper to predict and analyse student database which calculates the confidence and support with L1 and L2 to perform apriori algorithm. We also introduce the term called kafka which does the stream processing, In the future we are combining the apriori algorithm with Hash-based technique, Transaction Reduction, Portioning, Sampling, and Dynamic item counting.

The authors are also willing to collaborate on data from tests and examinations for each course in the future in order to determine what types of students succeed in what types of courses. It may specify the types of courses that are tailored to each student's model who shares similar characteristics. It can also generate a variety of multi - dimensional reports and reshape pedagogical practises. learning paths.

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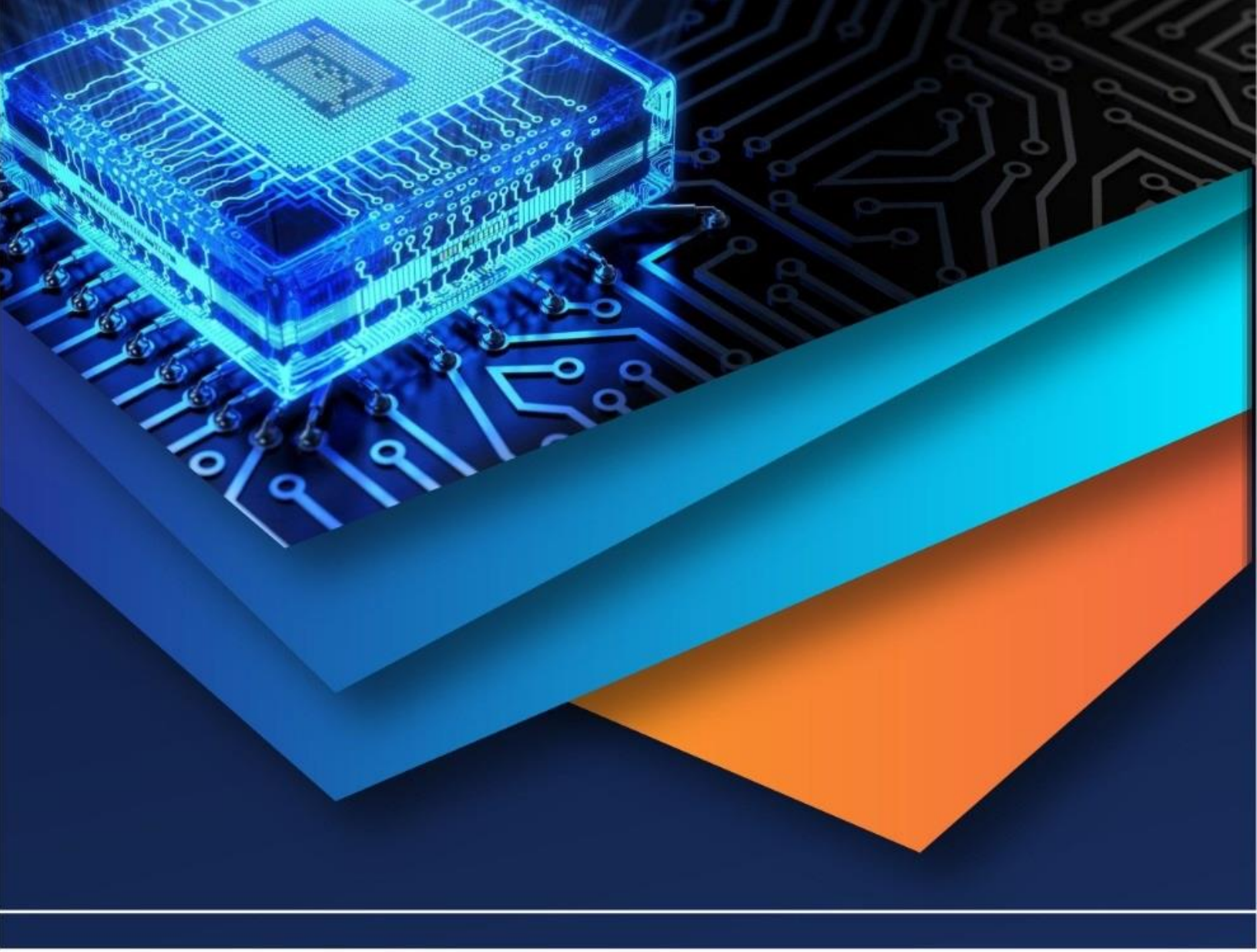

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