Easy and Intelligent Pivot Tables with DuckDB

Josef Machytka

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After exploring the various capabilities of DuckDB in my earlier articles, I want to focus more on its powerful data analytical functionality. In this article, I will delve into the PIVOT command, an amazing powerful tool for creating pivot tables, even from complex datasets.

Pivot tables are a staple for data analysis, but they can be tedious to set up in some systems. DuckDB makes this process both simple and efficient. Let me demonstrate it with a classic "sales" example, inspired by a testing scenario I explored using ChatGPT.

The Example Data

I will use a `sales` table that tracks sales figures for various products, salespeople, and years. Here's the table structure and some sample data:

```
CREATE TABLE sales (
    id SERIAL PRIMARY KEY,
    salesperson VARCHAR(50),
    product VARCHAR(50),
    year INT,
    sales_amount NUMERIC
);

INSERT INTO sales (salesperson, product, year, sales_amount) VALUES
('Alice', 'Laptop', 2022, 1200),
('Alice', 'Phone', 2022, 800),
('Alice', 'Tablet', 2022, 300),
('Alice', 'Laptop', 2023, 1400),
('Alice', 'Phone', 2023, 900),
('Alice', 'Tablet', 2023, 400),
('Bob', 'Laptop', 2022, 1000),
('Bob', 'Phone', 2022, 600),
('Bob', 'Laptop', 2023, 1100),
('Charlie', 'Tablet', 2022, 500),
('Charlie', 'Laptop', 2022, 1100),
('Charlie', 'Phone', 2022, 700),
('Charlie', 'Tablet', 2023, 600),
('Charlie', 'Laptop', 2023, 1200),
('Charlie', 'Phone', 2023, 800);
```

Pivoting in PostgreSQL: The Hard Way

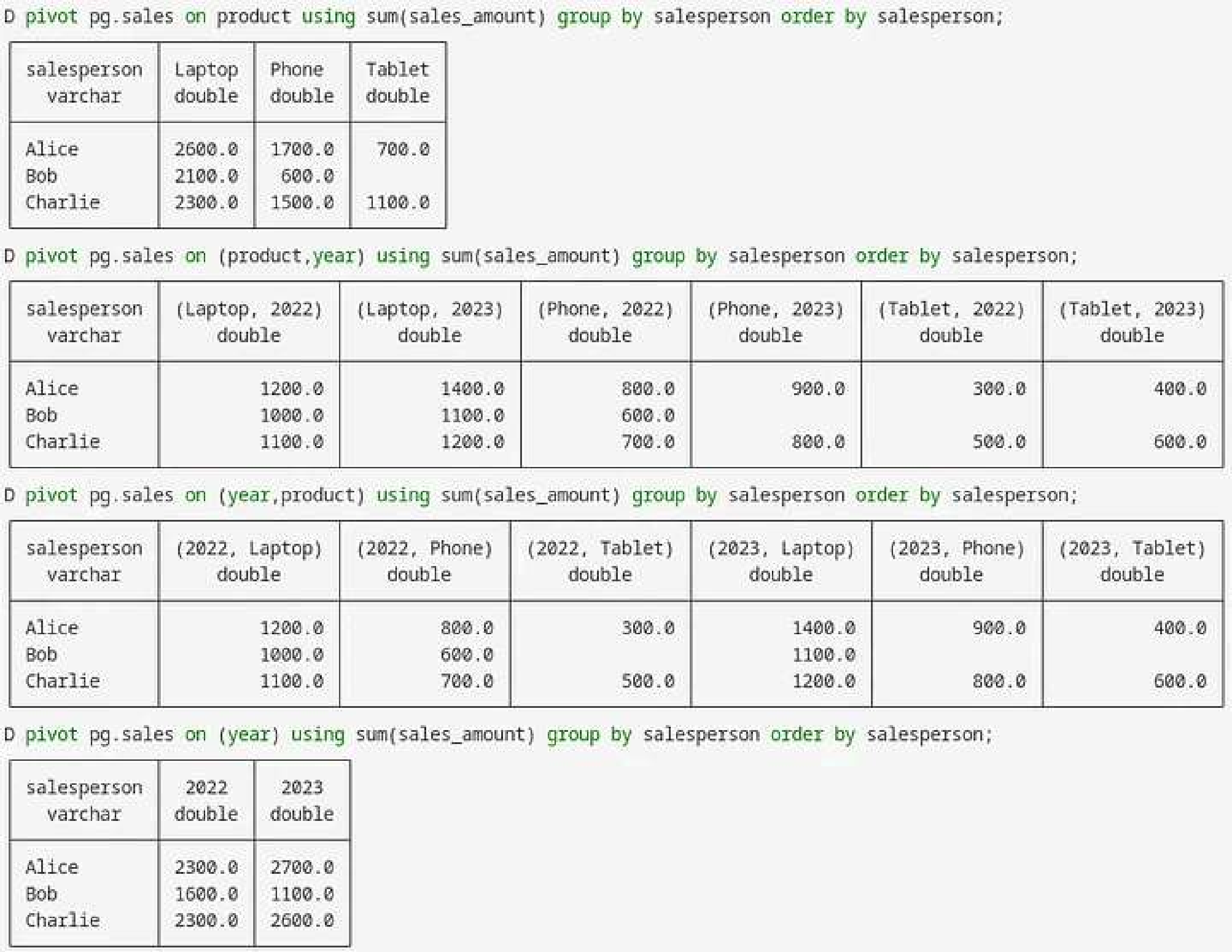
Creating a pivot table in standard PostgreSQL is of course perfectly possible but involves a fair amount of manual work. For example, let’s pivot the `sales` table to display sales amounts for each salesperson by product and year. Here’s the query:

```
SELECT
    salesperson,
    SUM(sales_amount) FILTER (WHERE product = 'Laptop' AND year = 2022) AS Lapto
    SUM(sales_amount) FILTER (WHERE product = 'Phone' AND year = 2022) AS Phone_
    SUM(sales_amount) FILTER (WHERE product = 'Tablet' AND year = 2022) AS Table
    SUM(sales_amount) FILTER (WHERE product = 'Laptop' AND year = 2023) AS Lapto
    SUM(sales_amount) FILTER (WHERE product = 'Phone' AND year = 2023) AS Phone_
    SUM(sales_amount) FILTER (WHERE product = 'Tablet' AND year = 2023) AS Table
    FROM
        sales
    GROUP BY
        salesperson
    ORDER BY
        salesperson;
```

This works but requires explicitly specifying every product and year combination in the query. If people later add new products or years, we must rewrite the query to account for those changes. Clearly, this approach doesn't scale well and involves too much manual effort.

Pivoting in DuckDB: Let's Make Pivot Fun Again

DuckDB offers a simpler and more flexible solution with its internal **PIVOT** command. By attaching a remote PostgreSQL database, we can process the same data in a far more elegant way. Adjusting pivot criteria is effortless, making it an incredibly user-friendly tool for dynamic data exploration.



```
D pivot pg.sales on product using sum(sales_amount) group by salesperson order by salesperson;
┌─────────────┬────────┬────────┬────────┐
│ salesperson │ Laptop │ Phone  │ Tablet │
│   varchar   │ double │ double │ double │
├─────────────┼────────┼────────┼────────┤
│ Alice       │ 2600.0 │ 1700.0 │  700.0 │
│ Bob         │ 2100.0 │  600.0 │        │
│ Charlie     │ 2300.0 │ 1500.0 │ 1100.0 │
└─────────────┴────────┴────────┴────────┘
D pivot pg.sales on (product,year) using sum(sales_amount) group by salesperson order by salesperson;
┌─────────────┬────────────────┬────────────────┬───────────────┬───────────────┬────────────────┬────────────────┐
│ salesperson │ (Laptop, 2022) │ (Laptop, 2023) │ (Phone, 2022) │ (Phone, 2023) │ (Tablet, 2022) │ (Tablet, 2023) │
│   varchar   │     double     │     double     │    double     │    double     │     double     │     double     │
├─────────────┼────────────────┼────────────────┼───────────────┼───────────────┼────────────────┼────────────────┤
│ Alice       │         1200.0 │         1400.0 │         800.0 │         900.0 │          300.0 │          400.0 │
│ Bob         │         1000.0 │         1100.0 │         600.0 │               │                │                │
│ Charlie     │         1100.0 │         1200.0 │         700.0 │         800.0 │          500.0 │          600.0 │
└─────────────┴────────────────┴────────────────┴───────────────┴───────────────┴────────────────┴────────────────┘
D pivot pg.sales on (year,product) using sum(sales_amount) group by salesperson order by salesperson;
┌─────────────┬────────────────┬───────────────┬────────────────┬────────────────┬───────────────┬────────────────┐
│ salesperson │ (2022, Laptop) │ (2022, Phone) │ (2022, Tablet) │ (2023, Laptop) │ (2023, Phone) │ (2023, Tablet) │
│   varchar   │     double     │    double     │     double     │     double     │    double     │     double     │
├─────────────┼────────────────┼───────────────┼────────────────┼────────────────┼───────────────┼────────────────┤
│ Alice       │         1200.0 │         800.0 │          300.0 │         1400.0 │         900.0 │          400.0 │
│ Bob         │         1000.0 │         600.0 │                │         1100.0 │               │                │
│ Charlie     │         1100.0 │         700.0 │          500.0 │         1200.0 │         800.0 │          600.0 │
└─────────────┴────────────────┴───────────────┴────────────────┴────────────────┴───────────────┴────────────────┘
D pivot pg.sales on (year) using sum(sales_amount) group by salesperson order by salesperson;
┌─────────────┬────────┬────────┐
│ salesperson │  2022  │  2023  │
│   varchar   │ double │ double │
├─────────────┼────────┼────────┤
│ Alice       │ 2300.0 │ 2700.0 │
│ Bob         │ 1600.0 │ 1100.0 │
│ Charlie     │ 2300.0 │ 2600.0 │
└─────────────┴────────┴────────┘
```

Conclusion

DuckDB transforms the process of creating pivot tables into a seamless experience, saving us both time and effort. As shown in these examples, its built-in capabilities outperform traditional SQL methods for pivoting. Whether we are dealing with a simple dataset or a complex one, DuckDB makes data analysis not just easier but also more enjoyable.

Duckdb Pivot Tables Pivoting Postgresql

Written by Josef Machytka

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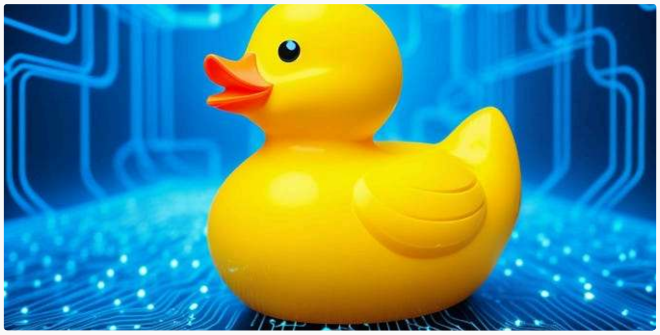

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Extending DuckDB ETL Capabilities with Python

DuckDB has recently become my go-to solution for small ETL tasks. It is an…

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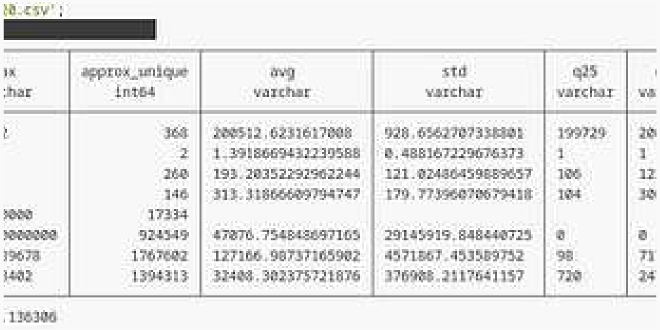
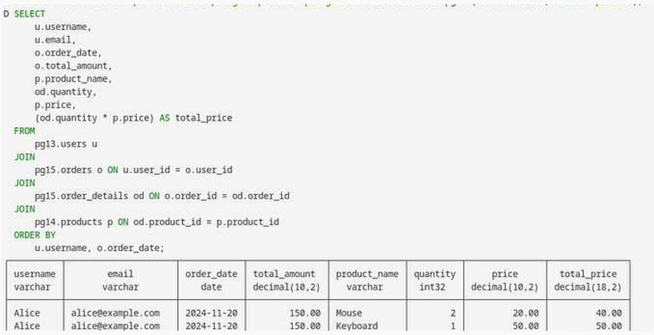


```
0.csv';
[redacted]
 x    │ approx_unique │         avg          │         std          │  q25   │ 
char  │     int64     │       varchar        │       varchar        │ varchar│ va
──────┼───────────────┼──────────────────────┼──────────────────────┼────────┼───
2     │           360 │ 200512.6231617008    │ 928.6562707338001    │ 199729 │ 20
      │             2 │ 1.3918669432239588   │ 0.488167229676373    │ 1      │ 1
      │           260 │ 193.20352292962244   │ 121.02480459889657   │ 106    │ 12
      │           146 │ 313.31866609794747   │ 179.77396070679418   │ 104    │ 30
0000  │         17334 │                      │                      │        │
0000000│       924349 │ 47876.754848697165   │ 29145919.848440725   │ 0      │ 0
79678 │       1767602 │ 127166.98737165902   │ 4571867.453589752    │ 98     │ 71
3402  │       1394313 │ 32408.302375721876   │ 376988.2117641157    │ 720    │ 24
.136306
```



```
D SELECT
      u.username,
      u.email,
      o.order_date,
      o.total_amount,
      p.product_name,
      od.quantity,
      p.price,
      (od.quantity * p.price) AS total_price
  FROM
      pg13.users u
  JOIN
      pg15.orders o ON u.user_id = o.user_id
  JOIN
      pg15.order_details od ON o.order_id = od.order_id
  JOIN
      pg14.products p ON od.product_id = p.product_id
  ORDER BY
      u.username, o.order_date;
┌──────────┬───────────────────┬────────────┬───────────────┬──────────────┬──────────┬───────────────┬───────────────┐
│ username │       email       │ order_date │ total_amount  │ product_name │ quantity │     price     │  total_price  │
│ varchar  │      varchar      │    date    │ decimal(10,2) │   varchar    │  int32   │ decimal(10,2) │ decimal(18,2) │
├──────────┼───────────────────┼────────────┼───────────────┼──────────────┼──────────┼───────────────┼───────────────┤
│ Alice    │ alice@example.com │ 2024-11-20 │        150.00 │ Mouse        │        2 │         20.00 │         40.00 │
│ Alice    │ alice@example.com │ 2024-11-20 │        150.00 │ Keyboard     │        1 │         50.00 │         50.00 │
```

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There is a lot of hype around DuckDB these days. At one PostgreSQL conference, I even…

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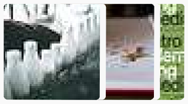

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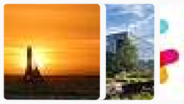

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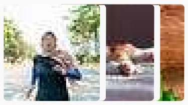

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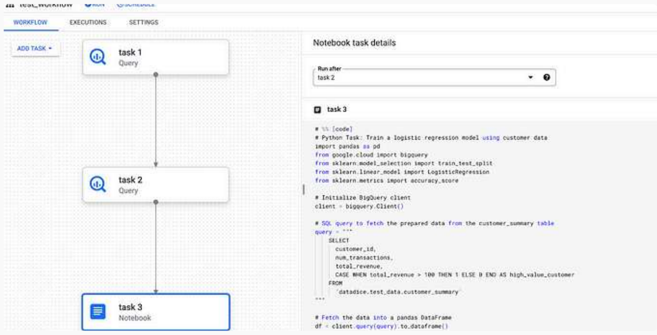

```
# %% [code]
# Python Task: Train a logistic regression model using customer data
import pandas as pd
from google.cloud import bigquery
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import accuracy_score

# Initialize BigQuery client
client = bigquery.Client()

# SQL query to fetch the prepared data from the customer_summary table
query = """
    SELECT
      customer_id,
      num_transactions,
      total_revenue,
      CASE WHEN total_revenue > 100 THEN 1 ELSE 0 END AS high_value_customer
    FROM
      `datadice.test_data.customer_summary`
"""

# Fetch the data into a pandas DataFrame
df = client.query(query).to_dataframe()
```

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