polars

Done by:

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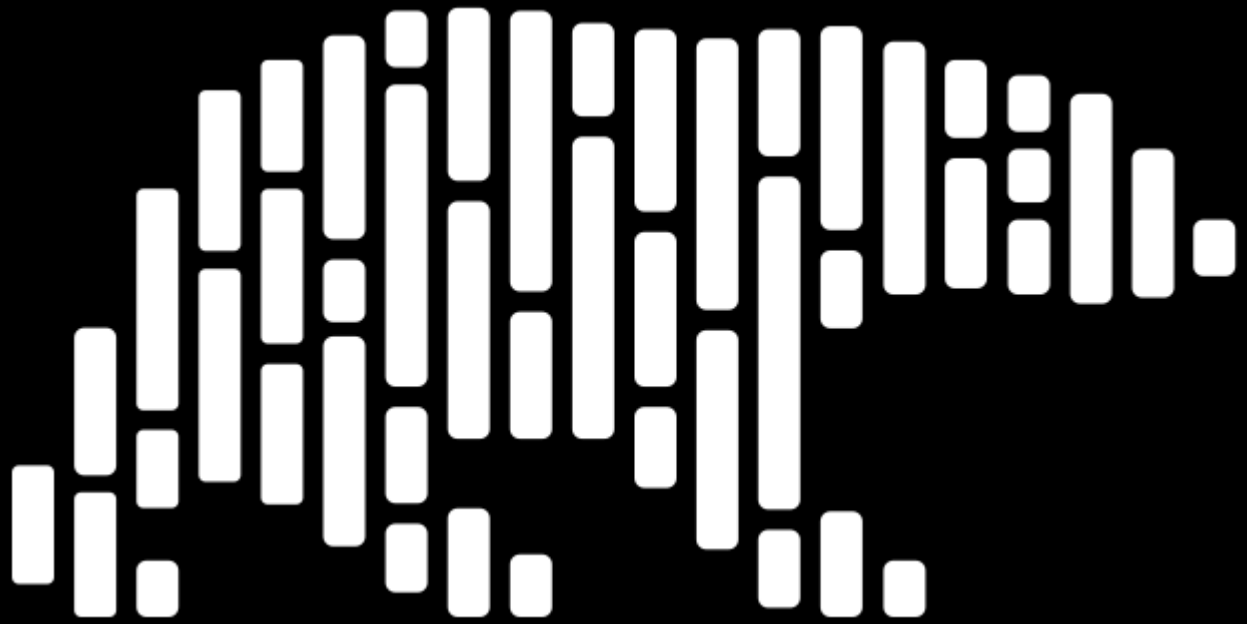
What is polars

Polars is a free tool for working with data, It's one of the fastest ways to process data on a single computer, It has a clear and organized system that makes it simple and efficient to use.



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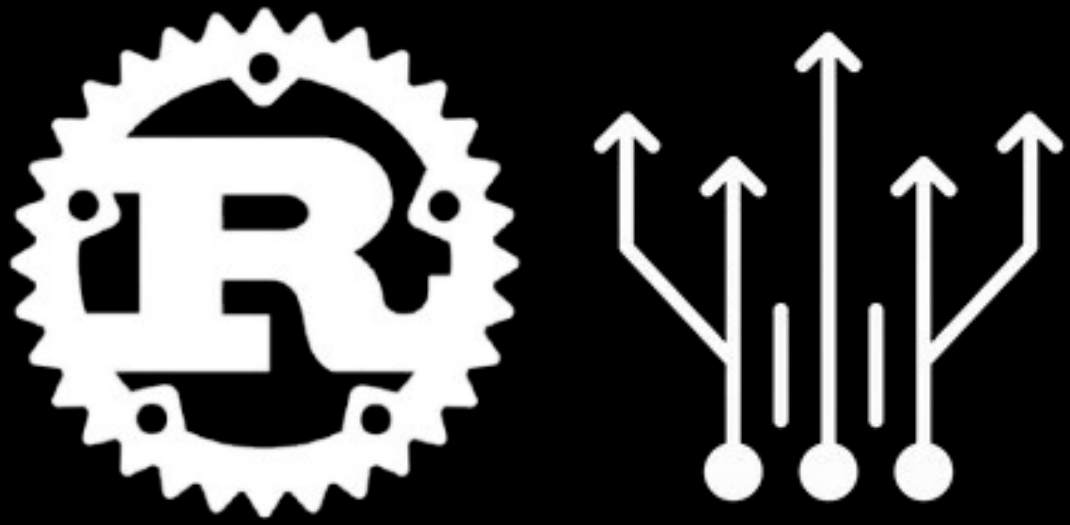
Why use polars?

1-Fast

- Polars is built from scratch to be fast and efficient.
- written in Rust for better speed.
- Designed to handle multiple tasks at the same time (parallel processing).
- Works with column-based data and uses modern techniques for high performance.



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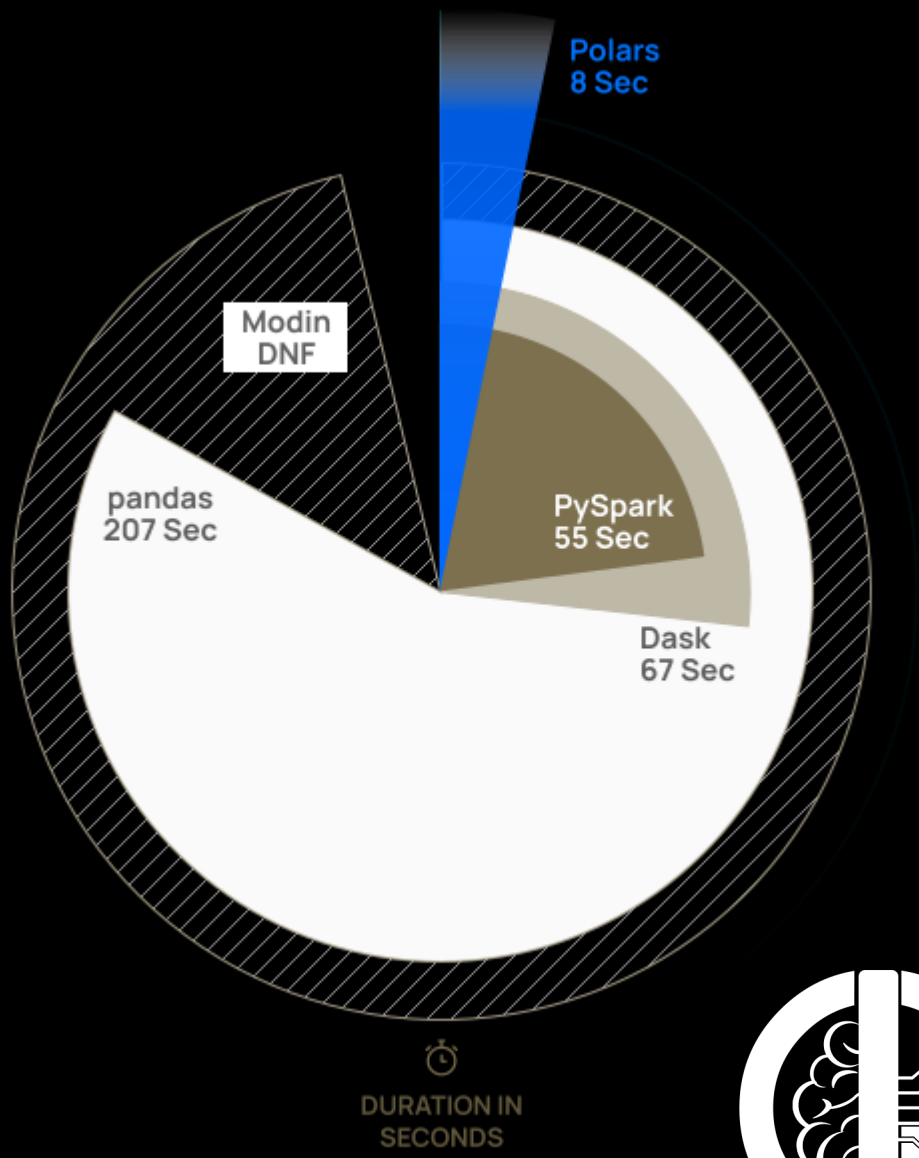
Why use polars?

Tools Compared:
-Pandas: A popular Python library for data analysis and manipulation.
-Modin: A framework that speeds up Pandas by parallelizing its operations.
-PySpark: A Python API for Apache Spark, a distributed computing framework.
-Dask: A flexible parallel computing library in Python.



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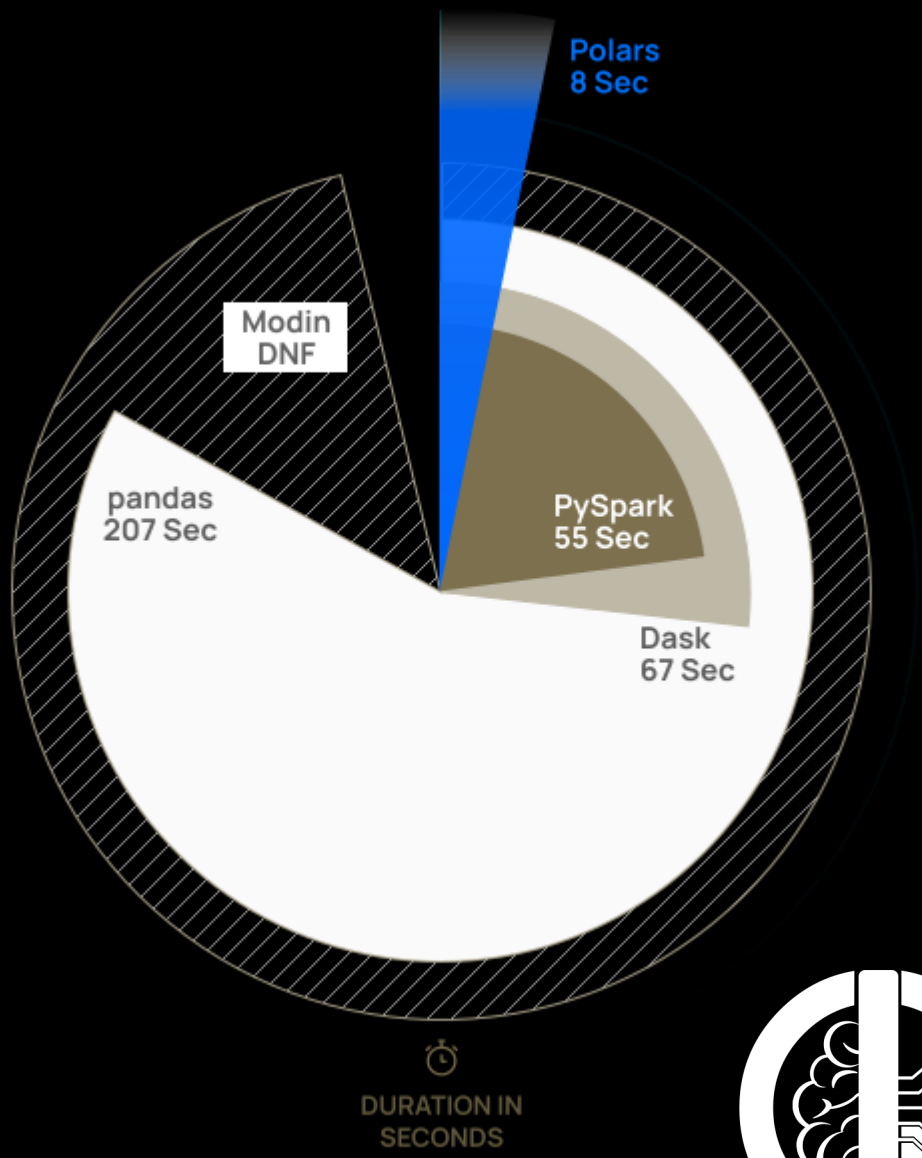
Why use polars?

Polars was tested on real-world data tasks and outperformed other tools by using parallel processing, smart algorithms, and modern CPU features. It can be over 30 times faster than Pandas.

Read more:
https://pola.rs/posts/benchmarks/



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Why use polars?

2-Easy to use

Polars is easy to use, with a simple design similar to Pandas, so you can learn it quickly. It has tools to handle data easily and great guides and community support to help you get started.

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Why use polars?

3-open source

Polars is and always will be open source, driven by an active community of developers, everyone is encouraged to add new features and contribute.

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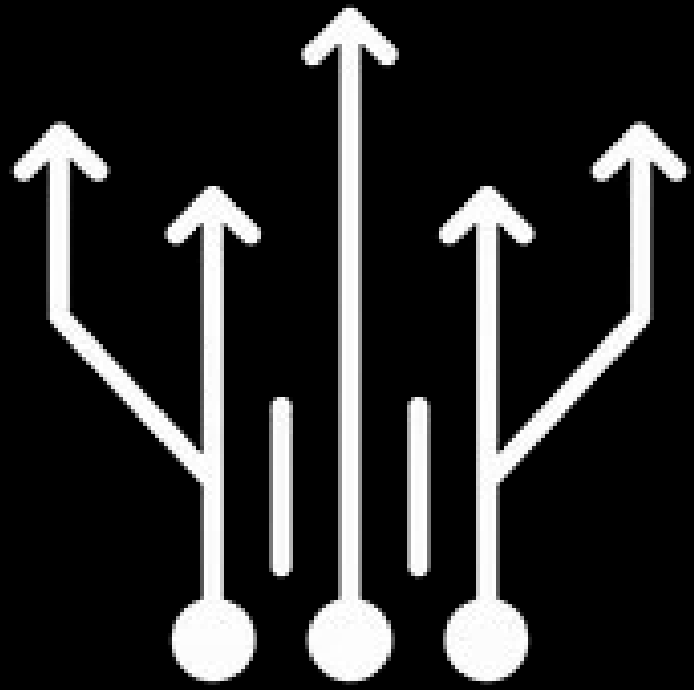
Parallelism in polars

Polars is a high-performance DataFrame library for Python that leverages parallelism at multiple levels to accelerate data processing.

Its efficiency is achieved through a combination of SIMD (Single Instruction, Multiple Data) and multi-threaded parallel programming.



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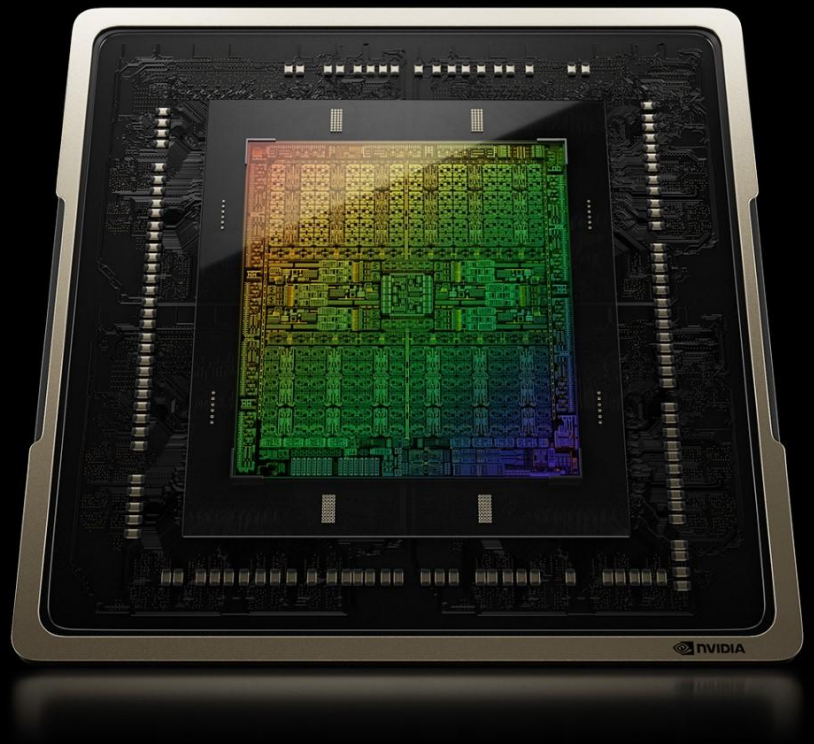
SIMD

SIMD (Single Instruction, Multiple Data) is a computational paradigm used in modern processors to perform the same operation on multiple data points simultaneously. This approach is particularly well-suited for applications that involve repetitive tasks on large datasets, such as graphics processing, scientific simulations, and data analytics.



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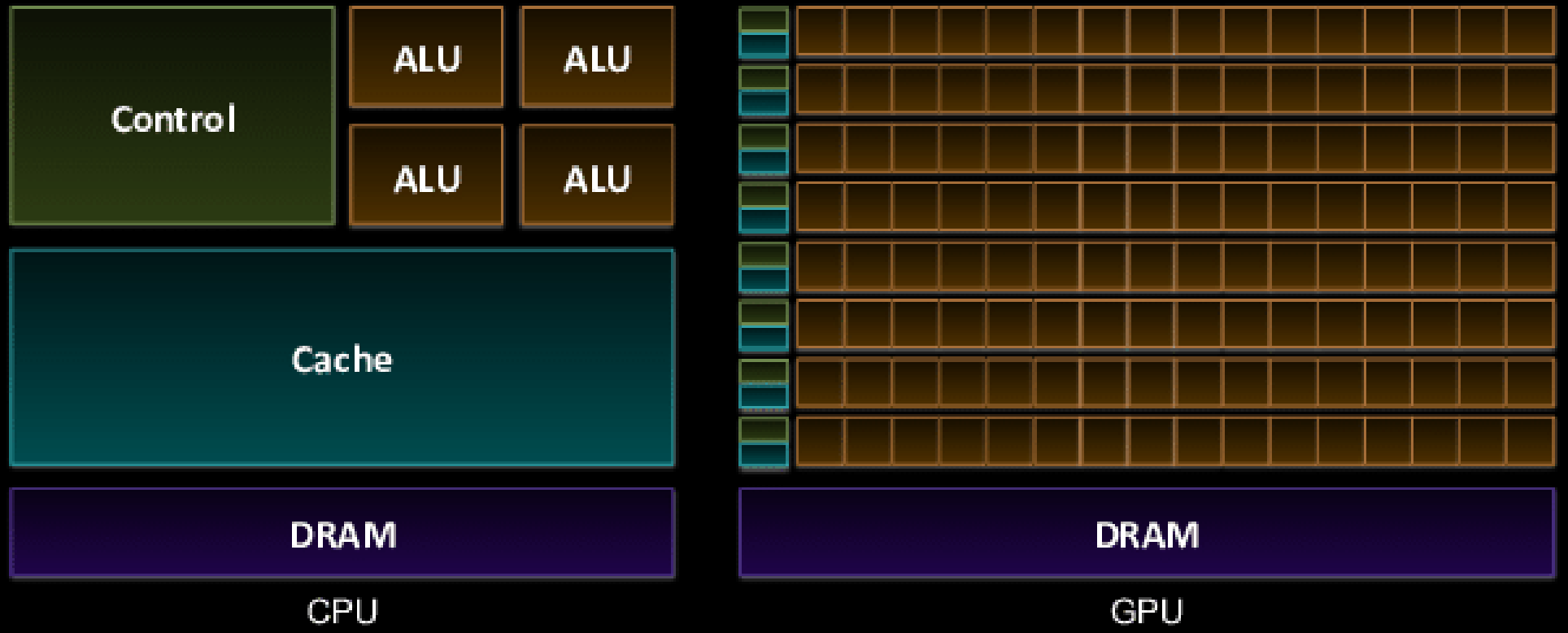
SIMD



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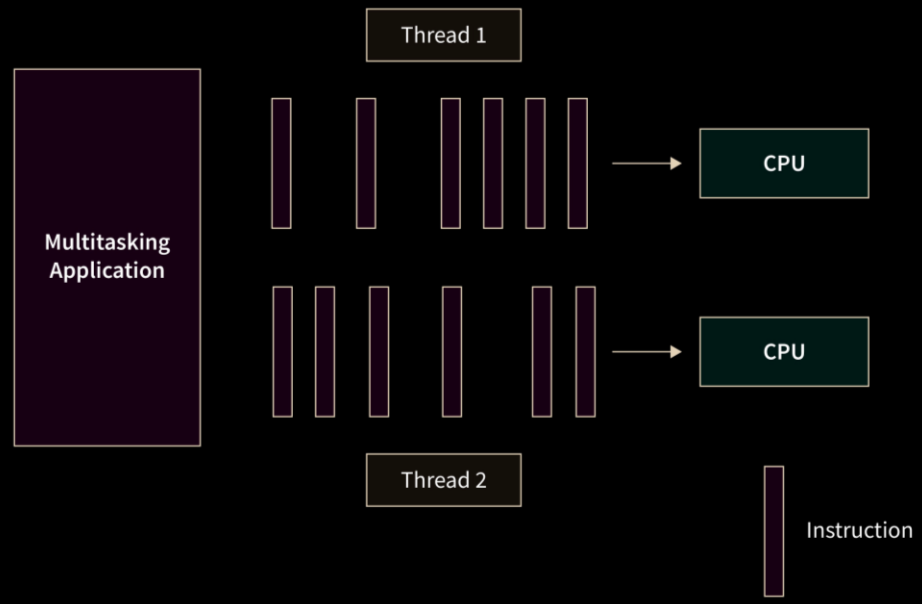
Parallel programming

Parallel programming is a method of writing software that can execute multiple tasks simultaneously by dividing a problem into smaller sub-problems, which are solved concurrently. This approach maximizes the utilization of computational resources and significantly improves performance, particularly for tasks that are computationally intensive.



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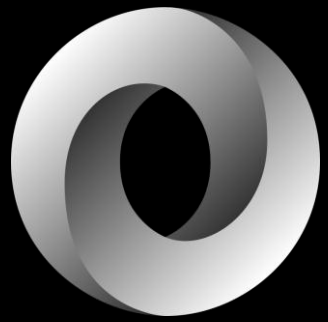
Data formats support

Polars supports reading and writing to all common data formats. This allows you to easily integrate Polars with your existing data stack.



Data formats support

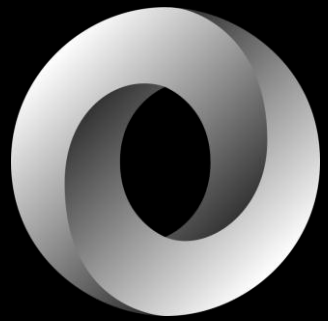
Text: CSV & JSON

Binary: Parquet, Delta Lake, AVRO & Excel

IPC: Feather, Arrow

Databases: MySQL, Postgres, SQL Server, Sqlite, Redshift & Oracle

Cloud storage: S3, Azure Blob & Azure File



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Installing polars

To get started with Polars, simply install the library on your device by running the following command in your Python environment:

-pip install polars

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Reading data

reading data involves loading datasets from various file formats into a DataFrame, which is the core structure used for data manipulation.

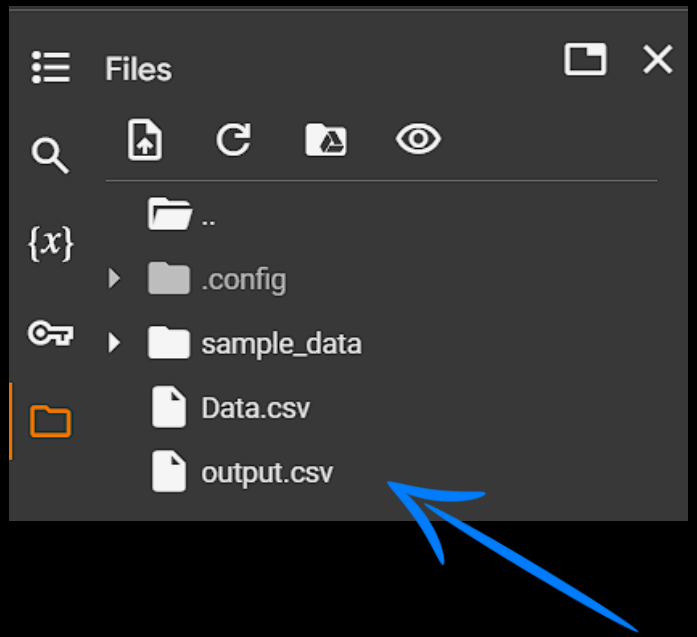
```
import polars as pl
dataset=pl.read_csv('Data.csv')
```

Sample code number	Clump Thickness	Uniformity of Cell Size	Uniformity of Cell Shape
i64	i64	i64	i64
1000025	5	1	1
1002945	5	4	4
1015425	3	1	1
1016277	6	8	8
1017023	4	1	1
…	…	…	…
776715	3	1	1
841769	2	1	1
888820	5	10	10
897471	4	8	6
897471	4	8	8

Writing data

```python
import polars as pl
df = pl.DataFrame({
    "workshop": ["polars", "polars", "polars"],
    "time": [1, 3, 0],
    "Lecturer": ["yosef", "alsheikh", "qasem"]
})
print(df)
df.write_csv("output.csv")
```

workshop	time	Lecturer
str	i64	str
polars	1	yosef
polars	3	alsheikh
polars	0	qasem



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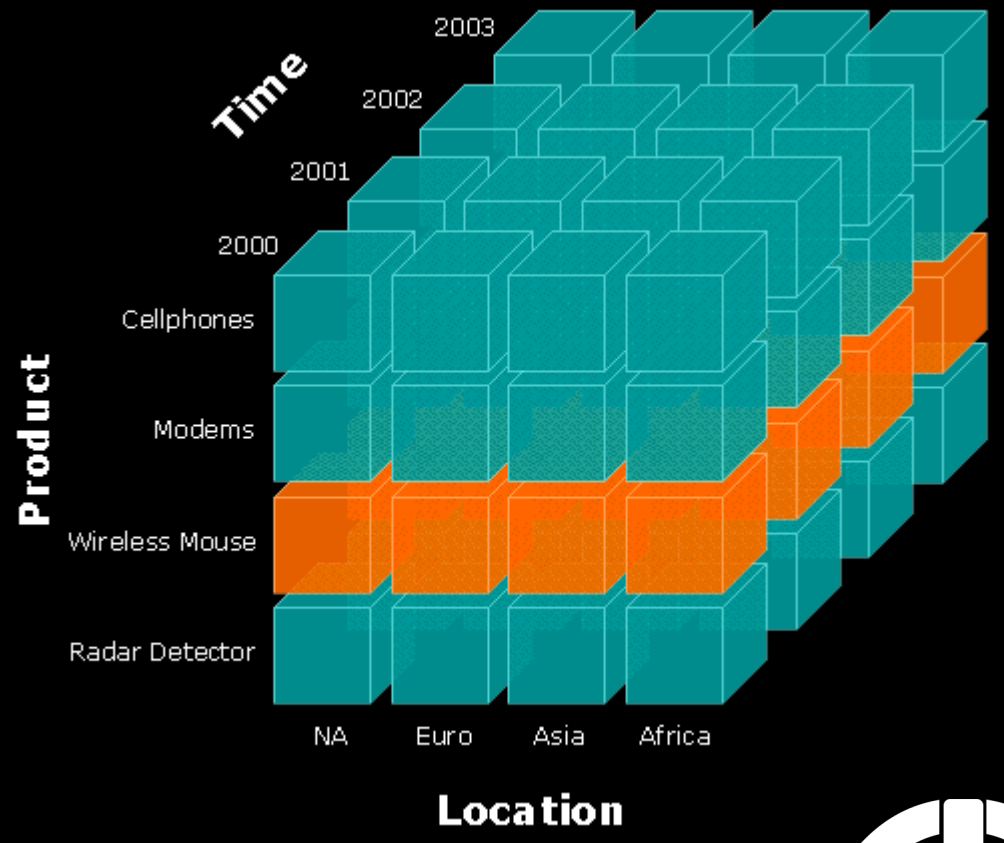
Column selection

This function allows you to select specific columns from a DataFrame. You can also perform operations on the selected columns.

```
dataset.select(["col1", "col2"])
```



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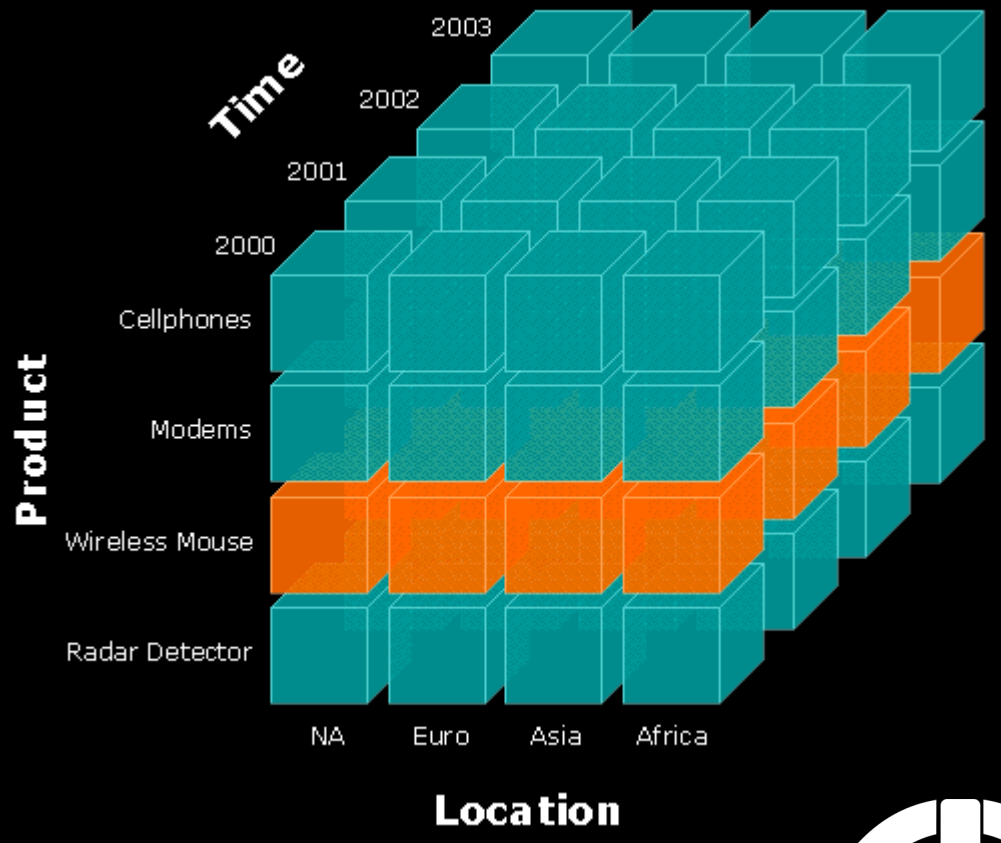
Row filtering

Filters rows based on a condition or a set of conditions.

```
dataset.filter(pl.col("age") > 30)
```



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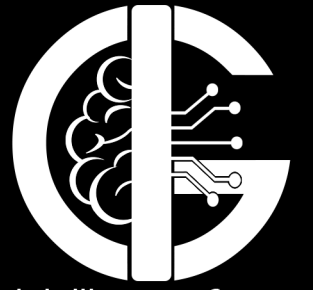
describe

The describe() function in Polars provides a quick statistical summary of a DataFrame.

1-Count: Number of non-null values in each column.
2-Mean: Average of numeric values.
3-Std: Standard deviation for numeric values.

statistic	Country	Age	Salary	Purchased
str	str	f64	f64	str
count	10	9.0	9.0	10
null_count	0	1.0	1.0	0
mean	null	38.777778	63777.777778	null
std	null	7.693793	12265.579662	null
min	France	27.0	48000.0	No
25%	null	35.0	54000.0	null
50%	null	38.0	61000.0	null
75%	null	44.0	72000.0	null
max	Spain	50.0	83000.0	Yes



describe

4-Min/Max: Minimum and maximum values in each column.
5-Median: Middle value of sorted data for numeric columns.
6-25th/75th Percentiles: Values at the 25% and 75% positions.

```
print(dataset.describe())
```

statistic	Country	Age	Salary	Purchased
str	str	f64	f64	str
count	10	9.0	9.0	10
null_count	0	1.0	1.0	0
mean	null	38.777778	63777.777778	null
std	null	7.693793	12265.579662	null
min	France	27.0	48000.0	No
25%	null	35.0	54000.0	null
50%	null	38.0	61000.0	null
75%	null	44.0	72000.0	null
max	Spain	50.0	83000.0	Yes

Modifying columns

Adds or modifies columns in the DataFrame.

```
dataset.with_columns([pl.col("age") * 2])
```

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

Country	Age	Salary	Purchased
str	i64	i64	str
France	88	72000	No
Spain	54	48000	Yes
Germany	60	54000	No
Spain	76	61000	No
Germany	80	null	Yes
France	70	58000	Yes
Spain	null	52000	No
France	96	79000	Yes
Germany	100	83000	No
France	74	67000	Yes

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sorting

Sorts the rows in a DataFrame based on one or more columns, either in ascending or descending order.

```
dataset=dataset.sort("Age",descending=False)
```

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

Country	Age	Salary	Purchased
str	i64	i64	str
Spain	null	52000	No
Spain	27	48000	Yes
Germany	30	54000	No
France	35	58000	Yes
France	37	67000	Yes
Spain	38	61000	No
Germany	40	null	Yes
France	44	72000	No
France	48	79000	Yes
Germany	50	83000	No

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Unique

Returns the unique rows or values from a column, similar to removing duplicates.

```
dataset.select("city").unique()
```

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

Country
str
France
Spain
Germany

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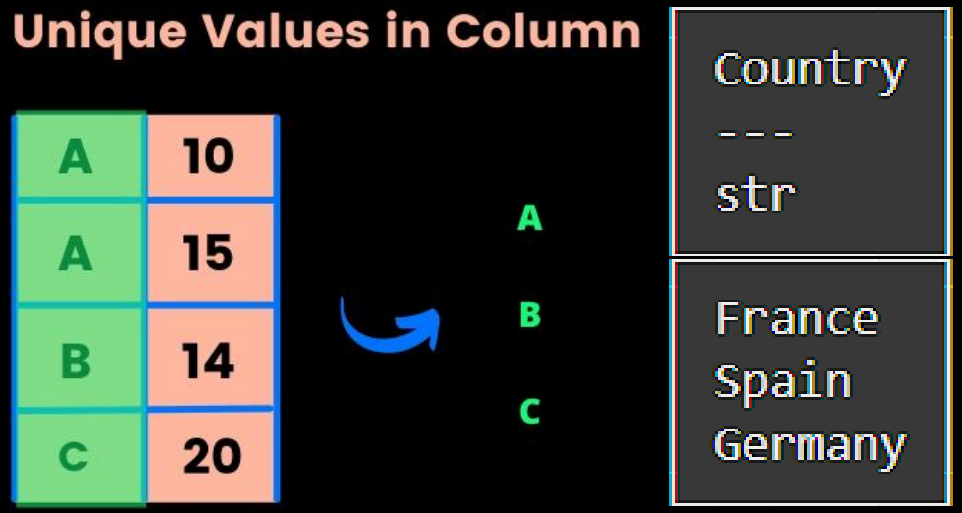
Unique

Returns the unique rows or values from a column, similar to removing duplicates.

```
dataset.select("city").unique()
```



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drop

Drops one or more columns from the DataFrame.

```
dataset=dataset.drop("Country")
```

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

Age	Salary	Purchased
i64	i64	str
44	72000	No
27	48000	Yes
30	54000	No
38	61000	No
40	null	Yes
35	58000	Yes
null	52000	No
48	79000	Yes
50	83000	No
37	67000	Yes

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Handling missing values

Use with_columns to update or add columns, select to target a specific column, and fill_null to replace missing values with a desired value.

```
dataset = dataset.with_columns(dataset.select("Age").fill_null(strategy='forward'))
```

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	35	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

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Handling missing values

Use with_columns to update or add columns, select to target a specific column, and fill_null to replace missing values with a desired value.

```
dataset = dataset.with_columns(dataset.select("Age").fill_null(strategy=backward'))
```

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	48	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

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Handling missing values

Use with_columns to update or add columns, select to target a specific column, and fill_null to replace missing values with a desired value.

```
dataset = dataset.with_columns(dataset.select("Age").fill_null(strategy=mean'))
```

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	38	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

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Handling missing values

Use with_columns to update or add columns, select to target a specific column, and fill_null to replace missing values with a desired value.

```
dataset = dataset.with_columns(dataset.fill_null(strategy=mean'))
```

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	63777	Yes
France	35	58000	Yes
Spain	38	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

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concatenation

Concatenates multiple DataFrames together either vertically (stacking rows) or horizontally (stacking columns).

```
print(dataset)
x = pl.concat([dataset, dataset])
print(x)
```

shape: (20, 4)

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
…	…	…	…
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

shape: (10, 4)

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

concatenation

To concatenate multiple DataFrames vertically (stacking rows), the datasets must have the same structure, meaning they should contain the same columns or features.

```
print(dataset)
x = pl.concat([dataset, dataset])
print(x)
```

shape: (20, 4)

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
…	…	…	…
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

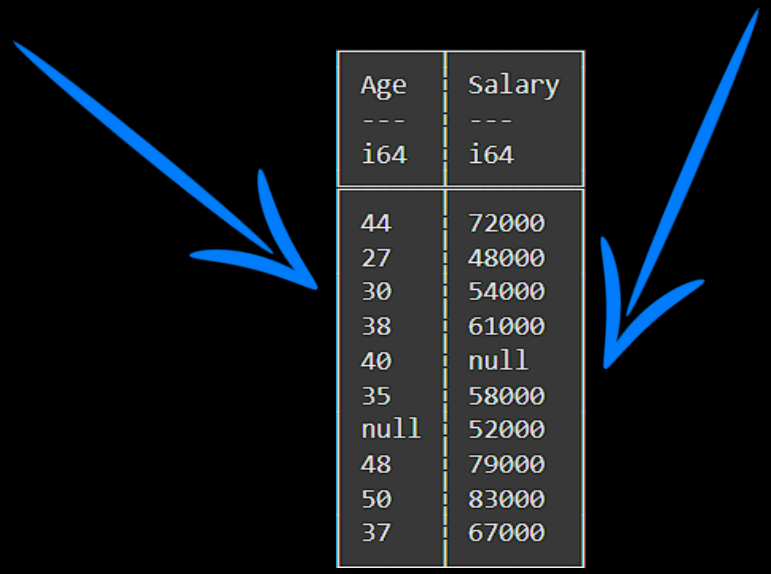
shape: (10, 4)

Country	Age	Salary	Purchased
str	i64	i64	str
France	44	72000	No
Spain	27	48000	Yes
Germany	30	54000	No
Spain	38	61000	No
Germany	40	null	Yes
France	35	58000	Yes
Spain	null	52000	No
France	48	79000	Yes
Germany	50	83000	No
France	37	67000	Yes

concatenation

To concatenate multiple DataFrames horizontally (stacking columns), the datasets should have different columns or features.

```
print(dataset)
x = pl.concat([dataset.select('Age'), dataset.select('Salary')],how='horizontal')
print(x)
```



Age	Salary
i64	i64
44	72000
27	48000
30	54000
38	61000
40	null
35	58000
null	52000
48	79000
50	83000
37	67000

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sample

Randomly samples rows from the DataFrame, useful for selecting a random subset of the data.

```
print(dataset.sample(n=5))
```

Country	Age	Salary	Purchased
str	i64	i64	str
Germany	50	83000	No
France	35	58000	Yes
France	44	72000	No
Spain	27	48000	Yes
France	37	67000	Yes

Null_counts

The null_count function in Polars is used to calculate the number of null (or missing) values in each column of a DataFrame. It provides a quick and efficient way to check the presence of missing data in your dataset.

```
dataset.null_count()
```

id	v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	v11	v12	v13	v14	v15	v16	v17	v18	v19
u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32	u32
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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