MotherDuck

GO BACK TO BLOG

EXPLORING STACKOVERFLOW WITH DUCKDB ON MOTHERDUCK (PART 1)

2023/08/09 - 8 min read

BY MICHAEL HUNGER

Share in

TABLE OF CONTENTS

StackOverflow Data Dump Preparation and Import into DuckDB

Data Dump and Extraction

The Data Model

Loading the Data into DuckDB

Exploratory Queries

Export the Data to Parquet

STACKOVERFLOW DATA DUMP PREPARATION AND IMPORT INTO DUCKDB

I was always fascinated by the StackOverflow dataset. We all spen searching, reading and writing StackOverflow questions and answe

GET STARTED

In this article series we explore the StackOverflow dataset using DuckDB both locally and on MotherDuck. First we download and transform the raw data, then we load it into DuckDB and inspect it with some EDA queries before exporting it to Parquet.

Then we can use these Parquet files to create the database on MotherDuck and explore it with the new natural language search (AI prompt) features launched last month. To allow you to avoid all the tedious data ingestion work, we use MotherDuck's database **sharing feature** to share the database with you.

Finally, for some more interesting queries, we access the DuckDB database on MotherDuck from a Python notebook and visualize the results. We also try out the distributed querying capabilities of MotherDuck from our local machine.

DATA DUMP AND EXTRACTION

If you just want to explore and query the data, you can use the **stack exchange data explorer**, but for real analysis you want to get access to all the data. Thankfully StackOverflow publishes all their data publicly on the **internet archive stack exchange dump** every moth, we are looking at the (largest) set of files of the StackOverflow site itself.

It takes a long time (for me two days in total) to download, especially the posts file, as the internet archive bandwidth is limited and aborts in between. We end up with 7 files with a total size of 27 GB.

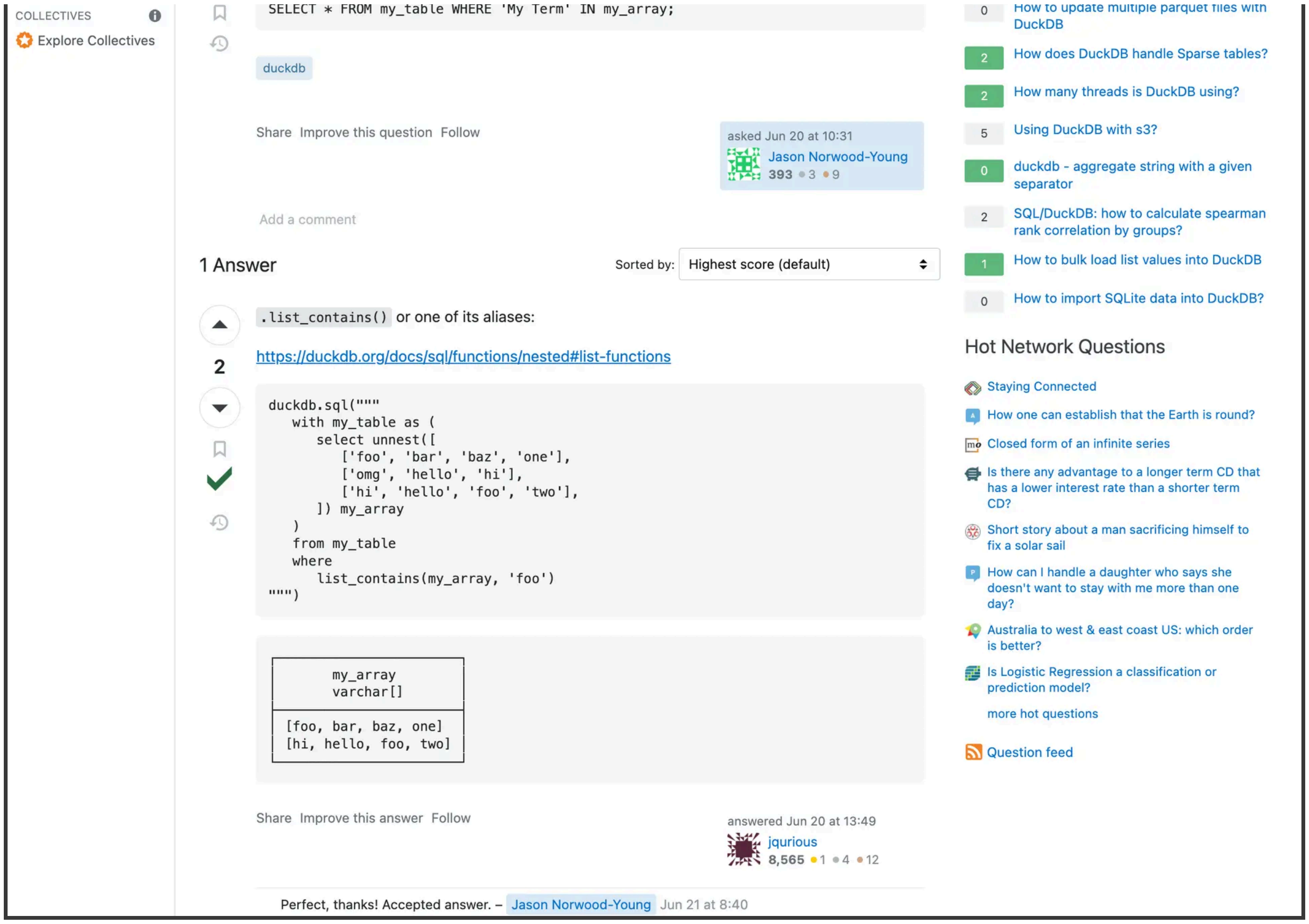
StackOverflow Dump files

```
19G stackoverflow.com-Posts.7z
5.2G stackoverflow.com-Comments.7z
1.3G stackoverflow.com-Votes.7z
684M stackoverflow.com-Users.7z
343M stackoverflow.com-Badges.7z
117M stackoverflow.com-PostLinks.7z
903K stackoverflow.com-Tags.7z
```

```
5.0G Comments.csv.gz
3.1G Posts.csv.gz
1.6G Votes.csv.gz
613M Users.csv.gz
452M Badges.csv.gz
137M PostLinks.csv.gz
1.1M Tags.csv.gz
```

THE DATA MODEL

Let’s look at the data model of the StackOverflow dataset. To remind ourselves of the UI, here is a screenshot with most information visible.


COLLECTIVES
Explore Collectives

```
SELECT * FROM my_table WHERE 'My Term' IN my_array;
```

duckdb

Share Improve this question Follow

asked Jun 20 at 10:31
Jason Norwood-Young
393 ●3 ●9

Add a comment

1 Answer

Sorted by: Highest score (default)

2

`.list_contains()` or one of its aliases:

https://duckdb.org/docs/sql/functions/nested#list-functions

```
duckdb.sql("""
   with my_table as (
      select unnest([
         ['foo', 'bar', 'baz', 'one'],
         ['omg', 'hello', 'hi'],
         ['hi', 'hello', 'foo', 'two'],
      ]) my_array
   )
   from my_table
   where
      list_contains(my_array, 'foo')
""")
```

```
┌────────────────────────┐
│        my_array        │
│        varchar[]       │
├────────────────────────┤
│ [foo, bar, baz, one]   │
│ [hi, hello, foo, two]  │
└────────────────────────┘
```

Share Improve this answer Follow

answered Jun 20 at 13:49
jqurious
8,565 ●1 ●4 ●12

Perfect, thanks! Accepted answer. – Jason Norwood-Young Jun 21 at 8:40

0	How to update multiple parquet files with DuckDB
2	How does DuckDB handle Sparse tables?
2	How many threads is DuckDB using?
5	Using DuckDB with s3?
0	duckdb - aggregate string with a given separator
2	SQL/DuckDB: how to calculate spearman rank correlation by groups?
1	How to bulk load list values into DuckDB
0	How to import SQLite data into DuckDB?

Hot Network Questions

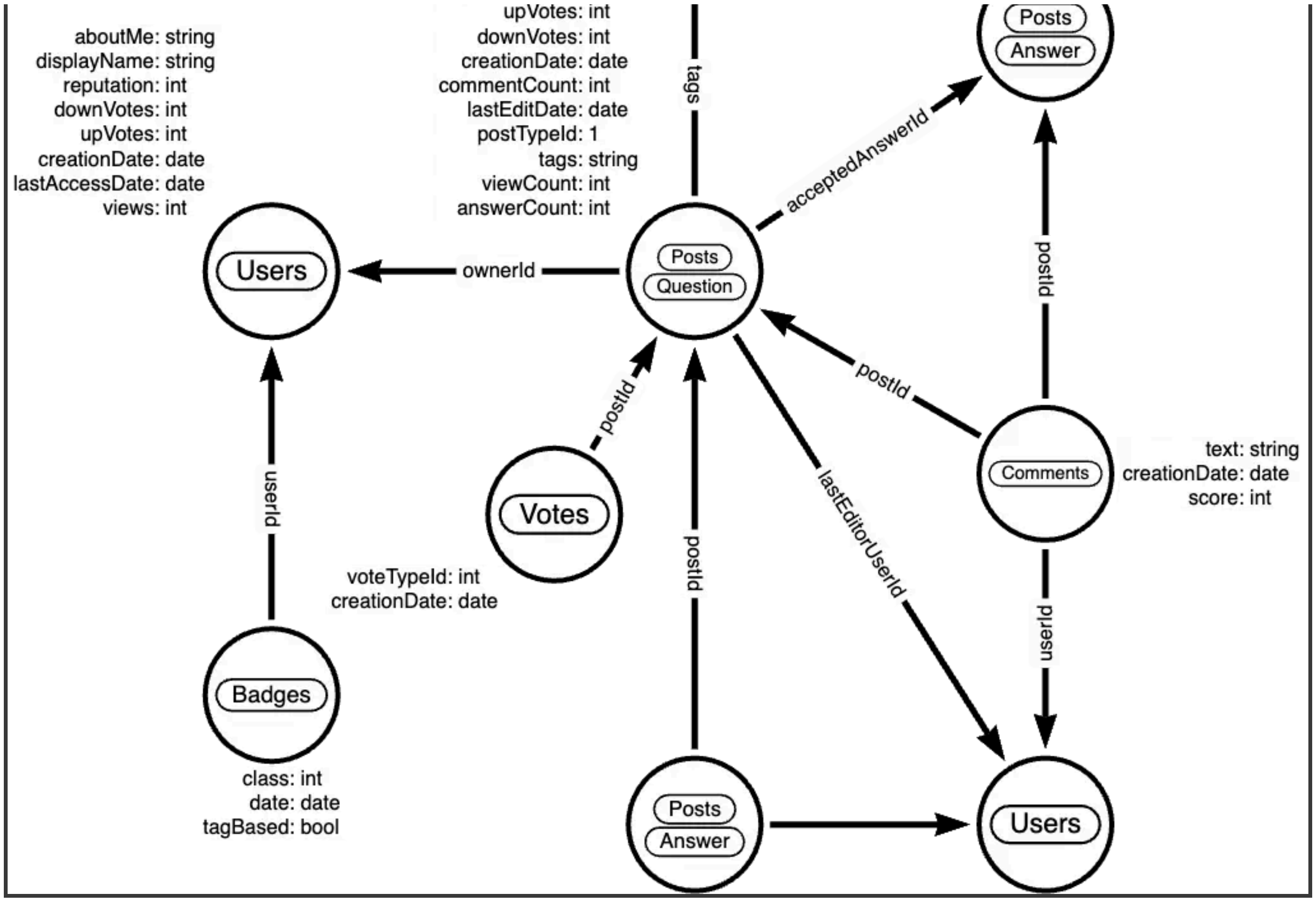
- Staying Connected
- How one can establish that the Earth is round?
- Closed form of an infinite series
- Is there any advantage to a longer term CD that has a lower interest rate than a shorter term CD?
- Short story about a man sacrificing himself to fix a solar sail
- How can I handle a daughter who says she doesn't want to stay with me more than one day?
- Australia to west & east coast US: which order is better?
- Is Logistic Regression a classification or prediction model?

more hot questions

Question feed

We have the **`Questions`** (**`Post`** with **`postTypeId=1`**) with a **`title`** , **`body`** , **`creationDate`** , **`ownerUserId`** , **`acceptedAnswerId`** , **`answerCount`** , **`tags`** , **`upvotes`** , **`downvotes`** , **`views`** , **`comments`** . The up to 6 **`Tags`** define the topics of the question. The **`User`** with **`displayName`** , **`aboutMe`** , **`reputation`** , **`last login`** date, etc. The **`Answers`** (Post with **`postTypeId=2`**) with their own **`ownerUserId`** , **`upvotes`** , **`downvotes`** , **`comments`** . One of the answers can be accepted as the correct answer. Both Questions and Answers can have comments with their own **`text`** , **`ownerUserId`** , **`score`** . There are also **`Badges`** with **`class`** columns that users can earn for their contributions. Posts can be linked to other posts, e.g. duplicates or related questions as **`PostLinks`** .

The dump doesn't have any information of indexes or foreign keys so, we need to discover them as we go.



LOADING THE DATA INTO DUCKDB

Now we're ready to import the files into DuckDB, which is so much easier than our previous steps.

With the **`read_csv`** function, we can read the CSV files directly from the compressed gzipped files. As we have header-less files, we need to provide the column names as a list. The **`auto_detect`** option will try to guess the column types, which works well for the StackOverflow data.

Let's look at the **`Tags`** file first and query it for structure and content.

```
$ duckdb stackoverflow.db

SELECT count(*)
FROM read_csv_auto('Tags.csv.gz');
```

```
DESCRIBE(SELECT * from read_csv_auto('Tags.csv.gz') LIMIT 1);
```

```
┌───────────────┬─────────────┐
│  column_name  │ column_type │
│    varchar    │   varchar   │
├───────────────┼─────────────┤
│ Id            │ BIGINT      │
│ TagName       │ VARCHAR     │
│ Count         │ BIGINT      │
│ ExcerptPostId │ BIGINT      │
│ WikiPostId    │ BIGINT      │
└───────────────┴─────────────┘
```

```
SELECT TagName, Count
FROM read_csv('Tags.csv.gz',column_names=['Id','TagName','Count'],auto
ORDER BY Count DESC LIMIT 5;
```

```
┌────────────┬─────────┐
│  TagName   │  Count  │
│  varchar   │  int64  │
├────────────┼─────────┤
│ javascript │ 2479947 │
│ python     │ 2113196 │
│ java       │ 1889767 │
│ c#         │ 1583879 │
│ php        │ 1456271 │
└────────────┴─────────┘
```

We could either create the tables first and read the data into them or we can create the tables on the fly as we read the data. I won't show all of the import statements, only Users and Posts, but you can imagine what it will look like.

CREATING TABLES IN DUCKDB

```
CREATE TABLE users AS
SELECT * from read_csv('Users.csv.gz',auto_detect=true,
    column_names=['Id','Reputation','CreationDate','DisplayName',
    'LastAccessDate','AboutMe','Views','UpVotes','DownVotes']);

-- 19942787 rows
```

```
    'CommunityOwnedDate','ContentLicense']);

-- 58329356 rows
```

EXPLORATORY QUERIES

Now that we have our tables loaded, we can run a a few queries to see what we have.

First we check who our top users are and when did they last login (from this dump), this computes on my machine in 0.126 seconds for 20 million users.

```
.timer on

SELECT DisplayName, Reputation, LastAccessDate
FROM users ORDER BY Reputation DESC LIMIT 5;

┌─────────────────┬────────────┬─────────────────────────┐
│   DisplayName   │ Reputation │     LastAccessDate      │
│     varchar     │   int64    │        timestamp        │
├─────────────────┼────────────┼─────────────────────────┤
│ Jon Skeet       │    1389256 │ 2023-03-04 19:54:19.74  │
│ Gordon Linoff   │    1228338 │ 2023-03-04 15:16:02.617 │
│ VonC            │    1194435 │ 2023-03-05 01:48:58.937 │
│ BalusC          │    1069162 │ 2023-03-04 12:49:24.637 │
│ Martijn Pieters │    1016741 │ 2023-03-03 19:35:13.76  │
└─────────────────┴────────────┴─────────────────────────┘
Run Time (s): real 0.126 user 2.969485 sys 1.696962
```

Now let's look at the bigger posts table and see some yearly statistics.

```
SELECT  year(CreationDate) as year, count(*),
        round(avg(ViewCount)), max(AnswerCount)
FROM posts
GROUP BY year ORDER BY year DESC LIMIT 10;

┌───────┬──────────────┬───────────────────────┬──────────────────┐
│ year  │ count_star() │ round(avg(ViewCount)) │ max(AnswerCount) │
│ int64 │    int64     │        double         │      int64       │
   │  2017  │      5022978 │                  1994.0 │                 65 │
   │  2016  │      5277269 │                  2202.0 │                 74 │
   │  2015  │      5347794 │                  2349.0 │                 82 │
   │  2014  │      5342607 │                  2841.0 │                 92 │
   ├─────────────────────────────────────────────────────────────────────┤
   │ 10 rows                                                   4 columns │
   └─────────────────────────────────────────────────────────────────────┘
   Run Time (s): real 5.977 user 7.498157 sys 5.480121 (1st run)
   Run Time (s): real 0.039 user 4.609049 sys 0.078694
```

The first time it takes about 6 seconds, and subsequent runs are much faster after the data has been loaded.

Nice, seems to have worked well.

Our DuckDB database file is 18GB, which is a two times as big as the ultra-compressed 8.7GB of the CSV files.

EXPORT THE DATA TO PARQUET

We could continue to use our local database file, but we wanted to explore MotherDuck, so let's upload the data to the cloud.

We can export our tables to Parquet files for safekeeping and easier storage and processing in other ways. Parquet as a columnar format compresses better, includes the schema and supports optimized reading with column selection and predicate pushdown.

```
COPY (FROM users) TO 'users.parquet'
(FORMAT PARQUET, CODEC 'SNAPPY', ROW_GROUP_SIZE 100000);
-- Run Time (s): real 10.582 user 62.737265 sys 65.422181

COPY (FROM posts) TO 'posts.parquet'
(FORMAT PARQUET, CODEC 'SNAPPY', ROW_GROUP_SIZE 100000);
-- Run Time (s): real 57.314 user 409.517658 sys 334.606894
```

```
6.9G comments.parquet
4.0G posts.parquet
2.2G votes.parquet
734M users.parquet
518M badges.parquet
164M post_links.parquet
1.6M tags.parquet
```

I uploaded them to S3 you can find them here: `s3://us-prd-motherduck-open-datasets/stackoverflow/parquet/2023-05`

So if you don’t want to wait for the second part in the series, where we load the data into MotherDuck and query it with AI prompts, you can use this share:

```
ATTACH 'md:_share/stackoverflow/6c318917-6888-425a-bea1-5860c29947
```

Take a look at the **StackOverflow Example in the docs** for a description of the schema and example queries. If you don't already have an invite for MotherDuck, you can request one using the **form on their homepage**.

Please share any interesting queries or issues on the **MotherDuck Slack channel**.

TIP: Continue to Learn in Part 2

Editor's note: **Exploring StackOverflow with DuckDB on MotherDuck Part 2** has now been published.

SUBSCRIBE TO MOTHERDUCK BLOG

PREVIOUS POSTS

VIEW ALL

MOTHERDUCK'S FIRST EUROPEAN CLOUD REGION IS COMING! JOIN THE WAITLIST TO GET NOTIFIED. →

MotherDuck

Docs	Overview	**Blog**	About us
Pricing	Data Warehousing and BI	Slack	Careers
	Customer-facing Analytics	Events	Quacking
	For DuckDB Users	YouTube	Contact Us
	Postgres Integration	Small Data SF	
	Case Studies	Community and OSS	
	Ecosystem	Videos & Streams	
	Startups	DuckDB News	
	Support	DuckDB Snippets	
	Trust & Security	Free DuckDB Book	
	EU Region	Learn	
		Code of Conduct	

MotherDuck is powered by DuckDB