Extending DuckDB ETL Capabilities with Python

Josef Machytka

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DuckDB has recently become my go-to solution for small ETL tasks. It is an exceptional database created by people who quite obviously prioritize productivity and automation. Compared to traditional databases, DuckDB feels like a fresh take, free from some unnecessary constraints of 1970s and 1980s academic legacies that sometimes make database management unnecessarily complex.

In my previous articles, I covered how DuckDB can serve as a smart ETL tool for PostgreSQL and checked its ability to manage data sets that doesn't fit into memory. Recently, I encountered additional use cases where DuckDB, combined with other programming languages, proved invaluable. In this article I explore how we can easily extend DuckDB's ETL capabilities using simple Python code.

DuckDB was right from the beginning conceived as a modern replacement for SQLite. Created in academia by the National Research Institute for

Mathematics and Computer Science in Amsterdam, it embraces simplicity and effectiveness — features that suit today's data analytics demands far better than long existing legacy systems.

One of DuckDB's strong features is its deep integration with Python, reflecting the language's prominent place in both academia and industry. One of the great advantages of this integration is DuckDB direct support of Pandas and NumPy data frames, which enables seamless manipulation of data.

A Practical Example

To illustrate DuckDB's flexibility, let us look at an example inspired by my conversation with a scientist from a statistical research department. I learned they still have some old but important data stored in DBF format, a legacy data storage of dBase/XBase relational databases. They face challenge ensuring continued accessibility of this data, as support for importing DBF files in major databases is being removed over time.

DuckDB's built-in extensions currently do not support this format. However,


```
import pandas as pd
import duckdb
from dbfread import DBF

table = DBF('dbase_sample_data.dbf', load=True)
dataframe = pd.DataFrame(iter(table))

conn = duckdb.connect('testdb.duckdb')

conn.execute("""
```

```
    ATTACH 'dbname=duckdb_test user=postgres password=postgres host=localhost port=5
    AS pg (TYPE POSTGRES, SCHEMA 'public')
    """)

    conn.execute("CREATE TABLE IF NOT EXISTS pg.dbase_sample_data AS SELECT * FROM d

    conn.close()
```

In this example, I used a random DBF file from GitHub. Without knowing anything about the file's structure or contents, I was able to load it into PostgreSQL in seconds — avoiding the usual steps like defining foreign data wrapper objects or creating tables manually.

Expanding Possibilities

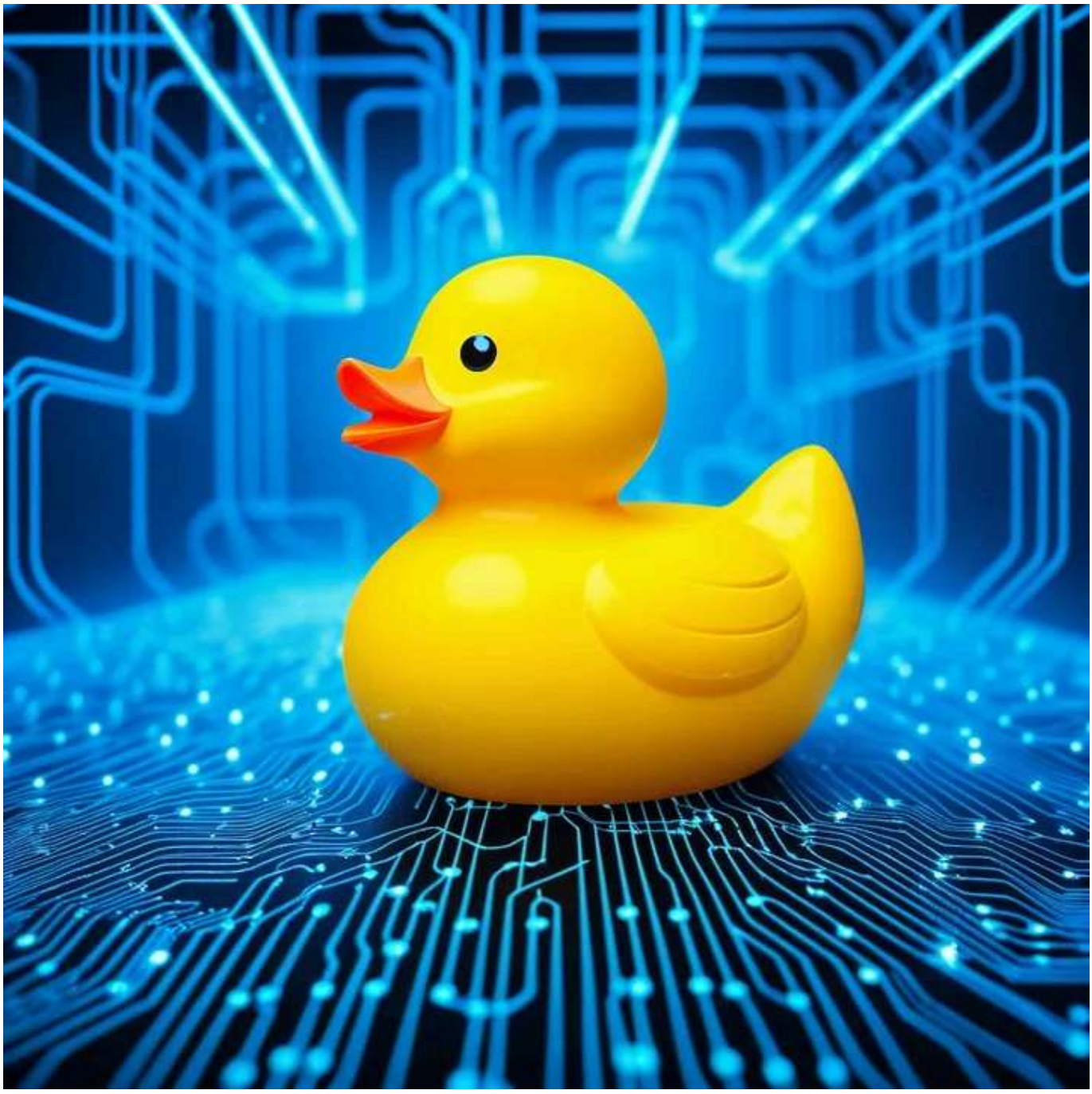
This approach can easily be adapted to other data formats by utilizing Python's extensive library ecosystem. With a corresponding Python library, we could also use similar code to import data from other databases currently unsupported by DuckDB extensions. However, it's worth noting that connecting Python to certain databases can pose challenges, which is beyond the scope of this article. I intend to cover these issues in future articles.

You might of course also rightly point out Pandas library is not the best tool for handling very large datasets. I completely agree, and in future articles, I will address efficient solutions for working with big data in DuckDB.

Summary

DuckDB, with its modern design and great Python integration, offers remarkable flexibility for ETL tasks. In this article I demonstrated how Python can extend DuckDB's capabilities. While this example was very trivial, focused on small data and simplicity, the potential for handling

complex data scenarios is vast, making DuckDB a powerful tool for modern data workflows.



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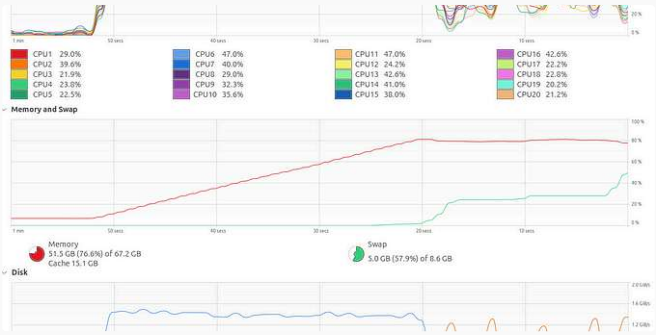

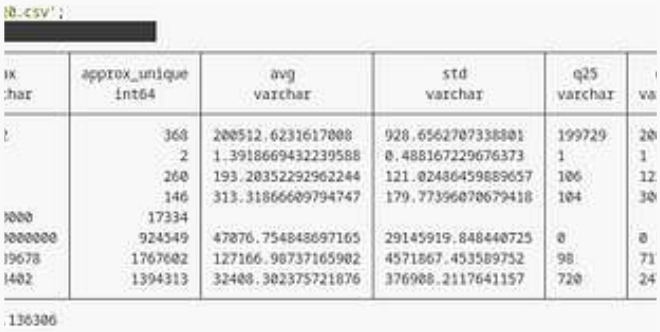

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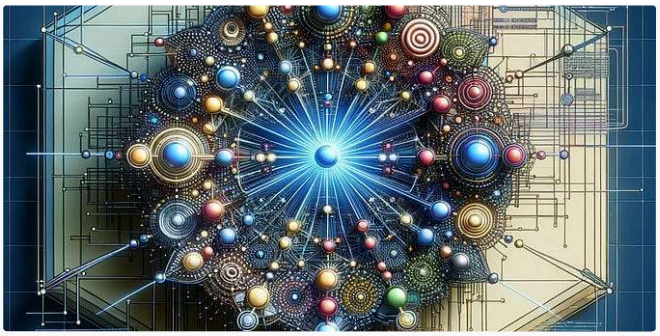

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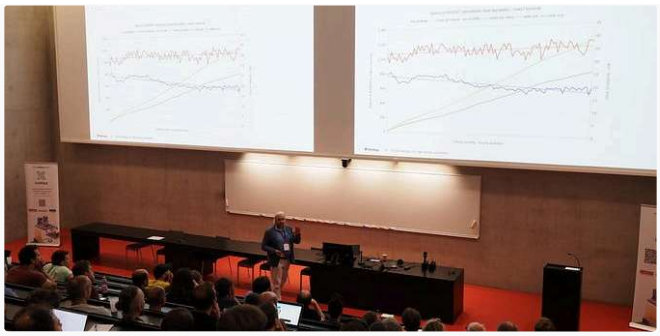

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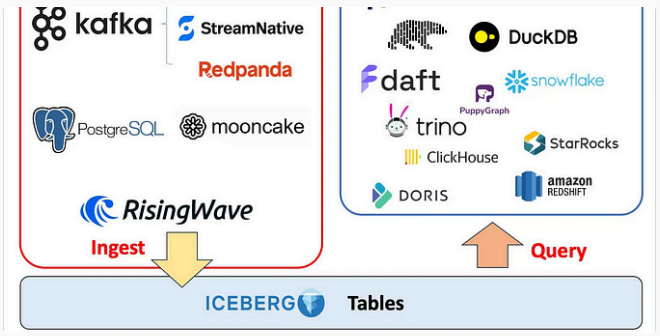

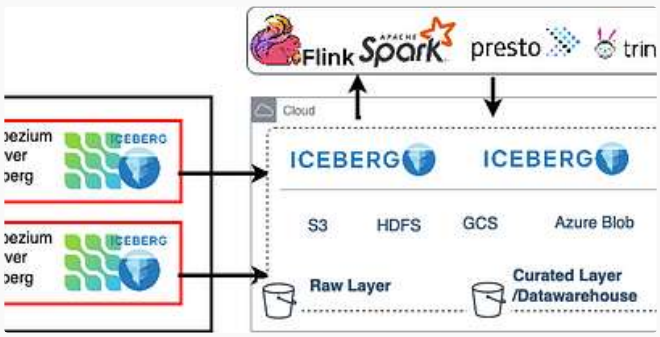

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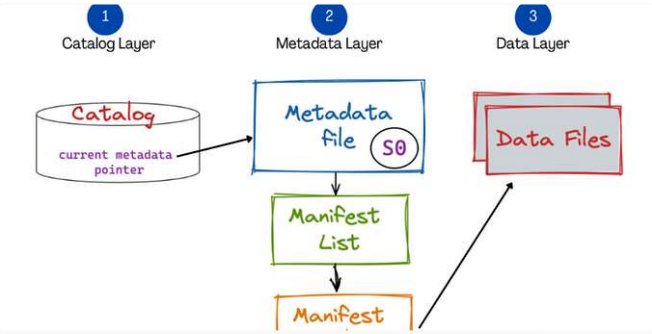

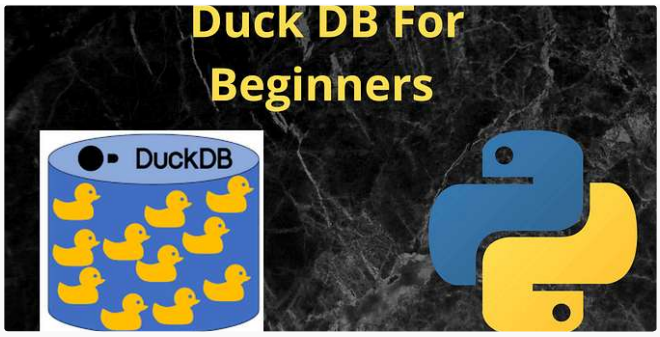

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