Data Analysis Using Cloud Technologies

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Git Hub Link: https://github.com/nrohit78/PigHive_StackExhangeData

Introduction

The objective of this project is to procure data from stack exchange, transform and clean it in Pig, stored the cleaned result in Hive and perform information retrieval (TF-IDF) in Hive using Hivemall.

4 CSV files, consisting of 50 thousand records each are downloaded from Stack Exchange. The table structure is as follows:

Id: int
PostTypeId: tinyint
AcceptedAnswerId: int
ParentId: int
CreationDate: datetime
DeletionDate: datetime
Score: int
ViewCount: int
Body: nvarchar (max)
OwnerUserId: int
OwnerDisplayName: nvarchar (40)
LastEditorUserId: int
LastEditorDisplayName: nvarchar (40)
LastEditDate: datetime
LastActivityDate: datetime
Title: nvarchar (250)
Tags: nvarchar (250)
AnswerCount: int
CommentCount: int
FavoriteCount: int
ClosedDate: datetime
CommunityOwnedDate: datetime
ContentLicense: varchar (12)

Tasks

1. Acquire the top 200,000 posts by viewcount from stack exchange.
2. Using Pig or MapReduce , extract, transform and load the data as applicable
3. Using Hive and/or MapReduce , get:
    a. I. The top 10 posts by score.
    b. The top 10 users by post score.
    c. The number of distinct users, who used the word “Hadoop” in one of their posts
4. Using Mapreduce /Pig/Hive calculate the per user TF IDF.

Data Acquisition

Stack Exchange provides 50000 records atmost in each file. To fetch 2 lakh records, we will have to create 4 queries which are as follows:

```
select TOP 50000 * from posts
where posts.ViewCount > 110000
ORDER BY posts.ViewCount DESC;
```

```
select TOP 50000 * from posts
where posts.ViewCount < 112524 AND posts.ViewCount > 60000 AND posts.Id != 904910
ORDER BY posts.ViewCount DESC;
```

```
select TOP 50000 * from posts
where posts.ViewCount < 66244 AND posts.ViewCount > 45000 AND posts.Id != 20482207
ORDER BY posts.ViewCount DESC;
```

select TOP 50000 * from posts
where posts.ViewCount < 47291 AND posts.ViewCount > 30000 AND posts.Id not in (24853847,45351434,488811,2293592,14476448)
ORDER BY posts.ViewCount DESC;

Pig Data Transformation

Each CSV file is loaded using "LOAD" command and then combined using "UNION" command. As multiline text in the CSV file was creating an issue while loading CSVExcelStorage [1] was used instead of PigStorage. Id and OwnerUserId were needed for further processing, all records that didn't have a value in these 2 columns were filtered out. After fitering records Body, Score, Id, ViewCount, OwnerUserId, OwnerDisplayName, Title, Tags columns were generated and the cleaned data was stored.

```
Input(s):
Successfully read 50000 records from: "hdfs:/csvFiles/QueryResults_2.csv"
Successfully read 50000 records from: "hdfs:/csvFiles/QueryResults_1.csv"
Successfully read 50000 records from: "hdfs:/csvFiles/QueryResults_4.csv"
Successfully read 50000 records from: "hdfs:/csvFiles/QueryResults_3.csv"

Output(s):
Successfully stored 194864 records (207958580 bytes) in: "hdfs://cluster-9f4d-m/postsPigResult"
```

Hive Loading And Query

A table in hive was created to load data with the following create statement:

CREATE TABLE postsDB.posts
(Body string, Score int, Id int, ViewCount int, OwnerUserId int, OwnerDisplayName string, Title string, Tags string)
ROW FORMAT DELIMITED FIELDS TERMINATED BY ',';

Pig generates 4 output files which is used to load data into the Hive table using 4 different load commands. The total number of records inserted into the hive table were 194864 which is equal to the records generated by the Pig.

```
OK
_c0
194864
Time taken: 15.263 seconds, Fetched: 1 row(s)
hive>
```

Hive queries for task 2 are as follows:

SELECT Id, Title, Score FROM postsDB.posts
ORDER BY Score DESC LIMIT 10;

```
OK
id      title   score
11227809        Why is processing a sorted array faster than processing an unsorted array?      25013
927358  How do I undo the most recent local commits in Git?     21842
2003505 How do I delete a Git branch locally and remotely?      17427
292357  What is the difference between 'git pull' and 'git fetch'?      12217
231767  What does the "yield" keyword do?       10655
477816  What is the correct JSON content type?  10479
348170  How do I undo 'git add' before commit?  9339
1642028 What is the "-->" operator in C++?      9188
6591213 How do I rename a local Git branch?     8947
5767325 How can I remove a specific item from an array? 8799
Time taken: 12.418 seconds, Fetched: 10 row(s)
```

SELECT OwnerUserId, SUM(Score) AS Total_Score
FROM postsDB.posts GROUP BY OwnerUserId
ORDER BY Total_Score DESC LIMIT 10;

```
OK
owneruserid     total_score
87234   36275
4883    27025
9951    25440
6068    24621
89904   22491
51816   21350
49153   18892
95592   18327
63051   18209
179736  17437
Time taken: 14.156 seconds, Fetched: 10 row(s)
```

SELECT COUNT(DISTINCT OwnerUserId) AS User_Count FROM postsDB.posts
WHERE (LOWER(Body) LIKE '%hadoop%' OR LOWER(Title) LIKE '%hadoop%' OR LOWER(Tags) LIKE '%hadoop%');

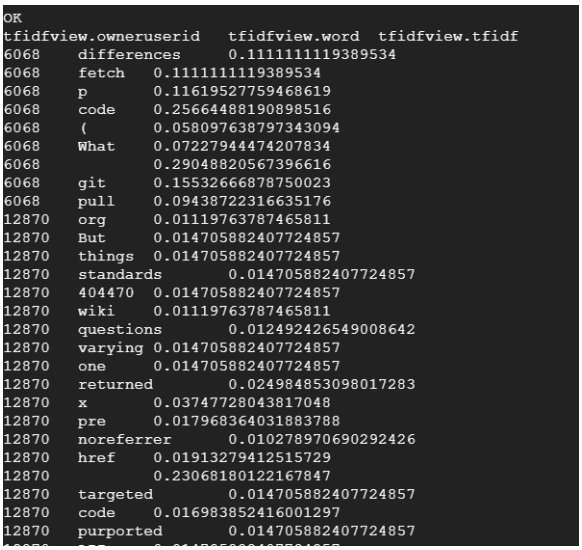
```
owneruserid     total_score
87234   36275
4883    27025
9951    25440
6068    24621
89904   22491
51816   21350
49153   18892
95592   18327
63051   18209
179736  17437
Time taken: 14.156 seconds, Fetched: 10 row(s)
```

In the 3rd query, a case insensitive search is done. This fetches all records irrespective of the case. A case sensitive search can also be done by removing "LOWER" function.

TF-IDF Using Hive

The data for the last task is being stored in a separate table and this table is being used to calculate the TF-IDF.

First, the entire body section must be split into different words and stop words need to be removed while doing so. To handle this, Hivemall [2][3] was used. Each record is being split into its corresponding word; values of the word frequency, the document frequency and finally TF-IDF is being calculated by the different views that have been created.



```
OK
tfidfview.owneruserid   tfidfview.word  tfidfview.tfidf
6068    differences     0.1111111119389534
6068    fetch   0.1111111119389534
6068    p       0.11619527759468619
6068    code    0.25664488190898516
6068    (       0.058097638797343094
6068    What    0.07227944474207834
6068            0.2904882056739661 6
6068    git     0.15532666878750023
6068    pull    0.09438722316635176
12870   org     0.01119763787465811
12870   But     0.014705882407724857
12870   things  0.014705882407724857
12870   standards       0.014705882407724857
12870   404470  0.014705882407724857
12870   wiki    0.01119763787465811
12870   questions       0.012492426549008642
12870   varying 0.014705882407724857
12870   one     0.014705882407724857
12870   returned        0.024984853098017283
12870   x       0.03747728043817048
12870   pre     0.017968364031883788
12870   noreferrer      0.010278970690292426
12870   href    0.01913279412515729
12870           0.23068180122167847
12870   targeted        0.014705882407724857
12870   code    0.016983852416001297
12870   purported       0.014705882407724857
```

These are a few records from the final view that calculates TF-IDF for each user.

Note

1. All files and screenshots are added to the GitHub repo shared in the beginning of this document.
2. The screenshots added in this document are cropped to keep the document short and concise.

References

1. *"CSVExcelStorage,"* [Online] Available: https://pig.apache.org/docs/r0.17.0/api/org/apache/pig/piggybank/storage/CSVExcelStorage.html

2. *"TF-IDF Term Weighting,"* [Online]. Available: https://hivemall.incubator.apache.org/userguide/ft_engineering/tfidf.html.

3. *"Hivemall User Manual,"* [Online] Available: https://hivemall.incubator.apache.org/userguide/getting_started/installation.html